KING'S
AMERICAN DISPENSATORY

BY

HARVEY WICKES FELTER, M. D.

ADJUNCT PROFESSOR OF CHEMISTRY, PHARMACY, AND TOXICOLOGY, AND PROFESSOR OF ANATOMY, IN
THE ECLECTIC MEDICAL INSTITUTE, CINCINNATI, OHIO; EDITOR OF LOCKE'S SYLLABUS
OF MATERIA MEDICA AND THERAPEUTICS; EX-PRESIDENT OF THE OHIO
STATE ECLECTIC MEDICAL ASSOCIATION, ETC., ETC., ETC.

AND

JOHN URI LLOYD, PHR M., PH. D.

PROFESSOR OF CHEMISTRY, PHARMACY, AND TOXICOLOGY, IN THE ECLECTIC MEDICAL INSTITUTE,
CINCINNATI, OHIO; FORMERLY PROFESSOR OF CHEMISTRY AND PHARMACY IN THE CINCINNATI
COLLEGE OF PHARMACY; EX-PRESIDENT OF THE AMERICAN PHARMACEUTICAL
ASSOCIATION; AUTHOR OF THE CHEMISTRY OF MEDICINES; DRUGS AND
MEDICINES OF NORTH AMERICA; A STUDY IN PHARMACY;
ETIDORHPA, ETC., ETC., ETC.

ENTIRELY REWRITTEN AND ENLARGED.

NINETEENTH EDITION. THIRD REVISION.

IN TWO VOLUMES.

VOL. II.

CINCINNATI:
THE OHIO VALLEY COMPANY,
317–321 RACE STREET.
1905.

AUTHORIZATION.

Resolution passed by the National Eclectic Medical Association at the annual meeting, in Cleveland, Ohio, June 19, 1879:

Resolved, That this Association adopt THE AMERICAN DISPENSATORY as its STANDARD AUTHORITY.

ALEXANDER WILDER, M. D., *Secretary*.

"AUTHORITY to use for comment the *Pharmacopœia of the United States of America* (1890), Seventh Decennial Revision, has been granted by the Committee of Revision and Publication."

AUTHORITY to print selections from the *National Formulary*, has been granted by the Council of the American Pharmaceutical Association.

COPYRIGHTS.

PRINTED AND BOUND
BY
THE OHIO VALLEY COMPANY,
CINCINNATI.

LIST OF ILLUSTRATIONS.

ABBREVIATIONS.

Endeavor has been made to extend full credit in the text by means of abbreviations, most of which are self-explanatory. The following selective list may assist some readers:

A. J. P., American Journal of Pharmacy.
A. P. A., American Pharmaceutical Association.
A. P. A. Proc., American Pharmaceutical Association Proceedings.
Am. Hom. Pharm., American Homœopathic Pharmacopœia.
Amer. Hom. American Homœopathist.
Amer. Med. Plants, Millspaugh's American Medicinal Plants.
Ann. de Chim. et Pharm., Annales de Chimie et de Pharmacie.
Ann. der Chem. und Pharm., Annalen der Chemie und Pharmacie (Liebig's Annalen).
Arch. der Pharm., Archiv der Pharmacie.
Attfield, Attfield's Chemistry.
Av., Avoirdupois.
B., Bigelow's Vegetable Materia Medica and American Medical Botany.
B. A. A. S., British Association for the Advancement of Science.
Bar., Barton's Vegetable Materia Medica of the United States.
Ber. d. d. Chem. Ges., Berichte der Deutschen Chemischen Gesellschaft.
Bot. Reg., Botanical Register.
Br., British Pharmacopœia.
Br. Phar., British Pharmacopœia.
Buchner's Rep., Buchner's Repertorium für die Pharmacie.
Buchner's Neues Repert., Buchner's Neues Repertorium für Pharmacie.
C., Christison's Dispensatory.
°*C.*, Degree Centigrade.
Cc., Cubic Centimeter.
Cm. Centimeter.
Chem. Centralbl., Chemisches Centralblatt.
Chem. Ztg., Chemiker Zeitung.
Coblentz, Coblentz's Newer Remedies.
Com. Dict. of Inorganic Solubilities, A. M. Comey, Dictionary of Inorganic Solubilities, 1896.
Compt. Rend., Comptes Rendus.
Coxe, Coxe's Dispensatory.
D., David Don, Linnaean Transactions and Philosophical Magazine.
D. and M. of N. A., Lloyd's Drugs and Medicines of North America.
Dub., Dublin Pharmacopœia.
Dymock, Dymock's Vegetable Materia Medica of Western India.
E. & V., Edwards and Vavasseur, Manual of Materia Medica, tr. by Tongo and Durand.
Ed., Edinburgh Dispensatory.
Ed. Med. Jour., Edinburgh Medical Journal.
Ed. Duncan, Duncan's Edinburgh Dispensatory, 1830.
Ed. E. M. J., Editorial, Eclectic Medical Journal.
°*F.*, Degree Fahrenheit.
F. Sylv., Michaux's North American Sylva.
Foltz, Dr. Kent O. Foltz in Webster's Dynamical Therapeutics.
G., Gray's Botany of the Northern States.
Gm., Gramme.
Gen., Genesis (Bible).
Ger. Pharm., German Pharmacopœia.
Imp., Imperial measure.
Jahresb. der Pharm., Jahresbericht der Pharmacie.
Jour. de Chim. Méd., Journal de Chimie Médicale de Pharmacie et de Toxicologie.
Jour. de Pharm., Journal de Pharmacie et de Chimie.
K., Prof. John King. M. D.
L., Lindley's Medical Flora.
Lieb. Annal., Liebig's Annalen (Ann. d. Chem. and Pharm.).
Locke, Locke's Syllabus of Materia Medica and Therapeutics. By Felter.
Lond., London Pharmacopœia.
Lond. Disp., Thomson's London Dispensatory.
Man. of Bot., Eaton's Manual of Botany.

Mat. Med. Western India, Dymock's Vegetable Materia Medica of Western India
Matt., Matthew (Bible).
Med. Flora, Rafinesque's Medical Flora.
Mm., Millimeter.
N. F., National Formulary.
Nat. Form., National Formulary.
Nat. Ord., Natural Order.
P., Pareira's Materia Medica and Therapeutics.
P. J. Tr., Pharmaceutical Journal and Transactions (British).
P. J. Proc., Pharmaceutical Journal and Proceedings.
Par. Cod., Parisian Codex.
Pharm. 1880, United States Pharmacopœia of 1880.
Pharm. Centralh., Pharmaceutische Centralhalle.
Pharm. India, Pharmacopœia of India.
Pharm. Jour., Pharmaceutical Journal and Transactions (British).
Phil. Trans., Philosophical Transactions.
R., Rafinesque's Medical Flora.
R. & S., Roscoe and Schorlemmer's Treatise on Chemistry.
Spec. Diag., Scudder's Specific Diagnosis.
Spec. Med., Scudder's Specific Medication.
Syllab. of Mat. Med., Locke's Syllabus of Eclectic Materia Medica and Therapeutics. By Felter.
Sylva, Michaux's North American Sylva.
T., Thomson's Chemistry of Organic Bodies and Inorganic Chemistry.
T. S., Pharmacopœial Test Solution.
Taylor, Taylor's Medical Jurisprudence.
U. S., United States.
U. S. P., United States Pharmacopœia.
V. S., Pharmacopœial Volumetric Solution.
Var., variety (botany).
W., Wood's Class Book of Botany.
Webster, Webster's Dynamical Therapeutics.
Witt., Wittstein's Practical Pharmaceutical Chemistry and Wittstein's Organic Constituents of Plants.
Wo., Woodville's Medical Botany.

GALANGA.—GALANGAL.

The rhizome of *Alpinia officinarum*, Hance.

Nat. Ord.—Scitamineæ (Zingiberaceæ).

COMMON NAMES: *Colic root, East India root, Galangal.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 271.

Botanical Source and History.—The plant that yields galangal was described by Mr. H. F. Hance, in the *Journal of the Linnæan Society* (1871). The plant was obtained from Hainan, an island directly south of China, but it also doubtless grows on the adjacent mainland, as the root is largely exported from Shanghai and other China ports. The galangal of commerce is known as *Lesser galangal;* another variety known as *Greater galangal*, is rarely found in the market. It is the product of *Alpinia Galanga*, Willdenow, (*Maranta Galanga*, Linné), and grows in Java. The name *galangal* is said to be derived from the Arabic *Khanlanjan*, which, in turn, is perhaps the perversion of a Chinese word, signifying mild ginger. Galangal has long been an article of commerce with the Eastern nations, and has been known in Northern Europe since the twelfth century (Hance). The stem is from 2 to 4 feet high, erect, and bears a close resemblance to the common cultivated canna, or shot plant. The parallel-veined leaf blades are about a foot long, 2 to 4 inches wide, smooth, entire, and sharply acuminate. They are attached at the base to a scarious, margined sheath, which clasps the stem. The flowers are borne in a terminal dense spike; they consist of a short, tubular, superior calyx, a white corolla, with 3 lobes, a large ovate labellum marked with red veins, a single anther-bearing stamen, and a pistil with an inferior ovary and a slender style (Bentley and Trimen, *Med. Plants*).

Fig. 116.

Root of Alpinia officinarum.

Description.—The rhizome, as found in market, is in sections of from 1 inch to 4 inches in length, and of a reddish-brown color, as though covered with rust. The cut ends are usually rounding, while the edges expand outwardly and turn back. Each fragment has, generally, one or more short branches, and it is evident that the roots are taken from the ground in masses, and chopped into pieces. Encircling them at intervals of from ¼ to ½ inch apart, are corrugated rings of a light color consisting of adhering bases of leaf sheaths. The roots are stout, and break with a granular fracture presenting a brownish-gray color, interspersed throughout which are small ligneous fibers. These fibers project a short distance beyond one surface of the root, thus leaving depressions on the opposite side, resembling pin-holes; the center of the root, for about one-fourth to one-third of its diameter, consists of a bundle of these fibers. Galangal reminds us of ginger, and imparts a pungent taste and an aromatic odor, very similar to that article. In this country, galangal has not come into use among physicians, but has been sold extensively by street-corner venders under such names as "colic root," "the wonderful East India root," etc., and was asserted by them to be a certain cure for toothache, headache, etc.

Chemical Composition.—The constituents of galangal are similar to those of ginger. A volatile oil is obtained by distilling the root with water, which possesses a camphoraceous smell resembling that of cajeput oil. This is due, according to Schimmel & Co. (1890), to the presence of appreciable amounts of *cineol.* It is soluble in alcohol, and is lighter than water. A soft resin, having a pungent taste, is extracted by ether, and also a peculiar, crystalline substance, named by Brandes (1839), *kæmpferid*. Jahns (1881) differentiated the kæmpferid of Brandes into three compounds, all forming yellow crystals, viz., *kæmpferid* ($C_{16}H_{12}O_6$), fusing at 222° C. (431.6° F.), almost insoluble in water, and soluble with difficulty in alcohol; *galangin* ($C_{15}H_{10}O_5$), fusing at 214° C. (417.2° F.), soluble in 34 parts of absolute and 68 parts of 90 per cent alcohol; and *alpinin* ($C_{17}H_{12}O_6$), fusing at 173° C. (343.4° F.).

Kæmpferid, by oxidation with nitric acid, forms *anisic acid* ($C_6H_4[OCH_3]COOH$), oxalic acid and other products. *Galangin* similarly yields benzoic and oxalic acids (*Amer. Jour. Pharm.*, 1882, p. 288). Kostanecki and Harry M. Gordin

(*Dissert.*, 1897), showed *kæmpferid* to be a flavonol derivative and established its exact graphic formula. Probably galangin is similarly constituted. Thresh (*Pharm. Jour. Trans.*, Vol. XV., 1884, p. 234), announced the presence of a pungent principle, which he designated *galangol*, and gave the tabulated results of a complete analysis of the root, which shows as much as 23.7 per cent of starch.

Action, Medical Uses, and Dosage.—Galangal is a stimulating aromatic, and has been successfully employed to aid the digestive process, preventing fermentation and removing *flatus*. It will be found especially useful in some forms of *dyspepsia*, preventing vomiting or sickness of the stomach, and facilitating digestion. It may be used in all cases in which a stimulating aromatic is indicated. It has some reputation as a remedy for *perineal relaxation* with *hemorrhoids*, and for a *lax* and *pendulous abdomen*. Its best form of administration is in tincture, the dose of which is from ½ to 1 fluid drachm. The powder may be given in doses of 15 to 20 grains; from 30 to 60 grains may be given in infusion. It is rarely prescribed at the present day.

GALBANUM.—GALBANUM.

The gum-resin of *Ferula galbaniflua*, Boissier and Buhse; *Ferula rubricaulis*, Boissier; and probably from other related species.

Nat. Ord.—Umbelliferæ.

SYNONYM: *Gummi-resina galbanum.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 128.

Botanical Source.—*Ferula galbaniflua* is a north Persian plant having a solid, tall stem about 4 or 5 feet high. The leaves are grayish-tomentose, the radical ones being triangular in outline, and decompound-pinnate, pinnatifid, the sections being linear-obtuse. The radical leaves are large and the stem leaves small. The fruit is thin and flat, winged near the face, has slender, prominent ribs, and in the grooves presents single oil-tubes. Sometimes two narrow tubes are present. The commissure has no tubes.

Ferula rubricaulis is a south Persian plant, probably growing to some extent in northern Persia also. It has been classed with the preceding by some botanists, while others accord to it a separate place. It differs chiefly in the greater width of the leaf segments, and in having more numerous and narrower oil-tubes.

History and Description.—The plant from which the gum-resin *Galbanum* is obtained, is not definitely known. The *British Pharmacopœia* (1898) mentions the above-named species and refers to the probability of other species of *Ferula* yielding it. That the *Ferula galbaniflua* is believed to yield it is due to the statement of F. A. Buhse, a German resident of Persia, who relates that in 1848 (see Flückiger, 1891), he was informed that the product spontaneously exudes from the plant in question, and was told by the natives that it was the source of galbanum. Galbanum is imported from the Levant, and from India in cases and chests. It is generally met with in lumps, consisting of large, irregular masses of a brownish or dark-brownish color, and composed of agglutinated tears, some few of which, when broken, are somewhat translucent; they have a waxy density, but become soft and sticky at a temperature of 35° to 37.7° C. (95° to 100° F.), are not pulverizable unless in very cold weather, have a strong, unpleasant odor, and a hot, somewhat acrid, and amarous taste. Occasionally, galbanum is met with in the form of oval, globular, or irregular tears. On account of the impurities it contains, it should be melted and strained previous to employing it. When the color of galbanum is dark-brown or blackish, and when it contains an admixture of sand, straw, chips of wood, and other foreign matters, the article should be rejected as being inferior. The specific gravity of galbanum is 1.212. Galbanum is partially dissolved by water, vinegar, or wine, forming therewith an emulsion. Alcohol dissolves about three-fifths of it, the residue being gum and impurities. Diluted alcohol is its best solvent.

Chemical Composition.—According to Pelletier, galbanum contains 6 per cent volatile oil, 67 per cent resin, 19 per cent gum, and 8 per cent foreign matter (H. and H.). The *volatile oil* consists mainly of a hydrocarbon of the terpene series, $C_{10}H_{16}$. According to Mössmer its boiling point is between 160° and 165° C.

(320° and 329° F.). It is dextro-rotatory, colorless, has a specific gravity of 0.884, and forms crystals with gaseous hydrochloric acid. Probably other hydrocarbons are also present. The yellow-brown *resin* of galbanum may be obtained (Flückiger, *Pharmacognosie*, 1891, p. 65), by extracting galbanum with alcohol and distilling off the solvent. The residual resin is also soluble in carbon disulphide in commercial but not quite in absolute ether, and in caustic soda. Upon destructive distillation galbanum resin yields an aqueous fraction containing fatty acids, and a thick blue oil of the composition $C_{20}H_{30}O$, or more probably $C_{10}H_{16}O$, after removing therefrom a hydrocarbon $C_{10}H_{16}$ (Kachler, 1871). The blue oil boils at 289° C. (552.2° F.), and holds in solution or suspension a crystalline body which Sommer (1859) named *umbelliferon*. This substance is a common constituent of the products of the dry distillation of such gum-resins as asafœtida, sagapenum and opopanax, and those derived from *Imperatoria Ostruthium*, *Angelica Archangelica*, etc., all being umbelliferous plants, hence the name. An occurrence exceptional to this rule was observed in the non-umbelliferous plant, *Daphne Mezereum* (Zwenger, 1854).

Umbelliferon may be abstracted from the blue oil by means of boiling water, or by slightly alkaline water. It may also be obtained from galbanum resin direct by heating it with hydrochloric acid to 100° C. (212° F.), abstracting with chloroform and evaporating the solvent. *Umbelliferon* ($C_9H_6O_3$), is closely related to *coumarin*, being *para-oxycoumarin*. It is hardly soluble in cold, soluble in 100 parts of boiling water, little soluble in ether, soluble in alcohol. It melts at 224° C. (435.2° F.), developing thereby an aromatic smell. In aqueous solution it exhibits a bluish fluorescence markedly increased by alkalies. Its solution in concentrated sulphuric acid is likewise beautifully fluorescent. When boiled with caustic potash umbelliferon is decomposed into *resorcin* (*meta-dioxy-benzene*) ($C_6H_4[OH]_2$), and formic and carbonic acids. *Resorcin* is likewise formed when galbanum resin is fused with caustic potash, and was discovered by this reaction in 1866, by Hlasiwetz and Barth. It enters into the composition of many dyestuffs, especially fluoresceine (which see), and has been produced since on the manufacturing scale. When boiled with nitric acid, galbanum resin yields *trinitroresorcin* or *styphnic acid* ($C_6H[NO_2]_3[OH]_2$). Galbanum gum may be obtained by exhausting the drug with alcohol, and extracting the residue with water. The aqueous solution is optically inactive (Hirschsohn), and is precipitated by basic, but not by neutral acetate of lead.

A distinctive test for galbanum is as follows: Extract its resin by means of carbon disulphide, dissolve it in alcohol, and gently warm with hydrochloric acid of sp. gr. 1.15. The mixture then assumes a beautiful blue color which is evanescent. Galbanum resin, when in prolonged contact (for several hours) with hydrochloric acid of sp. gr. 1.12 or higher, imparts to the latter, especially upon warming, a beautiful red color (Flückiger, *Pharmacognosie*, 1891).

Action, Medical Uses, and Dosage.—The effects of galbanum are similar to those of asafœtida and ammoniac, being weaker than the former, but stronger than the latter. Upon the unbroken skin it produces papules, while it causes ulceration if the skin be broken. It controls *excessive catarrhal discharges*, and causes some arterial tension and cerebral fullness. It has been used in *hysteria*, *chronic rheumatism*, *suppressed menstruation*, *leucorrhœa* and *chronic mucous affections of the air passages;* and may be given in doses of from 10 grains to ½ drachm, in pill form, or in emulsion. Externally, a plaster is sometimes employed, as a mild stimulant and resolvent to *indolent tumors;* and the tincture has been efficient in *scrofulous ophthalmia*, or *irritability* or *weakness of the eyes.*

Related Gum-resins and Drugs.—SAGAPENUM (or *Serapinum* of mediæval times). Sagapenum is imported from the Levant. It is the solidified juice of an unknown plant, probably a *Ferula*, of Persian origin. It is commonly in tears agglutinated together, of a brownish-yellow color, a hot and bitter taste, often alliaceous odor, softens between the fingers, is sparingly soluble in water, not completely soluble in alcohol, and when distilled with water it yields a pale-yellow, very fluid volatile oil, lighter than water, of a strong, alliaceous smell, and a bitter, acrid taste, it is readily soluble in ether and alcohol, and is speedily changed to a transparent resin on exposure to the air. According to Hager (*Handbuch der Pharm. Praxis*, 1886), sagapenum consists of about 50 per cent resin, 30 per cent gum, 5 to 10 per cent volatile oil, and 5 to 8 per cent impurities. Flückiger (*Pharmacographia*), states that sagapenum contains *umbelliferon* but no sulphur, and that it is remarkable for the permanent, intense blue color it assumes in the cold when a very small piece is placed in hydrochloric acid (density 1.13). Sagapenum possesses medicinal properties similar to ammoniac and asafœtida; but is not so powerful as the last of these. It is sometimes added to discutient plasters as a stimulating ingredient. The dose is from 10 grains to ½ drachm.

OPOPANAX.—The gum-resin of *Opopanax Chironium*, Koch (*Pastinaca Opopanax*, Linné). *Nat. Ord.*—Umbelliferæ. This plant, called *Rough parsnip*, is indigenous to the south of Europe. On wounding the stalk-base, or the root, a yellowish lactescent juice exudes and concretes. This is opopanax. The best grade is that which occurs in irregularly angular pieces, or subglobular tears, varying in size, and of a reddish or yellowish brown color. It readily fractures, displaying a waxy interior, and often exhibits imbedded fragments of vegetable tissues. Its odor is strong and disagreeable, and its taste acrid, bitter and balsamic. When warmed it becomes soft, exhaling an onion-like odor. It burns with a bright, non-sooty flame. The poorer qualities are not so bitter as good opopanax, and come in masses larger than a walnut. A specimen of false opopanax has been observed in commerce by J. H. Marais (see *Amer. Jour. Pharm.*, 1875, p. 39), consisting entirely of gum myrrh, which it resembles in appearance. Myrrh changes to a rose color with the vapors of nitric acid, while gum opopanax is not altered by the same treatment. It forms a yellow emulsion with water. Besides vegetable impurities it contains starch (4.2 per cent), wax, volatile oil, resin (42 per cent), and gum (33.4 per cent (Pelletier, *Bull. de Pharm.*, 1812, p. 51). It is seldom used in medicine now, but in olden times was one of the gum-resins thought to be applicable to almost all ills, hence the name *opopanax*, meaning the "all-healing juice." In later times it was used in plasters, and internally in *bronchitis* with abundant expectoration, *asthma*, *hysteria*, *hypochondriasis*, *amenorrhœa*, etc. Dose, from 15 to 30 grains.

Herniaria glabra.—About 1885 a demand was made in this city for Herniaria glabra, the drug being introduced by a specialist for whom the writer procured a supply in England. The remedy is still employed by physicians, several claiming to derive good results from the fluid extract. This is a very old remedy, popular with the early herbalists of England. *Herniarine*, the crystallizable body obtained from this plant has been shown to be *methyl-umbelliferon* ($C_{10}H_8O_3$). *Paronychine*, an alkaloid, has been found in small amounts in the plant by Schneegans (*Amer. Jour. Pharm.*, 1890, p. 488). About the only use the plant now has is in *catarrhal affections of the bladder*. J. H. Schröder (1693) and Samuel Dale (*Pharmacologia*, 7th ed., 1751) refer to the plant as being principally employed to cure *hernia* (hence its name) and to increase the flow of urine. It was also said to increase the flow of bile, and was employed for the cure of *jaundice* and excess of mucus in the stomach (probably *gastric catarrh*). Internally and externally it was praised in *snake-bites*, and the powdered plant was employed to kill maggots upon unhealthy *sores* of horses. It was reputed to "crush" and expel *calculi* from the kidneys and bladder, assisting in their expulsion by carrying with them an enveloping coating of mucus. Its general properties were said to be cooling and drying, and the plant was popularly known as *Breast wort* and *Knot weed*.

GALEGA.—GOAT'S RUE.

The herb of *Galega officinalis*, Linné.
Nat. Ord.—Leguminosæ.
COMMON NAME: *Goat's rue.*

Botanical Source and History.—This is an herbaceous plant, native of southern Europe. It has an erect, perennial, glabrous stem, about 3 feet high, and is found growing mostly in sandy soil. The leaves are alternate, oddly pinnate, and furnished at the base with lanceolate stipules. The leaflets are smooth, lanceolate, and terminate in a mucronate point. The flowers appear in June and July, are blue, and borne in loose, axillary racemes longer than the leaves. The calyx has 5 narrow, equal lobes. The corolla is papilionaceous with an obtuse keel. The stamens are united in one set; the filament of the tenth, however, is distinct for about one-half its length. The fruit is a dry, round, smooth, many-seeded legume.

Tephrosia virginiana, Persoon (see *Tephrosia*), a plant formerly referred to the genus Galega, is a native of the United States, and the root, which is slender and very tough, is reputed to be an anthelmintic. We can not find that either of the aforenamed plants have been examined chemically.

Action, Medical Uses, and Dosage.—Galega has a disagreeably bitter taste, and upon being chewed, imparts a dark-yellowish color to the saliva. Various properties were attributed to it in former times, in which it was considerably employed as a vermifuge, as a stimulant to the nervous system, as a diuretic and tonic in *typhoid conditions*, and is also stated to have been of service in the *plague*, as well as to stimulate the lactiferous vessels to an increased secretion during the period of lactation. It is seldom, if ever, prescribed in practice.

GALIUM.—CLEAVERS.

The herb of *Galium aparine*, Linné, and other species of Galium.

Nat. Ord.—Rubiaceæ.

COMMON NAMES: *Cleavers*, *Goose-grass*, *Catch-weed*, *Bedstraw*, etc.

Botanical Source.—*Galium aparine* is an annual, succulent plant, with a weak, procumbent, quadrangular, retrorsely-prickled stem, which grows from 2 to 6 feet long, and is hairy at the joints. The leaves are 1 or 2 inches in length, 2 or 3 lines in width, verticillate in sixes, sevens, or eights; linear-oblanceolate, nearly sessile, mucronate, tapering to the base, and rough on the margins and midvein; the peduncles are axillary and 1 or 2-flowered; the flowers white, small, numerous and scattered. Calyx 4-toothed, corolla rotate and 4-parted, stamens 4 and short, styles 2. The fruit is large and bristly, with hooked prickles (W.—G.).

History, Description, and Chemical Composition.—This plant is common to Europe and the United States, growing in cultivated grounds, moist thickets, and along banks of rivers, and flowering from June to September. Its root consists of a few hair-like fibers, of a reddish color. There are several species of Galium, all of which possess similar medicinal virtues, as *Galium asprellum*, Michaux, *Rough* or *Pointed cleavers*, which differs from the above in having its leaves in whorls of 4 or 6, and smaller, its fruit smooth, its stem less in length, and is perennial; *Galium verum*, Linné, or *Yellow bedstraw*, with an erect stem, leaves in whorls of 8, root long, perennial, fibrous, flowers densely paniculate, yellow, and terminal; *Galium trifidum*, Linné, or *Small cleavers*, with a perennial root, decumbent stem, herb smaller than the others, leaves in fours or fives, and white flowers; *Galium triflorum*, Michaux, or *Sweet-scented bedstraw* contains *coumarin* ($C_9H_6O_2$), an odorous principle found also in tonka beans, melilotus and other plants; the *Galium tinctorium*, a variety of the G. trifidum, having a stouter and a nearly smooth stem, leaves of the branches in fours, of the stem in sixes; peduncles 2 to 3-flowered; parts of the flowers usually in fours; *G. lanceolatum*, Torrey, and *G. circæzans*, Michaux, are sometimes known as *Wild licorice* on account of their taste.

In a green state these plants have an unpleasant odor, but are inodorous when dried, with an acidulous, astringent, and bitter taste. Cold or warm water extracts the virtues of the plants; boiling destroys them. The roots dye a permanent red, and the bones of the animals who eat the plant are said to be colored, similar to that caused by madder. The flowers are said to curdle milk, but this is not a constant effect. Analysis has detected in *G. verum* and *G. aparine rubichloric acid*, *galitannic acid*, citric acid, starch, chlorophyll, etc, *G. aparine* contains more citric acid than *G. verum*, while the latter holds the most galitannic acid. Oxalic acid may be present.

Action, Medical Uses, and Dosage.—A most valuable refrigerant and diuretic, and will be found very beneficial in many diseases of the urinary organs, as *suppression of urine*, *calculous affections*, *inflammation of the kidneys* and *bladder*, and in the scalding of urine in *gonorrhœa*. It is contraindicated in diseases of a passive character, on account of its refrigerant and sedative effects on the system, but may be used freely in *fevers* and all *acute diseases*. It has been recommended in *scorbutic* and *nervous affections*, but can not be depended upon. *Growths* or deposits of a nodular character in the skin or mucous membranes are regarded as indications for its use. An infusion may be made by macerating 1½ ounces of the herb in a pint of warm water for 2 hours, of which from 2 to 4 fluid ounces may be given 3 or 4 times a day, when cold. It may be sweetened with sugar or honey. Equal parts of cleavers, maiden-hair, and elder-blows, macerated in warm water for 2 or 3 hours, and drank freely, when cold, form an excellent drink in *acute erysipelas*, *scarlatina*, and other *exanthematous diseases*, in their inflammatory stages. The infusion made with cold water is also considered very beneficial in removing *freckles* from the face, likewise *lepra*, and several other *cutaneous eruptions;* the diseased parts must be washed with it several times a day, and continued for 2 or 3 months in case of freckles. It has also been found useful in many cutaneous diseases, as *psoriasis*, *eczema*, *lichen*, *cancer*, and *scrofula*, and is more particularly useful in these diseases when they are combined with a strumous diathesis. The infusion may be prepared and administered as above mentioned. Of specific galium the dose is from 5 to 60 drops.

Galium tinctorium is said to be nervine, antispasmodic, expectorant, and diaphoretic. It has been used successfully in *asthma*, *cough*, and *chronic bronchitis*, and appears to exert an influence principally upon the respiratory organs. The plant has a pungent, aromatic, pleasant, persistent taste. A strong decoction of the herb may be given in doses of from 1 to 4 fluid ounces, and repeated 2 or 3 times a day, according to circumstances. The root of this plant is said to dye a permanent red.

Specific Indications and Uses.—Dysuria, painful micturition; renal and cystic irritation with burning; diuretic for inflammatory states of the urinary tract, and for febrile conditions; "nodulated growths or deposits in skin or mucous membranes" (Scudder).

GALLA.—NUTGALL.

"An excrescence on *Quercus lusitanica*, Lamarck (*Quercus infectoria*, Olivier), caused by the punctures and deposited ova of *Cynips Gallæ tinctoriæ*, Olivier. *Class:* Insecta. *Order:* Hymenoptera"—(*U. S. P.*).

Nat. Ord.—Cupuliferæ.

SYNONYMS: *Galls*, *Galla tinctoria*, *Galla halepense*, *Galla levantica*, *Galla quercina*.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 249.

Botanical Source.—*Quercus lusitanica* (*Quercus infectoria*), is a small shrub, or tree, from 4 to 6 feet in height. The stems are crooked; the leaves borne on short petioles, 1 to 1½ inches long, oblong, with a few coarse mucronate teeth on each side, bluntly mucronate, rounded and rather unequal at the base, smooth, bright-green, and shining on the upper side. The fruit or acorns are solitary, long, and obtuse; the cup is scaly and hemispherical (L).

History.—Dyer's oak, or gall oak, is indigenous to the country from the Bosporus to Syria, and from the Archipelago to the frontier of Persia. It furnishes the *gall-nuts* or *galls* of commerce. These are produced by the puncture of the foliaceous or cortical parts of the tree by an insect, for the deposition of its eggs. The insect producing the galls of commerce is the *Cynips Gallæ tinctoriæ*, Olivier (*Cynips quercusfolii*, of Linnæus, or *Diplolepsis Gallæ tinctoriæ*, of Geoffroy). After the female has made a puncture, she deposits her eggs therein; in consequence of the irritation thus caused, an excrescence is soon formed, from the concretion of the morbid secretion which subsequently ensues, and which is called galls. The larva of the insect is soon developed from the egg, changing first into the pupa and then into the imago. Toward the end of July, the young insect, having passed through all its stages of transformation into the state of fly, perforates its prison and escapes. The best galls are those which are gathered about the middle of July, just before the escape of the insect. These are bluish-black, heavy, not yet perforated, and constitute the commercial *black*, *blue*, or *green galls*. Those galls from which the insect has escaped are commonly larger, lighter colored, perforated, and less astringent; they are called *white galls*, and command a lesser price in commerce (P.—*Ed.*).

Galls are chiefly imported from the Levant, *i. e.*, Syria and Turkey, though some valuable grades (rhus galls) are brought in smaller quantity from several other countries, *e. g.*, China and Japan (see below). The *Aleppo* or *Syrian galls* are blue or black; *Sorian galls* are small and blackish, and the radiation of the interior is absent; and the *Smyrna galls* are grayish or olive-gray green intermingled with *white galls*. European countries also furnish oak galls, *e. g.*, England, Germany, Italy, but these are decidedly inferior in the amount of tannin they contain. For an interesting monograph on various species of galls, including American oak galls, see C. Hartwich, *Arch. der Pharm.*, 1883, pp. 819 to 881.

Description and Chemical Composition.—Galls are described by the *U. S. P.* as follows: "Subglobular, 1 or 2 Cm. ($\frac{2}{5}$ to $\frac{4}{5}$ inch) in diameter, more or less tuberculated above, otherwise smooth, heavy, hard; often with a circular hole near the middle, communicating with the central cavity; blackish olive-green or blackish-gray; fracture granular, grayish; in the center a cavity containing either the partly developed insect, or pulverulent remains left by it; nearly inodorous, taste strongly astringent. Light, spongy, and whitish-colored nutgall should be rejected"—(*U. S. P.*). Water is the best solvent of galls, and proof-spirit the next; pure alcohol or ether acts more feebly upon them. The chemical reactions of galls in decoction or tincture, are similar to those named for *tannic acid* or *tannin* (gallotannic acid, which see), as this substance exists in galls in large proportions. A number of analyses of galls from various sources are recorded in "*The Tannins*" (1892) by the late Prof. Henry Trimble. The amount of tannin varied from 24 per cent in European galls (German, English, Italian), to 61 per cent in Aleppo galls, and 69 per cent or more in Chinese galls.

H. K. Bowman (*Amer. Jour. Pharm.*, 1869) obtained from selected oak galls 80 per cent of tannin; from white galls about 30 per cent; and from good commercial powdered galls 52 per cent.

Prof. Trimble (*Amer. Jour. Pharm.*, 1890, p. 563) found in two species of galls, both from *Quercus alba*, growing in the vicinity of Philadelphia, from 32 to about 35 per cent of tannin, and 1.11 and 1.71 per cent of ash, referred to dried substance. Moisture was 46 and 73 per cent. Trimble observed that galls, when allowed to air-dry slowly, will deteriorate in tannin strength, hence must be rapidly dried at 100° C. (212° F.) in order to destroy the insect in whose development the tannic acid seems to be consumed. Gallic acid is present in galls in small amounts (about 1.5 per cent).

Action, Medical Uses, and Dosage.—Galls are astringent, and were used in all cases where astringents are indicated, as in *chronic dysentery*, *diarrhœa*, *passive hemorrhages*, and in cases of *poisoning by strychnine*, *veratrine*, and other *vegetable alkaloids*, with which it forms tannates possessing less activity than the other salts of these bases. Boiled in milk the decoction is used for the *diarrhœa of children*. As a local application, the infusion is employed as an injection in *gleet*, *leucorrhœa*, *prolapsus ani*, or for a gargle in *indolent ulceration of the fauces*, *relaxed uvula*, and the *chronic stage of mercurial action on the mouth*. The addition of alum is said to render it more beneficial. Dose of the powder, from 5 to 20 grains; of the tincture, ½ to 1 fluid drachm; of the infusion, from ½ to 1 fluid ounce. Gallic and tannic acids have now supplanted it as a medicine.

Related Galls and Drugs.—GALLÆ CHINENSES SEU JAPONICÆ. *Chinese and Japanese galls.* This important variety of galls, containing 70 per cent of gallotannic, or common tannic acid, is derived from the *Rhus semialata*, Murray, being produced upon the leaf or leafstalk through the agency of the *Aphis chinensis*, Bell, which punctures the part. These galls are hollow, light, very irregular in shape, more or less lobed, and have numerous protuberances. Their shell is thin, horny and translucent, brittle, and breaks with a smooth, glistening fracture. These galls are attenuated toward the base and inflated at the other extremity. The shell is of a red-brown color, densely covered with a velvety gray downy pubescence. The interior of the gall contains a number of dead insects. The Japanese galls are similar but more slender, and have more lobes. Their pubescence is denser than that of the Chinese variety, and of a pale brown color. The Japanese galls are thought to be derived from *Rhus japonica*, Siebold.

TAMARISK GALLS.—Product of *Tamarix orientalis*, Forskal. South and southwest Asia. These are knotty, subglobular, and from ⅛ to ½ inch in thickness. They yield tannin to the extent of 40 to 50 per cent. *Tamarisk africana*, Poiret, of northern Africa, yields a similar gall, while the bark and leaves of the *Tamarisk gallica*, Linné, are used as astringents in Europe.

AMERICAN NUTGALLS.—Several species of Quercus, especially *Quercus alba*, Linné, yield inferior light, spongy galls, which contain comparatively little tannin. Forty per cent of tannin is said to be yielded, however, by a Texan species, the *Quercus virens*, Aiton (see Trimble, *The Tannins*). The *Quercus lobata*, Engelmann, furnishes *California oak-galls*, rich in tannin.

VALLONEA (*Valonia*), *Acorn cups.*—Several varieties of acorn cups, including many of our indigenous products, are astringent. Those of *Quercus Robur*, Linné, furnish *Hungaria valonia*, while the *Oriental valonia* is the product of several species of Quercus from southwestern Asia and southeast Europe, especially Greece and Asia Minor, such as *Quercus Vallonea*, Kotschy, *Quercus Ægilops*, Linné, and others.

BASSORA GALLS contain on an average 27 per cent of tannin. They are ground and subsequently pressed into rectangular cakes. Persia and Asia Minor produce them, and they are employed in tanning.

NANCE BARK.—Probably from *Malpighia glabra*. Contains over 26 per cent of tannin Holberg, *Amer. Jour. Pharm.*, Vol. XVI . Considerably employed by the Mexicans in tanning.

BEDEGUAR.—An excrescence, known as *Fungus rosarum*, produced by the puncture of insects (*Cynips*) upon the *Eglantine* or *Sweet briar* and other species of the rose family. It is roundish or irregular, about an inch through, and made up of cavities, each containing a larva. It is feebly astringent and almost odorless. It was formerly regarded anthelmintic, lithontriptic and diuretic, being given in doses of from 10 to 40 grains.

GARCINIA.—MANGOSTEEN.

The fruit of *Garcinia mangostana*, Linné, and other species of *Garcinia*.

Nat. Ord.—Guttiferæ.

COMMON NAMES: *Mangosteen*, *Mangostan*.

ILLUSTRATIONS: *Botanical Magazine t.*, 1847. Of *G. indica*, Bentley and Trimen, *Med. Plants*, 32.

Botanical Source, Description, and History.—The tree furnishing the mangosteen is large and handsome, having elliptic, oblong or oblong-lanceolate, deep-green glossy leaves. The bark of the tree is bitter and exceedingly astringent. The fruit is brownish or brownish-gray, marbled with yellow, and is crowned by the 4-parted, sessile stigma. There are from 6 to 8 seeds, and the pulp is juicy, white, and delicious in taste and odor. It is about the size of an orange.

Garcinia pedunculata, Roxburgh, yields a yellow fruit having an acidulous taste. It is of an inferior quality.

Garcinia Kydia, Roxburgh, yields a small fruit of a deep-yellow color. It is of better quality than the preceding variety.

Garcinia indica, Choisy (*Garcinia purpurea*, Roxburgh; *Brindonia indica*, Du-Petit-Thouars).—The fruit of this species is of a dull or purplish-red or purple color, having also a purple, acid pulp. The pulp, dried in the sunlight and slightly salted, is a commercial article, and when fresh the fruit is used in a currie in India, where a purple syrup, for use in bilious affections, is also prepared from it. The juice is occasionally used as mordant for dyeing purposes. The fruit, seeds and bark are all employed in India (Dymock, *Mat. Med.*, *Western India*). The seeds, when bruised and boiled with water, yield the *concrete oil of mangosteen*, known as *kokam* or *kokum butter*. It is hard and friable at all ordinary temperatures, has a crystalline structure, and comes pressed in the form of hand-molded, egg-shaped cakes. It has a greenish-white or yellowish color, and produces the unctuous touch of spermaceti. The fat, as found in market, must be strained before being employed in pharmaceutical operations. This removes particles of seed, fruit, etc., with which it is usually mixed. This butter is sometimes used for cooking purposes in India, but is more valuable in the preparation of *ointment of nitrate of mercury*, for, when added to lard, it gives it a good consistence for hot climates (Dymock, *Mat. Med.*, *Western India*).

Garcinia mangostana is found in the Malay islands. It was grown in the gardens of the Duke of Northumberland in 1855, and produced both blossom and fruit (see illustration in *Bot. Mag. t.*, 1847). The fruit of this tree is the famous *mangostan* or *mangosteen*, said to be among the most luscious of tropical fruits. Its rind is about the fourth of an inch in thickness, contains a very astringent juice, from which, during wet weather, a yellow gum exudes, which is a variety of gamboge. The Chinese use the bark of the tree to produce a black dye, and it is also used in dysentery.

Chemical Composition.—The bitter and astringent rind of the fruit of Garcinia mangostana, according to W. Schmid, contains tannin, resin, and crystallizable *mangostine* ($C_{20}H_{22}O_5$), forming golden-yellow, tasteless scales, melting at 190° C. (374° F.), readily soluble in alcohol or ether, insoluble in water. Basic lead acetate precipitates it from its alcoholic solution. Its solution in alkalies reduces gold and silver solutions. The acidity of the fruit is due to malic acid. The resinous exudation of the trunk of the tree was investigated, in 1858, by N. Reitler in Wittstein's laboratory (*Vierteljahresschr. f. prakt. Pharm.*, Vol. VII, p. 170), and found to consist of 88 per cent of resin, soluble in alcohol and in ether. Ammonia differentiates it into a soluble and an insoluble resin.

Kokum butter exists in the seeds of *Garcinia purpurea* to the extent of 30 per cent, and consists chiefly of tristearin and the glycerides of oleic and myristic acids (*Jahresb. der Pharm.*, 1896, p. 71).

Action, Medical Uses, and Dosage.—The rind of the fruit is highly recommended for *dysentery*, and has been extensively employed in India for that disease. A few years ago the rind was introduced into Europe by Gruppe, of Manila, who prepared an extract which was administered in the Vienna hospitals, as an astringent, with success in *catarrhal conditions of the throat*, *bladder*, *urethra*, and *uterus*, etc. The dose of the solid extract is 1 grain, repeated 6 or 8 times per day, in pill form, or rubbed up with syrup.

Related Products.—KOLA BITTER or MALE KOLA. These seeds have a coffee-like, astringent and bitter taste. They are produced by the *Garcinia Kola*, Heckel, of western Africa (see *Kola*).

MAMMEE APPLE.—A subglobular, brownish-yellow fruit, about the size of a large orange, the pulp of which is yellow and aromatic, and the rind coriaceous and bitter. The seeds are 3 or 4 and rough. It is the product of the West Indian *Mammea americana*, Linné, *Nat. Ord.*—Guttiferæ. Another fruit is also known in the West Indies as *mammee.* It is the rusty-brown, oblong-ovoid berry of *Lucuma mammosa*, Jussieu, of the *Nat. Ord.*—Sapotaceæ. It has one large polished seed of a yellow-brown color. The pulp of the fruit is sweet and mucilaginous, and of a yellowish or reddish color.

GAULTHERIA.—WINTERGREEN.

The leaves of *Gaultheria procumbens*, Linné (*Gaultiera repens*, Rafinesque; *Gaultheria humilis*, Salisbury).

Nat. Ord.—Ericaceæ.

COMMON NAMES: *Wintergreen*, *Mountain tea*, *Deerberry*, *Teaberry*, *Boxberry*, and improperly as *Partridgeberry* and *Checkerberry*.

ILLUSTRATIONS: Bentley and Trimen, *Med. Plants*, 164; Bigelow, *Medical Botany*, 22.

Botanical Source.—Gaultheria procumbens is a native, suffruticose plant, with a woody, horizontal root or rhizome, often ¼ of an inch in thickness. The stems are several, ascending about 3 inches from the rhizome, round and downy. The leaves are alternate, evergreen, scattered, near the extremities of the branches, coriaceous, shining, oval or obovate, acute at both ends, revolute at the edge, furnished with a few small serratures, each terminating in a bristle. The flowers are few, drooping, axillary, white, on round, downy stalks. Bracts 2, concave and cordate. The calyx is white, cleft into 5 roundish, acute segments. The corolla is urceolate, 5-angled, contracted at the mouth; the limb divided into 5 short, reflexed segments. Stamens 10, rose colored; filaments white, hairy, bent toward the corolla; anthers oblong, orange colored, ending in 2 double horns, bursting outwardly for their whole length above the filaments; pollen white. The ovary is roundish, depressed, and 5-angled, resting on a reddish, 10-toothed, glandular disk; style erect and straight; stigma simple. The fruit is a small, 5-celled, many-seeded capsule, invested with the calyx, which becomes large, round and fleshy, having the appearance of a bright scarlet berry.—(L.)

Fig. 117.

Gaultheria procumbens.

History, Description, and Chemical Composition.—This plant is a native of the United States, growing from Maine to Florida, and westward to Pennsylvania and Kentucky, in cool, damp woods, sandy soils, and on mountains, flowering from June to October. It does not grow in alluvial soil, nor in limestone countries. The leaves are medicinal, yet the whole plant may be used; the leaves have a peculiar fragrance and an agreeable, characteristic flavor, with a slight astringency; the berries possess a similar flavor with sweetness, and are eaten by many; some wild animals, as deer, partridges, etc., use it for food. Water, by infusion, and alcohol extract the virtues of the plant. The leaves contain an odorous volatile oil, which may be obtained in the same manner as oil of peppermint. The specific gravity of the oil is 1.173 at 10° C. (50° F.). It is colorless at first, but subsequently becomes more or less of a pinkish color, has a hot and aromatic taste, possesses acid properties, and is soluble in alcohol or ether (see *Oleum Gaultheriæ*).

Mr. J. Oxley, in 1872, found the leaves to contain glucose, chlorophyll, gum, tannic acid, a body analogous to gallic acid, but not yielding pyrogallic acid upon heating, and principles found also in uva ursi and chimaphila, viz.: *Arbutin*, *ericolin* and *urson*. A quantitative proximate analysis of the leaves made by F. W. Droelle (*Amer. Jour. Pharm.*, 1887, p. 289) largely confirmed these results.

Volatile oil was found to the extent of ½ per cent. Gaultheria procumbens was ascertained by Prof. Power and N. C. Werbke to be free from *andromedotoxin*, a neutral poisonous principle present in several plants of the natural order Ericaceæ (see *Amer. Jour. Pharm.*, 1889, p. 361).

Action, Medical Uses, and Dosage.—Wintergreen possesses stimulant, aromatic, and astringent properties. It is used in infusion as an astringent in *chronic mucous discharges*, as a diuretic in *dysuria*, as an emmenagogue, as a stimulant in cases of *debility*, and is said to augment the flow from the lactiferous vessels of nursing women, but this is doubtful. It is also recommended as a valuable remedy for *articular* and *muscular rheumatism.* The infusion and the essence both relieve *irritation of the urethra* and *bladder*, and are adapted to the incipient stages of *renal inflammation. Tubal nephritis* is alleged to have been arrested by it even when examination has revealed in the urine the presence of blood corpuscles and tube casts (Webster). Scudder recommends it in *spermatorrhœa* with increased sexual excitement, and as a sedative in *irritation* and *inflammation of the urethra, prostate gland* and *bladder.* The volatile oil (see *Oleum Gaultheriæ*), or its tincture, is used to render syrups and other preparations more agreeable. The oil allays the pain of *carious teeth*, and large doses of it administered internally have caused death by producing inflammation of the stomach; the essence of wintergreen is a carminative, and is sometimes used in the *flatulent colic* of infants. An infusion of the leaves or whole plant (℥j to water Oj) may be drunk freely. Dose of essence, 1 to 30 drops; of specific gaultheria, 1 to 20 drops.

Specific Indications and Uses.—Cystic and prostatic irritation, undue sexual excitement, renal inflammation (early stage).

Related Species.—*Gaultheria hispidula*, or *Cancer wintergreen*, is supposed to be efficient in removing the carcinomatous taint from the system; used also in *scrofula* and *prolapsus uteri.*

Melastoma Ackermanni.—Colombia. Yields an oil probably identical with oil of wintergreen (methyl salicylate). Used provincially as an anti-neuralgic.

GELATINA.—GELATIN.

Purified glue prepared by boiling gelatinous animal tissues in water, evaporating and drying the product in the air. Carefully selected fresh bones are preferred.

Synonyms: *Gelatine, Artifical isinglass, Glutin.*

Source and History.—Gelatin is found in abundance in various animal substances, especially in the skin, cartilages, tendons, membranes and bones. The common gelatin of commerce, called *glue*, is made from trimmings and scraps of skins, ears, bones and hoofs of animals. It may be obtained by boiling these animal parts in water, straining the decoction, and evaporating it until it forms a jelly on cooling. This is divided into thin slices of various sizes, which are allowed to dry in the open air. The purest variety of gelatin is obtained from the air bladder of fishes—*e. g.*, the sturgeon and codfish—and is named isinglass (see *Ichthyocolla*). The gelatin used for culinary and pharmaceutical purposes, in photography, etc., usually called *gelatin* proper, is carefully prepared from the bones of animals from which the fat is previously removed and the earthy matter dissolved out by means of hydrochloric acid. (For a detailed description of the processes of manufacture involved, see Prof. S. P. Sadtler, *Ind. Org. Chem.*, 1895, p. 334.) Gelatin may also be obtained from the vegetable kingdom, viz.: From certain species of sea weeds in Asiatic waters (see, for example, *Agar Agar*).

Description and Chemical Composition.—Glue (*Colla*). Glue of good quality is firm and friable, not easily pulverized, of a light-brown color, and translucent. On the addition of water it becomes soft and swells up, but does not dissolve except the water be hot or boiling. When dissolved in hot water, it is much in use for uniting wood and various other substances together, but is too impure for internal employment or for a chemical test. Addition of acetic acid, or boiling with dilute nitric acid, has the effect of destroying the gelatinizing power of gelatin, while its adhesive properties are fully retained. A cement or liquid glue is thus obtained, which does not require the aid of heat to render it fit for use. A strong, liquid glue, very convenient for a number of objects, and even for porcelain, glass, and pearl, and which is preferable to that made with vinegar or nitric acid, is prepared as follows: To 3 parts of strong glue well bruised add 8 parts of water, and allow them to remain in contact for several hours; then add ½ a part of hydrochloric acid, and ¾ of a part of sulphate of zinc. Expose the whole for 10 or 12 hours to a temperature of 80° to 90° C. (176° to 194° F.).

GELATIN appears in commerce in thin, rectangular, transparent sheets, variously marked by impressions received from the nets upon which the moist jelly is spread in order to dry. It also occurs in smooth, transparent pieces, or in thicker, opaque, porous pieces. It is not so thick as pieces of glue. Gelatin comes also in shreds and is often artificially colored. After digestion in hot water it should develop no odor nor should it change color. Dried gelatin, when dissolved in 100 parts of hot water, solidifies in the form of a tremulous jelly upon cooling. Prolonged boiling of the aqueous solution causes it to lose its gelatinizing properties.

Gelatin differs from albuminous bodies in not coagulating in aqueous solution on boiling, nor being precipitated by nitric acid or potassium ferrocyanide. Its aqueous solution is precipitated, however, by alcohol and by tannic acid. Upon the latter reaction depends the conversion of hide into leather in the process of tanning. Two proximate principles may be distinguished in various forms of gelatin: *Glutin*, or gelatin proper, which is the gelatinous principle of tendons, hides, and the larger bones; and *chondrin*, which occurs mostly in the cartilages of the ribs and joints and the young bones while yet soft (S. P. Sadtler). *Glutin* has all the aforenamed properties of gelatin, and has a greater adhesive power than chondrin, swelling up in cold and dissolving in hot water, forming a jelly upon cooling. When boiled with diluted sulphuric acid or alkali, *glycocoll* ($C_2H_5NO_2$) and *leucin* ($C_6H_{13}NO_2$) are chiefly produced. The former substance is not formed with chondrin. Dry distillation yields bases of the fatty and the *pyridine* series. *Chondrin* is precipitated by alum, lead acetates and metallic salts, not by corrosive sublimate, while *glutin* is precipitated by corrosive sublimate, but not by lead acetates, nor by alum or ferric chloride T.S.

Action and Medical Uses.—Gelatin probably does not affect the growth of the bodily structures. In the form of jellies it has been used during convalescence, but the nutrition derived from these preparations is believed to be due to the sugar, etc., usually employed in preparing them. Gelatin may act as a protective in rectal enemas, in the treatment of *skin affections*, and in cases of *poisoning by corrosive substances.* Medicated gelatin (see *Gelanthum*) is now used to some extent in the treatment of *skin diseases*, particularly those of an *eczematous type*, and in the treatment of *catarrhal affections of the nasal passages.*

Gelatin has been introduced here, in consequence of its application in pharmacy, for the purpose of promoting certain useful indications. Several remedial agents of a valuable character, are unfortunately so repulsive to the palate as to produce nausea and vomiting whenever swallowed, and, as in many instances, it is almost impossible to dispense with them, an important object is to prepare them so that they may reach the stomach without offending the organs of taste. This has been effected by inclosing the medicine in a case or cover of gelatin, forming what are called *gelatin capsules*, invented in France by M. Mothe. There are several methods at the present day for making these capsules; thus the end of an iron rod is made bulbous or egg-shaped, and is highly polished; being slightly oiled it is dipped into a hot, concentrated solution of 3 parts of pure gelatin, ½ part of sugar, and 6 parts of water. A number of rods are generally used. The rods are then rotated to spread the solution evenly over the mold or bulb, and placed, bulb upward, on a board perforated for the purpose; when cool and dry they may be removed by giving to the capsule or bulb a pulling and gently twisting motion. These are then filled with the medicine, and the orifice closed over with more of the gelatin solution. Sometimes animal membrane, or fine skin, distended with mercury, is used instead of the iron bulb. (For a detailed method of preparing gelatin capsules, see standard works on pharmacy and *Amer. Jour. Pharm.*, Vol. IX, p. 20). In this way capsules may be made to contain from 10 to 20 grains of liquid. Since the foregoing appeared in former editions of this Dispensatory, commercial empty capsules of all sizes have become a standard article of commerce. When received into the stomach the gelatin is dissolved, allowing the medicine to accomplish its therapeutical influences. If *soft capsules* are demanded a little glycerin added to the gelatin will make the product elastic. Capsules are now largely employed for dispensing quinine and similar medicines of unpleasant taste. These capsules are oblong, rounded and closed at one end, and cut off and open at the other end. It is only necessary to introduce the powder and slip a second capsule over the open end of the filled one. *Folding* or *devorative capsules* are thin films of gelatin designed to be used like powder-papers, except that after folding upon the powder the edges are made to adhere by moistening them. When ready to be taken the whole capsule (and powder) is dipped in water until softened, and then swallowed. *Medicinal pearls* of gelatin, combined with sugar, acacia and honey, are also employed to enclose ether and similar fluids. Gelatin (3 parts) and glycerin (7 parts) is sometimes used as a basis for *bougies* and rectal and vaginal *medicated suppositories.* Gelatin is also used for making *court-plaster*, *hectographs*, for *coating pills*, and for estimating the amount of tannin contained in a drug or preparation.

A good paste is made by dissolving best white glue, 3 ounces (av.); refined sugar, 1½ ounces; water, 10 fluid ounces, or a sufficient quantity, together by the aid of a water-bath, and, while warm, apply it by means of a suitable brush to the reverse side of the labels while uncut or in sheets. After being dried and moderately pressed they are ready for cutting. Thick paper and not sized will require less water than when thin and well sized, and in all cases it should be quickly and evenly applied. It can only be used while warm. It does not penetrate the paper and disfigure the labels, is very adhesive, never loosens from glass and leaves no disagreeable impression in the mouth after being moistened with saliva.

GELATINUM CHONDRI (N. F.)—IRISH MOSS GELATIN.

Preparation.—*Formulary number*, 184: "Irish moss, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; water a sufficient quantity. Wash the Irish moss with cold water, then place it in a suitable vessel, and add fifty thousand cubic centimeters (50,000 Cc.) [about 106 pints] of hot water, and heat it on a boiling water-bath for 15 minutes, frequently stirring. Strain the decoction, while hot, through a strong muslin strainer; return the strained, mucilaginous liquid to the water-bath, evaporate it to a semi-fluid consistence, then transfer it to shallow, flat-bottomed trays, and evaporate it at a temperature not exceeding 90° C. (194° F.), so that the gelatin may become detached in scales. *Note.*—Irish moss gelatin thus prepared furnishes a mucilage of Irish moss which is opaque, like that made directly from the moss itself. It may be prepared so as to yield a transparent mucilage by following the plan pointed out in the *Note to Mucilago Chondri* (F. 275)"—(*Nat. Form.*).

Action and Medical Uses.—(See *Chondrus.*)

GELSEMIUM (U. S. P.)—GELSEMIUM.

The rhizome and roots of *Gelsemium sempervirens* (Linné), Persoon. (*Gelsemium nitidum*, Michaux; *Gelsemium lucidum*, Poiret; *Bignonia sempervirens*, Linné; *Anonymos sempervirens*, Walter; and *Lisianthus sempervirens*, Miller).

Nat. Ord.—Loganiaceæ.

COMMON NAMES: *Yellow jasmine, Yellow jessamine, Wild woodbine, Carolina jasmin* or *jessamine.*

ILLUSTRATIONS: Johnson, *Med. Bot. of N. A.*, Plate 7; Meehan, *Native Flowers and Ferns*, I, 9; Bentley and Trimen, *Med. Plants*, 181; Millspaugh's *Amer. Med. Plants*, Plate 130.

Botanical Source.—The Yellow jasmine is a handsome climber growing along banks and in lowlands and woods. The stem is smooth and twining; the leaves opposite, entire, ovate, or lanceovate, nearly evergreen, being dark-green, smooth, and shining on top; paler beneath. The flowers are in axillary clusters, showy, and of deep-yellow color, and emit an agreeable, but rather narcotic odor.

The calyx is 5-parted and very small, with acute, lanceovate lobes. The corolla is ¾ to 1½ inches long, with 5-lobed margin; stamens 5, half as long as the corolla, and inserted on it. The style is longer than the stamens, and supports two 2-parted stigmas. The fruit is an elliptical pod, 2-celled, 2-valved, and many-seeded. The seeds are flat, and attached to the margins of the valves. Owing to its evergreen leaves, fragrant flowers, and the shade it affords, it is extensively cultivated in the gardens of the South for ornamentation.

Fig. 118.

Gelsemium sempervirens.

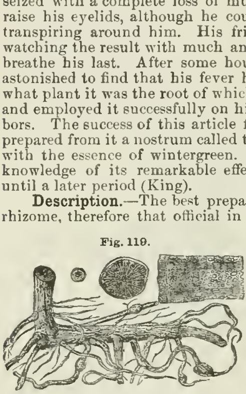
History.—This strikingly beautiful climber, peculiar to our southern cities, furnishes one of the most valued and universally used Eclectic remedies. It is a twining vine, flourishing in great profusion from Virginia to Florida, hanging in festoons from the neighboring trees and shrubs, sometimes growing to the height of 50 feet. The average height, however, is from 20 to 30 feet. The plant blooms in early spring—in Florida during March, and in Mississippi and Tennessee in May and June. During the flowering period it perfumes the air with a delightful fragrance similar to that of the true jasmine. When the vine is abundant, the odor of the flowers is said to be almost overpowering. Gelsemium is known by several popular names, as Yellow jessamine, Yellow jasmin, Carolina jessamine, Carolina jasmin, and Wild woodbine. The name gelsemium was given it by Jussieu, and is derived from the Italian *gelsomina*, meaning jasmine. The plant, however, resembles the true jasmine only in its fragrance, and belongs to an entirely different natural order. Mr. E. M. Holmes (*Pharm. Jour. Trans.*, 1875, p. 481) states that it is rather unfortunate that it should often be called the Yellow jessamine in America, since there is a true jessamine (*Jasminum fruticans*, Linné) with yellow flowers, which is often found in cultivation. If the name jessamine be applied to *Gelsemium sempervirens* at all, it should be carefully distinguished as the *Carolina jessamine* (see also Dr. A. R. L. Dohme, in *Drug. Circ.*, 1897, p. 179). Gelsemium was formerly known botanically as *Bignonia sempervirens* of Linnæus, and the *Gelsemium nitidum* of Michaux and Pursh. The name *gelsemium*, as used exclusively by Eclectics, arose from a typographical error, and was widely copied in various writings, and accepted as authority before the mistake was discovered (see Prof. J. U. Lloyd, in *Ec. Med. Jour.*, for March, 1892).

While gelsemium is one of our best remedies, yet, like iris, phytolacca, and other plants, it suffers from worthless representatives on the market. These preparations, made from old, dried material, will fail to fulfil the expectations of he who administers them for the specific effect. Specific gelsemium, the preparation employed by Eclectic physicians almost exclusively, fully represents the plant. Prof. J. U. Lloyd informs me that, in the preparation of specific gelsemium, the green root only is used. It is gathered in February or in early spring, cut into small pieces, put in barrels, and to the contents of each barrel is added 10 gallons of alcohol. In this condition it is shipped from the Carolinas (where it is gathered) to Cincinnati. On arrival, it is dumped into the drug mill and ground, alcohol and all, and from this material the specific medicine is made. He further states that, in one season, when the winter was uncommonly mild, the continuous growth of the plant caused a large amount of albuminous material to form in the root, and that preparations manufactured from such a product threw down an unsightly albuminous precipitate, which, though it did not impair the therapeutic value of the preparation, rendered it unsalable.

This plant was brought into notice, as far as we can learn, in the following manner: A planter of Mississippi, whose name we have forgotten, while laboring under a severe attack of bilious fever, which resisted all the usual remedies, sent a servant into his garden to procure a certain medicinal root, and prepare an infusion of it for him to drink. The servant, by mistake, collected another root, and gave an infusion of it to his master, who, shortly after swallowing some of it, was seized with a complete loss of muscular power, unable to move a limb, or even raise his eyelids, although he could hear, and was cognizant of circumstances transpiring around him. His friends, greatly alarmed, collected around him, watching the result with much anxiety, and expecting every minute to see him breathe his last. After some hours, he gradually recovered himself, and was astonished to find that his fever had left him. Ascertaining from his servant what plant it was the root of which acted in this manner, he collected some of it, and employed it successfully on his own plantation, as well as among his neighbors. The success of this article finally reached the ear of some physician, who prepared from it a nostrum called the "Electrical Febrifuge," which was disguised with the essence of wintergreen. This plant was the Yellow jessamine, and a knowledge of its remarkable effects was not communicated to the profession until a later period (King).

Description.—The best preparations of gelsemium are made from the green rhizome, therefore that official in the *U. S. P.* is not adapted to the uses of the Eclectic pharmacist and doctor. That work simply states the "*rhizome and roots*," without specifying whether green or dried, hence it is to be inferred that the dried root is the one intended. For the sake of completeness we give the official description:

Fig. 119.



Rhizome of Gelsemium sempervirens.

"Cylindrical, long, or cut in sections, mostly from 5 to 15 Mm. ($\frac{1}{5}$ to $\frac{3}{5}$ inch), and occasionally 3 Cm. ($\frac{1}{5}$ inch) thick, the roots much thinner; externally light yellowish-brown, with purplish-brown, longitudinal lines; tough; fracture splintery, bark thin, with silky bast-fibres, closely adhering to the pale-yellowish, porous wood, which has fine, medullary rays, and in the rhizome a thin pith, odor aromatic, heavy; taste bitter"—(*U. S. P.*). Gelsemium yields its virtues to water or alcohol. The rhizome is several feet in length (roots in Fig. 119 are cut off), with scattered fibers, and is from 2 to 3 lines in diameter to nearly 2 inches. The internal part is woody, and of a light-yellowish color; the external part, or bark, in which the medicinal virtues are said principally to reside, is of a light snuff-color, and from $\frac{1}{2}$ to 3 lines in thickness. The root of this plant has been said to contain a resin which is poisonous in very small doses, and a tincture, made by digesting it in undiluted alcohol, is stated to have proved fatal. This statement is denied, and upon good grounds, for, were it true, death would necessarily follow the use of the tincture made with undiluted alcohol, in consequence of the presence of this resin, which would still be taken up by alcohol in a proportion corresponding to the alcoholic strength of the solvent. Again, it has been asserted, that the deaths, which have occurred where the article was used, were owing, not to the gelsemium, but to the presence of another very poisonous root, somewhat resembling it, which was carelessly or ignorantly collected and mixed with it. Others again, state that they have given large doses without any serious consequences, and, in one case, 6 fluid drachms of the tincture were swallowed by a lad of 20 years of age, without any permanent injury. Notwithstanding these statements, death has followed the employment of what was supposed to be the tincture of gelsemium, in a few instances, and further investigations are required to determine its probable cause, and whether this agent will produce any fatal results in large medicinal doses. Yellow jessamine may be administered in decoction, infusion, or tincture.

Dr. Hiram H. Hill, formerly of the late firm of F. D. Hill & Co., of Cincinnati, has collected many hundred pounds of the gelsemium root in the South. I am indebted to him for the following statement of it: "The length of the gelsemium root, in clay soil, is from 3 to 10 feet, and on the Magnolia ridges, and along small streams, I have traced some roots to the extent of 30 feet, although the average length is about 15 feet. Like the roots of many other vines, it is branching, with scattered fibers, and runs horizontally near the surface of the ground, sometimes merely under the leaves, for several feet. When first pulled up it is very yellow, and has a peculiar odor like that of the tincture, with a bitter, rather pleasant taste to most persons, at least people were constantly tasting or chewing it, while I was collecting it. The vine is of a green color, and always runs to the top of the tree or bush on which it fastens, then branches out, covering the topmost branches with its thick foliage. I have seen it on trees that were 50 feet in height, and the size of the vine was the same near the top as at the ground; its general length is from 20 to 30 feet. The bark of the vine is full of a silk-like fiber, which is not found in other vines that I have seen. On old vines, the leaves are about 1½ inches in length, of a dark-green color, lance-shaped, and on short foot-stalks; on young vines or shoots they are longer, and are 4 or 5 inches apart, while on the old ones they are very close and always opposite. The flowers are funnel-shaped and yellow. The vine, the root of which is sometimes gathered by mistake for the gelsemium, resembles it very much in appearance, though it is of a lighter color, and the outer bark is covered with white specks or marks somewhat similar to those on young cherry or peach limbs, and the lower parts of the old vines become rough, and have small tendrils that fasten upon the bark of trees, and which are never seen on the gelsemium. The bark of the vine is also more brittle, and the leaves are always on long foot-stalks, which are opposite, at the end of which are two opposite leaves, almost exactly resembling the leaf of the *Aristolochia Serpentaria*. The root is almost white, very tough, brittle when dry, not so fibrous as the true root, straight, about the same length of the medicinal root, and has a slightly bitter, disagreeable, nauseating taste. I never saw any of the flowers, though they are said to resemble the others in shape, but are pale, dirty-white, with a slight unpleasant odor, by no means like that peculiar to gelsemium. The vine is called *White poison vine* and *White jessamine*" (King).

Chemical Composition.—Mr. Henry Kollock, in 1855 (*Amer. Jour. Pharm*,. Vol. XXVII, p. 197), found, beside the usual constituents of plant roots, a volatile oil, a dry, acrid resin (the *gelsemin* of the older Eclectics, see later), and a bitter, crystalline, alkaloidal substance which he named *gelseminia*. Prof. Maisch and C. L. Eberle (*Amer. Jour. Pharm.*, 1869, p. 35) again obtained this alkaloid; the latter stated its being absent from the wood of the root, which was later confirmed by Gerrard. In 1870 (*Amer. Jour. Pharm.*, p. 1), Prof. Th. G. Wormley, examining a fluid extract of the root, discovered therein a crystallizable acid, which he called *gelseminic* (or *gelsemic*) *acid*, and which is remarkable for the beautiful blue fluorescence exhibited by solutions of the acids in aqua ammoniæ or other alkalies, even when highly diluted. Chas. A. Robbins, in Prof. Sonnenschein's laboratory (*Amer. Jour. Pharm.*, 1876, p. 191), found gelsemic acid to be non-nitrogenous, and pronounced it to be identical with *æsculin*, the characteristic glucosid of horse chestnut bark. Prof. Wormley (*Amer. Jour. Pharm.*, 1882, p. 337) and recently, Prof. V. Coblentz (*Proc. Amer. Pharm. Assoc.*, 1897, p. 225) proved, however, that gelsemic acid and *æsculin* presented some striking differences in solubilities, etc., and could not, therefore, be identical. In this connection, it may be said that, 15 years ago, Prof. F. A. Flückiger, from gelsemic acid made for him by J. U. Lloyd, and æsculin made by himself, established that they presented certain differences. He communicated his results by letter to Mr. Lloyd, but they were not published to our knowledge. More recently, Prof. E. Schmidt (*Archiv der Pharm.*, 1898, p. 324) has clearly proved the identity of gelsemic acid with the known substance *beta-methyl-æsculetin* ($C_{10}H_8O_4$). In harmony with this result are the researches of Prof. Coblentz, who gave experimental proof of the fact that gelsemic acid contains two hydroxyl groups, which agrees with the constitution of that substance identified by Prof. Schmidt. More doubt exists with regard to the alkaloidal principle, owing to the difficulty of obtaining it in crystallized form. Sonnenschein and Robbins (1876) gave it the formula $C_{11}H_{19}NO_2$, while A. W. Gerrard (*Amer. Jour. Pharm.*, 1893, p. 256), evidently obtaining it in much purer form (from the purified hydrochloride), finds $C_{12}H_{14}NO_2$. L. Spiegel's results

(1893) agree with the latter formula. Finally, Mr. F. A. Thompson (laboratory of Parke, Davis & Co.) (*Pharm. Era*, 1887, p. 3) believes that, besides this alkaloid, which he calls *gelsemine*, there exists another in gelsemium root, which he calls *gelsiminine;* its hydrochloride is more easily soluble in water than that of the first alkaloid. Gelsemine is believed to act as a paralyzing, gelseminine as a tetanizing, medium. A. R. Cushny (*Ber. d. Deutsch. Chem. Ges.*, 1893, p. 1725) corroborates the existence of the two alkaloids mentioned.

Wormley (*Amer. Jour. Pharm.*, 1877, p. 150) gives the following directions for obtaining from the fluid extract of gelsemium root the alkaloid, *gelseminine* (*gelsemine*), and *gelsemic acid:* Acidulate the fluid extract with acetic acid; add this slowly to 8 times its bulk of water, filter from the resins, concentrate the filtrate on the water-bath to somewhat less than the original volume; then abstract gelsemic acid by ether, and, subsequently, the gelsemine by ether or chloroform, after rendering the fluid alkaline with sodium carbonate. In fluid extracts, prepared in the quantity of 480 grains of root to the ounce, Prof. Wormley obtained a yield of 0.2 per cent of gelsemine and 0.4 per cent of gelsemic acid.

Comparative analyses of the rhizome, root, and stem of gelsemium, carried out in the laboratory of Prof. L. E. Sayre (*Amer. Jour. Pharm.*, 1897, p. 234), showed the total absence of the alkaloid and the acid in the stem, while the rhizome contained 0.2 per cent of alkaloid and 0.37 per cent of gelsemic acid, and the root 0.17 per cent of alkaloid and 0.3 per cent of gelsemic acid. The alkaloid, *gelseminine* (*gelsemine* of Thompson), is described by Wormley as a colorless, odorless, intensely bitter, basic principle, and was obtained by A. W. Gerrard in crystalline form. When pure, it exhibits no color reaction with sulphuric and nitric acids, as claimed by Sonnenschein. It is sparingly soluble in water, freely soluble in acids, in chloroform and ether (1 in 25). Its nitrate crystallizes best of all its salts (Spiegel, *Amer. Jour. Pharm.*, 1893, p. 381).

Gelsemic acid (*beta-methyl-æsculetin* of E. Schmidt), according to Prof. Wormley, is a colorless, odorless, nearly tasteless, crystallizable acid, readily dissolving in alkalies with beautiful blue fluorescence; sparingly soluble in cold water (1 in 1000), more easily soluble in hot water; also soluble in chloroform, ether, and alcohol. Its salts formed with heavy metals are soluble, with difficulty, in water.

GELSEMIN, the so-called concentration (resinoid), should not be employed for at least two reasons. First, it is of uncertain strength and quality. Secondly, its name being so similar, both in spelling and sound, to that of the alkaloid, *gelsemine*, that, through mistake, the latter agent might be supplied and serious results follow. Death has resulted from such a mistake, consequently it should be discarded, especially as it is not equal in therapeutic power to the fluid preparations of gelsemium. It may be of interest to state that nearly all of the so-called concentrations (excepting podophyllin) of the earlier Eclectics have been discarded by the Eclectics of the present day, and are now used almost exclusively by the regular school, and especially by European physicians; also, by that class who believe that *all* the virtues of a remedy reside in concentrations and alkaloidal principles. Clinical experience proves that such preparations do not fulfil the indications as do the fluid preparations containing all the soluble medicinal ingredients of the plant.

Action, Medical Uses, and Dosage.—Gelsemium powerfully impresses the nervous system, though in man it never produces convulsions. Convulsions may occur in the lower animals. Small (medicinal) doses relax the muscles, especially the levator palpebræ, and allay nervous irritation. A pleasant or languid sense of ease and relaxation is usually experienced, accompanied in the case of larger doses by a tendency of the lower jaws to drop, and a difficulty in managing the eyelids. Sometimes sensation is lost first; again, and usually, muscular paralysis is the first to take place. The continued administration of it effects the brain (indirectly), spinal centers, and medulla, causing marked feebleness of muscular movements, confusion of vision, and vertigo. Large doses paralyze the spinal cord and cause almost complete loss of muscular power. Reflex action is depressed with the loss of muscular power, and these and the lack of sensibility, which usually takes place, are due to its action upon the spinal marrow. Consciousness may be lost, but it is usually retained even when toxic doses have been taken. When fatal, however, dissolution is usually preceded by loss of consciousness. The characteristic toxic symptoms are palpebral relaxation, disturbance of the ocular muscles, the dropping of the lower jaw, and the profound prostration and muscular relaxation. The pupil dilates, there is drooping of the eyelids (ptosis), and double vision (diplopia). Applied locally to the eye, it dilates the pupils and interferes with the action of the muscles of accommodation. The pulse is slowed to 30 or 40 beats, and there is a marked decrease in temperature. Respiration is at first quickened, then slowed, breathing becomes shallow, and the action upon the heart appears to depend upon the effect upon respiration. As a rule, the mental faculties are not directly affected by it, unless it be due to accumulation of carbon dioxide, the result of respiratory paresis. Occasionally, death results from overdoses, and, when it does so occur, is due to asphyxia. Persons are reported to have been poisoned by eating honey gathered by the bees from gelsemium flowers.

Gelsemium is said to increase the tetanizing power of strychnine. The postmortem appearances after death from gelsemium present nothing specially characteristic. Twelve minims of the fluid extract have been asserted to have killed a boy of 3 years, yet recoveries have taken place from much larger doses. Death from gelsemium usually takes place in from 1 to 8 hours. (For report of two fatal cases, see Taylor's *Med. Jurisp.*, 1892, p. 164.)

In poisoning by gelsemium or its alkaloid, gelsemine, evacuate the stomach by emetics or stomach pump, administer, hypodermatically, morphine and atropine, use friction, internal stimulation, hot drinks, external heat, etc. Tannin and the alkalies and their carbonates are reputed chemically antagonistic. Artificial respiration should be resorted to, and the heart should be sustained by digitalis and similar agents. As but few cases of poisoning by gelsemium have occurred, the antidotal treatment is as yet not well established.

Therapeutically, gelsemium acts upon the cerebro-spinal nerve centers, diminishing the blood supply to them, as in determination of the blood to the head and spine, thereby preventing spasmodic action. Consequently, in *determination of the blood to the brain and spinal cord* and their appendages, or in *inflammatory conditions of the cerebro-spinal system*, the drug would be clearly indicated. It is never the remedy for congestion. Prof. Scudder has pointed out as the specific indications for it: "The flushed face, bright eye, contracted pupils, increased heat of head, great restlessness, and excitation." With these may be associated a general headache. Bearing these indications in mind, the drug will be found useful in the diseased conditions named in this article. Gelsemium was first employed in febrile diseases, as *bilious, remittent, typhoid and malarial fevers*. In these conditions, it was found to have such a marked antipyretic action that it rapidly rose in favor among the earlier Eclectics. More pronounced effects were looked for by the Eclectic fathers than are now known to be most desirable. They regarded it as the only agent ever yet discovered capable of subduing in from 2 to 20 hours, and without the least possible injury to the patient, the most formidable and most complicated, as well as the most simple *fevers* incident to our country and climate, quieting all nervous irritability and excitement, equalizing the circulation, promoting perspiration, and rectifying the various secretions, without causing nausea, vomiting, or purging. They also believed it adapted to any stage of the disease, while the majority of those who now employ it believe it best adapted to the earlier stages of fevers, and seldom of marked value, if not harmful, in the advanced stages, or after the period of excitation has passed. It may follow any preceding treatment with safety. It is best suited to sthenic cases with determination of blood to nerve centers. It is to its controlling influence over nerve irritation that its antipyretic action is mainly due. As soon as its physiological effects are observed, the remedy should be discontinued, lest the relaxation may be too great for the system to recover from. A writer observes that his experience in the treatment of fevers, with this agent, inclines him to believe that when given in doses sufficiently large to produce its full and complete constitutional effects, it impairs the tonicity of the muscular fibers of the heart (which are always weakened in those fevers), and thus retards or prolongs convalescence. Gelsemium is a remedy for elevation of temperature, whether from cold, or due to graver affections, as the fevers above noticed, or whether due to *pneumonia, pleurisy*, or even *puerperal fever*, in which it is often of marked value. Chilly sensations upon moving the body are indications for it, and are usually followed by the high temperature and the stage of excitation, in which the drug has earned its reputation.

Gelsemium possesses a most perfect control over the nervous system, removing nervous irritability more completely than any other known agent. Such agents as passiflora increase its efficiency in this direction. Prof. W. E. Bloyer (*E. M. J.*, 1894, p. 532) writes: "There is a species of *nervousness* that gelsemium always overcomes. The patient says that he is 'nervous.' He is grouchy, touchy, every impulse and feeling, whether painful or pleasant, is magnified or accelerated, and the contracted pupil is not always specially noticeable. If the patient be nervous and without fever or inflammation, give him pulsatilla; with these, give specific gelsemium."

By allaying nervous excitement and restoring the secretions it prepares the system for quinine, for quinine is very frequently associated with gelsemium in the treatment of various conditions. In the *fevers* and *inflammations of children* this irritation is often marked, and frequently results in *convulsions*. These cases are promptly relieved by gelsemium, which, as an antispasmodic, is second to no other drug. Its power is well displayed in *convulsions from dentition*, and in like conditions from *inflammatory states of the digestive tract*, as *enteritis*, *gastro-enteritis*, especially in *bowel troubles of the second summer*, as *cholera infantum*, *diarrhœa*, and *dysentery*. Its powerful antispasmodic action makes it especially applicable to hysterical females. In *hysteria*, begin with 1 drop and increase until the muscles relax and diplopia results. In *convulsions*, with cramping rigidity of the muscles, give gelsemium until its physiological effects are produced. *Neuralgia*, with powerful nervous twitching, is relieved by it. *Toothache*, from peridental inflammation, is relieved by it as well as that form of toothache frequently accompanying pregnancy. It is a good agent in *facial neuralgia* from nerve excitation and darting pain, from cold, or from dental caries. Administer in drop doses. *Insomnia* is often relieved by gelsemium. It is prominent as a remedy for *pain*, though the specific indication (nervous tension) should be present or the remedy will be likely to fail. There must also be evidence of increased circulation—hyperemia of the part. In *headache*, with active circulation, and especially from *eye strain*, in *migraine*, in *nervous headache*, and in *myalgia*, administer small doses. It also benefits *bilious headache* and *tic-douloureux*. For *ovarian neuralgia* full doses are necessary. It benefits *intercostal neuralgia* and *sciatica*. It relieves the tenesmus of *dysentery* and other *spasmodic conditions of the bowels*. It is a valuable agent in *chorea*, and it has been used with marked success in *epilepsy* and *tetanus*, its effects in the latter affection having been very favorable. In *spasmodic conditions of the urinary tract* it is frequently indicated. It produces relaxation during the passage of *renal calculi*. Scanty flow of urine, with irritation of urinary passages, calls for gelsemium. It should generally, unless specially contraindicated, be given previously to or with the indicated diuretic, when *urinal suppression* is due to renal or cystic irritation (not congestion). It is *the* remedy for *dysuria* from *spasmodic urethral stricture*. Hot applications to the loins and back aid its action. It acts promptly in the *retention of urine* in the hysterical woman. It is a good remedy in *gonorrhœa*, and some cases of *spermatorrhœa* in plethoric subjects have been cured by it, though as a rule it is far less serviceable than other agents in nocturnal emissions. One of its early uses was for gonorrhœa, for which it was thought to be almost specific. For the early inflammatory stages of this affection, with tendency to *chordee*, no agent is more prompt than gelsemium. It is frequently given with aconite and cannabis indica for this purpose. Gelsemium quickly relieves the tenesmic pain, ischuria, etc., of *irritative catarrhal conditions of the bladder*. *Inflammation of the kidneys, bladder* or *urethra*, are relieved by gelsemium. In *puerperal convulsions* it has probably been used oftener than any other remedy, excepting morphine and chloroform.

In the pelvic disorders of women it is a favorite remedy. With the usual indications it subdues *ovaritis*, *metritis*, and *salpingitis*. Severe *dysmenorrhœa* with colicky pains, and *uterine colic* are promptly relieved by large doses of it. *Rigid os uteri*, with thin, unyielding edges, and a dryness of the parts, is relaxed by gelsemium. In fact, it relaxes all sphincters. By rectifying such complications it facilitates *labor*. Free doses should be administered. Gelsemium, alone or combined with pulsatilla, is invaluable to overcome the marked restlessness evinced by some parturients, and gelsemium will often retard a labor that has begun before the parts are ready for the ordeal, particularly when the woman is excessively excitable and nervous, and the pains are spurious, or at least jerky and ineffectual. The *nervous tension* following accouchement is quickly relieved by this drug. *After-pains* are controlled by it, and it is serviceable in some forms of *leucorrhœa*.

By blunting peripheral sensibility it allays the itching of *eczema*, and locally applied (diluted) is serviceable in *prurigo*. *Delirium tremens*, *mania*, and *paralysis* have been treated successfully with this drug. It has also been employed to some extent as a mydriatic in eye practice. Prof. King derived considerable advantage from gelsemium in *conjunctivitis*, *muscular asthenopia*, *iritis*, and in *tinnitus aurium*, administered in small doses every 3 or 4 hours; being extremely careful not to carry the influence of the agent to depression or relaxation. Dr. J. Parrish, of Philadelphia, derived the greatest benefit from the administration of this drug, in cases of *habitual drunkards* and *opium eaters*. *Gastro-intestinal irritation* and *irritative dyspepsia*, with feeling of rawness, heat, and pain, with a sensation of knotty contraction in the stomach, call for gelsemium. In the *exanthemata* this remedy is often indicated by the great heat and restlessness. It is nearly always called for in *cerebro-spinal meningitis*. In the recent epidemics of *influenza* (*la grippe*) probably no one remedy was more extensively used, or oftener indicated. Where there were persistent high temperature and headache, with great excitability, it acted promptly and kindly. Gelsemium has been used quite extensively in *whooping-cough*, *spasmodic cough*, *spasm of the glottis*, *asthma*, and the *cough of hysteria*. In *excessive action of the heart*, especially in hysterial subjects, it is often serviceable. Gelsemium has also proved beneficial in *vertigo*, *hemorrhages*, *ague-cake*, *gout* and *rheumatism*, in the latter disease aiding some of the antirheumatic remedies. *Bronchitis*, *laryngitis* and *albuminuria* have also been successfully treated with gelsemium. Externally, gelsemium will be found of service in *neuralgic* and *rheumatic pains*. The usual prescription is from 5 to 15 drops of specific gelsemium in 4 ounces of water. Dose, a teaspoonful. For the larger doses begin with 1 drop, and administer cautiously until the physiological effects are apparent. Dose of specific gelsemium, $\frac{1}{10}$ drop to 10 drops.

Specific Indications and Uses.—Gelsemium is indicated by bright eyes, contracted pupils, flushed face, great heat, and restlessness; mental irritability; insomnia, with excitation; pain over the whole head; dysuria, with scanty secretion of urine; irritation of the urinary tract; pinched, contracted tissues; thin, dry, unyielding os uteri, with dry vaginal walls; arterial throbbing and exalted sensibility; chilly sensations upon motion; hyperemia; and convulsions.

GENISTA.—GENISTA.

The young branches and leaves of *Genista tinctoria*, Linné.

Nat. Ord.—Leguminosæ.

Common Names: *Dyer's green-weed*, *Wood-waxen*, *Green weed*, *Dyer's broom*, *Dyer's weed*.

Botanical Source and History.—This plant is an erect shrub, about a foot high, and is a native of Central Europe. It is quite common in poor soil throughout England, and has been naturalized, and grows abundantly, in a few localities of the eastern United States. The stem is short, woody, and sends up numerous erect branches. The leaves are simple, a character distinguishing the plant from most of the native leguminous plants. They are narrowly lanceolate, acute, entire, sessile, alternate, and attached to the stem at an acute angle. The flowers are numerous, bright yellow, and are borne in terminal, showy racemes. The calyx is 2-lipped, with a deeply 2-lobed upper, and a 3-lobed lower lip. The corolla is papilionaceous, and the 10 stamens are united into a complete tube at the base. The fruit is a flat, several-seeded pod.

There are three English species of Genista, two unarmed; *G. tinctoria*, with smooth, and *G. pilosa*, with hairy, leaves. The armed species, *G. anglica*, has sharp, simple thorns. The leaves of *G. purgans*, a native of France, are used as a cathartic.

Little is known of the chemical history of the several species of *Genista*. Dr. Plugge (*Jahresb. der Pharm.*, 1895, p. 134), investigating the occurrence of the alkaloid *cytisine* in various species of Papilionaceæ, found *Genista tinctoria* and *G. pilosa* to be free from this substance. Genista tinctoria has been in some little repute as a medicine since the day of Culpepper. The flowers yield an inferior yellow dye. The dried plant possesses scarcely any taste. It must not be confused with *Broom tops* (*Scoparius*).

Action, Medical Uses, and Dosage.—Both the flowers and the seeds have been employed in medicine, in *dropsical affections*, and with considerable efficacy. Sixty grains of the powdered seeds produce active catharsis, and even emesis, and is the dose generally advised in *dropsy*. An infusion of the flowers has been advantageously employed in *gout* and *rheumatism*, and is also stated to have been successful in several cases of *albuminuria*, in doses of 2 tablespoonfuls every 1 or 2 hours. Probably a tincture would be found more available. Formerly this plant had an unmerited reputation for the prevention, as well as the cure, of *hydrophobia*.

Specific Indications and Uses.—"Ascites, and œdema with cutaneous disease, or erosion of the skin with exudation" (Scudder, *Spec. Med.*).

GENTIANA (U. S. P.)—GENTIAN.

"The root of *Gentiana lutea*, Linné"—(*U. S. P.*).

Nat. Ord.—Gentianeæ.

COMMON NAMES: *Gentian, Gentian-root.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 182.

Botanical Source.—This plant has a long, thick, cylindrical, wrinkled, ringed, forked, perennial root, brown externally, and yellow within. The stem is 3 or 4 feet high, hollow, stout, and erect. The radical leaves are ovate-oblong, 5-nerved, and 2 or 3 inches broad; those on the stem sessile, ovate, and acute; those next the flowers cordate, amplexicaul, and concave; all are a pale, bright-green. The flowers are large, bright-yellow, in many-flowered whorls, and peduncled; the calyx is monophyllous, of a papery texture, semitransparent, 3 or 4-cleft, with short, lanceolate, unequal segments. The corolla is rotate, with a very short tube, 5 or 6 green glands at the base, 5 or 6-parted, with oblong, acute, narrow, veiny lobes; the stamens, 5 or 6 in number, are not so long as the corolla; the anthers are subulate, somewhat united, becoming distinct; the ovary conical; the stigmas sessile and revolute; the capsule stalked, oblong, 2-valved, and 1-celled, and the seeds are many and flattened, with thin, brownish edges (L.).

Fig. 120.

Gentiana lutea.

History and Description.—This plant is common to the central and southern parts of Europe, especially the Pyrenees, Alps, etc., being found from 3,000 to 5,000 feet above the level of the sea. Its root affords the medicinal portion, and is brought to this market from Havre, Marseilles, etc. The *U. S. P.* describes it as follows:

"In nearly cylindrical pieces or longitudinal slices, about 25 Mm. (1 inch) thick, the upper portion closely annulate, the lower portion longitudinally wrinkled; externally deep yellowish-brown; internally lighter; somewhat flexible and tough when damp; rather brittle when dry; fracture uneven; the bark rather thick; separated from the somewhat spongy meditullium by a black cambium line; odor peculiar, faint, more prominent when moistened; taste sweetish and persistently bitter"—(*U. S. P.*).

The root imparts its virtues readily to cold or hot water, alcohol, or sulphuric ether. A liquor prepared from it in some parts of Switzerland is much prized as a stomachic; it is made by macerating the root in cold water, adding some sugar, yeast, and distilling after vinous fermentation has occurred. Flückiger (*Pharmacognosie*, 1891), states that as a consequence of this use, the plant has almost disappeared from some parts of Switzerland.

Chemical Composition.—The following three proximate principles are the characteristic constituents of gentian root: *Gentiopikrin*, of Kromayer (1862), to which the root owes its bitterness; *gentisin*, of Hlasiwetz and Habermann (1875), a yellow, tasteless substance, whose reactions with ferric chloride seem to have been mistaken for those of tannin (see Maisch, *Amer. Jour. Pharm.*, 1876, p. 486, and 1880, p. 1); and *gentianose*, of Arthur Meyer (1882), a crystallizable, fermentable sugar, not reducing Fehling's solution, and which occurs in the fresh root only. The root also contains a volatile oil to which its odor is due; fatty and resinous matter, uncrystallizable sugar, large quantities of mucilage, about 8 per cent of ash, but no starch. Drying the root seems to have the effect of increasing the resinous matter (Flückiger, *Pharmacognosie*, 1891).

GENTIOPIKRIN ($C_{20}H_{30}O_{12}$), first obtained pure by Kromayer (*Arch. der Pharm.*, 1862, Vol. CLX, p. 27), was previously described as *gentianin* by Henry and Caventou (1821), and later differentiated by Trommsdorff, Leconte, and Dulk into the bitter *gentianin* and the non-bitter acid *gentisin* or *gentisic acid*.

Gentiopikrin is completely abstracted from aqueous solution by animal charcoal; on this principle its purification was affected. It crystallizes in needles of bitter taste, soluble in water and alcohol, insoluble in pure ether. It is a glucosid, being decomposed by diluted acids into sugar and amorphous, yellow-brown, bitter *gentiogenin* ($C_{14}H_{16}O_5$). Kromayer obtained from 6 pounds of fresh root only 4 grammes of crystallized gentiopikrin. Flückinger (1891) records that alcoholic tinctures of gentian root lose their bitterness upon standing, crystallized dextrose being deposited (Crawfurd and Wittstein). Alkali likewise destroys the bitterness of the tincture.

GENTISIN ($C_{14}H_{10}O_5$), of Hlasiwetz and Habermann (*Jaresb. der Pharm.*, 1874, p. 309), forms yellow, tasteless needles, nearly insoluble in water and ether, crystallizable from alcohol. The researches of Kostanecki and his pupils (*Ber. d. Deutsch. Chem. Ges. Ref.*, 1891 and 1894) have shown that this substance is a *trioxyxanthone* belonging to the same class of substances as *chrysin*, *quercetin*, *fisetin*, and other vegetable dyes. Fusing with caustic potash splits gentisin into acetic acid, phloroglucin, and oxysalicylic acid ($C_9H_6O_4$), an isomer of protocatechuic acid: it was probably the *gentisic* or *gentianic acid* of older authors. In 1894, Kostanecki and Tambor succeeded in effecting the complete chemical synthesis of gentisin (which is *methyl-gentiseïn*, Kostanecki, 1891); *gentiseïn* ($C_{13}H_8O_5+H_2O$) being the intermediary product (*Ber. d Deutsch. Chem. Ges. Ref.*, 1894, p. 190). G. W. Kennedy (*Amer. Jour. Pharm.*, 1881, p. 280), found *gentiopikrin* and *gentisin* also in the root of *Frasera Walteri* (which see).

Action, Medical Uses, and Dosage.—A powerful tonic, improves the appetite, strengthens digestion, gives more force to the circulation, and slightly elevates the heat of the body. When taken in large doses it is apt to oppress the stomach, irritate the bowels, and even produces nausea and vomiting, as well as fullness of pulse and headache. Its administration is contraindicated where gastric irritability or inflammation are present. Used in cases of *debility* and *exhaustion*, and in all cases where a tonic is required, as *dyspepsia*, *gout*, *amenorrhœa*, *hysteria*, *scrofula*, *intermittents*, *diarrhœa*, *worms*, etc. A tincture made by percolation of 1 part of podophyllum and 5 parts of gentian, diluted alcohol being the menstruum, was prized by Prof. Scudder as one of the most efficient remedies for "*atony of the stomach and bowels* with feeble or slow digestion" (*Spec. Med.*). Gentian is valuable to relieve irritation and increase the appetite, after protracted fevers, where the powers of life are depressed and recovery depends upon ability to assimilate food. Dose of the powder, from 10 to 30 grains; of the extract, from 1 to 10 grains; of infusion, 1 or 2 fluid ounces; of tincture, 1 or 2 fluid drachms; of specific gentiana, 5 to 40 drops.

Dr. Küchenmeister believes that impure and uncrystallized gentianin (see previous editions of the *Amer. Disp.*) is the most valuable substitute for quinine, acting as rapidly and as efficaciously on the spleen, in doses of from 15 to 30 grains twice a day.

Specific Indications and Uses.—"Sense of depression referred to epigastric region, and associated with sense of physical and mental weariness" (Scudder, *List of Specific Indications*).

Related Species.—*Gentiana Catesbæi*, Walter (*Gentiana Saponaria*, Linné), *Blue* or *American gentian*, has a perennial, branching, somewhat fleshy root, with a simple, erect, rough stem, 8 to 10 inches in height. Leaves opposite, ovate or lanceolate, slightly 3-veined, acute, rough on the margin. Flowers large, blue, crowded, subsessile, axillary, and terminal. Calyx divided into 4 or 5 linear-lanceolate segments longer than the tube. Corolla large, blue, ventricose, plaited; its border divided into 10 segments, the outer 5 roundish and more or less acute, the inner 5 bifid and imbricate. Stamens 5, with dilated filaments and sagittate anthers. Ovary oblong-lanceolate, compressed, supported by a sort of pedicel. Style none; stigmas 2, oblong, reflexed. Capsule oblong, acuminate, 1-celled, 2-valved (L.—B.). It grows in the grassy swamps and meadows of North and South Carolina, flowering from September to December. The root is about ⅓ inch in thickness and 3 inches long, having a vivid, yellow, epidermal covering, under which is a whitish, spongy, cortical layer enclosing a thin column of woody tissue. Its bitterness is less pronounced than that of the official drug. It is little inferior to the foreign gentian, and may be used as a substitute for it in all cases, in the same doses and preparations. Alcohol and boiling water extract its virtues. Probably the *Gentiana Andrewsii*, Grisebach, or *Closed blue gentian*, the *Gentiana puberula*, Michaux, and the *Gentiana crinita*, Frœlich, or *Blue fringed gentian*, possess analogous medicinal virtues. Maisch believed the two first-mentioned to be collected indiscriminately with the *Gentiana Catesbæi*, of Walter, The same author also found the root of *Gentiana crinita*, Frœlich, and of *G. Catesbæi*, Walter. to be free from tannin (*Amer. Jour. Pharm.*, 1876, p. 487).

The following European species are sometimes gathered and used like gentian:

Gentiana purpurea, Linné. South and Central Europe, in Alpine meadows. Differs from gentian root only in having a peculiarly branched top, and being of a more pronounced bitter. Flowers yellow-purple.

Gentiana punctata, Linné. South and Central Europe, Alpine districts. Resembles preceding. Flowers yellow and dotted with purple.

Gentiana pannonica, Scopoli. Austrian mountain districts. Root smaller than that of *G. purpurea*, but similar in other respects. Flowers deep-purple.

GENTIANA OCHROLEUCA.—OCHROLEUCOUS GENTIAN.

The root and tops of *Gentiana ochroleuca*, Frœlich.

Nat. Ord.—Gentianeæ.

Common Names: *Marsh gentian*, *Yellowish-white gentian*, *Straw-colored gentian*, *Sampson snakeroot*, etc.

Botanical Source.—This plant has a stout, ascending stem, mostly smooth, from 1 to 2 inches in height. The leaves are from 2 to 4 inches long, ¾ of an inch to 1½ inch wide, obovate-oblong, sessile or amplexicaul, margin slightly scabrous, narrowed at the base, the lowest broadly ovate and obtuse, the uppermost somewhat lanceolate. The flowers are straw-colored, 2 inches long, ¾ of an inch thick, disposed in a dense, terminal cyme, often also in axillary cymes. The calyx is 5-cleft, the lobes unequal, linear, longer than the tube, and shorter than the corolla. The corolla is clavate, connivent or slightly expanding at the top, ochroleucous or straw-colored, with green veins and lilac-purple stripes internally; the lobes are ovate and obtuse; the folds entire, acute, and short. Anthers separate. The capsule or pod is included in the persistent corolla. The seeds are entirely wingless (W.—G.).

History.—This plant is found growing in dry grounds, especially through the middle and low country of the southern states, flowering in September and October. Said likewise to inhabit Canada, and the western states, but this must be rare. The root is the medicinal part, and the tops are also often employed. They are bitter to the taste, and probably possess the medicinal properties, in a greater or less degree, of the other plants of the same family. Alcohol or boiling water extracts their virtues. None of the American Gentians seem to have been satisfactorily analyzed.

Action, Medical Uses, and Dosage.—Bitter tonic, anthelmintic, and astringent. Formerly much used in *dyspepsia*, *intermittents*, *dysentery*, and all *diseases of periodicity*. To 2 ounces of the tops and roots, pour on 1½ pints of boiling water, and when nearly cold, add ½ pint of brandy. Dose, from ½ to 4 fluid ounces, every ½ hour, gradually increased as the stomach can bear it, at the same time lengthening the intervals between the doses. Also used for *bites of snakes*, and in *typhus fever*, *pneumonia*, etc. This is a valuable agent, and deserves greater attention from the profession than it has received. It will be found very useful as a tonic to all enfeebled mucous tissues, and especially when there is more or less mucous discharge, as in *chronic catarrhal affections*, *mucous diarrhœa*, etc.

GENTIANA QUINQUEFLORA.—FIVE-FLOWERED GENTIAN.

The root of *Gentiana quinqueflora*, Lamarck.

Nat. Ord.—Gentianeæ.

COMMON NAMES: *Five-flowered gentian*, *Gall-weed.*

ILLUSTRATION: *Botanical Magazine*, Plate 3496.

Botanical Source.—This is an annual plant, found in woodland pastures and other open situations in the eastern section of the United States. The stem is smooth, erect, 4-angled, and from 1 to 2 feet high. The leaves are opposite, entire, sessile, slightly cordate, clasping the stem at the base, and acute at the apex. They are about 1 inch long, and have from 3 to 5 veins proceeding from the base. The flowers, which appear late in the summer, and open only in sunshine, are of a bright-blue color, and erect. They are borne on loose panicles. in axillary and terminal clusters of 3 to 5, on pedicels shorter than the flowers. The calyx is about one-quarter the length of the corolla, and is deeply 5-parted, having very narrow, linear lobes. The corolla is smaller than in the other native species of Gentiana, being slightly less than an inch in length. It is narrowly bell-shaped, and has 5 acute, short lobes. The stamens are 5, and attached to the corolla tubes; they have versatile anthers, which are introrse when the flower expands, but at length turn away from the pistil. The pistil consists of a 1-celled ovary, supported on a slender stipe, and bears 2 distinct, sessile stigmas. The fruit is a dry capsule, opening by 2 valves, and filled with very numerous small seeds. The plant above described is the form of Gentiana quinqueflora occurring in the eastern section of the United States. A western variety (var. *occidentalis*, Gray) differs in being more robust, and in having the calyx-lobes half the length of the corolla. It occurs in the prairies of Illinois, and throughout the neighboring states, and southwardly.

History and Description.—This plant was recommended as a substitute for quinine, the root being employed. As found in the market, under the above name, it is about the size of senega, has the general appearance of this root, excepting the angled form and ridge. It has a smooth bark, which is light-yellow externally, and white within. It breaks with a clear fracture and is hard and woody. The taste is very bitter, resembling the Apocynums rather than *Gentiana lutea.* It has never been chemically examined. The plant grows in woods and pastures, flowering in September and October, and is found from Vermont to Pennsylvania.

Action, Medical Uses, and Dosage.—Gentiana quinqueflora, Five-flowered gentian, sometimes called Gall-weed, on account of its intense bitterness, has been found of much service in *headache*, *liver affections*, *jaundice*, etc., and is greatly superior in its action to the official root. This is certainly a valuable tonic and cholagogue, and deserves further investigation. It is regarded a valuable agent in *chronic gastro-intestinal atony.* Dose of a saturated tincture of the recent root, from 5 to 40 drops.

GERANIUM (U. S. P.)—GERANIUM.

"The rhizome of *Geranium maculatum*, Linné"—(*U. S. P.*).

Nat. Ord.—Geraniaceæ.

COMMON NAMES: *Cranesbill*, *Wild cranesbill*, *Crowfoot*, *Spotted geranium*, *Alum-root*, etc.

ILLUSTRATIONS: Bentley and Trimen, *Med. Plants*, 42; Johnson's *Med. Bot. of N. A.*, Plate 4.

Botanical Source.—Geranium has a perennial, horizontal, thick, rough and knobby root, with many small fibers. The stems are grayish-green, erect, round, clothed with reflexed hairs, angular, dichotomous, and 1 or 2 feet high. The leaves are spreading, hairy, palmate, with 3, 5, or 7 deeply cleft lobes, 2 leaves at each fork; lobes cuneiform, entire at the base, and incisely serrate above. The radical leaves are on long petioles, erect and terete; leaves at the top opposite, subsessile, those at the middle of the stem opposite, petiolate, and generally reflexed. Stipules linear or lanceolate. The flowers are large, generally purple, mostly in pairs, on unequal pedicles, sometimes umbelled at the ends of the peduncles. Peduncles long, round, hairy, tumid at the base, and at the forks of the stems 2-flowered. The calyx consists of 5 obovate, ribbed, mucronate sepals, the outermost hairy. The petals are 5, obovate, entire, light purple, and marked with green at the base. The stamens are erect or curving outward, alternately longer, furnished at the base with glands, terminated by oblong, convex, deciduous, purple anthers. Ovary ovate; style straight, as long as the stamens; stigmas 5, at first erect, and afterward recurved. The capsules are 5, together, and each 1-seeded (L.—W.).

Fig. 121.

Geranium maculatum.

History and Description.—Geranium is a native of this country, growing in nearly all parts of it in low grounds, open woods, etc., flowering from April to June. There are several varieties of this species which are probably equivalent in medicinal virtues to the *G. maculatum.* The dried root is the official part. It is officially described as follows: "Of horizontal growth, cylindrical, 5 to 7 Cm. (2 to 3 inches) long; about 1 Cm. ($\frac{2}{5}$ inch) thick; rather sharply tuberculated, longitudinally wrinkled, dark-brown; fracture short, pale reddish-brown; bark thin; wood-wedges yellowish, small, forming a circle near the cambium line; medullary rays broad; central pith large; roots thin, fragile; inodorous; taste strongly astringent (*U. S. P.*).

Chemical Composition.—Geranium was analyzed, in 1829, by Dr. Staples, who found it to contain a large quantity of gallic acid, tannic acid, mucilage, red coloring matter, principally in the external covering of the root, a small amount of resin, and a crystallizable vegetable substance (*Jour. Phil. Col. Pharm.*, Vol. I, p. 171). The Messrs. Tilden have more recently made a quantitative analysis of the root, and found it to contain a resin soluble in alcohol, a resin soluble in ether, an oleoresin soluble only in ether, tannin, gallic acid, gum, pectin, starch, sugar, albumen, lignin, chlorophyll, etc. (*Pharm. Jour.*, 1863, Vol. V., p. 22). H. K. Bowman, in 1869, found in the root of Geranium maculatum about 13 and 17 per cent, and Chas. F. Kramer, in 1882, about 17 per cent of tannin; while Henry J. Mayers, who made a complete analysis of the root (*Amer. Jour. Pharm.*, 1889, p. 238), obtained only 4.28 per cent, with much decomposed tannin (phlobaphene); from another specimen he obtained about 11.5 per cent. He also confirmed the presence of gallic acid. More recently (*Bull. Kew. Gardens*, 1896, No. 109, p. 30) Henry R. Procter found as high as 25.7 per cent tannin. These contradictory results are sufficiently explained by the researches of Prof. Trimble and Mr. J. C. Peacock (*Amer. Jour. Pharm.*, 1891, p. 265). In these experiments moisture and tannin were determined in samples which were obtained from 14 collections systematically extending over a period of two years. The principal result of this work may be summarized as follows:

I. Root collected in January had 11.72 per cent tannin, calculated on absolutely dry drug. The amount rose to 27.85 per cent in spring, just before bloom, and fell to 9.72 per cent in October.

II. The tannin obtained yields pyrogallol, upon heating, hence is related to gallotannic acid.

III. The tannin obtained is a glucosid; when heated with 2 per cent hydrochloric acid it easily decomposes into gallic acid, glucose, and *geranium red*, a phlobaphene, which also forms as a red-brown precipitate when a 1 per cent solution of the tannin is allowed to stand.

IV. No gallic acid is present in the fresh root, nor in the decoction made therefrom; only after the rhizome is dried is gallic acid present, due to the decomposition of the tannin.

Action, Medical Uses, and Dosage.—Geranium is a powerful astringent. Used in infusion with milk in the second stage of *dysentery*, *diarrhœa*, and *cholera* *infantum.* In bowel disorders it is the chronic or subacute states in which it is applicable, and especially where the discharges are abundant and debilitating. The relaxation of membranes following the inflammatory stage is an indication for its use. In dysentery it is not adapted to the first and acute stage, but should be used, atter a laxative, as magnesium sulphate, where the disease tends to chronicity. The infusion or the specific geranium in milk may be employed. Both internally and externally it may be used wherever astringents are indicated, in *hemorrhages, indolent ulcers, aphthous sore mouth, ophthalmia, leucorrhœa, gleet, hematuria, menorrhagia, diabetes,* and all excessive *chronic mucous discharges;* also, to cure *mercurial salivation. Relaxation of the uvula* may be benefited by gargling with a decoction of the root, as well as *aphthous ulceration of the mouth and throat. Chronic pharyngeal catarrh* has been cured with it, while recently an old-school authority claims for it restorative properties in *incipient pulmonary consumption.* From its freedom from any nauseous or unpleasant qualities, it is well adapted to infants and persons with fastidious stomachs. In cases of *bleeding piles,* a strong decoction of the root may be injected into the rectum, and should be retained as long as possible. Hemorrhoids are said to be cured by adding of the root in fine powder, 2 ounces, to tobacco ointment, 7 ounces, and apply to the parts, 3 or 4 times a day. Troublesome *epistaxis, bleeding from wounds* or small vessels, and from the extraction of teeth, may be checked effectually by applying the powder to the bleeding orifice, and, if possible, covering with a compress of cotton. With Aletris farinosa in decoction, and taken internally, it has proved of superior efficiency in *diabetes,* and in *Bright's disease of the kidney.* A mixture or solution of 2 parts of hydrochlorate of berberine and 1 part of extract of geranium, will be found of unrivaled efficiency in all *chronic mucous diseases,* as in *gleet, leucorrhœa, ophthalmia, gastric affections, catarrh,* and *ulceration of the bladder,* etc., etc. A decoction of 2 parts of geranium and one of sanguinaria forms an excellent injection for *gleet* and *leucorrhœa.* Dose of the powder, from 20 to 30 grains; of the decoction, from 1 to 2 fluid ounces; of specific geranium, 5 to 30 drops.

Specific Indications and Uses.—Relaxed mucous tissues, with profuse, debilitating discharges; chronic diarrhœa, with mucous discharges; chronic dysentery; diarrhœa, with constant desire to evacuate the bowels; passive hemorrhages.

Related Species.—*Geranium Robertianum,* Linné, or *Herb Robert,* grows wild both in Europe and in the United States, but is rare in this country; and Pursh states that the American plant is destitute of the heavy smell by which the European is so well known, though the two agree in all other respects. It has a tapering root, with several round, leafy, branched, reddish, brittle, succulent, and diffuse stems, hairy, chiefly on one side (L.—W.). The plant flowers from May to September, and has a strong, unpleasant smell. The herb has a disagreeable, bitterish, astringent taste, and imparts its virtues to boiling water. A bitter principle and tannin are among its constituents. It has been used internally in *intermittent fever, consumption, hemorrhages, nephritic complaints, jaundice,* etc., and has been employed as a gargle in *affections of the throat,* and applied externally as a resolvent to *swollen breasts* and other *tumors.*

Erodium cicutarium, L'Héritier (*Geranium cicutarium,* Linné), *Storksbill.*—Southern Europe and common in Western United States, though scarce in Atlantic states. A valuable nutritious forage plant, and, though neither a clover nor a grass, is known as *Alfilaria* (from Spanish *alfilerilla,* signifying *pin;* hence pin-weed), *Pin-clover, Pin-grass,* and *Filaree.* Cold weather does not kill it and it is the only green vegetable substance available for stock in dry seasons. It is said to impart a fine flavor to butter and milk (see *Agr. Grasses and Forage Plants of U. S.,* by Vasey, 1889). Diuretic for *dropsy.*

Erodium moschatum, Aiton.—Mediterranean Europe, north and south Africa, and California. Valuable forage plant in dry seasons. It has the odor of musk. Therapeutically it is diaphoretic. Other astringents are:

Vinca major, Greater periwinkle; Vinca minor, Lesser periwinkle.—England. Reputed useful in *menorrhagia* and other *hemorrhagic states.*

Oroxylum indicum.—East India. Bark contains an acrid substance and a yellow crystalline principle. *oroxylin* (*Pharm. Jour. Trans.,* 1890, Vol. XXI, p. 257). Bark a powerful sudorific, astringent and tonic. Employed in *diarrhœa.*

Raimbaultii combretum.—Africa. Contains an abundance of tannin. Employed by the Africans in *hematuric bilious fever.*

GERARDIA.—BUSHY GERARDIA.

The herb of *Gerardia pedicularia,* Linné (*Dasystoma pedicularia,* Bentham).

Nat. Ord.—Scrophulariaceæ.

COMMON NAMES: *Bushy gerardia, Lousewort, Fever weed, American fox-glove.*

Botanical Source.—This is a perennial plant, whose stem is tall and bushy, with a scattered woolly pubescence, 2 or 3 feet in height, and brachiate-panicled. The leaves are numerous, opposite, ovate-lanceolate or oblong, pinnatifid, the segments being doubly cut-dentate. The flowers are large, yellow, axillary, trumpet-shaped, opposite, and pediceled; the pedicels are longer than the calyx. Calyx 5-cleft, cut-dentate, segments as long as the hairy tube. Corolla yellow, an inch or more in length, subcampanulate, unequally 5-lobed, segments mostly rounded, spreading, leaf-like, and woolly inside. Capsule 2-celled, dehiscent at the top (L.—W.).

History.—This is a most elegant plant, found growing in dry copses, pine ridges, and barren woods and mountains from Canada to Georgia and Kentucky, and flowering in August and September. The whole plant is used. Water or spirit extracts its virtues. It has not been analyzed. There are several varieties of the species, which probably possess analogous virtues.

Action, Medical Uses, and Dosage.—Diaphoretic, antiseptic, and sedative. Used principally in *febrile* and *inflammatory diseases;* a warm infusion produces a free and copious perspiration in a short time. Dose of the infusion, from 1 to 3 fluid ounces.

GEUM.—GEUM.

The rhizome and rootlets of *Geum rivale*, Linné, and *Geum virginianum*, Linné. *Nat. Ord.*—Rosaceæ.

Common Names: (1) *Water avens*, *Purple avens;* (2) *Virginia geum*, *Throat-root*, *Chocolate-root*.

Botanical Source.—*Geum rivale*, likewise known as *Purple avens*, is a perennial, hairy, deep-green herb, with a creeping, blackish, somewhat woody root, running deep into the ground, with numerous fibers. The stems are 1 or 2 feet high, nearly simple, erect, and slightly paniculate at top. The radical leaves are nearly lyrate, uninterruptedly pinnate, with large terminal leaflets on long hairy petioles, rounded, lobed, and crenate-dentate, and from 4 to 6 inches long. The cauline leaves are few, subsessile, from 1 to 3 inches long, and divided into 3 serrate, pointed lobes; the stipules are ovate, acute, cut, and purplish, The flowers are few, sub-globose, nodding, yellowish-purple, on axillary and terminal peduncles. The calyx is inferior, erect, purplish-brown, with 10 lanceolate, pointed segments, 5 alternately smaller than the others; petals 5, as long as the erect calyx segments, broad-obcordate, clawed, purplish-yellow, and veined. The seeds are oval, bearded, and hooked at the end (L.—W.—G.).

Geum virginianum, Linné, also known as *Throat-root*, *Chocolate-root*, etc., is also perennial, with a small, brownish, horizontal, crooked root. The stem is simple or branched, smoothish above, pubescent below, and 2 or 3 feet high. The radical leaves are pinnate, lyrate, or simple and rounded, with appendaged petioles from 6 to 8 inches long; the cauline leaves 3 or 5-lobed, softly pubescent; all the leaves are unequally and incisely dentate. The flowers are rather small, white, erect, and borne on long, diverging peduncles; the calyx is 5-cleft, with 5 smaller and exterior, alternate bracteoles; the petals 5, about the length of the calyx; the stamens numerous; filaments slender, anthers yellowish and round. The styles are many, persistent, mostly jointed, geniculate, bearded, and hooked after the upper joint falls away. The fruit is an achenia, aggregated on a dry receptacle caudate with the style (W.—G.).

History and Description.—*Geum rivale* is common to Europe and this country, and is found growing in woods, wet meadows, and along streams, especially in the northern and middle states, and flowering in June and July. The American species differs from the European (*Geum urbanum*, Linne), in having the petals more orbicular on their free margin, the flowers of less size, and its leaves with deeper incisions. The fresh root is aromatic.

Geum virginianum is found in hedges and thickets, and in moist places in most parts of the United States, flowering from June to August. These plants, with some other varieties, have long been used in domestic practice. The whole herb contains medicinal properties, but the medicinal and most efficient portion is the root. The dried root of the *G. rivale* is scaly, jointed, tapering, hard, brittle.

easily pulverized, of a reddish or purplish color, and inodorous; that of the *G. virginianum*, is brown, crooked, tuberculated, and brittle; both are white internally, and of a bitterish, astringent taste. Boiling water or alcohol extracts their virtues, the solution becoming reddish. They have not been analyzed, but probably contain tannic acid, bitter extractive, gum, resin, etc. A weak decoction of the root of *G. rivale* is sometimes used by invalids as a substitute for tea and coffee. Its constituents are probably the same as those of Avens (*Geum urbanum*, Linné) (see *Related Species*).

Action, Medical Uses, and Dosage.—Tonic and astringent. Useful in all cases where there is an enfeebled state of mucous tissues, or morbid secretions therefrom. Large doses may cause emesis. Used in numerous diseases, as *passive* and *chronic hemorrhages*, *chronic diarrhœa* and *dysentery*, *leucorrhœa*, *dyspepsia*, *phthisis*, *congestions of the abdominal viscera*, *intermittents*, *aphthous ulcerations*, etc. Dose of the powder, from 20 to 30 grains; of the decoction, from 1 to 2 fluid ounces, 3 or 4 times a day. *Geum urbanum*, or *European avens*, possesses similar properties (see below).

Specific Indications and Uses.—(*Geum rivale*). "Tearing, spasmodic, abdominal pains recurring upon taking food or exercise" (Scudder).

Related Species.—*Geum album*, Gmelin; *White geum*. United States. Flowers in May and August. Used in *headaches* and *irritable conditions of the stomach* (*Amer. Jour. Pharm.*, 1883).

Geum urbanum, Linné; *Avens*, *European avens*. Europe, growing in woodlands and shady situations, and has yellow flowers. The rhizome of this plant is hard, dark-brown, tuberculated at top, short (1 or 2 inches long and from ¼ to ½ inch thick), and has the summit beset with hairy, reddish-brown leaf scales. The fresh rhizome resembles cloves in odor, hence has been called *radix caryophyllata*. Internally the rhizome is whitish, surrounding a central red portion. It has many fibrous roots of a lighter brown hue. It imparts a red color to both water and alcohol. Buchner analysed it in 1844, and found a considerable amount of tannin and an amorphous and neutral yellow mass, to which he gave the name *geum bitter*. He also confirmed the observation of Trommsdorff as to the presence of a greenish-yellow volatile oil (0.04 per cent), and found that it has a clove-like odor (*Rep. d. Pharm.*, 1844, Vol. LXXXV, p. 168 to 201).

Avens is an astringent tonic considerably employed in European practice, where it is used in *intermittents*, *dysentery* and *diarrhœa*, *passive hemorrhages*, and *leucorrhœa*. It is apt to derange the stomach and induce emesis if given too freely. The dose of the powder is from 20 to 60 grains, but the decoction, made by boiling 1 ounce of avens in 1 pint of water, is preferable. The dose is 1 or 2 fluid ounces

GILLENIA.—INDIAN PHYSIC.

The bark of the rhizome of *Gillenia trifoliata*, Moench (*Spiræa trifoliata*, Linné), and *Gillenia stipulacea*, Nuttall (*Spiræa stipulata*, Willdenow).

Nat. Ord.—Rosaceæ.

COMMON NAMES: *Indian physic*, *American ipecac*, *Indian hippo*, and sometimes *Bowman's root*.

Botanical Source.—Indian physic is an indigenous, perennial herb, with an irregular, brownish, somewhat tuberous caudex, from which radiate many long, knotted, delicate fibers. The stems are several, from the same root, about 2 or 3 feet in height, erect, slender, flexuose, smooth, branched above, and of a reddish or brownish color. The leaves are alternate, trifoliate, subsessile, furnished with small linear-lanceolate and slightly-toothed stipules at the base; the leaflets are lanceolate, acuminate, sharply and unequally toothed, the upper ones often single, the lower broader at the end, but acuminately terminated. The flowers are white, with a reddish tinge, borne in terminal, loose panicles, few in number, scattered, on long peduncles, occasionally furnished with minute, lanceolate bracts. The calyx is subcampanulate or tubular, terminating in 5 sharp, reflexed teeth. Petals 5, the 2 upper ones separated from the three lower, white with a reddish tinge on the edge, lanceolate, unguiculate, contracted and approximated at base and 3 times as long as the calyx. The stamens are about 20, in a double series within the calyx, with short filaments, and small, yellow anthers. Styles 5, with obtuse stigmas. Capsules 5, connate at base, oblong, acuminate, diverging, gibbous without, sharp-edged within, 2-valved, 1-celled, and 1 or 2-seeded. The seeds are oblong, brown, and bitter (L.—B.).

History.—The plant *Gillenia trifoliata*, sometimes called *Bowman's root*, is found growing from Canada to Florida, in rich woods, light, gravelly soils, and in moist and shady situations; it is more common in the Atlantic States than the Western. It blossoms from May to August. The root is the medicinal part, and must be collected in autumn. As met with in commerce it is a dry, tuberculated root, 3 or 4 lines in diameter, corrugated lengthwise, and of a reddish-brown color externally; it is composed of a light-colored, ligneous, internal substance, and an easily removed, dense, friable, brownish bark, which is readily reduced to a powder, having a similar color. It is nearly odorless, and has a nauseous, amarous taste, and yields its properties to alcohol or water at 100° C. (212° F.). The bark is the active portion, the internal woody substance being nearly inert. The root of *G. stipulacea* is larger, tuberculated, and the rootlets present an annulated appearance due to constrictions passing part way around the rootlet, forming semicircular depressions.

Gillenia stipulacea, Nuttall, also called *Bowman's root*, which is found on the western side of the Allegheny Mountains, growing through Ohio, Indiana, Illinois, Missouri, and southward, flowering at the same time as the above, possesses similar properties, but is more efficient in the same doses. It may be distinguished by its drab-colored and branching stems, its greater size, its large, clasping, ovate-cordate, leafy, gashed, and serrated stipules, its lower leaves being of a reddish-brown color at the tips; the stipules are leafy, ovate, doubly incised and clasping; and the flowers are fewer, smaller, on slender peduncles, hanging in loose panicles. It is seldom met with in limestone or alluvial soils. (For an interesting article on the nomenclature of Gillenia, see *Amer. Jour. Pharm.*, 1898, p. 501.)

Chemical Composition.—According to Mr. Shreeve, gillenia contains starch, gum-resin, wax, a fatty matter, a red coloring substance, a volatile coloring matter, and a peculiar principle soluble in alcohol and diluted acids, but insoluble in water or ether (*Amer. Jour. Pharm.*, Vol. I, p. 28). Mr. W. B. Stanhope procured *gillenin* from Gillenia trifoliata by making an alcoholic extract of the powdered bark, evaporating to dryness, treating with water, macerating the resinous and bitter residue with diluted sulphuric acid for 10 days, filtering, evaporating with excess of magnesia, extracting with alcohol and allowing the solvent to evaporate spontaneously. The gillenin thus obtained was permanent in the air, very bitter, soluble in water, alcohol, ether, and diluted acids, neutral, giving a fine green color with chromic acid, and blood-red with strong nitric acid. Tannic acid produced no effect, but caustic potash, subacetate of lead, and tartar emetic threw down white precipitates. In doses of ½ grain it produced emesis, with considerable vertigo (*Amer. Jour. Pharm.*, 1856, p. 200). Mr. Frank W. White (*Amer. Jour. Pharm.*, 1892, p. 121), found the active principle of Gillenia trifoliata to be a glucosid, obtainable by agitating the aqueous solution of the alcoholic extract with chloroform.

In *Gillenia stipulacea* Mr. Gordon L. Curry found two glucosids which he obtained from the ether extract of an aqueous infusion. One, which he named *gillein*, was obtainable in feathery crystals, easily gives off sugar, is soluble in water, alcohol, and diluted acids, and causes nausea in the dose of ¼ grain. The other glucosid, called *gilléenin*, is amorphous, much more stable, soluble in water, but sparingly soluble in alcohol and ether. Neither of these substances gives the reactions of Stanhope's *gillenin*. Sugar, gum, and tannin were also found (*Amer. Jour. Pharm.*, 1892, p. 513). Both this root and that of the Gillenia trifoliata were formerly official in the *U. S. P.*

Action, Medical Uses, and Dosage.—The root-bark of these plants is emetic, cathartic, sudorific, expectorant, and tonic. In their action, they resemble ipecacuanha. Like the latter, their dust will provoke irritation of the throat and breathing organs. They have been recommended in *amenorrhœa*, *rheumatism*, *dropsy*, *habitual costiveness*, *dyspepsia*, *worms*, and in *intermittents*. As an emetic and cathartic, from 20 to 35 grains is a dose, which, when vomiting is required, may be repeated at intervals of 20 minutes. It may be used in all diseases where emetics are indicated, as a safe and efficient agent. In *dyspepsia*, accompanied with a torpid condition of the stomach, from 2 to 4 grains forms an excellent tonic. As a sudorific, 6 grains may be given in some cold water, and repeated at intervals of 2 or 3 hours, or it may be given in combination with a small portion of opium. Large and oft-repeated doses of the infusion cause severe vomiting and purging.

GLECHOMA.—GROUND IVY.

The plant *Glechoma hederacea*, Linné (*Nepeta Glechoma*, Bentham
Nat. Ord.—Labiatæ.

COMMON NAMES: *Ground ivy, Cat-foot, Gill-go-over-the-ground.*

ILLUSTRATION: Johnson's *Med. Bot. of N. A.*, Fig. 145, p. 213.

Botanical Source and Description.—This plant, the *Glechoma hederacea* of Linnæus, is a perennial, gray, hairy herb, with a prostrate, creeping stem, radicating at base, square, and from a few inches to 1 or 2 feet long. The leaves are petiolate, opposite, roundish, cordate-reniform, crenate, hairy, and glaucous on both sides, though often purplish beneath. The floral leaves are of the same form. The flowers are bluish-purple, about 3 together in axillary whorls. The corolla is about 3 times as long as the calyx, with a variegated throat. The calyx is long, curved, villous, the limb oblique, the teeth lanceolate-subulate, the upper being the largest. The bracts are scarcely as long as the pedicel. The 2 anthers of each pair of stamens meet with their 2 divaricate cells, forming the appearance of a cross (L.—W.—G.).

History and Chemical Composition.—This plant is common to Europe and the United States, where it is found growing in shady places, waste grounds, dry ditches, fences and hedges, and on the sides of moist meadows, flowering in May and August. The leaves are the parts used, and yield their virtues, by infusion, to boiling water. They have an unpleasant odor, and a harsh, bitterish, slightly aromatic taste. This plant was found by Mr. Charles A. Ridgway to contain an essential oil (0.06 per cent), fat, resin, gum, wax, sugar, tannic acid, about 16 per cent of ash, etc., and an acrid, fatty substance (0.96 per cent) (*Amer. Jour. Pharm.*, 1892, p. 66).

Action, Medical Uses, and Dosage.—Ground ivy is stimulant, tonic, and pectoral, and has been recommended in *diseases of the lungs* and *kidneys*, *asthma*, *jaundice*, *hypochondria*, and *monomania*. An infusion of the leaves is highly recommended in *lead colic*, and it is stated that painters who make use of it often are never troubled with that affliction. The fresh juice snuffed up the nose is said to cure *headache*. Dose of the powdered leaves, from ½ to 1 drachm; of the infusion, 1 or 2 fluid ounces. A tincture of the fresh plant, prepared with 98 per cent alcohol, may be given in doses of 1 to 15 drops.

GLYCERINUM (U. S. P.)—GLYCERIN.

FORMULA: $C_3H_5(OH)_3$. MOLECULAR WEIGHT: 91.79.

"A liquid obtained by the decomposition of vegetable or animal fats or fixed oils, and containing not less than 95 per cent of absolute glycerin ($C_3H_5[OH]_3$ 91.79)"—(*U. S. P.*).

SYNONYMS: *Glycerina* (*U. S. P.*, 1870), *Glycerine*, *Glycerol*, *Propenyl alcohol.*

History and Preparation.—Glycerin was discovered, in 1779, by Scheele in the saponification products of olive oil by means of litharge, and later recognized by him as a common constituent of other oils and fats, and therefore named the "sweet principle of fats." Chevreul gave it the name *glycerin*, and cleared up the nature of its combination in the fats. Glycerin, or *glycerol*, as it is now preferably called to indicate its alcohol character, is a trihydric alcohol ($C_3H_5[OH]_3$), containing the trivalent radical "glyceryl" (C_3H_5). It exists in oils and fats, combined with palmitic, stearic, and oleic acids in the form of glycerylesters of these acids (*tripalmitin*, *tristearin*, *triolein;* also see under *Adeps*). In some oils and fats it is combined partially with other acids—*e. g.*, in butter—wherein 5 per cent of the total fat is glyceryl-tributyrate, or *tributyrin;* in cod-liver oil it is said to exist in part combined with acetic acid, as glyceryl triacetate, or *triacetin*, etc. Glycerin also exists in the yolk of eggs and the human brain in the form of *phospho-glyceric acid*. Pasteur's researches have also established its occurrence as a regular constituent among the products of fermentation (see *Alcohol*).

On a small scale glycerin may be obtained in the process which led to its discovery, viz., that of making lead plaster (see *Emplastrum Plumbi* The late

Mr. Robert Shoemaker prepared by this method probably the first commercial glycerin in the United States, in 1848, at $4.00 a pound (*Amer. Jour. Pharm.*, 1879, p. 289). The article became official in the *U. S. P.*, in 1850.

Large quantities of glycerin are now obtained as a by-product in the manufacture of soaps and candles. This was formerly thrown away as useless. The principle involved is simply that of splitting the fat into its constituents (*fatty acid* and *glycerin*) by adding the elements of water (see *Emplastrum Plumbi*). The process of saponification is being carried out in several different ways: (1) With *alkalies;* the fatty acids thereby combine with alkali and form soap (see *Sapo*); the glycerin in diluted form is contained in the aqueous layer below the soap. (2) With *milk of lime* (old process of Campbell Morfit, see this *Dispensatory*, previous revision), or with *milk of lime* and *water* in closed vessels under a pressure of 10 atmospheres and a temperature of 172° C. (242.6° F.) (Milly's Autoclave Process, see Prof. S. P. Sadtler, *Handbook of Indust. Org. Chem.*, 1895, p. 56). The glycerin water separates from the layer of lime soap and fatty acids; glycerin is obtained therefrom best by evaporation *in vacuo.* (3) With *superheated steam* ("aqueous saponification") and subsequent redistillation of the raw glycerin. This method was introduced, in 1855, by Messrs. Wilson and Paine, and marked a great step forward in the problem of obtaining a pure article. In saponifying the fats with superheated steam, the temperature must not exceed 300° C. (572° F.), or else decomposition products will be formed. Both the fatty acid and the glycerin distill over. In redistilling the raw glycerin by superheated steam, the liquid is heated to about 180° C. (356° F.), and the steam has a temperature of about 110° C. (230° F.). For details regarding the manufacture of glycerin, consult the various works on chemical technology.

Description.—Glycerin is officially described as follows; "A clear, colorless, liquid, of a thick, syrupy consistence, oily to the touch, odorless, very sweet and slightly warm to the taste. When exposed to the air, it slowly abstracts moisture. Specific gravity, not less than 1.250 at 15° C. (59° F.). Soluble, in all proportions, in water or alcohol, also soluble in a mixture of 3 parts of alcohol and 1 part of ether, but insoluble in ether, chloroform, carbon disulphide, benzin, benzol, and fixed or volatile oils. Glycerin is slowly volatilized from an aqueous solution, at or above 100° C. (212° F.), with the vapor of water. Heated by itself to a higher temperature, it yields acrid decomposition products, boils at a temperature at or above 165° C. (329° F.), and is finally entirely decomposed and dissipated"—(*U. S. P.*). The exceedingly irritating decomposition products are chiefly due to the formation of *acrolein* (*allyl aldehyde*, $C_2H_3.CHO$), which is also formed when fats are burned, or when glycerin is heated with strong sulphuric acid. Yet Prof. Trimble has demonstrated (*Amer. Jour. Pharm.*, 1885, p. 275) the propriety of the use of the vapors of pure glycerin for inhalations, the details being as follows: When 50 grammes of pure glycerin were slowly heated in an open capsule, vaporization became abundant at 130° C. (266° F.). At 264° C. (497.2° F.), slight boiling was perceptible, but very little was left, and the dense vapors formed had a purely sweet taste, absolutely free from any irritating quality. Pure glycerin, when heated to 150° C. (302° F.) in an open crucible, can be ignited, and burns with a blue flame. Glycerin of only 90 per cent can be burned with the aid of a wick, like alcohol, in a spirit lamp. Absolute glycerin has the specific gravity of 1.266 at 15° C. (59° F.), and boils at 290° C. (554° F.), while 95 per cent glycerin has a specific gravity of 1.2526 and boils at 164° C. (327.2° F.) (Gerlach). At one time crystallized glycerin, from a Vienna manufacturer, was brought to London, requiring the knife and hammer to break it. It resembled rock-candy (sugar), being in white, octahedral crystals, with considerable refractive power, and, when melted, the liquid glycerin presented all its usual properties, but could not be again reduced to the crystalline condition. It seems that prolonged exposure to a temperature of 0° C. (32° F.) will bring about crystallization, and contact with a crystal already formed will promote this process. The crystals, while hard and gritty, are very hygroscopic. More recently, some specimens, after being melted, were found by Prof. Trimble to have a high specific gravity (1.2618) (see Wallace Procter, in *Amer. Jour. Pharm.*, 1885, p. 273).

Glycerin dissolves many vegetable exudations and resinous substances. It does not dissolve sugar or gum, but readily mixes with syrups and mucilages.

It is insoluble in fatty matter, and can only be incorporated with it mechanically, to effect which it is necessary that the fat should have a soft consistence, which may be imparted to it by combination with oil of sweet almonds, or some other fixed oil. Glycerin mixes with acetic acid; moistens bodies without rendering them greasy, does not become rancid, and is easily charged with the aroma of volatile oils.

The solubilities of certain substances in glycerin (Klever) as taken from *Chemiker Kalender*, 1897, are as follows: One hundred parts (by weight) of glycerin dissolve at 15.5° C. (60° F.):

	PARTS.		PARTS.
Alum	40	Phosphorus	0.20
Ammonium carbonate	20	Potassium arsenate	50
Ammonium chloride	20	Potassium bromide	25
Arsenic trioxide	20	Potassium chlorate	3.5
Arsenic pentoxide	20	Potassium cyanide	32
Atropine	3	Potassium iodide	40
Atropine sulphate	33	Quinine	0.5
Barium chloride	10	Quinine tartrate	0.25
Benzoic acid	10	Sodium arsenate	50
Boric acid	10	Sodium biborate	60
Brucine	2.2	Sodium bicarbonate	8
Calcium sulphide	5	Sodium carbonate	98
Cinchonine	0.5	Sodium chlorate	20
Cinchonine sulphate	6.7	Strychnine	0.25
Cupric acetate	10	Strychnine nitrate	4
Cupric sulphate	30	Strychnine sulphate	22.50
Iodine	1.9	Sulphur	0.10
Lead acetate	20	Tannic acid	50
Mercuric chloride (corr. subl.	7.5	Tartar emetic	5.5
Mercuric cyanide	27	Urea	50
Morphine	0.45	Veratrine	1
Morphine acetate	20	Zinc chloride	50
Morphine chloride	20	Zinc iodide	40
Oxalic acid	15	Zinc sulphate	35

Glycerin dissolves the vegetable acids, aloes, some resinous substances, the deliquescent salts, the sulphates of potassium, sodium, and copper, the nitrates of potassium and silver, the alkaline chlorides, caustic potash, caustic soda, baryta, strontia, bromine, iodine, and even oxide of lead, and one-fifth part of arsenous acid. It dissolves about 1 per cent of its weight of calcium sulphate, and 2 per cent of chloride of lead. It dissolves the salts of morphine, sulphate of quinine, and, when triturated with these, or with the salts of strychnine, veratrine, brucine, and other vegetable alkaloids, forms a medicinal cerate very useful for frictions and embrocations. It also dissolves sulphides of potassium, of calcium, and of iodine, iodides of sulphur, of potassium, and of mercury, and some chlorides. It promotes the solution of borax in tincture of myrrh, no water being required; added to tincture of kino it retards gelatinization. The vegetable extracts are soluble in it, some of the solutions, as of extract of belladonna, forming useful external applications. Being possessed of strong antiseptic properties, it preserves animal and vegetable substances; meat has been immersed in glycerin for several months and preserved its freshness. It dissolves the carbonate of iron immediately on its formation, giving a deep-green solution. Like sugar it arrests the conversion of the ferrous into ferric salts, and has kept iodide of iron for years without change. It may be used in the preparation of spirits (*essences*) of cloves, cinnamon, etc., for syrups of phosphate of iron, bromide of iron, and iodide of quinine, for preserving fresh lemon juice, and for preserving the soft consistence of pill masses and confections. Thus it is seen that the solvent powers of glycerin, both diluted and undiluted, are very extensive and important.

By oxidation with cold nitric acid, glycerin yields *glyceric acid* ($CH_2OH.CH.OH.COOH$) and a variety of other acids. Potassium permanganate in alkaline solution produces oxalic acid. Upon the latter reaction is based a quantitative determination of glycerin by Benedict and Zsigmondy, a process also indicated by Wm. Fox and J. A. Wanklyn (see *Amer. Jour. Pharm.*, 1886, p. 248). Another method for the quantitative determination of glycerin, by L. Legler and O. Hehner (*Amer. Jour. Pharm.*, 1887, p. 464, from *The Analyst*, Jan. and Feb., 1887).

is based on the fact that glycerin can be completely oxidized to carbonic acid and water by being heated with sulphuric acid and potassium bichromate. Sulphuric acid combines with glycerin to form an ester glycerylsulphuric acid $(SO_4H.C_3H_5[OH]_2)$. Likewise glycerin combines with phosphoric acid to form a similarly constituted compound $(PO_4H_2.C_3H_5[OH]_2)$. Nitroglycerin is a highly explosive compound that is made by methods safe only on a manufacturing scale and in the hands of qualified men (see *Spiritus Glonoini*). Glycerin liberates from borax half its quantity of boric acid; thus if blue litmus solution is added to separate quantities of neutral glycerin and borax solution, when mixed, a red color results. W. R. Dunstan (*Amer. Jour. Pharm.*, 1883, pp. 447–456) has shown that the red color turns blue upon warming, and reappears on cooling. Again, when adding glycerin to a mixture of molecular quantities of bicarbonate of sodium and borax, the boric acid liberated by the glycerin will expel with effervescence half of the carbonic acid in the bicarbonate, and monocarbonate will remain (with reference to this reaction, see also Mr. L. F. Kebler, *Amer. Jour. Pharm.*, 1894, p. 428).

Glycerin is capable of undergoing fermentation under certain conditions. A. Fitz (1877) obtained, by the action of a certain class of fungi, called *Schizomycetes*, from glycerin diluted with twenty times its bulk of water, large quantities of normal butylalcohol and normal butyric acid; also ethyl alcohol, capronic acid, hydrogen, and carbonic acid. Freund has also shown that *trimethyleneglycol* $(C_3H_8O_2)$ is one of the principal products formed. This substance has more recently been demonstrated by A. A. Noyes and W. H. Watkins (*Amer. Jour. Pharm.*, 1895, p. 633), to occur as a troublesome by-product in the manufacture of glycerin from fats that have undergone spontaneous saponification and subsequent fermentation.

Tests and Uses.—For medicinal purposes, glycerin only should be used that has been purified by distillation; an impure glycerin when applied to wounds or ulcers is very apt to cause a burning sensation, and a papular eruption on the skin; when pure it is unirritating. Formerly its impurities were more numerous than now, owing to the imperfect method of its manufacture. The process of purifying glycerin by distillation has reduced the proportion of ash considerably, which in pure distilled glycerin does not exceed 0.2 per cent, while undistilled glycerin from soap lyes may have from 7 to 14 per cent of ash. Impurities liable to occur in glycerin are: water, volatile fatty acids (*e. g.*, formic and butyric acids), added sugar or glucose, empyreumatic substances, oxalic acid, chlorides, sulphates of calcium, magnesium, and heavy metals, as iron, lead, zinc, etc. Siebold (1889) observed the presence of arsenic in glycerin (in one instance, 0.04 per cent), an impurity due to the employment, during manufacture, of sulphuric acid containing it. When present in glycerin, arsenic is exceedingly difficult to remove; it is claimed that agitating with recently precipitated ferric hydrate will remove this contamination (*Amer. Jour. Pharm.*, 1890, p. 523) The presence of iron in glycerin, due, according to Hanssmann (*Amer. Jour. Pharm.*, 1895, p. 84) to its being kept in tinned iron cans, disturbs the color of pharmaceutical preparations in which glycerin is combined with tannin, or phenols, or salicylic acid. Another impurity occasionally occurring in commercial glycerin is the *trimethyleneglycol* before mentioned. Glycerin, beside answering to the official description given before, should conform to the following tests of the *U. S. P.*: "If a fused bead of borax, on a loop of platinum wire, be moistened with glycerin, and then held in the non-luminous flame, the latter will be transiently tinted deep green. An aqueous solution of glycerin is neutral to litmus paper. When a small portion of glycerin is heated to boiling in an open porcelain or platinum capsule, and then gently ignited, it should burn and vaporize so as to leave not more than a dark stain (absence of dextrin and sugar), which would leave a bulky, difficultly combustible, charred mass); and on full combustion no residue whatever should be left (absence of fixed impurities). If 5 Cc. of glycerin be mixed with 50 Cc of water and 10 drops of hydrochloric acid in a small flask, and heated for half an hour on a boiling water-bath, then 10 Cc. of the hot liquid mixed with 2 Cc. of sodium hydrate T.S. and 1 Cc. of alkaline cupric tartrate V.S., no yellowish-red cloudiness or precipitate should appear within six hours (absence of sugars). On gently warming a mixture of equal volumes of glycerin and of concentrated sulphuric acid in a test-tube, the liquid should not acquire a dark color (absence of readily carbonizable impurities). On gradually heating 5 Cc. of glycerin with 3 Cc. of diluted sulphuric acid in a test-tube, short of boiling, no offensive or acidulous odor should be evolved (absence of fatty acids, etc.). No color, cloudiness or precipitate should appear when separate portions of its aqueous solution (1 in 10) are treated with hydrogen sulphide or ammonium sulphide T.S. (absence of metals), barium chloride T.S. (sulphuric acid), calcium chloride T.S. (oxalic acid), or ammonium oxalate T.S. (calcium salts). If a mixture of 2 Cc. of glycerin with 10 Cc. of water, contained in a perfectly clean, glass-stoppered cylinder, be heated for five minutes in a water-bath at a temperature of 60° to 65° C. (140° to 149° F.), then mixed with 10 drops of silver nitrate T.S., and the cylinder set aside, well stoppered, in diffused daylight, no change of transparency or color should occur in the mixture within five minutes (absence of chlorides, and limit of impurities having reducing properties)"—(*U. S. P.*). The presence of butyric acid may be detected, according to the *British Pharmacopœia* (1898), by adding a mixture of equal volumes of alcohol (90 per cent) and diluted sulphuric acid, and gently heating, whereupon the pineapple odor of butyric ether is at once developed. As pure glycerin does not polarize transmitted light, the presence of sugar may be easily recognized also by optical methods. The *British Pharmacopœia* (1898) fixes the limit of arsenic in glycerin by the following test: "2 Cc. diluted with 5 Cc. of a mixture of 1 part of hydrochloric acid and 7 parts of water, 1 Gm. of pure zinc being added, and the whole placed in a long test-tube, the mouth of which is covered by a piece of filter paper moistened with a drop or two of test solution of mercuric chloride, and dried, should not afford a yellow stain on the paper, even after 15 minutes (limit of arsenium)"— *Br. Ph.*, 1898). (Also see article on arsenic in glycerin, by A. C. Langmuir, *Jour. Amer. Chem. Soc.*, 1899, p. 133.) The most extensive use of glycerin, in the industries and arts, is in the manufacture of nitroglycerin; large quantities are also used in the making of cosmetics, and for filling wet-process gas meters to prevent the containing fluid from freezing in winter and evaporating in summer. It is also employed as a food preservative, and for the treatment of wine, vinegar and beer (this process being called *scheelizing*), and in addition to its use in pharmacy and medicine, it is also employed for many practical purposes in the mechanical arts.

Action, Medical Uses, and Dosage.—Stimulant, antiseptic, laxative and demulcent. Pure glycerin abstracts water from the tissues, leaving them hard and irritated, and if of the skin liable to crack; impure glycerin, besides acting in the same manner, is more of an irritant on account of traces of sulphuric and nitric acids as well as certain organic acids, and other deleterious substances contained in it. In view of these facts only the purest glycerin should be used, and that should be mixed with a certain amount of water or rose-water before using. Glycerin may be used in *prurigo*, *psoriasis*, *impetigo*, *lichen*, *lepra*, *pityriasis*, *herpes exedens*, and some *syphilitic* and *strumous affections*. M. Fonssagrives considers its usefulness in *parasitical cutaneous affections* to be due to its antiseptic, antiputrid, and antiparasitical properties. Glycerin has been used in the place of cod-liver oil, to improve nutrition in convalescence from exhausting diseases, and in asthenic conditions generally. It is also used as a solvent of many alkaloids, extracts, salts, acids, etc., etc., especially for local application to *inflamed*, *ulcerated* or *suppurating parts;* also, as stated above, to several cutaneous maladies. Pure glycerin has been recommended for *diabetic patients* by Drs. Pavy and Abbot Smith, as a substitute for cane sugar, honey, molasses, etc., sweetening tea, coffee, various drinks, cakes, etc., with it. It is generally regarded as a non-nutritious substance at the present day, and has lost prestige as a food in *phthisis* and *diabetes*, and other *exhausting diseases*. It can not compare with cod-liver oil for this purpose, though there is some good evidence that it lessens, and in some instances checks, the excretion of sugar in *saccharine diabetes*. Large amounts of glycerin act not unlike alcohol, producing intoxication and the same gastric effects. From one-third to one-twelfth of glycerin may be added to washes or cataplasms, to render them soothing, and to keep the latter moist for some time. It acts as an emollient and soothing application, absorbing moisture from the air, and preventing the parts to which it is applied from becoming too dry.

A very small amount added to a few grains of borax and rose-water, furnishes one of the most elegant and efficient washes for *chapped hands, face, lips, or nipples*. A small quantity of glycerin added to pills or extracts, will preserve them from becoming hard and moldy. Vaccine virus may be preserved by mixing it with glycerin. It has been highly recommended for *deafness* in which there is a partial or total absence of ceruminous secretion, by protecting the tympanum, and gradually restoring the parts to their natural condition; it is likewise said to cause hearing in cases where the tympanum is thickened and indurated, or where it is in an unsound state or destroyed by ulceration; but in this last case it is not permanent; and when there is a hardness of the cerumen, and induration of the tympanum, it has proved successful. The plan is to moisten wool with the glycerin, pure or diluted with water, and pass it into the ear. In fact water and glycerin, or glycerin alone, are the best solvents for impacted and *hardened cerumen*, and by softening the mass with either, it may be readily removed by syringing carefully with warm water. An efficient lotion for dressing the parts after the removal of the impacted mass, is the following: ℞ Colorless hydrastis (Lloyd's), ʒj; glycerin, gtt. xx; distillate of hamamelis, q. s. fl℥ss. Mix. Sig. Apply warm to the parts by means of cotton. The bland and unirritating character of pure glycerin, in the presence of a little water, its permanence when exposed to the atmosphere (except its absorption of moisture), and the completeness with which it shields the parts covered by it, render it susceptible of many important applications. Mr. J. H. Ecky has given a formula for the preparation of a glycerin ointment, especially useful for *chapped hands, lips, excoriations of the skin*, etc. It will also serve as a medium for applying powders, etc., to *ulcers, cutaneous affections*, or other difficulties, by combining them with it, in the desired proportions. The formula is as follows: Melt together spermaceti half an ounce, and white wax 1 drachm, with oil of almonds 2 fluid ounces, at a moderate heat; put these into a Wedgewood mortar, add glycerin 1 fluid ounce, and rub together until well mixed and cold. An excellent lotion for cracked hands, and especially for those who work in water, is the following: ℞ Carbolic acid (liquefied by warmth), gtt. v; tincture of arnica, fl℥ss; glycerin, fl℥ss; rose-water (or water or distillate of hamamelis), q. s. fl℥vj. Mix. Sig. Wash the hands thoroughly with asepsin soap and warm water, rinse them, and apply the lotion while the hands are still wet.

A *Glycerin Balsam* for chapped lips and hands is made by melting together 1 ounce, each, of white wax and spermaceti, then stirring in half a pound of sweet almond oil and 2 ounces of glycerin, and when nearly cold, half a drachm of attar of roses. Mr. Wilson recommends glycerin as an injection into the bladder to dissolve *calculous deposits*, especially urea, and phosphate of calcium; also to be used as a substitute for syrups in preserving fruits; mixed with alcohol or pyroxylic spirit as an economical fuel for spirit-lamps; and as a remedy in *diseases of the mucous membrane of the stomach*. Dr. Wm. Bayes advises a solution of tannic acid in pure glycerin as a local application to *local hemorrhages*, by a sponge or brush, also to the vaginal, uterine, urethral, rectal, or nasal membranes, where a strong and non-irritant astringent lotion is desired. Glycerin dissolves nearly its own weight of tannic acid; the solution should be recently prepared and be kept in the dark, else it will decompose (see *Glycerites*). On account of its affinity for the water of the tissues, glycerin may be used as an astringent. It has thus been employed to dry and constringe *wounds*, lessening the tendency to the formation of pus, and a cotton pledget first dipped in hot water, squeezed, and saturated with glycerin, applied to fresh wounds, is said to cause union by first intention. Glycerin is an efficient astringent for *leucorrhœa*. *Otorrhœa, ozæna*, and other *catarrhal discharges* may be lessened by the local use of glycerin. *Abscesses, boils, carbuncles*, and *local œdemas*, as of the prepuce, may be treated with it. A mixture of glycerin and water is in common use to relieve *dryness of the mouth* induced by febrile and other states. Internally administered, glycerin is somewhat laxative, and cures of *chronic constipation* and *hemorrhoids*, both blind and bleeding, have been accredited to its use. When used by rectal injection, or by means of the glycerin suppository, it certainly is a very efficient remedy for *habitual costiveness*, provided the fecal mass be located in the rectum, and there is no lesion of the parts. If the parts be sound and the glycerin pure, no smarting or pain is likely to follow its use. It may be employed even with very young infants, and a few injections will generally break up the constipation habit. Occasionally irritation of the rectum has followed in infants, but such instances are rare, and probably due to an unhealthy condition of the rectum or to the use of an impure glycerin. The amount to be used is from ½ to 1 drachm. A small glass syringe may be employed. Added to washes and ointments for *skin diseases*, glycerin aids in allaying itching, when present. One of the best applications for *tibial ulcerations* is the following: ℞ Glycerin, ℥j; carbolic acid (melted by warmth), gr. iij; aqua pura, q. s. Oj. Mix. Sig. Bathe the part two or three times a day, and keep the part wetted by laying upon it a cloth saturated with the solution.

Dr. Goddard has given a formula for a very adhesive *glycerin paste*, suitable for fixing paper labels to glass and other surfaces, and which keeps well; it is to dissolve 1 ounce of gum Arabic in 2 fluid ounces of boiling water, add 2 fluid drachms of glycerin, and strain if necessary. This forms a valuable paste for druggists, chemists, and others. A *glycerin jelly* is prepared by intimately mixing half a drachm of soft soap with 2 fluid drachms of pure honey, then gradually adding 5 ounces of clear olive oil, stirring without intermission until all the oil is taken up. Care must be taken not to add the oil too fast. Or it may be prepared by rubbing and mixing well together half an ounce of powdered gum Arabic, and 4 ounces of simple syrup, then add the yolks of 3 eggs, and when well mixed, add gradually 4 ounces of olive oil, and 2 ounces of glycerin, previously mixed together. The ordinary dose of glycerin is 1 drachm, though from 2 to 4 drachms night and morning may be used.

Related Preparation.—GLYCONES, prepared by Eli Lilly & Co., Indianapolis, Ind., are rectal suppositories containing 95 per cent of pure glycerin, covered with an easily removable coating which is impervious and unchangeable, preserving the suppositories in all climates. They are designed to overcome *constipation*, and quickly and easily produce rectal evacuation.

GLYCERITA.—GLYCERITES.

SYNONYMS: *Glycerina* (*Br.*), *Glycerines* (*Br.*), *Glycerata*, *Glyceroles*, *Glycerolata*, *Glycerols*, *Glycerates*, *Glycemates*.

By this class of preparations is generally understood solutions of medicinal substances in glycerin, although in certain instances the various Pharmacopœias deviate to an extent. The term Glycerita as here applied to fluid glycerines, or solutions of agents in glycerin, is preferable to the ordinary names, "*glyceroles*," "*glycerates*," or "*glycemates*," etc., and includes all fluid preparations of the kind referred to, whether for internal administration or local application. Many solutions of glycerin or glycerin and water, are apt upon standing to develop microscopic cryptogams, unless a certain proportion of alcohol is added to the solutions. On this account, it is better to prepare many members of this class of solutions in small quantity at a time, and only as they are wanted (see *Lotions* and *Plasma*).

Related Preparation. GLYCELÆUM. This was introduced, in 1867, by T. B. Groves. Take almond meal (fine), ½ ounce; glycerin, 1 ounce; olive oil, 3 ounces. Triturate the meal with the glycerin and gradually incorporate the oil with the mixture. This semi-gelatinous, pasty mass may be made into emulsions by gradually adding water to it. Powders may also be incorporated with it. Oleoresins and essential oils may be employed as substitutes, wholly or in part.

GLYCERITUM ACIDI CARBOLICI (U. S. P.)—GLYCERITE OF CARBOLIC ACID.

SYNONYMS: *Glycerin of carbolic acid*, *Glycerole of carbolic acid*.

Preparation.—"Carbolic acid, twenty grammes (20 Gm.) [309 grs.]; glycerin, eighty grammes (80 Gm.) [2 ozs. av., 360 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Weigh the carbolic acid and glycerin, successively, into a tared capsule, and stir them together until the acid is dissolved. Then transfer the solution to a bottle."—*U. S. P.*

Action and Medical Uses.—This has been beneficially employed as a local application in several forms of *cutaneous disease*, attended with intense itching, *prurigo*, *psoriasis*, etc.; likewise in parasitical affections of the skin, as *tinea*, *pityriasis*, *itch*, etc.

This preparation may be used of full strength in the preparation of carbolic acid plaster, but when designed for local applications, it should be still further diluted with glycerin. A solution of the above has been advised as a dressing to *gangrenous wounds* in preference to a solution of permanganate of potassium (Maissonneuve). Solutions of various strengths have been used in various *cutaneous affections*, *cancerous* and other *fetid ulcerations*.

GLYCERITUM ACIDI GALLICI.—GLYCERITE OF GALLIC ACID.

Synonym: *Glycerin of gallic acid.*

Preparation.—Take of gallic acid, 1 troy ounce; glycerin, 4 fluid ounces. Powder the gallic acid in a mortar, then gradually add the glycerin, rubbing the mixture constantly, until an even mixture is effected. Transfer this to a porcelain evaporating dish, and warm gently upon a water-bath, stirring constantly until the acid dissolves. This preparation should not be heated above the boiling point of water, 100° C. (212° F.), lest poisonous pyrogallol be formed (T. E. Thorpe).

Action, Medical Uses, and Dosage.—This preparation has been taken internally, instead of gallic acid in substance, in the several varieties of disease in which this acid is indicated, and is supposed to be more promptly absorbed when used in this form. Useful in *inflammatory affections of mucous surfaces*, as of the fauces, nasal membrane, ear, vagina, etc. It is to be applied locally, either as a wash, gargle, or injection. Its dose is from 10 minims to 1 fluid drachm. Externally it has been applied to the scalp, in cases of *alopecia*.

GLYCERITUM ACIDI SALICYLICI.—GLYCERITE OF SALICYLIC ACID.

Synonym: *Glycerin of salicylic acid.*

Preparation.—Take of salicylic acid (made from wintergreen oil), borax (in fine powder), each, 60 grains; glycerin, 2 fluid ounces. Triturate the acid with the borax, in a mortar, until thoroughly mixed; then add the glycerin, and rub until a clear solution is obtained.

Action, Medical Uses, and Dosage.—(See *Acidum Salicylicum.*) This preparation will be found very useful in all maladies in which salicylic acid is indicated. It may be used internally as well as externally, and constitutes a useful local application in several *diseases of the mouth and pharnyx*, in *gangrenous ulcers*, *leucorrhœa*, *offensive discharges*, *pediculi*, *pruritis*, etc. The dose internally is from ½ to 2 fluid drachms.

GLYCERITUM ACIDI TANNICI (U. S. P.)—GLYCERITE OF TANNIC ACID.

Synonyms: *Glycerin of tannin*, *Glycerole of tannin.*

Preparation.—"Tannic acid, twenty grammes (20 Gm.) [309 grs.]; glycerin, eighty grammes (80 Gm.) [2 ozs. av., 360 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Weigh the tannic acid and glycerin, successively, into a tared porcelain capsule, avoiding contact with metallic utensils, and apply the heat of a water-bath, until the acid is completely dissolved. Then transfer the solution to a bottle"—(*U. S. P.*).

Action and Medical Uses.—This forms a useful local application in *bleeding* from *cuts*, *leech bites*, *epistaxis*, *sore nipples*, *anal fissure*, *chronic coryza*, *spongy gums*, *vaginal leucorrhœa*, and *chronic mucous inflammations*, in which the mucous membrane is relaxed. It will be found an excellent local application in gleet, the *nasal* *discharges* following the *exanthematous affections, otorrhœa* in children, *granular ophthalmia, ozæna*, etc. It is contraindicated in active inflammations, which should be allayed previous to its use (see *Acidum Tannicum*). Chronic diseases of the skin, as *eczema, impetigo, tinea, lichen*, etc., have also been greatly benefited by its application.

GLYCERITUM ALOES.—GLYCERITE OF ALOES.

SYNONYMS: *Glycerinum aloes, Glycerin of aloes, Glycerole of aloes.*

Preparation.—Take of finely powdered socotrine aloes, 4 drachms; glycerin, 4 troy ounces: triturate the aloes with the glycerin in a glass or porcelain mortar, transfer to a bottle and agitate well together. If the aloes is not entirely dissolved digest the mixture for 15 minutes in a water-bath and strain. This forms a syrupy liquid of a bright mahogany color.

Action and Medical Uses.—This is recommended as a local application in *lichen agrius*, and *eczematous affections*.

GLYCERITUM ALUMINIS.—GLYCERITE OF ALUM.

SYNONYM: *Glycerin of alum.*

Preparation.—Alum, 1 ounce; glycerin, 5 fluid ounces; place ingredients in a porcelain vessel, stir them together, and heat gently until solution is accomplished. Set the solution aside, and when all particles have settled pour off the clear liquid.

Action and Medical Uses.—This is to be used for the same purposes as alum (see *Alumen*). It is more irritating than glycerite of tannin, but has the advantage of being stainless.

GLYCERITUM AMYLI (U. S. P.)—GLYCERITE OF STARCH.

SYNONYMS: *Glycerin of starch, Plasma, Glycamyl.*

Preparation.—"Starch, ten grammes (10 Gm.) [154 grs.]; water, ten cubic centimeters (10 Cc.) [162 ♏]; glycerin, eighty grammes (80 Gm.) [2 ozs. av., 360 grs.]. To the starch, contained in a porcelain capsule, add the water and glycerin, and stir until a homogeneous mixture is produced. Then apply a heat gradually raised to 140° C. (284° F.), and not exceeding 144° C. (291.2° F.), stirring constantly, until a translucent jelly is formed. Transfer the product to suitable vessels, provided with well-fitting covers"—(*U. S. P.*).

This preparation, if exposed to the atmosphere, readily absorbs moisture, hence it should be kept in closely-stoppered bottles. According to Willmott the substitution of water in place of one-third of the glycerin used will prevent this change.

Action and Medical Uses.—Glycerite of starch forms a bland preparation, very useful in cases in which it is desired to apply mild, non-irritating dressings, as in the burning heat of *eczema*, in *excoriated surfaces*, in *erythema*, and in several other *irritated* or *inflamed conditions of the skin*. It likewise forms a vehicle for the application of other agents with which it may be mixed.

GLYCERITUM BISMUTHI (N. F.)—GLYCERITE OF BISMUTH.

SYNONYMS: *Liquor bismuthi concentratus, Concentrated solution of bismuth.*

Preparation.—"Bismuth and ammonium citrate, two hundred and seventy-five grammes (275 Gm.) [9 ozs. av., 307 grs.]; stronger water of ammonia (*U. S. P.*), a sufficient quantity; glycerin, five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the bismuth and ammonium citrate with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of water and two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of glycerin, and add to it gradually just enough stronger water of ammonia to dissolve the salt, and to produce a neutral solution. Then add the remainder of the glycerin and enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and filter. Each fluid drachm contains 16 grains of bismuth and ammonium citrate. *Note.*—If glycerite of bismuth should at any time deposit a precipitate, this may be redissolved by the addition of just sufficient stronger water of ammonia"—(*Nat. Form.*).

Action and Medical Uses.—Useful as a local application in *eczema, excoriations, chaps of the lips and hands*, in *gonorrhœa, vaginitis, chronic granular conjunctivitis, ciliary* and *glandular blepharitis*, etc. It should always be well shaken just previous to using it.

GLYCERITUM BOROGLYCERINI (U. S. P.)—GLYCERITE OF BOROGLYCERIN.

Synonyms: *Glycerite of glyceryl borate, Solution of boroglyceride.*

Preparation.—"Boric acid, in fine powder, three hundred and ten grammes (310 Gm.) [10 ozs. av., 409 grs.]; glycerin, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Heat four hundred and sixty grammes (460 Gm.) [1 lb. av., 99 grs.] of glycerin, in a tared porcelain capsule, to a temperature not exceeding 150° C. (302° F.), and add the boric acid in portions, constantly stirring. When all is added and dissolved, continue the heat at the same temperature, frequently stirring, and breaking up the film which forms on the surface. When the mixture has been reduced to the weight of five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.], add to it five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.] of glycerin, mix thoroughly, and transfer it to suitable vessels"—(*U. S. P.*).

This may also be made quickly by dissolving boroglyceride (1 ounce, av.) in glycerin (1 ounce, av.) by gently heating the mixture.

Description and Uses.—This preparation is colorless, thick, viscid and sweet. It is antiseptic and possesses marked preservative qualities.

Boroglycerinum (N. F.), *Boroglycerin, Glyceryl borate, Boroglyceride.*—"Boric acid, in powder, six hundred and twenty grammes (620 Gm.) [1 lb. av., 5 ozs., 381 grs.]; glycerin, nine hundred and twenty grammes (920 Gm.) [2 lbs. av,, 198 grs.]. Heat the glycerin in a tared porcelain capsule to a temperature not exceeding 150° C. (302° F.), and add the boric acid in portions, constantly stirring. When all is added and dissolved, continue the heat at the same temperature, frequently stirring, and breaking up the film which forms on the surface. When the mixture has become reduced to a weight of one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.], pour it out on a flat surface previously coated with a very small quantity of petrolatum, let it cool, cut it into pieces and transfer them immediately to bottles or jars, which should be well-stoppered. *Note.*—The official glycerite of boroglycerin may be made from this by adding an equal weight of glycerin to the finished boroglycerin while it is still warm"—(*Nat. Form.*).

GLYCERITUM HYDRASTIS (U. S. P.)—GLYCERITE OF HYDRASTIS.

Preparation.—"Hydrastis, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; glycerin, five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]; alcohol, water, each a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the hydrastis with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol until the hydrastis is practically exhausted. To the percolate add two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water, and then drive off the alcohol by evaporation or distillation. After the alcohol is driven off, add enough water to the residue to make it measure five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏], and set it aside for 24 hours. Then filter, pass enough water through the filter to make the filtrate measure five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏], add the glycerin, and mix thoroughly"—(*U. S. P.*).

History.—This preparation was first elaborated by Prof. J. U. Lloyd, in response to a call from Dr. L. E. Wickens, of Holly, Michigan. It came into extended use, and the published formula has now found its way into the *National Formulary* and *United States Pharmacopœia*. Owing to the yellow color it has fallen into general disfavor.

Action and Medical Uses.—(Those of *Hydrastis*.) Dose, ½ to 1 fluid drachm.

GLYCERITUM IODINII COMPOSITUM.—COMPOUND GLYCERITE OF IODINE.

SYNONYMS: *Glycerinum iodinii compositum, Compound glycerin of iodine, Glycerole of iodine.*

Preparation.—Take of iodine, 1 drachm; iodide of potassium, 1 drachm; glycerin, 4 drachms; thoroughly triturate in a glass mortar the iodide of potassium and glycerin together, then gradually add the iodine, and continue the trituration until it is all dissolved, and keep the mixture in a well-closed vessel.

Action and Medical Uses.—This is a somewhat caustic preparation, very useful as a local application to *ulceration of the os uteri, non-vascular goitre, scrofulous ulcers*, as well as those from *constitutional syphilis*. It should be applied by means of a hair pencil, or lamp-wick porte-caustic.

GLYCERITUM KINO.—GLYCERITE OF KINO.

SYNONYMS: *Glycerinum kino, Glycerin of kino, Glycerole of kino.*

Preparation.—Take of powdered kino, 4 drachms; glycerin, 2 fluid ounces. Triturate thoroughly together in a Wedgewood mortar, and transfer to a vial.

Action and Medical Uses.—This forms a permanent solution, not giving any deposit, and should be employed as a substitute for the tincture of kino.

GLYCERITUM PEPSINI (N. F.)—GLYCERITE OF PEPSIN.

Preparation.—*Formulary number*, 187: "Pepsin (*U. S. P.*), eighty-five grammes (85 Gm.) [3 ozs., av.]; hydrochloric acid (*U. S. P.*), ten cubic centimeters (10 Cc.) [162 ♏]; purified talcum (F. 395), fifteen grammes (15 Gm.) [231 grs.]; glycerin, five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the pepsin with four hundred and fifty cubic centimeters (450 Cc.) [15 fl℥, 104 ♏] of water and the hydrochloric acid, and agitate until solution has been effected. Then incorporate the purified talcum with the liquid, filter, returning the first portions of the filtrate until it runs through clear, and pass enough water through the filter to make the filtrate measure five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]. To this add the glycerin, and mix. Each fluid drachm represents 5 grains of pepsin (*U. S. P.*). *Note.*—For filtering the aqueous solution of pepsin first obtained by the above formula, as well as for filtering other liquids of a viscid character, a filter paper of loose texture (preferably that known as "Textile Filtering Paper"), or a layer of absorbent cotton placed in a funnel, or percolator, should be employed"—(*Nat. Form.*).

Action and Medical Uses.—(Those of *Pepsin*.)

GLYCERITUM PICIS.—GLYCERITE OF TAR.

SYNONYMS: *Glycerin of tar, Glycerole of tar.*

Preparation.—Take of tar, 1 troy ounce; glycerite of starch, 8 troy ounces. Transfer the tar to a mortar, and gradually add the glycerite of starch, stirring constantly until an even mixture results (*New Remedies*, 1879, p. 200). It is advisable to previously warm the glycerite of starch.

Action and Medical Uses.—This preparation forms a very useful local application in *lichen*, *prurigo*, *pityriasis*, *psoriasis*, *lepra*, *herpes*, *erythema*, *eczema*, *tinea*, *pruritis*, and *alopecia;* also in *indolent* and *gangrenous ulcers.* It may be rubbed upon the affected part, or be spread on a piece of linen and thus applied. It is very apt to afford more or less relief, even when it does not remove the disease. Do not confound this valuable tar compound for external use with the following liquid to be taken internally:

Related Preparation.—GLYCERITUM PICIS LIQUIDÆ. A good formula, with its uses, is as follows: Take of tar, strained, 1 troy ounce; carbonate of magnesium, rubbed to powder on a sieve, 3 troy ounces; alcohol, 2 fluid ounces; glycerin, 4 fluid ounces; water, a sufficient quantity. Mix the alcohol and glycerin with 10 fluid ounces of water. Rub the tar in a mortar with the carbonate of magnesium added gradually, until a smooth pulverulent mixture is obtained, then, add gradually, in small portions at a time, with thorough trituration continued for 15 or 20 minutes, 6 fluid ounces of the mixture of alcohol, glycerin, and water, and strain with strong pressure; return the residue to the mortar, and repeat the trituration as before, with 5 fluid ounces more of the same liquid, and again strain and express; again treat the dregs in the same manner with the remainder of the fluid mixture, and after expression, reduce the residue by trituration to a uniform condition, and finally pack firmly in a glass funnel, prepared for percolation, and pour upon it the expressed liquors, previously mixed, and when the mixture has all passed from the surface, continue the percolation with water until 1 pint of liquid has been obtained.

This is an elegant and palatable preparation of tar, of a beautiful rich reddish-brown color at first, but losing its transparency from a deposition of resinous matter, which does not, however, affect the medicinal virtues of the preparation in the least. If glycerin be substituted for the alcohol, in its preparation, the solution is nearly as strong as when alcohol is employed and deposits less resin. Glycerin appears to be a good solvent of the medicinal properties of tar, and possessing demulcent, alterative, and nutrient properties, serves as a valuable adjunct to the latter therapeutically.

Glycerin solution of tar is very valuable in *chronic cough*, *chronic laryngeal*, *bronchial* and *pulmonary affections*, and, being free from sugar, it is less liable to offend the stomach and disturb the digestive functions of patients requiring its long-continued use. It may be associated with the fluid extracts of wild cherry bark, blood-root, etc., to suit the views of the prescribing physician. The dose is from 2 to 4 fluid drachms, 3 or 4 times a day, which will represent from about 7½ to 15 grains of tar (J. B. Moore, *Amer. Jour. Pharm.*, 1869, p. 115)

GLYCERITUM POTASSII CHLORAS.—GLYCERITE OF POTASSIUM CHLORATE.

SYNONYMS: *Glycerinum potassii chloras*, *Glycerin solution of chlorate of potassium*, *Glycerole of chlorate of potassium.*

Preparation.—Take of chlorate of potassium, in powder, 1 drachm; glycerin, 10 drachms. Place the two articles in a vial, and agitate until the chlorate is all dissolved.

Action and Medical Uses.—This has been found valuable as a disinfectant and dressing for *ill-conditioned wounds* and *ulcers*, and as a local application to enfeebled and ulcerated mucous surfaces, as in *aphthous affections of the mouth*, *leucorrhœa*, *gonorrhœa* in females, *nasal ulcerations*, etc.

GLYCERITUM QUININÆ SULPHAS.—GLYCERITE OF QUININE SULPHATE.

SYNONYMS: *Glycerinum quininæ sulphas*, *Glycerin of sulphate of quinine*, *Glycerole of quinine.*

Preparation.—Take of sulphate of quinine, 24 grains; glycerin, 2 fluid ounces. Triturate the quinine with the glycerin, in a glass mortar, until it is dissolved, and transfer to a vial.

Action and Medical Uses.—This forms an elegant preparation, containing 1½ grains of sulphate of quinine to the fluid drachm. It may be used both internally and externally in all cases where quinine is indicated

GLYCERITUM SAPONIS.—GLYCERITE OF SOAP.

Preparation.—Take neutral cocoanut-oil-soda soap (or tallow-soda soap), 1 part; glycerin (sp. gr., 1.250), 4 parts. The soap must be exactly neutral and dried at 100° C. (212° F.). Dissolve the soap in the glycerin on a water-bath, and while still hot filter the solution.

Description and Uses.—This process yields a hygroscopic, odorless, light-yellow mass, having elasticity. The heat of the body is sufficient to liquify it. This has been proposed by Hebra as an ointment base, the desired medicinal agents being added to it (*Proc. Amer. Pharm. Assoc.*, 1891).

GLYCERITUM SODII BORATIS.—GLYCERITE OF BORATE OF SODIUM.

SYNONYMS: *Glycerite of borax, Glycerin of borax.*

Preparation.—Take of crystallized borate of sodium (borax), 1 troy ounce; glycerin, 8 fluid ounces. Rub the borax in a mortar until it is finely powdered, then gradually add the glycerin and rub together until the borax is dissolved. The *Glycerinum Boracis* of the *Br. Pharm.* contains powdered borax, 1 ounce (av.); glycerin, 4 fluid ounces; and distilled water, 2 fluid ounces.

Action and Medical Uses.—This preparation is employed, locally, in *aphthæ*, *thrush*, and other forms of *stomatitis*, in *fissured* and *ulcerated nipples*, in *eczema*, *lichen*, *intertrigo*, in *parasitic cutaneous diseases*, and especially in *pityriasis of the scalp*. It is also useful in *aphthous* and *ulcerative conditions of the vulva*. It most generally relieves the burning and itching attending many *cutaneous maladies*.

GLYCERITUM TRAGACANTHÆ (N. F.)—GLYCERITE OF TRAGACANTH.

Preparation.—*Formulary number*, 189: "Tragacanth, in fine powder, one hundred and twenty-five grammes (125 Gm.) [4 oz. av., 179 grs.]; glycerin, seven hundred and seventy-five cubic centimeters (775 Cc.) [26 fl℥, 99 ♏]; water, one hundred and eighty-five cubic centimeters (185 Cc.) [6 fl℥, 123 ♏]. Triturate the tragacanth with the glycerin in a mortar, add the water, and continue the trituration, until a homogeneous, thick paste results."

Note.—"The *Glycerinum Tragacanthæ* of the *Br. Pharm.* (1885) is prepared by mixing 3 troy ounces of tragacanth with 12 fluid ounces of glycerin in a mortar, adding 2 fluid ounces of water, and triturating until a translucent, homogeneous jelly is formed.

"*Mucilago Tragacanthæ* of the *U. S. P.* (1890) is made by mixing 18 grammes of glycerin with 75 cubic centimeters of water, heating the mixture to boiling, adding 6 grammes of tragacanth, macerating for 24 hours, and then adding water to make 100 grammes, heating it to a uniform consistence, and straining.

"*Unguentum Glycerini* of the *Ger. Pharm.* is prepared by triturating 1 part of powdered tragacanth with 5 parts (by weight) of alcohol (of about 91 per cent), then adding 50 parts of glycerin, and heating on a steam-bath"—(*Nat. Form.*).

Uses.—This jelly-like mass is used chiefly as a pill excipient.

GLYCERITUM VITELLI.—GLYCERITE OF YOLK OF EGG.

SYNONYMS: *Glyconin, Glyconinum.*

Preparation.—"Fresh yolk of egg, forty-five grammes (45 Gm.) [1 oz. av., 257 grs.]; glycerin, fifty-five grammes (55 Gm.) [1 oz. av., 411 grs.]: to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Rub the yolk of egg, in a mortar, with the glycerin, gradually added, until they are thoroughly mixed. Then transfer the mixture to a bottle"—(*U. S. P.*)

This preparation is of a honey-like consistence and is of value as an emulsifying agent for cod-liver and other oils. If kept from contact with the air, so that it can not absorb moisture, it keeps unaltered for a great length of time.

Action and Medical Uses.—Protective and emollient. Useful in *burns, erysipelas, erythema*, and other *cutaneous irritations* for which glycerite of starch is employed. It is inferior to that agent for most purposes.

GLYCYRRHIZA (U. S. P.)—GLYCYRRHIZA.

"The root of *Glycyrrhiza glabra*, Linné, and of the variety *glandulifera* (Waldstein et Kittaibel) Regel et Herder" (*U. S. P.*) (*Liquiritia officinalis*, Mœnch).

Nat. Ord.—Leguminosæ.

COMMON NAMES: *Liquorice-root, Spanish licorice-root, Licorice-root, Radix glycyrrhizæ hispanicæ.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 74.

Botanical Source.—The liquorice-plant has a perennial, cylindrical root, running to a considerable length and depth, grayish-brown externally, yellow internally, succulent, tough, flexible, rapid in growth, and provided with scattered fibers. The stems are erect, herbaceous, smooth, striated, with few branches, of a dull, glaucous-gray color, growing 2 or 3 feet in height. The leaves are alternate and unequally pinnate; the leaflets generally about 13, oval, entire, obtuse, slightly emarginate, viscid, and 1 terminal; the stipules are inconspicuous. The flowers are small, bluish or purplish, in axillary, erect spikes, shorter than the leaves, and borne on long peduncles. Calyx persistent, tubular, bilabiate, and 5-cleft. The corolla is a straight, ovate-lanceolate vexillum; the keel is biparted, acute and straight. Stamens diadelphous; anthers simple and rounded; style filiform; and stigma blunt. The legumes are oblong, compressed, 1-celled, and 1 to 4-seeded; the seeds are small and reniform (L.—Wi.).

The variety *glandulifera* differs in not being smooth like the preceding, but in partaking more or less of a pubescent character, the leaves (beneath) and stem being glandular-pubescent, while the pods are glandular and prickly.

History.—This plant inhabits southern Europe, and some parts of Asia, and is cultivated in England, Germany, France, and in the United States to some extent. The so-called *Russian liquorice* (that produced by the variety *glandulifera*) grows from Hungary and Turkey into western Asia. Liquorice root is imported chiefly from Spain and Sicily. Commercially considered there are 5 grades, viz.: *Italian*, the best and sweetest, *Spanish* or *Common liquorice root*, *Syrian*, *Turkish* and *Russian*, the bitterest. These grades are preferred in the order named.

Fig. 123.

Glycyrrhiza glabra.

Description.—"In long, cylindrical pieces, from 5 to 25 Mm. (⅕ to 1 inch) thick, longitudinally wrinkled, externally grayish-brown, warty; internally tawny-yellow; pliable, tough; fracture coarsely fibrous; bark rather thick; wood porous, but dense, in narrow wedges; medullary rays linear; taste sweet, somewhat acrid. The underground stem, which is often present, has the same appearance, but contains a thin pith. The drug derived from the variety *glandulifera* (so-called Russian liquorice) consists usually of roots and root-branches, 1 to 4 Cm. (⅖ to 1 inch) thick, 15 to 30 Cm. (6 to 12 inches) long, frequently deprived of the corky layer, the wood rather soft, and usually more or less cleft"—(*U. S. P.*). Liquorice root has a faint odor and is so dense as to sink in water. It must be kept in a dry place. Those roots are to be preferred which are not worm-eaten or decayed, and whose surfaces of fracture are bright yellow.

Chemical Composition.—The characteristic constituent of the root is *glycyrrhizin*, so named by Robiquet (1809) on account of its sweet taste. There are furthermore present, fatty and resinous matter (0.8 per cent), small amounts of gum, albuminous substances, tannin, starch, yellow coloring matter, a bitter principle (*glycyramarin*), and *asparagin* (Plisson, 1828), a substance already recognized by Robiquet, who named it *agédoïte*. Sestini (1878) found from 2 to 4 per cent of this principle present in liquorice root.

Glycyrrhizin was obtained by Gorup-Besanez by making a cold infusion of the root, and heating the solution to boiling, filtering, evaporating to a smaller bulk, and precipitating with sulphuric acid. The yellow flakes thus obtained are washed with water and further purified by means of ether-alcohol (Husemann and Hilger). Z. Roussin (1875) and Habermann (1879) showed that the sweet principle, glycyrrhizin, is the acid ammonium salt of a peculiar nitrogenous tribasic acid, called *glycyrrhizic acid* (often termed glycyrrhizin), to which Habermann assigned the formula $C_{44}H_{63}NO_{18}$. The acid potassium salt of this acid is remarkable for its intensely sweet taste. The free acid, prepared from the lead salt, forms a brown, gelatinous mass, soluble in hot water, and having a bitter-sweet taste and acid reaction. It decomposes carbonates, swells up in cold water, is easily soluble in glacial acetic acid, but not in alcohol or ether.

Habermann (1880) found that by boiling with diluted sulphuric acid, it splits into *glycyrretin* ($C_{32}H_{47}NO_4$), a white, tasteless powder, insoluble in water, alkali and ether, soluble in alcohol; and *parasaccharic acid* ($C_6H_{10}O_8$), which reduces Fehling's solution. Gorup-Besanez believed that dextrose was formed in this reaction. Habermann obtained the *acid ammonium glycyrrhizinate* (glycyrrhizin proper) by crystallizing the commercial liquorice extract from glacial acetic acid, and subsequent recrystallization. In the purest state it forms yellow crystals of sweet taste, little soluble in cold water. When dissolved in hot water and then cooled, a stiff jelly is formed. This salt is hardly soluble in alcohol or ether. The amount of glycyrrhizic acid contained in liquorice root is varying. Sestini (1878) obtained 3.3 per cent from air-dried root; H. J. Möller, in 1880, obtained 7.5 per cent from Russian root (Flückiger, 1891). Mr. L. McCullough (*Amer. Jour. Pharm.*, 1890, p. 389), found 7.18 per cent. In *commercial liquorice extract* glycyrrhizin was found by Kremel (*Archiv der Pharm.*, 1889, p. 511) to vary from 5.8 to 11.9 per cent. Peltz (*Pharm. Zschr. f. Russland*, 1876, p. 257) records the results of 10 analyses of commercial extracts of liquorice root. Glycyrrhizin was found to vary from 1.33 to 18.14 per cent, starch from 1.33 to 35 per cent. Sestini (1878) found water, 48.7; glycyrrhizin, 3.27; carbohydrates, 29.62; asparagin, 1.25; ash, 2.08. (For methods of valuation of commercial liquorice extracts, see Flückiger, *Pharmacognosie*, 3d ed., 1891, and Alfred Mellor, *Amer. Jour. Pharm.*, 1898, p. 136.) Glycyrrhizin is stated (Flückiger) to occur in other plants, *e. g.*, *Abrus precatorius* (Berzelius), *Astragalus glycyphyllos*, *Polypodium vulgare* (Guignet, 1885), *Myrrhis odorata* (Schroeder, 1885), *Gulielma speciosa*, Martius, and *Monesia bark* (Peckolt, *Pharm. Rundschau*, 1888, pp. 31, 203, 206), but these statements, according to Flückiger, require verification.

Action, Medical Uses, and Dosage.—Liquorice root is emollient, demulcent, and nutritive. It acts upon mucous surfaces, lessening irritation, and is consequently useful in *coughs*, *catarrhs*, *irritation of the urinary organs*, and *pain of the intestines in diarrhœa*. It is commonly administered in decoction, sometimes alone, at other times with the addition of other agents, and which is the preferable mode of using it. As a general rule, the acrid bark should be removed previous to forming a decoction. When boiled for some time the water becomes impregnated with its acrid resin; hence, in preparing a decoction for the purpose of sweetening diet drinks, or covering the taste of nauseous drugs, it should not be boiled over 5 minutes. The efficiency of the root in *old bronchial affections* may be due to this acrid resin. The powdered root is also employed to give the proper solidity to pills, and to prevent their adhesion; the extract for imparting the proper viscidity to them. The extract, in the form of lozenge, held in the mouth until it has dissolved, is a very popular and efficient remedy in *coughs* and *pectoral affections*. An excellent troche or lozenge, very useful in ordinary cough, may be made by combining together 6 parts of refined liquorice, 2 parts of benzoic acid, 4 parts of pulverized alum, and ½ a part of pulverized opium. Dissolve the liquorice in water, and evaporate to the proper consistence, then add the powders with a few drops of oil of anise, and divide it into 3 or 6-grain lozenges. The bitterness of quinine, quassia, aloes, and the acrid taste of senega, guaiacum, mezereon and ammonium chloride are masked by liquorice.

Related Species. *Glycyrrhiza lepidota*, which grows in Missouri, possesses the taste of liquorice to a considerable degree. McCullough (*Amer. Jour. Pharm.*, 1890, p. 389) found it to contain over 6 (6.39) per cent of *glycyrrhizin*.

Ononis spinosa, Linné, *Rest-harrow.*—Europe, in sandy situations. The root of this plant is about 2 feet in length, and from less than ½ to nearly 1 inch in thickness. It is tough, curved, or twisted, and flattened, deeply rugose, and covered with a thin, deep grayish-brown bark. It is whitish internally. This has a mucilaginous taste, at first sweetish, then bitter and disagreeable, and on the whole somewhat resembles that of liquorice root. Reinsch (1842 obtained therefrom crystals of *ononin* ($C_{30}H_{34}O_{13}$), tasteless and colorless, and recognized by Hlasiwetz (1855) to be a glucosid. Another constituent, *ononid* ($C_{18}H_{22}O_8$, Hlasiwetz), discovered by Reinsch, much resembles glycyrrhizin in its chemical behavior. Hlasiwetz also isolated from Reinsch's impure ononin a waxy substance which he called *onocerin.* This body was recently found by H. Thoms (*Archiv. der Pharm.*, 1897, p. 28) to be a secondary alcohol ($C_{26}H_{42}[OH]_2$), for which he proposes the altered name *onocol.* It seems closely related to *phytosterin* (*vegetable cholesterin*).

Aqueous or acetous decoctions of this root are reputed diuretic and lithontriptic, other properties also being ascribed to it. Its principal use is as a diuretic for *dropsy*, for which it is a popular remedy in France. Other conditions in which it has been employed are as a wash for *ulcers*, *toothache*, *hemorrhoids*, *scalp eruptions*, *hydrocele*, *enlarged glands*, and internally in *jaundice*, *gout*, and *rheumatism*, usually combined, in the two latter diseases, with renal depurants. The decoction is made with from 1 to 2 ounces of ononis root to water, 1 pint, the dose of which is a wineglassful several times a day. From 3 to 5 grains of *ononin* produced a prolonged irritation and sense of rawness in the mouth and throat (Schroff).

GLYCYRRHIZINUM AMMONIATUM (U. S. P.)—AMMONIATED GLYCYRRHIZIN.

Preparation.—"Glycyrrhiza, in No. 20 powder, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]; water, ammonia water, sulphuric acid, each, a sufficient quantity. Mix four hundred and seventy-five cubic centimeters (475 Cc.) [16 fl℥, 30 ♏] of water with twenty-five cubic centimeters (25 Cc.) [406 ♏] of ammonia water, and, having moistened the powder with the mixture, macerate for 24 hours. Then pack it moderately in a conical glass percolator, and gradually pour water upon it until five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of percolate are obtained. Add sulphuric acid slowly to the percolate, with constant stirring, so long as a precipitate is produced. Collect this on a strainer. wash it with cold water until the washings no longer have an acid reaction, redissolve it in water with the aid of ammonia water, filter, if necessary, and again add sulphuric acid so long as a precipitate is produced. Collect this, wash it, dissolve it in a sufficient quantity of ammonia water previously diluted with an equal volume of water, and spread the clear solution upon plates of glass, so that, when dry, the product may be obtained in scales"—(*U. S. P.*).

Description and Chemical Composition.—"Dark-brown or brownish-red scales, without odor, and having a very sweet taste. Readily soluble in water and in alcohol. The aqueous solution, when heated with potassium or sodium hydrate T.S., evolves ammoniacal vapors. If the aqueous solution be supersaturated with an acid, there will be produced a precipitate (glycyrrhizin) which, when dissolved in hot water, forms a jelly on cooling. This substance, after being washed with diluted alcohol, and dried, appears as an amorphous, yellow powder, having a strong, bitter-sweet taste, and an acid reaction. Upon incineration, ammoniated glycyrrhizin should not leave more than a trace of ash"—(*U. S. P.*). This product consists largely of ammonium glycyrrhizate ($[NH_4]C_{44}H_{62}NO_{18}$) and glycyramarin ($C_{36}H_{57}NO_{13}$), a bitter glucosid, dissolving in ether-alcohol (see *Glycyrrhiza*). This preparation is used mainly for masking the bitterness of quinine salts. It produces with these substances, when in solution, precipitates which contain the quinine. Hence, care must be taken to shake the vial before taking a dose.

GNAPHALIUM.—WHITE BALSAM.

The herb of *Gnaphalium polycephalum*, Linné.

Nat. Ord.—Compositæ.

COMMON NAMES: *Indian posy*, *Sweet-scented life-everlasting*, *Old field balsam.*

Botanical Source.—This plant is indigenous, herbaceous, and annual, with an erect, whitish, woolly, and much-branched stem, from 1 to 2 feet in height The leaves are alternate, sessile, linear-lanceolate, acute, entire, scabrous above. and whitish tomentose beneath. The flowers are tubular and yellow, borne in heads clustered at the summit of the panicled-corymbose branches, ovate-conical before expansion, then obovate. The involucre is imbricate, with whitish, ovate, and oblong, rather obtuse scales. Florets of ray, subulate—of disk, entire. The receptacle is flat and naked, the pappus pilose and scabrous capillary (W.—G.).

History.—White balsam is found in Canada and various parts of the United States, growing in old fields and on dry, barren lands, and bearing whitish-yellow flowers in July and August. The leaves have a pleasant, aromatic smell, and a slightly bitter and astringent, but rather agreeable taste. They yield their properties to water. No analysis has been made of them. The *Antennaria Margaritacea*, R. Brown, formerly *Gnaphalium Margaritaceum*, Linne, or pearl-flowered life-everlasting, a perennial plant, possesses similar properties to the above (see *Antennaria*).

Action, Medical Uses, and Dosage.—Astringent. The leaves and blossoms chewed, and the juice swallowed, have proved beneficial in *ulcerations of the mouth* and *throat*. A warm infusion (℥ss to water Oj), may be used in *fevers* to produce diaphoresis, and is of service in *quinsy*, *pulmonary complaints*, *leucorrhœa*, etc.; it may be used internally and as a local application. Likewise used as an infusion in *diseases of the bowels*, and *hemorrhages*, and applied in fomentations to *bruises*, *indolent tumors*, and other local affections. Prof. Scudder suggests investigation to determine its influence upon the reproductive and urinary stuctures, in *acute* and *chronic ulcerations*, and in *digestive disorders*. The fresh juice is reputed an aphrodisiac.

GOODYERA.—NET-LEAF PLANTAIN.

The leaves of *Goodyera pubescens*, Robert Brown.

Nat. Ord.—Orchidaceæ.

Common Names: *Net-leaf plantain*, *Scrofula weed*, *Adder's violet*, *Rattlesnake-leaf*.

Botanical Source.—This plant has a perennial root, from which arises an erect, sheathed, and pubescent scape, from 8 to 12 inches in height. The leaves are radical, ovate, dark-green, conspicuously reticulated, blotched above with white, about 2 inches in length, and contracted at base into winged petioles scarcely half as long. The flowers are white, numerous, pubescent, and borne in a crowded, terminal, oblong, cylindric spike. Lip ovate, acuminate, saccate, and inflated. Petals ovate. The *Goodyera repens*, R. Brown, is a reduced variety of the above, the scape being from 6 to 8 feet in height; leaves less conspicuously reticulated, flowers being on a somewhat unilateral spike, more or less spiral; in other respects about the same as the preceding (W.—G.).

Fig. 123.

Goodyera pubescens.

History.—This herb grows in various parts of the United States, in rich woods, and under evergreens, and is common southward, while the *G. repens* is more common northward and on mountains. It bears white or yellowish-white flowers in July and August. The leaves are the parts employed, and yield their virtues to boiling water. No analysis has been made of them.

Action, Medical Uses, and Dosage.—Net-leaf plantain is anti-scrofulous, and is reputed to have cured severe cases of *scrofula*. The fresh leaves are steeped in milk and applied as a poultice to *scrofulous ulcers*, or the bruised leaves may be laid on them, and in either case they must be renewed every 3 hours; at the same time a warm infusion must be taken as freely as the stomach will allow. Used as an injection into the vagina, and at the same time exhibited internally, the infusion has proved beneficial in *leucorrhœa*, recent *prolapsus uteri*, and as a wash in *scrofulous ophthalmia*.

GOSSYPIUM PURIFICATUM (U. S. P.)—PURIFIED COTTON.

"The hairs of the seed of *Gossypium herbaceum*, Linné, and of other species of *Gossypium* (*Nat. Ord.*—Malvaceæ), freed from adhering impurities and deprived of fatty matter"—(*U. S. P.*).

SYNONYMS: *Gossypium* (*Pharm.*, 1880), *Absorbent cotton*, *Bombyx*, *Lana gossypii*, *Lanugo gossypii*, *Pili gossypii*, *Cotton wool.*

Source and Preparation.—Purified cotton is now made on an enormous scale by manufacturers whose processes, being private and of great personal value, should not be published in justice to the owners. All the absorbent cotton of commerce is purchased by pharmacists and other consumers, none being made on a small scale. It may be prepared from raw cotton by "*mercerizing*" the latter, that is, by boiling with weak solutions of alkalies. By union with the fatty material of the cotton a soap is formed which is removed by repeatedly washing the cotton with water. F. L. Slocum's process (*Amer. Jour. Pharm.*, 1881, p. 53), is as follows: Carded cotton is boiled for one-half hour in diluted solution (5 per cent) of caustic potash (or caustic soda). The soap formed is thoroughly washed out, the cotton expressed and placed for 15 or 20 minutes in a diluted solution (5 per cent) of chlorinated lime. It is then washed with water, dipped into water made slightly acid with hydrochloric acid, and again thoroughly washed with water. The cotton is then expressed and again boiled for 15 or 20 minutes with the diluted (5 per cent) alkali (hydroxide of potassium or sodium), washed again with water, next with acidulated water, and lastly with water. The cotton is then expressed and dried rapidly. It requires two boilings with alkalies to completely remove the fats. Mr. Slocum defines absorbent cotton to be cotton entirely freed from all matter (grease), that will obstruct capillary attraction. It is on record that in order to meet a popular demand for pure whiteness and a peculiar "feel" in purified cotton, the latter, after being freed from fatty and resinous matter, has been covered again with a trace of free fatty acid by passing it through a (diluted) soap solution, and an acid solution afterward (*Amer. Jour. Pharm.*, 1891, p. 189).

Description.—Cotton is tasteless, odorless, highly combustible, and according to Thompson, is not soluble in alcohol, water, ether, oils, or vegetable acids; weak alkaline liquids have no perceptible action on it, but when very strong they dissolve it by the aid of heat. Tannic acid forms a brown or yellow compound with it; nitric acid decomposes it when assisted with heat, oxalic acid being formed; sulphuric acid dissolves it. The strong mineral acids generally decompose it. Gun-cotton (*Pyroxylin*) a nitro-compound of an explosive character, is prepared from it by means of nitric acid (see *Collodium* and *Pyroxylinum*).

Purified cotton is almost pure cellulose. It is officially described as follows:

"White, soft, fine filaments, appearing under the microscope as hollow, flattened and twisted bands, spirally striate, and slightly thickened at the edges; inodorous and tasteless; insoluble in ordinary solvents, but soluble in copper ammonium sulphate solution. Purified cotton should be perfectly free from all visible impurities, and, on combustion, should not leave more than 0.8 per cent of ash. When purified cotton, previously compressed in the hand, is thrown on the surface of cold water, it should readily absorb the latter and sink, and the water should not acquire either an acid or an alkaline reaction (evidence of proper purification)"—(*U. S. P.*).

Action and Medical and Surgical Uses.—Externally, cotton is used as a local application in *erysipelas*, *erythema*, *fresh burns*, *wounds*, *severe bruises* or *contusions*. in *rheumatic pains*, and has been successfully employed in dressing *blisters*. In *burns* and *blisters*, it quickly allays pain, but care must be taken that the cotton does not harden and adhere firmly to the part over which it is applied, as it will then cause irritation the same as any other foreign body; this may usually be avoided by first applying some simple oleaginous substance over the surface which is to come in contact with the burn or ulcer. Cotton is supposed to prove efficient by excluding the air from the parts over which it is applied, and also by imbibing the secretions. As an application after surgical operations it is unsurpassed, and by taking up the discharges prevents purulent absorption. It is often medicated with boracic acid, carbolic acid, etc., for this purpose. Pessaries and tampons are often prepared with cotton, but should be frequently removed lest they become foul from absorption of the discharges. Surgeons make extensive use of absorbent cotton to clean surfaces and cavities, and it is specially applicable for use in the nasal and aural passages, both for cleansing purposes and for the introduction of medicaments. For packing wounds and cavities and similar surgical uses some of the forms of gauze are preferred.

Cotton Preparations.—Gossypium stypticum (N. F.), *Styptic cotton. Formulary number,* 190: "Purified cotton (*U. S. P.*), solution of chloride of iron (*U. S. P.*), glycerin, water, of each a sufficient quantity. Mix the liquids in the proportion of five (5) parts of the iron solution, one (1) part of glycerin, and four (4) parts of water, in such quantities that the purified cotton shall be completely immersed in the liquid when gently pressed. Allow the cotton to remain in the liquid 1 hour, then remove it, press it until it has been brought to twice its original weight, spread it out in thin layers, in a warm place, protected from dust and light, and when it is sufficiently dry, transfer it to well-closed receptacles"—*Nat. Form.*).

Hemostatic cotton is prepared by impregnating absorbent cotton with solution of subsulphate of iron or mixture of alum and chloride of iron.

Salicylic cotton or *Salicylated cotton*, contains from 5 to 10 per cent of the salicylic acid. Cotton is also impregnated with other substances, as benzoic acid (benzoic cotton), iodoform (iodoform cotton), chlorine (chlorinated cotton), boracic acid (borated cotton), etc.

GOSSYPII RADICIS CORTEX (U. S. P.)—COTTON ROOT BARK.

"The bark of the root of *Gossypium herbaceum*, Linné, and of other species of *Gossypium*"—(*U. S. P.*).

Nat. Ord.—Malvaceæ.

Illustration: Bentley and Trimen, *Med. Plants*, 37.

Botanical Source.—*Gossypium herbaceum* is a biennial or triennial herb with a fusiform root, giving off small radicles, and a round, pubescent, branching stem, about 5 feet high. The leaves are hoary, palmate, with 5 sublanceolate, rather acute lobes, 3 large, 2 small, lateral, and a single gland on the midvein below, ½ an inch from the base. The stipules are falcate-lanceolate. The flowers are yellow; the calyx cup-shaped, obtusely 5-toothed, surrounded by an involucel of 3 united and cordate leaves, deeply and incisely toothed. The petals are 5 in number and deciduous, with a purple spot near the base. Style simple, marked with 3 or 5 furrows toward the apex. Stigmas 3 or 5. Capsules 3 or 5-celled, 3 or 5-valved, and loculicidal; the seeds, 3 or 5, are involved in cotton, somewhat plano-convex and reniform (W.—R.—W.).

Gossypium barbadense, Linné, or *Sea Island cotton plant*, is a larger plant than the preceding; leaves 5-lobed, with 3 glands beneath, upper ones 3-lobed; cotton white and seeds black. It is likewise biennial or triennial (W.).

History.—Cotton is an Asiatic plant, but is extensively cultivated in India, Syria, Asia Minor, the Mediterranean, and America. Cultivation has considerably changed the plant so as to render it difficult for botanists to correctly describe the originals. Several species have been named by authors, which Swartz and Macfayden believe to be mere varieties of one species; while Wight, Arnold, and Hamilton believe that there are but two distinct species, the *G. album*, whose seeds are white, and which furnishes, according to A. W. Chapman, the *upland* or *short-staple* cotton, and the *G. nigrum*, whose seeds are black, and which furnishes *long-staple* or *Sea Island cotton* of the United States. *G. barbadense* yields true Sea Island cotton. The various cotton plants differ considerably in the form of the leaf and its gland, the height of the plant, the hue of the petals, and the elongation and delicacy of the cotton. The plant can not be profitably cultivated north of the Ohio River, or above that latitude. The leaves are very mucilaginous, and have been used in cases where mucilage is required. A fixed oil is contained in the seeds, which may be procured by pressure; it is a drying oil. The part used in medicine is the inner bark of the root, and the white, downy substance contained in the matured capsule, and known as "cotton." When examined microscopically, the filaments constituting cotton are seen to consist of distinct, flat, narrow ribbons or tubular hairs, with occasional appearances of joints, indicated by lines at right angles to the side of the tube.

The *U. S. P.* thus describes cotton root: "In thin, flexible bands or quilled pieces; outer surface brownish-yellow, with slight, longitudinal ridges or meshes, small, black, circular dots, or short, transverse lines, and dull, brownish-orange patches, from the abrasion of the thin cork; inner surface whitish, of a silky lustre, finely striate; bast fibers long, tough, and separable into papery layers; inodorous; taste very slightly acrid and faintly astringent"—(*U. S. P.*).

Chemical Composition.—Prof. E. S. Wayne (*Amer. Jour. Pharm.*, 1872, p. 289) regards the red resin so frequently precipitated in fluid extracts of gossypium as being produced by chemical change from a chromogene substance existing in all parts of the plant. It has acid properties, dissolves in alkali and forms colored precipitates with solutions of metallic salts, and is, therefore, called *gossypic acid*. About 8 per cent of the acid resin was found by Wm. C. Staehle (1875) in the powdered bark. It was soluble in alcohol, chloroform, ether, and somewhat less in benzol. Charles C. Drueding (*Amer. Jour. Pharm.*, 1877) removed from the red coloring matter a yellow principle by means of boiling benzin. He also finds in the root fixed oil, gum, sugar, tannin, and chlorophyll. Walter A. Taylor (*Amer. Jour. Pharm.*, 1876, p. 402) observes that fresh root yields with strong alcohol a tincture of pale yellow color, which turns red upon prolonged standing, yet without precipitating. A weaker alcohol solution exhibits the same change in color, but precipitates. Old root yields to strong alcohol at once a deep-red solution, which does not precipitate upon standing.

Action, Medical Uses, and Dosage.—The bark of the recent root of the cotton plant is emmenagogue, parturient, and abortive. It is said to promote uterine contraction with as much efficiency and more safety than ergot, and was used by the slaves of the South for inducing abortion, which it effected without any apparent detriment to the general system. It is adapted to cases of *uterine inertia*, and, while acting after the manner of ergot, is a much feebler though less dangerous drug. Four ounces of the inner root-bark may be boiled in a quart of water down to a pint, the dose of which is 1 or 2 fluid ounces every 20 or 30 minutes. The hydro-alcoholic extract, as well as the decoction and specific gossypium, form excellent emmenagogues, and may be used in *chlorosis*, *amenorrhœa*, *dysmenorrhœa*, etc. It is very doubtful whether this will ever take the place of other more certain parturients. In my own practice, it failed in producing any influence upon the uterus during parturition in about one-half the cases in which it has been used, owing, probably, to its not being fresh enough. It operated exceedingly well in the first cases in which it was exhibited (J. King). The old root-bark is valueless as a medicine. The fluid extract is less efficient than the decoction, and fluid preparations are valueless after they begin to gelatinize, and deposit the so-called "*red tannates*" (see *Fluid Extract of Gossypium*). Enthusiastic reports of its efficiency in *hysteria* have been made. It seems adapted to those cases in which there is an anemic state of the reproductive organs, with lack of sexual desire or pleasure. It is a remedy for *sexual lassitude*, and has been suggested for *impotency* (Webster). It is regarded as an efficient remedy for the reduction of *uterine subinvolution* and *fibroids*. It should not be used where there is marked irritation or tendency to inflammation. Gossypium is also a stimulant diuretic. The dose of the decoction (see above); of the fluid extract, 1 to 60 minims; of specific gossypium, 1 to 60 drops.

Specific Indications and Uses.—Uterine inertia during parturition (large doses). Menstrual delay, with backache and dragging pelvic pain; fullness and weight in bladder, with difficult micturition; hysteria, with anemic condition of the reproductive tract; sexual lassitude, with anemia.

Other Parts of the Plant.—The seeds are reputed to possess superior antiperiodic properties. A pint of cotton seed placed in a quart of water and boiled down to 1 pint, and 1 gill of the warm tea given 1 or 2 hours before the expected chill, is said to cure *intermittent fever* with the first dose. The flowers and leaves are reputed diuretic, and useful in *urinary affections*; the leaves steeped in vinegar, are said to relieve *hemicrania* when locally applied, and a decoction is considered beneficial in the *bites of venomous reptiles* in Brazil. An infusion of the whole plant is reputed galactagogue.

GRANATUM (U. S. P.)—POMEGRANATE.

"The bark of the stem and root of *Punica Granatum*, Linné"—(*U. S. P.*).

Nat. Ord.—Lythrarieæ.

COMMON NAME: *Pomegranate root-bark.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 113.

Botanical Source.—Pomegranate is a small tree or shrub, with spinescent branchlets. The leaves are opposite, oblong, inclining to lanceolate, entire, smooth, with no marginal vein, 2 or 3 inches long, by 5 or 10 lines wide, obtuse, deciduous, shortly petioled, rarely verticillate or alternate, and often axillary and fascicled. The flowers are large, red, 2 or 3, nearly sessile, on somewhat terminal branchlets. Calyx turbinate, 5-cleft, thick, pale, and succulent; æstivation valvate. The corolla consists of 5 much crumpled, membranous petals. The stamens are numerous, inserted on the calyx, filaments distinct; anthers yellow. The ovary is roundish and inferior; the style simple and filiform, the stigma globular and capitate. The fruit is a large, globose pericarp, the size of a small muskmelon, leathery, crowned by the prominent hardened tube of the calyx, divided horizontally into 2 parts by a very irregular, confused dissepiment; the lower division 3-celled, the upper 5 to 9-celled; dissepiments membranaceous; placentæ in the lower division at the bottom; in the upper stretching from the side of the fruit to the middle. The seeds are numerous, angular and covered with a bright red, succulent, acrid coat. Embryo oblong; radicle short and acute; cotyledons foliaceous and spirally convolute (L.—W.).

Fig. 124.

Punica Granatum.

History.—The pomegranate grows on the Mediterranean shores, Persia, China, and other countries of Asia, and has been naturalized in the West Indies, and other civilized countries in warm latitudes. It has splendid, dark-scarlet flowers, often doubled, which appear in July and August. The flowers, called *balaustion* by the ancients, have a slightly styptic taste, without odor, and their infusion gives a deep bluish-black precipitate with ferric salts. The saliva is colored a violet-red upon chewing them. Both tannic and gallic acids enter into their composition. In some foreign Pharmacopœias, they, together with the seeds, are recognized as official. The rose-colored, juicy, acid pulp is edible, and is very grateful to febrile patients. The bark of root and stem is the only part employed in this country. The rind of the fruit was also official with us formerly. The fruit varies in size and flavor, that of the West Indies becoming the most perfect. The root is large, ligneous, knotty and hard. Its wood is not used in medicine. In this country the pomegranate shrub grows out of doors as far north as Washington, D. C. (Coville).

Description and Chemical Composition.—GRANATI FRUCTUS CORTEX. The *rind of the fruit* (*Granati fructus cortex*), when dry, is brown externally, yellow within, about a line in thickness, smooth or finely tuberculated, hard, dry, brittle, in irregular fragments, inodorous, and of a very astringent, somewhat bitter taste. Its infusion gives an abundant, dark-bluish precipitate with the salts of iron. Analysis showed 18.8 per cent of tannin, 17.1 of mucilage, 10.8 of extractive matter, 30 of lignin, a trace of resin, and 29.9 of moisture.

GRANATI RADICIS CORTEX.—The bark of the root (*Granati radicis cortex*) is described by the *U. S. P.* as follows: "In thin quills or fragments, from 5 to 10 Cm. (2 to 4 inches) long, and from 1 to 3 Mm. ($\frac{1}{25}$ to $\frac{1}{8}$ inch) thick; outer surface yellowish-gray, somewhat warty, or longitudinally and reticulately ridged; the stem-bark often partly covered with blackish lichens; the thicker pieces of the root-bark more or less scaly externally; inner surface smooth, finely striate, grayish-yellow; fracture short, granular, greenish-yellow; indistinctly radiate; inodorous; taste astringent, very slightly bitter"—(*U. S. P.*).

The bitterness of the bark is nearly lost by drying. When chewed, it tinges the saliva yellow. Its infusion yields a deep-blue precipitate with the salts of iron, a yellowish-white one with a solution of gelatin, a grayish-yellow with corrosive sublimate, and caustic potash or ammonia colors it purple. Paper which has been colored yellow by the moistened inner face of the bark, changes to blue by the action of sulphate of iron, and to a delicate rose color, which is evanescent, by nitric acid. These changes do not occur with the bark of barberry, or of box-root, which are sometimes fraudulently mixed with it; the box bark is nearly white, very bitter, but not astringent, and its infusion is not precipitated by salts of iron (Guibourt—Planchon, *Hist. des Drogues Simples*, 1876, Vol. III, p. 280). The barberry bark likewise very much resembles the pomegranate, but is very bitter and not astringent, and is not affected by the salts of iron, solution of isinglass, corrosive sublimate, or caustic potash. The ligneous part of pomegranate root is inert, and should, therefore, be always separated from the bark.

Pomegranate bark contains about 20 per cent of tannin, which was believed by Rembold (1867) to consist of two astringent principles, one being *gallotannic acid*, the other *punicotannic acid* ($C_{20}H_{16}O_{13}$), peculiar to this bark. Diluted sulphuric acid hydrolyzed it into sugar and *ellagic acid* ($C_{14}H_8O_9$) (Flückiger, *Pharmacognosie*, 1891). The presence of *gallic acid* and *mannit* has been observed by various authors (*Jahresb. der Pharm.*, 1867, p. 139). The bark leaves from 10.5 to 16.5 per cent of ash. It also contains a yellow coloring matter (see above). The anthelmintic properties of pomegranate bark are due to the presence of several (4) alkaloids, discovered by Tanret in 1878 and 1880 (*Amer. Jour. Pharm.*, 1880, p. 416), and to which he gave the collective name *pelletierine*, in honor of the celebrated French chemist Pelletier (1788–1842). C. J. Bender (1885) proposes the more euphonic name *punicine*. By mixing the powdered bark with milk of lime, exhausting with water, shaking with chloroform, and abstracting this solution with diluted acid, a solution of the 4 alkaloids is obtained. From this solution sodium bicarbonate liberates *methylpelletierine* and *pseudopelletierine*, which are removed by chloroform; the addition of caustic potash then sets free *pelletierine* and *isopelletierine*.

PELLETIERINE ($C_{16}H_{30}N_2O_2$) is a colorless liquid, of specific gravity 0.988, rapidly absorbs oxygen, and resinifies. It boils at 195° C. (383° F.), is soluble in 20 parts of cold water, and mixes in all proportions with ether, alcohol, and chloroform. Its salts are crystallizable, but give off the base upon heating either dry or in solution. Its sulphate is lævo-rotatory. *Isopelletierine* ($C_{16}H_{30}N_2O_2$) is a liquid optically inactive, forming salts with acids. Density, solubilities, and boiling point are the same as with its preceding isomer. Its sulphate is deliquescent and optically inactive. *Methylpelletierine* ($C_{18}H_{34}N_2O_2$) is a liquid whose boiling point is 215° C. (419° F.). Its hydrochlorate is dextrogyre. The alkaloid dissolves in 25 times its weight of water at 12° C. (53.6° F.), and is soluble in alcohol, ether, and chloroform. *Pseudopelletierine* ($C_{18}H_{30}N_2O_2$) is a crystalline body, fusing at 46° C. (114.8° F.), is optically inactive, soluble in water, alcohol, ether, and chloroform. The chemistry of this base (called also *granatonin*) was investigated more recently by Ciamician and Silber (see *Jahresb. der Pharm.*, 1893, p. 532, and 1894, p. 526).

Tanret recommended the *tannate of pelletierine* as the most efficient form of application. The bark of the stem contains principally *pelletierine*, while in the root-bark methylpelletierine predominates (Flückiger, 1891). As to the yield in total alkaloids, W. Stoeder (1894) obtained from Java root-bark from 1.29 to 1.86 per cent of hydrochlorates of alkaloids, the white-flowering variety yielding the most alkaloid. In 1890 (*Jahresb. der Pharm.*), the same author had obtained a yield as high as 3.75 per cent of hydrochlorates from the white-flowering variety. On the other hand, E. Aweng (*ibid.*, 1890), observed that the alkaloid may entirely disappear from the commercial bark upon storing.

Action, Medical Uses, and Dosage.—The flowers and rind of the fruit are astringent and have been used for arresting *chronic mucous discharges*, *passive hemorrhages*, *aphthous disorders of the mouth*, *night sweats*, *colliquative diarrhœa*, etc., but are now seldom employed. The rind has also been found serviceable in *intermittent fever* and *tapeworm*. The bark of the root possesses anthelmintic properties, and is chiefly serviceable in tapeworm. The bark of the wild pomegranate is considered by the French to be more active than the cultivated plant, and the fresh bark is more active than an old bark. It may be given in powder, but the decoction is more frequently used. Pomegranate is one of the oldest of drugs, having been used from time immemorial. The bark and its alkaloid *pelletierine*, are now by common consent, acknowledged as specifics for the removal of tapeworm. Dizziness, imperfect vision, sleepiness, or faintness, benumbing of the extremities, and occasionally convulsions have been produced by it. Foy, as well as Brenton, recommend to prepare the decoction by placing 2 ounces of the root in 1½ or 2 pints of water, and boiling down to 1 pint; this is to be strained, and from 2 to 4 fluid ounces given for a dose every half hour or hour, until the pint of the decoction has been taken. It commonly occasions several stools, an increased flow of urine, or nausea and vomiting, owing, it is supposed, to the agitation into which the worm is thrown from its presence. Sometimes joints of the worm begin to come away in less than an hour after the last dose. But often the doses must be repeated several successive mornings before they take effect, and it is right to repeat them occasionally for 4 or 5 days after the joints have ceased to come away. Laxatives should be administered from time to time. It is said to act with the greatest certainty when the joints of the worm come away naturally. The dose of the rind or flowers in powder, is from 20 to 40 grains, and in decoction from 1 to 3 fluid ounces. Eclectic physicians, as a rule, follow Prof. Locke's method of administering granatum. According to Dr. Locke, it is the best remedy for the removal of the worm, but as ordinarily recommended, the dose is too small. Its great drawback is its tendency to make the patient vomit, which may, in a measure, be prevented by administering a little lemon juice and keeping the patient quiet. When vomiting can be prevented, it seldom or never fails to bring the worm whole. Prof. Locke's method is as follows: Press 8 ounces (av.) of the coarse bark (not powdered), into a vessel, and pour upon it 3 pints of boiling water. Boil, strain, and then boil this down until the finished product will measure 1 pint. First prepare the patient by giving him at night a brisk cathartic, such as the antibilious physic, and in the morning allow a light breakfast. At about 10 o'clock in the forenoon administer 4 fluid ounces of the decoction. For the purpose of causing it to pass quickly into the intestines and thereby prevent its absorption as much as possible, a fluid drachm of fluid extract of jalap with a drop of oil of anise or cinnamon may be added to the dose. In 2 or 3 hours repeat this dose in the same manner. When its action begins give an enema to hasten its operation (see Locke's *Syllabus of Mat. Med.*). Should this treatment fail the first time, it may be repeated another day. As to treatment with the alkaloid the sulphate of pelletierine was first employed, but was superseded by the tannate which, on account of being tasteless and having less of a tendency to provoke nausea or vomiting, seems the preferable form to employ. The patient should have a light diet, preferably milk, the night previous to taking the medicine. Single doses of about 7 grains are now administered upon an empty stomach, the patient being kept quiet in a reclining posture. The dose is usually preceded by a drink of water, and followed at regular intervals by more water. A purgative, like fluid extract or compound tincture of jalap, is administered about 2 hours after taking the pelletierine tannate. Some prefer castor oil as an evacuant. To insure the passage of the worm entire it should be received into a vessel of warm water, which will prevent its separation into segments.

There seems to be a diversity of opinion regarding the effects of pelletierine upon the system. Undoubtedly it acts pronouncedly upon the nervous system, causing motor paralysis, while the contractility of the muscular fibers and sensation remain unaffected. Its action has been compared to that of curare (Dujardin-Beaumetz). Temporary general paralysis is said to have occurred in a woman after a dose of 5 grains. Marked congestion of the retina and diplopia are asserted to have followed the subcutaneous injection of 6 grains of the alkaloid. On account of its action upon the ocular nerves, it has been successfully used in *paralytic states of the sixth* and *third cranial nerves.* While many contend that it has a powerful control over certain of the nervous functions, others declare it innocuous. As great diversity exists in regard to dosage as to its effects. The dose of pelletierine has been given as ranging from ½ to 8 grains; the sulphate in about 5-grain doses; the tannate in doses of from 5 to 23 grains, about 7 grains being the average dose. Pelletierine preparations are usually sold in solution containing enough for one dose. Dose of pomegranate flowers or rind, 20 to 40 grains.

Specific Indications and Uses.—Tæniacide and tæniafuge for the destruction and expulsion of tapeworm (*Tænia Solium*).

GRATIOLA.—HEDGE-HYSSOP.

The plant and root of *Gratiola officinalis*, Linné.

Nat. Ord.—Scrophulariaceæ.

Common Name: *Hedge-hyssop.*

Botanical Source and History.—The genus Gratiola is composed of small herbs less than a foot high, and found growing in low, damp situations. They all possess bitter properties and cattle refuse to eat them. They have opposite, sessile leaves and small axillary flowers. The calyx is sub-equally 5-parted, and the corolla tubular and bilabiate. The stamens are 2, and there are often 2 or 3 sterile filaments. The fruit is a dry, many-seeded, 2-celled capsule opening by 4 valves.

Gratiola officinalis, Linné, is a native of Europe, and has a smooth, 4-angled stem, and lanceolate, 3 or 5-nerved leaves. The corolla is pale-yellow, and striped with light-purple. The calyx-lobes are often 7. This species has long been used as a medicine in the south of Europe, and was mentioned by Lewis in his *Materia Medica* (1761), under the names *Gratiola centaurioides*, *Gratia Dei*, *hedge-hyssop*, and *herb of grace.*

Gratiola virginica, Linné, is the most common indigenous species, and is found in large patches in damp soil. It is a small, much-branched plant, with an erect, glutinous stem. The leaves are lanceolate, dentate, and clasping. The flowers are very numerous, with small, white corollas variegated with yellow, and pubescent in the throat. The other indigenous species of Gratiola are mostly found in the southern states.

Chemical Composition.—Nothing is known about the chemical constituents of the indigenous species, but they are probably similar to those of *G. officinalis.* Vauquelin (1809) found in the latter a bitter resinous substance, an acid in combination with lime and soda, believed by him to be malic or acetic acid, and various earthy salts and principles common to plants. Marchand (*Journ. de Chim. Med.*, 1845, p. 518), proved the resin of Vauquelin to be a compound, identifying tannic acid and a white, bitter, crystallizable substance to which the name *gratiolin* was given. Afterward, Walz proved *gratiolin* to be a glucosid, and obtained in addition another glucosid, *gratiosolin*, and an acid named by him *gratiolic acid.* The chemical constituents of Gratiola officinalis are of little practical value, as the infusion, or tincture, or plant in substance, are alone used in medicine.

Action, Medical Uses, and Dosage.—Hedge-hyssop is rarely, if at all, used in this country. In Europe it has been employed as a hydragogue-cathartic in the treatment of *dropsical affections*, in doses of from 10 to 30 grains of the powdered root. Its use is frequently followed by emesis and diuresis. In large doses its irritant action is pronounced, inducing violent vomiting and purging, the stools often being bloody and attended with severe colic. Gastro-intestinal inflammation may follow, the rectum being most generally affected. In smaller doses, it has been advised in *chronic affections of the liver*, in *jaundice*, and also in certain *melancholic forms of insanity. Splenic engorgement*, *cerebral fullness* and *oppression*, and other conditions attended with an obstructed circulation are the states in which it is recommended by Prof. Scudder (*Spec. Med.*), who regards the indications to be "soreness and rawness of the mouth." It is an active agent, and should be administered with judgment. An infusion of 4 drachms to a pint of boiling water, may be given in ½ fluid-ounce doses. Thirty grains act as a drastic cathartic. Probably a tincture of the root might be useful; but every indication for this agent can be fulfilled by one of our indigenous plants, as podophyllum, iris, euphorbia, apocynum, etc.

GRINDELIA (U. S. P.)—GRINDELIA.

"The leaves and flowering tops of *Grindelia robusta*, Nuttall, and of *Grindelia squarrosa*, Dunal"—(*U. S. P.*).

Nat. Ord.—Compositæ.

Common Names: 1. *Hardy grindelia.* 2. *Scaly grindelia.*

Botanical Source and History.—*Grindelia robusta* is an erect perennial plant, native of California. It was brought to the notice of pharmacists and the medical profession generally, by Mr. Jas. G. Steele, of San Francisco, Cal., through a paper presented to the American Pharmaceutical Association, in 1875, although Dr. C. A. Canfield, long previously, had noticed it in the *Pacific Med. and Surg. Jour.* The plant has a smooth, round, striate stem, much divided into ascending branches, each of which ends in a large, yellow flower-head. The lower leaves are obovate-spatulate, and tapering at the base; the upper are alternate, ascending, and have broad, clasping bases. They are of a firm, coriaceous texture, and a light-green color; the margins are coarsely toothed. The flower-heads are large, nearly ¾ of an inch in diameter, and are solitary, terminating the branches. The involucre is very resinous and consists of many thick, imbricated scales, with recurved tips. The receptacle is flat, pitted like a honey-comb, and destitute of scales. The ray-flowers are large, yellow, spreading, and arranged in a single series. They are pistillate and fertile. The disk-flowers are very numerous and perfect. The achenia are smooth, oblong, and slightly 4-angled. The most distinguishing character of the genus Grindelia is the pappus, which consists of 3 or 4 very deciduous awns; they are rigid, more or less curved, white, very smooth, and, when magnified, have a waxy appearance. In the *G. robusta* they are about half the length of the disk-flowers. A very large variety (var. *latifolia*), of this species of Grindelia is frequent in California, and is often collected. It is much more robust in every particular, having heads over an inch in diameter. The upper stem-leaves are about an inch broad, and the flower-heads are surrounded at the base by a cluster of 3 or 4 leaves.

Grindelia squarrosa has the general appearance of Grindelia robusta, but is a smaller plant, and has lately been considered a variety of this species. It is more widely distributed than *G. robusta*, and is quite common on the plains, from the Rocky Mountains west to the Pacific. The mode of growth is different in the two species. In the *Grindelia squarrosa*, a perennial root-stalk sends up from its head a cluster of from 4 to 10 slender, erect, sub-parallel, and generally undivided branches, from 1 to 2 feet high. The stem-leaves are alternate, acute, sessile, and slightly clasping at the base, and serrate on the margin. They are about an inch long, one-quarter as wide, and are attached to the stem in an erect position. The scales of the flower-heads are narrow, and have long, slender, recurved points (whence the specific name). In other respects the flower-heads resemble those of the *Grindelia robusta*, but are smaller. The pappus of the *Grindelia squarrosa* is slender and about the length of the disk-flowers. *Grindelia squarrosa* was introduced as a remedial agent some years after Mr. Steele brought *G. robusta* into notice. Its sensible properties are exactly like those of *G. robusta*, and it is often found on the market and substituted largely for *G. robusta*.

Description—Owing to the fact that both species are often indiscriminately gathered, or that the one is frequently adulterated with the other, both are described by the *U. S. P.* under the name GRINDELIA, as follows:

"Leaves about 5 Cm. (2 inches), or less, long, varying from broadly spatulate or oblong to lanceolate, sessile or clasping, obtuse, more or less sharply serrate, often spinosely toothed, or even laciniate-pinnatifid, pale green, smooth, finely dotted, thickish, brittle, heads many-flowered, subglobular or somewhat conical; the involucre hemispherical, about 10 Mm. (⅖ inch) broad, composed of numerous imbricated, squarrosely-tipped or spreading scales; ray-florets yellow, ligulate, pistillate; disk-florets yellow, tubular, perfect; pappus consisting of 2 or 3 awns of the length of the disk-florets; odor balsamic; taste pungently aromatic and bitter"—(*U. S. P.*).

Chemical Composition.—C. J. Rademaker (*New Rem.*, 1876, p. 205), was probably the first to make an analysis of Grindelia robusta, yet with no positive results. G. Linwood Libby (*Pharm. Era*, 1888, p. 11), isolated from the same plant an oleoresin and a resin.

A complete parallel analysis of G. robusta and G. squarrosa was made by W. H. Clark, in 1888, with the result that the constituents were qualitatively the same in both plants except that Grindelia robusta contained tannin (1.5 per cent), while G. squarrosa seemed to be free from it. Volatile oil was found in both. A crystallizable saponin-like body also occurred in both species (G. robusta contained 2 per cent, and G. squarrosa 0.82 per cent), for which the author proposes the name *grindelin* (*Amer. Jour. Pharm.*, 1888, pp. 433–441). On the other hand, Mr. John L. Fischer applies the name *grindeline* to a bitter, crystallizable alkaloid which he found in Grindelia robusta, and the name *robustic acid* to a crystallizable acid found in the aqueous solution of the alcoholic extract of the same drug (*Pharm. Era*, 1888, p. 208). Mr. Clark had obtained contradictory results with regard to the presence of an alkaloid. Dr. Schneegans, in 1892, found the saponin-like body to consist of two glucosids, one being identical with, the other closely resembling Kobert's saponin, from senega and quillaja. The presence of small amounts of an alkaloid was also indicated (*Amer. Jour. Pharm.*, 1892, p. 370).

Action, Medical Uses, and Dosage.—The grindelias leave in the mouth a bitter, acrid sensation, which persists for some time and is accompanied or followed by an increased flow of saliva. On account of their irritant effects upon the kidneys, they act as diuretics. The brain and cord are first stimulated by them, followed by motor impairment of the lower extremities and a desire to sleep. The number of respirations are reduced by them.

Grindelia robusta has been found especially efficient in *asthma*, giving prompt relief, and effecting cures in cases previously rebellious to medication. Occasionally, however, as is, indeed, the case with all the therapeutical agents, it has failed, but the circumstances attending these failures have not yet been determined. Further investigations regarding its action in this disease, and the cause of its occasional failure are required. It has likewise been found efficient in *bronchial affections*, in *pertussis*, and in some *renal maladies*. Prof. Scudder was partial to this remedy as a local application in *chronic diseases of the skin* with feeble circulation, particularly old chronic and indolent *ulcers*. Specific grindelia robusta (ʒi to ʒii to water Oj), was employed with marked benefit. The fluid extract and specific grindelia robusta are the preparations generally employed, the former in doses of from 10 to 60 minims, and the latter in doses of 5 to 40 minims, repeated 3 or 4 times a day, as may be required. Children require doses of from 5 to 15 or 20 minims (fluid extract), and 1 to 10 minims (specific grindelia robusta).

Grindelia squarrosa has been highly eulogized as an efficient remedy in *intermittent fever*, and in other *malarial affections*, also to remove the *splenic enlargement* which so frequently follows those disorders. Why two plants so closely allied as the G. robusta and the G. squarrosa, and possessing nearly identical constituents, should give such discordant therapeutical results, is certainly enigmatical. The fact is, that many physicians have a great proneness to run after new remedies, especially when introduced under some pretentious name, and to place a marvelous credulity in the statements of interested parties, who are incapable of determining accurate conclusions as to the value of a remedy. Webster, however, asserts that the remedy has a special action upon the splenic circulation, and points out as the case for it one of *splenic congestion* associated with sluggish hepatic action and *dyspepsia*. Dull pain in the left hypochondrium, sallow skin, debility, and indigestion are the symptoms pointing to its selection (*Dynam. Therap.*). The same author recommends it in *chronic dyspepsia* due to prolonged malarial influence, *gastric pain* when the spleen is seemingly involved, and in the *splenic congestion of malarial cachexia*. As a local application, the fluid extract is stated to be of value in the painful *eczematous inflammation* and *vesicular eruption* resulting from contact with the *poison vine* or the *poison oak*. The dose of the fluid extract is from 15 minims to 1 fluid drachm, repeated every 3 or 4 hours; of specific grindelia squarrosa, 5 to 40 drops.

Specific Indications and Uses.—GRINDELIA ROBUSTA: Asthmatic breathing, with soreness and raw feeling in the chest; cough, harsh and dry; breathing labored, with a dusky coloration of the face in plethoric individuals. Locally, old atonic ulcers; full tissues; rhus poisoning.

GRINDELIA SQUARROSA: Splenic congestion, especially when dependent on malarial cachexia; fullness and dull pain in left hypochondrium, with indigestion, pallid, sallow countenance, and general debility; gastric pains associated with splenic congestion.

Related Species.—*Grindelia glutinosa*, Dunal, of California, and *Grindelia hirsutula*, Hooker and Arnott, have a similar odor and taste to Grindelia, and are probably gathered with it. The leaves of the former are smooth. It constitutes the Mexican *Calancapatle de Pueblo*. The second species is found along the Pacific to Puget's Sound.

Haplopappus Baylahuen (*Hysterionica Baylahuen*). *Nat. Ord.:* Compositæ.—This plant is a native of Chili and contains a resin, tannin, and volatile and fixed oils. The resin acts upon the bowels and the essential oil upon the respiratory organs after the manner of the terebinthinates, without, however, being an irritant to the gastro-intestinal tract. The *chronic looseness of the bowels* of tuberculous patients is controlled by it, and the remedy is reputed of value in *inflammation of the bladder*. Locally, the tincture has been used on *ulcers*, *wounds*, etc., both as a stimulant and protective. The tincture is prepared of the strength of 1 part to 5, and the dose is from 5 to 25 drops.

GUAIACI LIGNUM (U. S. P.)—GUAIACUM WOOD.

"The heart-wood of *Guaiacum officinale*, Linné, and of *Guaiacum sanctum*, Linné"—(*U. S. P.*).

Nat. Ord.—Zygophylleæ.

SYNONYMS: *Lignum vitæ, Lignum sanctum, Lignum benedictum, Palus sanctus.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 41.

Botanical Source.—*Guaiacum officinale.* This tree grows very slowly, varying in height from 15 to 50 feet. The trunk is usually crooked, with crowded, knobby, short-jointed, flexuose, spreading branches, about 4 feet in diameter; the bark is furrowed, spotted, and grayish. The leaves are opposite, bijugate or trijugate; the leaflets sessile, more or less obovate, rounded at the apex, nerved, and glabrous; the common petiole is terete and channeled above. The flowers are light-blue, on axillary peduncles, which are an inch long, 1-flowered, filiform, minutely downy, and several together. The calyx of sepals have the 2 exterior, somewhat broader than the others; all are obtuse and hoary with down. Petals 5, thrice the length of the sepals, oblong, bluntish, unguiculate, and internally downy. Stamens 10, without scales; filaments twice the length of the sepals, grooved on the back; anthers bifid at the base and curved. Ovary 2-celled, with numerous suspended ovules, and compressed; style short, acute and subulate; stigma simple; capsule obcordate, succulent, glabrous, yellow, 2 to 5-celled; on short stalks, somewhat fleshy, angular; the seeds are solitary, compressed, roundish, smooth, and pendulous (L.).

Guaiacum sanctum differs from the preceding in its leaflets, 6 or 8 of which compose the leaf, having an oblique-obovate, or rhomboid-ovate outline; in having a fruit with 5 cells; and in having smaller wood, which is less compact and lighter in color. It grows in Cuba, Bahama, and other West India Isles.

History, Description, and Chemical Composition.—The tree (*Guaiacum officinale*, Linné) inhabits the West Indian Islands, especially Jamaica, St. Thomas and St. Domingo. The wood and resin, or solidified juice, are the parts used in medicine, though the whole tree possesses medicinal virtues. The bark is said to be the most active part of it, but it is seldom met with in commerce. The wood of this tree was used as a medicine by the natives long previous to the discovery of the country, and they made it known to the Europeans; by these it was introduced into Europe in the sixteenth century, and employed to much advantage in syphilitic affections. Guaiacum wood, also known as *Lignum vitæ*, a name given to it from a belief that its medicinal virtues were of a superior kind, is largely imported into this country from the West Indies for making block-sheaves, wooden pestles, and many other objects, for which it is peculiarly fitted by its extraordinary hardness and toughness. It is imported in billets, about a foot in diameter, and generally without the bark. The bark is hard, flat, a few lines thick, of a greenish-black color, with yellowish and grayish spots, inodorous, but very acrid. The wood, used for medicinal purposes, consists of turnings from the workshop of the turner, and is a uniform mixture of the alburnum and duramen, but that used in medicine should consist only of the latter.

The alburnum or sap-wood is of a yellow color, that of the duramen or heart-wood, greenish-brown. Guaiacum wood is only odorous when burned or rasped, the odor being aromatic; its taste is acrid, aromatic, and amarous, succeeded by a pricking in the throat. It is very dense and tough, and has a specific gravity of 1.333. It is officially described as follows: "Heavier than water, hard, brown or greenish-brown, resinous, marked with irregular, concentric circles, surrounded by a yellowish alburnum, splitting irregularly; when heated, emitting a balsamic odor; taste slightly acrid. Guaiacum wood is generally used in the form of raspings or turnings, which should be greenish-brown, containing few particles of a whitish color, and should acquire a dark bluish-green color on the addition of nitric acid"—(*U. S. P.*). When a very fine powder of guaiacum wood is acted upon by the atmosphere, its color is converted into green. Nitric acid turns it bluish-green, and a solution of ferric chloride turns it blue. Solution of chlorinated lime effects no change in other woods, but causes the guaiacum to assume a green color in a few seconds. These tests may be employed to determine the authenticity of the wood. Alcohol takes up its active parts (see *Guaiaci Resina*). dissolving about 21 per cent. Flückiger (*Pharmacognosie*, 1891), by extracting with ether, obtained 22.12 per cent of resin from the duramen, and only 2.85 per cent from the alburnum. The same authority found a trace of essential oil by distilling the wood with water. Frémy and Urbain found *vasculose* (the incrustating substance in wood) to exist in guaiac wood to the extent of 36 per cent (see *Jour. Pharm. Chim.*, 1882, p. 325). Several other trees of this family are stated to furnish the guaiacum wood, as the *G. sanctum* (now official), which has a translucent, paler-yellow, and less heavy and hard wood, and also the *G. arboreum.*

Action, Medical Uses, and Dosage.—Taken internally, guaiacum, both the wood and resin, commonly excites a sense of warmth in the stomach, and a dryness of the mouth, with thirst. They act upon the economy like stimulants, increasing the heat of the body, and accelerating the circulation. If the body be kept warm while using the decoction, which is the form generally preferred, it will prove diaphoretic; if cool, diuretic. As a diaphoretic and alterative, it has been administered (but usually in compound decoction or syrup), in *chronic rheumatism*, *chronic cutaneous diseases*, *scrofula*, and *syphilitic disease.* As water can not take up much of the active principle in the wood, it is probable that its reputed efficiency was owing principally to the active agents associated with the syrup or decoction. The resin of guaiacum is the active principle (which see). The decoction of guaiacum shavings may be made by boiling 2 ounces of the shavings in 3 pints of water down to 2 pints, the dose of which is from 2 to 4 fluid ounces every 3 or 4 hours (see *Guaiaci Resina*).

Related Species.—*Guaiacum angustifolium*, Engelmann (*Porliera angustifolia*, Gray). Mexico and south Texas. The wood of this tree is employed like that of guaiac. It is a yellow-brown, heavy and hard wood, splitting irregularly.

BALSAM WOOD. *Palo balsamo.*—A South American tree of unknown botanical origin, the wood of which is thought to contain *guaiacin.* Upon distillation of the wood, about 6 parts of a thick, sticky, fragrant oil are obtained. This oil contains a crystalline solid, fusing at 91° C. (195.8° F.), and answering closely to the composition $C_{14}H_{24}O$ (Schimmel & Co., *Reports*, 1892).

GUAIACI RESINA (U. S. P.)—GUAIAC.

"The resin of the wood of *Guaiacum officinale*, Linné"—(*U. S. P.*).

Nat. Ord.—Zygophylleæ.

SYNONYMS: *Guaiacum*, *Guaiacum resin*, *Resina guajaci.*

Source and Preparation.—The resin of guaiacum, or *gum guaiacum* as it is erroneously called by some, is procured from the wood of the tree, by natural exudation; by jagging or wounding the tree in several places; by heat applied to the wood sawed into large billets; and by boiling the chips of the wood in water and salt, and skimming off the resin as it floats on the surface (*Ed.*—P.). The last two modes are the most frequent in use.

Description and Tests.—Guaiacum is ordinarily met with in amorphous, hard masses of varying sizes, in which are found pieces of wood, dirt, and other foreign matters. It has a sweetish, faintly bitter taste, succeeded by a lasting acrimony, especially in the fauces. It does not soften by the heat of the hand, becomes tough when chewed, and is fusible at a moderate heat. Its specific gravity is 1.20 to 1.23. It is readily reduced to powder, becoming somewhat tenacious, and quickly aggregating, by the action of the air. Guaiac resin is officially required to be in "irregular masses, or subglobular pieces, externally greenish-brown, internally of a glassy lustre, and, in recent guaiac, usually reddish-brown, transparent in thin splinters, fusible, feebly aromatic, the odor becoming stronger on heating; taste somewhat acrid; powder grayish, turning green on exposure to air. Soluble in potassium or sodium hydrate T.S. and in alcohol; the alcoholic solution is colored blue on the addition of tincture of ferric chloride"—(*U. S. P.*).

The resin is practically insoluble in water, soluble, although not completely, in ether and oil of turpentine, easily soluble in acetone, amyl alcohol, chloroform and in creosote· fixed and volatile oils scarcely dissolve it, although oil of cloves and cassia oil are capable of dissolving appreciable quantities. Benzin, benzol and carbon disulphide dissolve the resin very sparingly. Guaiac resin is remarkable for the blue color reaction it yields in alcoholic solution (1 in 100) with *ozonizers* (Schönbein's *ozonide*). Ozone, chlorine, bromine and iodine, nitrous acid, chromic acid, hypochlorites, ferric salts, lead and manganese dioxide, etc., and some organic substances, especially vegetable ferments and *enzymes* of the most obscure kind, *e. g.*, the enzymes existing on freshly cut raw potato, etc., (*oxidation ferments* of Schönbein), cause a rapid bluing of tincture of guaiac. According to Prof. Ed. Schaer (*Forschungsberichte über Lebensmittel*, Vol. III, 1896, p. 1), the blue color is due to a very unstable ozone compound of guaiaconic acid (see *Chemical Composition*). Its formation is prevented by light, heat, free acids, especially by alkalies, but acetic acid, even in the form of glacial acetic acid, singularly promotes its formation. In contrast with these ozonizers stand Schönbein's *antozonide* (*antozonizers*), substances otherwise capable of giving off oxygen, but incapable of reacting with tincture of guaiac. The type of these substances is hydrogen peroxide (H_2O_2). They become active, however, toward tincture of guaiac through the intervention of certain inorganic substances, and a number of fluids containing animal and vegetable ferments, *e. g.*, malt extract, saliva, fresh milk, or the red corpuscles of the blood. Schönbein, the discoverer of ozone, was the first to base upon this behavior the well-known guaiac test for blood, often believed to be fallacious, while Prof. Schaer pronounces it exceedingly characteristic and sensitive if properly carried out.

Prof. Schaer, in the paper mentioned, publishes a new mode of carrying out this test, to which he has given 30 years' time of successful trial. This test is based on the following observation: When an alcoholic tincture of guaiac is poured into an aqueous solution of blood acidified with acetic acid, the guaiac resins, in precipitating, carry along with them almost quantitatively the blood coloring matter present in the fluid. Filter through paper and dry the latter with its contents, taking especial care to exclude light and air as much as possible. The blood test is then produced by moistening small pieces of the filtering paper with water and adding hydrogen peroxide solution containing some acetic acid. If blood is present the paper and liquid assume a pure blue color. The test can be applied with equal success to dry blood stains, and after a period of 5 or even 10 years after drying the paper. A modification of this process, involving the use of a concentrated aqueous solution of chloral hydrate to dissolve dried blood stains, is carried out as follows: Moisten the blood stains with acetic acid, extract with a 70 per cent solution of chloral hydrate, add an equal volume of guaiac-chloral solution (1 per cent guaiac resin in 70–75 per cent chloral hydrate); if ammonium nitrate is absent, a yellow-brown mixture results (otherwise a blue coloration takes place at once). If now the mixture is superposed by Hünefeld's solution (15 Cc. of a 3 to 5 per cent solution of hydrogen peroxide, 25 Cc. of alcohol, 5 Cc. of chloroform, and 1.5 Cc. of glacial acetic acid), previously ascertained not to react with a mixture of chloral and guaiac, an intensely blue zone is developed at the surface of contact of both fluids if blood is present. Soluble ferrous salts mixed with the blood stain also give the reaction (*Archiv der Pharm.*, 1898, p. 574).

Reversely, this reaction with ozonizers can be used as a delicate test for the presence of the resin of guaiacum in other resins, *e. g.*, scammony, jalap, etc. Guaiac is subject to adulteration with pine resin and other substances. This may be detected by observing that the genuine article, when heated, does not exhale a turpentine odor, and that oil of turpentine dissolves resin but not guaiac. Sulphuric acid forms with guaiac a deep-red solution; nitric acid dissolves it without the aid of heat, and with strong effervescence yielding oxalic acid upon evaporation. The so-called *Peruvian guaiac resin*, analyzed by E. Kopp (*Archiv der Pharm.*, [3] Vol. IX, p. 193), is entirely different from guaiac resin, and therefore does not give the characteristic reaction for this resin.

Chemical Composition.—In 1862, Hadelich found the composition of guaiac resin to be as follows: "*Guaiaconic acid*, 70.3 per cent; *guaiac-resinic acid*, 10.5 per cent; *guaiac-beta-resin*, 9.8 per cent; *guaiacic acid*, *guaiac-yellow* and impurities, 4.9 per cent; gum, 3.7 per cent; ash constituents, 0.8 per cent" (Flückiger, *Pharmacognosie*, 1891). The first three substances may be differentiated from the guaiac resin as follows: To a concentrated alcoholic solution of the resin (1 part add a warm alcoholic solution of potassium hydrate (½ part), and allow the mixture to stand for 24 hours; a magma of crystals results, consisting of the potassium salt of *guaiac-resinic acid*. Strain through cloth, evaporate the mother liquor to a syrup, add absolute alcohol in order to remove some more of this potassium salt. Now charge the alcoholic solution with carbonic acid gas, which precipitates the potassium as carbonate, filter, add water, acidulate with hydrochloric acid and distill off the alcohol. The residual resin is then washed with warm water and treated with ether. *Guaiaconic acid* is thereby dissolved, while *guaiac-beta-resin* remains. The substances thus obtained are then purified by further treatment, for which see details in Husemann and Hilger, *Pflanzenstoffe*, p. 857

Guaiaconic acid ($C_{19}H_{20}O_5$), isolated by Hadelich, in 1862, is the chief constituent of guaiac resin (70 per cent), and is the substance to which is due the blue color reaction with oxidizing agents. Prof. E. Schaer (*Wittstein's Vierteljahrsschrift*, 1873, p. 68), however, remarks that guaiaconic acid, when exposed to direct sunlight loses its property of turning blue with oxidizers, even when the air is excluded. It is a tasteless and odorless, brownish, amorphous body, fusible near the boiling point of water, easily soluble in alcohol, ether, chloroform, acetic ether and acetic acid. It is optically lævo-rotatory, forms soluble amorphous salts with alkalies, decomposable by the carbonic acid of the air, and forms insoluble salts with heavy metals. It dissolves in concentrated sulphuric acid with a cherry-red color, water precipitating violet flakes from this solution. Dry distillation yields an oily distillate.

Guaiac-resinic acid ($C_{20}H_{26}O_4$) was discovered by Hlasiwetz, in 1859, and is a crystallizable substance, insoluble in water, soluble in alcohol, ether, chloroform, benzol, carbon disulphide, acetic ether and acetic acid, also in solution of caustic soda or potash, but not ammonia. It melts between 75° and 80° C. (167° and 176° F.). It dissolves in sulphuric acid with a cherry-red color. Water precipitates white flakes from this solution. When heated with hydrochloric acid this substance (as well as guaiaconic acid) yields methyl chloride and *pyrocatechin* ($C_6H_4[OH]_2$). Fused with caustic potash, it yields protocatechuic acid ($C_6H_3[OH]_2.COOH$) (Hlasiwetz and Barth). Upon dry distillation it yields *guaiacol* ($C_6H_4OCH_3[OH]$) (which see), and crystallizable *pyroguaiacin*. The yield of this substance is 0.5 per cent. It melts at 180° C. (356° F.), is soluble in alcohol and ether, insoluble in water, can be sublimed in the form of needles or scales, which turn green with ferric chloride, and blue with warm sulphuric acid. When heated with zinc dust, the hydrocarbon *guaien* ($C_{12}H_{12}$) is obtained, forming fluorescing plates.

Guaiacic acid ($C_6H_8O_3$, Deville) was first obtained, in 1837, by Righini from guaiac wood as a white crystallizable substance. In 1841, Thierry isolated it from both the wood and the resin. It forms white needles, resembling benzoic acid, but is more soluble in water than the latter; also soluble in alcohol and in ether. Only 0.005 per cent of this acid could be obtained by Hadelich from guaiac resin. Deville found this substance upon rapid sublimation to decompose into carbonic acid and *guajacen* (*guajol*) (C_5H_8O), a colorless oil, of the odor of bitter almonds. It was found by Lieben and Zeisel (confirmed by Herzog, *Berichte*, 1882, p. 1085) to be identical with *tiglin-aldehyde* ($CH_3CH:C[CH_3].CHO$), convertible by oxidation into *tiglic acid*, a constituent of Roman chamomile oil, as well as of croton oil.

Guaiac yellow was first observed by Pelletier, and obtained by Hadelich (1862) in yellowish quadratic plates of neutral reaction and bitter taste, not easily soluble in water, diluted acids and chloroform, soluble in alcohol, ether, carbon disulphide and alkalies, in the latter with yellow color. With concentrated sulphuric acid it forms a beautiful blue solution, turning green, then yellow.

The resin of guaiac, upon dry distillation, yields a brown-red tar containing *guaiacol* ($C_7H_8O_2$) (see *Guaiacolum*), *pyroguaiacin* ($C_{12}H_{10}OH.OC_6H_6[OH]$), *guaiol* (*guaiacen*, *tiglin-aldehyde*, C_5H_8O), and *kreosol* ($C_8H_{10}O_2$). Fusion with caustic potash yields *protocatcchuic acid*, and by distillation with zinc dust, K. Bötsch (*Amer. Jour. Pharm.*, 1881, p. 60) obtained 50 per cent kreosol, 30 per cent toluol, meta and paraxylol, pseudocumol, and the hydrocarbon *guajon* or *guaien* ($C_{12}H_{12}$), aforenamed, which is identical with the *guaiacen* prepared by Wiesner.

Action, Medical Uses, and Dosage.—(See *Guaiaci Ligni* also.) Guaiac is stimulant. Taken internally it produces the same effects as named in the wood, but in a more active degree. Large doses act as a cathartic. It is used in the same affections as guaiaci ligni or guaiacum wood. Several practitioners have found it beneficial in *amenorrhœa*, *dysmenorrhœa*, and other *uterine diseases*, all of atonic character, likewise in *acute dysentery*, in which its employment is said to be followed by speedy beneficial results. It is much used in *chronic rheumatism*, and in the abating stages of the acute form, and has proved a most valuable agent in these diseases. It is said to be an antidote to the effects of the tincture of *Rhus Toxicodendron*. If the preparations of guaiacum produce sickness, defective appetite, and irregularity of the bowels, their use must be discontinued. Guaiac gained its greatest reputation in the treatment of *constitutional syphilis*, having been liberally used for centuries in the treatment of that malady, but at the present day it is almost discarded as an antisyphilitic. It undoubtedly benefits some cases of rheumatism and is well endorsed as a remedy for *rheumatic sore throat* or *rheumatic pharyngitis*. A tincture of guaiac, or preferably the ammoniated tincture is to be used. The latter preparation, as well as troches of the powder, have been highly endorsed as a remedy to abort *tonsilitis*. For this purpose they must be given early or good effects fail to be produced. In *chronic rheumatism*, where the circulation of the blood is feeble and the vital functions greatly depressed, and the hands and feet are cold, from 30 to 60 drops of the tincture may be used with expectation of benefit. A good tincture is prepared by macerating 8 ounces of guaiac in 1 pint of alcohol. Guaiac is also of some value in *atonic dyspepsia*, provided no inflammation is present. Certain *chronic skin diseases*, requiring stimulation, are benefited by guaiac. From $\frac{1}{20}$ to $\frac{1}{10}$ grain of the resin in $\frac{1}{2}$ ounce of thick malt extract is recommended as a remedy for *habitual constipation*. Guaiac is a remedy in atonic conditions only. It is contraindicated in all active febrile, plethoric, or inflammatory conditions, or where there is vascular excitment, tending to hemorrhage, or impaired digestion, with tendency to irritation (Locke). Dose of the powdered resin, from 5 to 20 grains; of the tincture, from 1 to 4 fluid drachms, either of which may be repeated 3 or 4 times a day; ammoniated tincture of guaiac, 10 drops to 1 fluid drachm. A mixture of 10 grains each of guaiac and compound powder of ipecacuanha and opium has been found of advantage in *rheumatism* and *dysentery*.

Specific Indications and Uses.—Dryness and stiffness of the throat, with tumid, swollen tonsils, painful deglutition, and dribbling of saliva; incipient tonsilitis (if used early); rheumatic pharyngitis.

GUAIACOLUM.—GUAIACOL.

FORMULA: $C_7H_8O_2$ or $C_6H_4.OCH_3.OH$. MOLECULAR WEIGHT: 123.71.

SYNONYMS: *Methyl-pyrocatechin*, *Catechol monomethyl ether*.

Source and Preparation.—Guaiacol is obtained from beechwood creosote (see *Creosotum*), of which it forms from 60 to 90 per cent, the other constituents of importance being creosol ($C_7H_6.OCH_3.OH$), and the cresols ($C_7H_7.OH$). To obtain it, beechwood tar creosote is subjected to fractional distillation whereby crude guaiacol passes over in the portion distilling between 200° and 205° C. (392° and 401° F.). After washing out the acid compounds with weak solutions of ammonia, the purified guaiacol is again fractionally distilled, and the lower fraction treated with ether, from which solution potassium-guaiacol is separated by the addition of a strong solution of caustic potash in alcohol. The potassium guaiacol is then thoroughly washed with ether, and the guaiacol liberated by means of diluted sulphuric acid, after which it is once more rectified. Commercial guaiacol frequently contains cresols. It may be obtained pure by saponification of its benzoyl compound, previously purified by repeated crystallization. Guaiacol is also formed in the dry distillation of resin of guaiac (which see), and may be prepared synthetically by heating the potassium salt of methyl-sulphuric acid (CH_3SO_4K), with pyrocatechin ($C_6H_4[OH]_2$), and caustic potash, to 180° C. (356° F.).

Description.—Guaiacol, when pure, is a pleasantly aromatic, colorless liquid. Its specific gravity at 15° C. (59° F.), is, according to Helbing, 1.133, and its boiling point, according to the same authority, 206° to 207° C. (402.8° to 404.6° F.). It dissolves to some extent in water (1 in 85), and freely in ether, alcohol, and acetic acid. Solutions of caustic soda and caustic potash dissolve it, producing the unstable salts of sodium-guaiacol and potassium-guaiacol. Impure guaiacol forms a clear solution with twice its bulk of benzol at 20° C. (68° F.), but when pure, rapid and complete separation occurs. If to a solution of guaiacol in alcohol be added a small amount of ferric chloride, a blue color is formed which turns emerald-green upon the addition of more of the iron compound. This is a characteristic reaction (even when OH is replaced by OCH_3, as with guaiacol), for all *ortho-dioxy-phenols.*

Action, Medical Uses, and Dosage.—Guaiacol and its compounds (see below), have been used in wasting diseases, particularly *phthisis pulmonalis* and other *tubercular affections. Lupus* has likewise been treated with it. It is useful in *profuse bronchorrhœa.* The indications sought to be fulfilled are the diminution of diarrhœa, excessive sweating, cough, and expectoration. It was introduced as a substitute for creosote, and is reputed to act by combining with the toxic products of the tubercle bacillus, and thereby effecting their elimination from the system. The dose of guaiacol for adults is from 2 to 5 minims; for children, 1 to 3 minims, 4 times a day, in milk, cod-liver oil, or capsules. Wine may be used as its vehicle, and the drug may be given for a length of time. Formerly it was inhaled, and it has been unwisely used hypodermatically. It agrees with the stomach better than creosote and dispels *flatulence.*

Guaiacol Derivatives and Compounds.—GUAIACOL CARBONATE ($[C_6H_4.OCH_3.O]_2CO$). This salt is produced by precipitating a soda solution of guaiacol with carbonyl chloride and crystallizing the product from alcohol. It is a white, crystalline powder, neutral in reaction and almost without taste or odor. It is sparingly soluble in glycerin, fixed oils, and cold alcohol; easily soluble in hot alcohol, benzol, chloroform, and ether, and insoluble in water. This is the di-guaiacol ester of carbonic acid and contains about 91 per cent of guaiacol. It does not irritate the stomach, but, passing through that organ, is decomposed in the intestines. Ordinary dose, 2 to 8 grains, gradually increased to 60 grains a day.

GUAIACOL BENZOATE ($C_6H_4.OCH_3.C_6H_5CO_2$), *Benzosol, Benzoyl-guaiacol.*—This salt is produced by the interaction of potassium-guaiacol and benzoyl chloride. The product is crystallized from alcohol. It forms a colorless, crystalline powder, devoid of taste and odor, soluble in boiling alcohol, chloroform, and ether, and nearly insoluble in water. Does not give the guaiacol reaction with ferric chloride. Used in *phthisis* and other *tuberculous diseases.* Dose, 5 to 100 grains per day.

GUAIACOL CINNAMATE ($C_6H_5.CH:CH.CO_2C_6H_4OCH_3$), *Cinnamyl-guaiacol, Styracol.*—Colorless, needle crystals of styracol are formed by the interaction of cinnamyl chloride and guaiacol, the product being crystallized from alcohol. It is nearly insoluble in water. It fuses at 130° C. (266° F.). This agent has been used in *phthisis, catarrhal digestive affections, chronic diarrhœa, gleet,* and *catarrh of the bladder.*

GUAIACOL DIIODIDE, *Guaiacol biniodide.*—This new salt is produced by precipitating a solution of crystallized sodium-guaiacol in water by means of an iodide of potassium solution of iodine. It forms a red-brown compound, having an iodine-like odor. It is unstable and easily decomposed by heat. Alcohol and the fixed oils dissolve it. The uses and dose are the same as for guaiacol.

GUAIACOL-CARBONIC ACID ($C_6H_3OHOCH_3.CO_2H+2H_2O.$), *Methoxysalicylic acid.*—This substance is prepared by a patented process. It forms a bitter, white, crystalline powder, devoid of odor. The fusing point of the anhydrous acid is 148° to 150° C. (298.4° to 302° F.). Alcohol, ether, hot water, and sodium bicarbonate solution easily dissolve it, while it dissolves with difficulty in cold water. This substance and its alkali salts have been used as antirheumatics and antiseptics.

GUAIACOL SALICYLATE ($C_6H_4OHCO_2.C_6H_4OCH_3$), *Guaiacol-salol, Guaiacolic salol, Salicyl-guaiacol.*—This compound is obtained by acting on a mixture of sodium-guaiacol and sodium salicylate with phosphorus oxychloride. It is a white, tasteless, odorless, crystalline powder, soluble in alcohol, chloroform, and ether, but not in water. Fusing point, 62° C. (143.6° F.). This agent is used as an intestinal antiseptic and to aid the digestion of phthisical subjects. Dose, 5 to 15 grains.

GUAIACOL SUCCINATE and GUAIACOL PHOSPHATE are occasionally employed for the same purposes as guaiacol.

GUARANA (U. S. P.)—GUARANA.

"A dried paste chiefly consisting of the crushed or pounded seeds of *Paullinia Cupana,* Kunth (*Paullinia sorbilis,* Martius)"—(*U. S. P.*).

Nat. Ord.—Sapindaceæ.

COMMON NAMES: *Guarana, Uaranazeiro, Uabano.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants,* 67.

Botanical Source.—The genus Paullinia comprises about 80 species, natives of tropical America, with a single African exception. The *Paullinia Cupana* (*Paul-*

linia sorbilis) is a climbing, shrubby vine, growing in northern Brazil, in moist, sandy locations. The flexible stem is very long, and takes root readily wherever it touches the ground, so that a single plant often extends over considerable space. In the wild state the vine attaches itself to large trees, and the fruit is difficult to collect, and of small yield; the vine is cultivated without support. The leaves are alternate, stipulate, and consist each of 5 smooth leaflets; the leaflets have the same shape and dentation as those of Rhus Toxicodendron, and look very much like them. The flowers are small, numerous, and disposed in erect, axillary, close panicles; the sepals are 5, the petals are 4, and have each a large pubescent scale on the inside, near the base; the stamens are 8, attached to a thick column. The pistil has a 3-lobed ovary, and a sessile, 3-parted stigma. The fruit is pear-shaped, and generally has a single brownish seed attached to the base, and nearly filling the pericarp.

History and Preparation.—This plant is of interest to the medical profession from the fact that the drug known as *Guarana* is prepared from the seeds. Guarana was introduced into France in the year 1817, by a French officer, and was described in the same year by Gassicourt in the *Journal de Pharmacie*, the botanical source, however, being then unknown. It was called "*guarana*," after the tribe of South American Indians (Guaranis), who prepared it, and in 1826, Martius, after identifying the plant, gave it the name of *Pauilinia sorbilis*, in allusion to the fact that *guarana* is employed to produce a drink. The preparation of guarana from the cultivated plant is described by Prof. H. H. Rusby (*Amer. Jour. Pharm.*, 1888, p. 267), as follows: "When the ripe pods begin to open the seeds are shelled from the husk by hand, washed to remove a phlegmy substance, and subjected for 6 hours to a roasting process whereby a papery shell is loosened, which is removed by placing the seeds in sacks and beating them with clubs. A small amount of water is then added and the seeds kneaded by hand into a mass of the consistence of dough. The mass is then rolled into cylinders, spread out on the upper floors of large buildings erected for that purpose, and subjected to a slow fire, as nearly free from smoke as possible. The temperature is kept equable for several weeks, and the product as known in commerce is then ready for the market." Sometimes, it is said, the moistened magma of the coarsely powdered seed is incorporated with cocoa and tapioca before kneading and rolling, but in Prof. Rusby's experience such is not the case.

Description.—Guarana appears in our market, generally in cylindrical sticks, from 6 to 12 inches in length, and from 1¼ to 2 inches in diameter, rounding at the ends, and averaging from 8 to 20 ounces in weight. Throughout the roll are fissures caused by contraction in drying. It leaves a sweetish after-taste resembling that of dulcamara. The *U. S. P.* thus describes it: "Subglobular or elliptic cakes, or cylindrical sticks, hard, dark, reddish-brown; fracture uneven, somewhat glossy, pale reddish-brown, showing fragments of seeds invested with blackish-brown integuments; odor slight, peculiar, resembling that of chocolate; taste astringent and bitter. It is partly soluble in water, and in alcohol"—(*U. S. P.*).

Chemical Composition.—Guarana was first analyzed in 1826, by Th. Martius, who discovered in it a crystallizable substance and named it *guaranine;* but the fact of its identity with *caffeine* became known by the researches of Berthemot and Deschastelus (*Jour. Pharm. Chim.*, 1840, p. 518), who concluded that it existed in guarana in combination as *tannate of caffeine*, and that it was obtainable in greater quantity from guarana than from any source of caffeine hitherto known. Subsequent researches confirmed the presence of caffeine; Stenhouse (*Pharm. Jour. Trans.*, 1856, Vol. XVI, p. 212), found 5.07 per cent of this substance in guarana, and Mr. F. V. Greene (*Amer. Jour. Pharm.*, 1877, pp. 338 and 388), obtained about the same amount. Still others claim that the average is only about 3 per cent. The standard established by J. U. Lloyd as proper for fluid extract of guarana, is 4 per cent.

The tannic acid of guarana was believed by Fournier (*Jour. Pharm. Chim.*, 1861, p. 291), to be identical with caffeotannic acid, and Peckolt (1866), stated that it resembled *kinotannic acid;* F. V. Greene (1877), termed it *paullinitannic acid.* Recently the tannic acid of guarana was more closely studied by Ernst Kirmsse (*Dissert.*, Strassburg, 1897), who established its non-glucosidal nature, hence its non-identity with kino- or caffeo-tannic acids, and pointed out its close relationship to *catechu-tannic acid* (see *Catechu*). The same author confirmed the observation of Peckolt as to the presence of *saponin* in guarana. By exhausting guarana paste of its caffeine by repeated extraction with chloroform, and subsequently extracting with absolute ether, Dr. Kirmsse furthermore obtained 0.05 per cent of a micro-crystalline substance anticipated by Prof. Schaer in 1890 (*Archiv der Pharm.*, Vol. CCXXVIII, p. 279), which proved to be *catechin* (*catechuic acid*), and was distinguished by its discoverer as *Paullinia catechin* (see *Catechu*). This substance was mistaken by Peckolt, in 1866, for gallic acid, as Dr. Kirmsse proved by employing Wackenroder's test to distinguish between gallic acid and catechin. This test is based on the fact that the green coloration produced by gallic acid in a freshly prepared solution of ferrous sulphate containing some sodium acetate, does not disappear upon adding acetic acid, while the color produced by catechin disappears under the same conditions. For methods recorded and results obtained in assay of guarana, see Kirmsse's dissertation, H. W. Snow (*Amer. Jour. Pharm.*, 1886, p. 483), Chas. A. La Wall (*ibid.*, 1897, p. 350), and method by J. U. Lloyd.

Action, Medical Uses, and Dosage.—It is very probable that from the tannin contained in guarana, it has effected recovery from *diarrhœa*, *leucorrhœa*, etc., of a very mild form; but as we have more prompt and efficient articles for these affections, in which this agent was at first so loudly heralded, it is no longer employed therapeutically, except chiefly for the relief of certain forms of *headache.* Like coffee and tea, it appears to be a gentle excitant, and is serviceable in cases where the brain becomes irritated or depressed by mental over-exertion, and when there is a sensation of fatigue or exhaustion during very warm seasons; as it has practically the same chemical composition as caffeine and theine, we find it has likewise precisely the same physiological action. It is chiefly in *nervous headache*, in the cephalalgia sometimes accompanying menstruation, and that following a course of dissipation, in which the most benefit is derived from it. Its use appears to be contraindicated in most cases of neuralgia, neuralgic headache, and chronic headache, and in all cases in which it is not desirable to excite the heart, increase arterial tension, or increase the temperature. Its administration is often followed by dysuria. The dose of guarana, in powder, is from 10 grains to 1 drachm, but this is an unpleasant and objectionable form of administration. The indications for its use are a feeble pulse, pallid countenance, and expressionless eyes, with sick headache. It is asserted by Foltz to relieve the *temporary paralysis of the third nerve*, which occasionally succeeds headache. The smaller doses act better than the excessively large doses, the medium dose of specific guarana being 10 drops. Webster claims that it is serviceable in *occipital neuralgia* and *lumbago.* The fluid extract and specific guarana are probably the most eligible preparations for use; the former may be given in doses of from $\frac{1}{2}$ to 1 teaspoonful, in syrup or sweetened water, repeated 3 times a day; the latter in from 1 to 30-drop doses. M. Gubler states that *guaranine* possesses diuretic properties, having tested it with several patients; in doses of about $7\frac{1}{2}$ grains daily, it increased the urine from 27 to 67 and 107 fluid ounces in the course of 24 hours.

Specific Indications and Uses.—Headache, with pallor of the face, weak circulation, and the pain aggravated by exertion; sick headache (migraine), with cerebral anemia; headache of menstruation, with cerebral anemia; mental exhaustion or depression; headache from dissipation.

Related Species.—Timbo. Several leguminous plants of Brazil are known by this name. They are used to stupefy fish. An alkaloid, *timbonine*, has been obtained from *Paullinia pinnata* by Stanislas Martin (*Pharm. Jour. Trans.*, Vol. VII, 1877, p. 1020). From another timbo Pfaff obtained two crystalline substances, one *timboïn*, being a nerve poison, and chemically neutral; the other *anhydro-timboin*, a non-poisonous substance. Crude timboïn yielded to a light petroleum *timbol*, an oily compound, probably a poisonous constituent of the stem and branches of the plant (*Amer. Jour. Pharm.*, 1891, p. 544).

GUTTA-PERCHA.—GUTTA-PERCHA.

The concrete juice of *Isonandra Gutta*, Hooker (*Dichopsis Gutta*, Bentley), and other species of same order.

Nat. Ord.—Sapotaceæ.

Common Names: *Gutta-percha, Gutta-taban, Gutta-percha depurata, Gummi-plasticum.*

Illustration: Bentley and Trimen, *Med. Plants*, 167.

Botanical Source.—This is the concrete milky juice of a tall tree, a native of the Malayan Archipelago, especially of Singapore, where it is now becoming rapidly extinguished through ruthlessness in collecting gutta-percha. It has a straight and lofty trunk, about 3 feet in diameter at the base, with numerous ascending branches; the terminal buds are white from exuding gutta. The wood is hard; the leaves crowded at the extremity of the branches, alternate, petiolate. oblong, with a small point at the apex, base tapering, 4 or 5 inches long, 2 inches broad, upper surface bright-green, feather-nerved, under surface brownish-red, from dense pubescence; the midrib and petiole the same; the petiole 1 inch long, channeled, not articulated with the stem. Stipules none. The flowers are axillary, sessile, 4 together, disposed in a quadrangular manner, small and white. Bracts none. Calyx persistent, 6 sepals, brownish-red, in a double series, the outer largest; æstivation valvate. The corolla is monopetalous, 6-cleft, the lobes ¼ of an inch long, tubes ½ an inch and deciduous; æstivation twisted. Stamens 12, in a single series, equal, similar, and inserted in the mouth of the tube. The filaments are equal in length to the lobes of the corolla; the anthers sagittate, extrorse, and affixed by their base to the filaments; the pollen scanty. The ovary is superior, conical, sessile, seated on a disk, 6-celled, each cell containing a single ovule suspended from a central axis; the funiculus is conspicuous. Style longer than the stamens and persistent; stigmas undivided (E. White).

History and Description.—This substance was introduced in 1842 to the profession, by Dr. William Montgomerie, a surgeon in the British army in the Indies. The natives cut down the tree, remove its bark, and collect the milky juice in conic receptacles made from the spathe of the Areca palm. The juice soon concretes upon exposure to the air. The product is then put into a pot with water warmed to 70° C. (158° F.) and kneaded, which removes particles of wood and bark, this process being repeated several times until a uniform mass is obtained. It has been stated that the yield from one tree is 20 to 30 pounds, but according to data given by Prof. Tschirch (*Indische Heil und Nutzpflanzen*, 1892, p. 203) this must be an exaggeration. Dr. Burck, in Buitenzorg (Java), has shown that by making incisions in living trees 1400 grammes of gutta may be obtained annually, and that this yield may be maintained during a period of 3 or 4 years. As imported it contains various foreign matters from which it should be freed before using it. It is a white or dirty pinkish opaque solid, having a faint odor, no taste, and hardens at 15.5° C. (60° F.). Water, alcohol, alkaline solutions, hydrochloric and acetic acids, and fixed oils have no action on it. It is soluble in coal naphtha, oil of turpentine, benzol, chloroform, boiling ether, and bisulphide of carbon. Hot water softens it, and a heat of 71.1° C. (160° F.) renders it adhesive and pliable; when soft it may be easily cut or molded into various shapes—a temperature of 55° to 60° C. (120° to 128° F.) being the most favorable for this purpose. It resembles caoutchouc, and like this substance, has the property of combining with sulphur, and is thus capable of being vulcanized for use in the arts (see *Elastica*). Its specific gravity is 0.979. Gutta-percha, when in contact with air for some time, oxidizes and undergoes a peculiar change, becoming brittle and ultimately losing all coherence. In this process formic acid is liberated. The oxidized substance is soluble in cold alcohol. This change does not take place when gutta-percha is kept under water. It is a better insulator for electric wires and cables than caoutchouc, and is employed for insulating purposes in large quantities.

Chemical Composition.—When gutta-percha, according to Payen (1852), is purified by kneading in warm water, dried, and treated with hot absolute alcohol a hydrocarbon, *gutta* (75 to 82 per cent) remains. From the hot solution an oxygen compound, *alban* (14 to 16 per cent), falls out upon cooling, while another oxygen compound, *fluavil* (4 to 6 per cent), remains in solution. To these constituents Otto Oesterle, in Prof. Tschirch's laboratory (*Archiv der Pharm.*, 1892, p. 641), added *guttane*, an unstable, thread-like body resembling gutta. Crude gutta-percha of commerce also contains tannin, salts and saccharine substances. No volatile oil could be identified.

Gutta determines the elasticity of gutta-percha, and its plasticity at elevated temperatures. It is a white, amorphous hydrocarbon of the formula $(C_{10}H_{16})_n$ (Oesterle); $C_{20}H_{32}$ (Oudemans, Baumhauer); $(C_4H_7)_n$ (Payen), etc., insoluble in alcohol and cold ether, little soluble in benzol and oil of turpentine, easily soluble in carbon disulphide and chloroform. It melts at 53° C. (127.4° F.) (Oesterle) and absorbs oxygen rapidly, whereby formic acid is liberated (Payen). Exposed to air and light pure gutta becomes yellow, friable, and partly soluble in alcohol, caustic potash and benzol.

Alban is a light powder, not dissolved by water, diluted acids or alkalies, dissolves in boiling, but not in cold, absolute alcohol; readily soluble in ether, chloroform, carbon disulphide, benzol, and oil of turpentine. It has the composition $C_{40}H_{64}O_2$ (Oesterle), yielding a hydrocarbon, *alben*, by heating with alcoholic potassa. It melts at 195° C. (383° F.). The presence of alban does not seem to have any harmful effect upon the technical properties of gutta-percha.

Fluavil is a lemon-yellow, amorphous body, having the composition $(C_{10}H_{16}O)_n$ (Oesterle), melting between 82° and 85° C. (179.6° and 185° F.), but becoming soft at a much lower temperature. When it occurs in gutta in larger quantities it renders this article brittle. Fluavil is more soluble in the solvents mentioned than the other constituents. Whether alban and fluavil are decomposition products of gutta, was not determined.

Action, Medical Uses, and Dosage.—Gutta-percha serves several useful ends in medicine, surgery, and pharmacy, and is likewise used for ornamental and various other purposes. Splints, etc., have been made of it, and employed in cases of *fractures*, *diseased joints*, and other cases where it is desired to keep the parts in a permanent position, and it is also formed into bougies, injection pipes, catheters, pessaries, specula, forceps, handles, etc. Its pliability after having been immersed into hot water renders it especially adapted for the preparation of splints, and such splints are preferable to carved wooden splints. The solution in bisulphide of carbon has been employed by M. Vogel in *wounds* effected by cutting instruments—the fluid evaporates with great rapidity, and leaves a thin layer which protects the wound from atmospheric action, at the same time keeping its edges in close contact. The following compound is recommended for the *hemorrhage* supervening the extraction of teeth: Take of gutta-percha, 1 ounce; best tar, 1½ ounces; creosote, 1 drachm; shellac, 1 ounce. Boil these in a crucible, stirring or beating them well, until they are blended into a stiff, homogeneous mass. The compound is readily softened between the fingers, and is easily introduced into the bleeding socket. It must be pressed in, and the hemorrhage will be speedily checked. For dental purposes solution of gutta-percha is purified by agitating it with calcium sulphate. Mixed with silica, powdered glass, zinc oxide, and similar mineral substances, to give hardness and the proper consistence, it is largely used by dentists to fill the cavities of *carious teeth*. Mr. Aiton recommends the following preparation, applied to the skin in the same manner as collodion, as a protection against poisonous or deleterious vapors or fluids: Add 30 grains of gutta-percha to ½ an ounce of benzene, and expose to a moderate heat; when the gutta-percha is dissolved, add to it a solution of 5 grains of caoutchouc dissolved in ½ ounce of benzene (benzol). A clear *solution of gutta-percha* may be made by adding to the solution a mixture of ⅔ of a part of finely powdered carbonate of lead in 2 parts of chloroform; agitating the whole 2 or 3 times, and then allowing the mixture to stand 10 or 12 days. The carbonate of lead, in becoming deposited, carries with it coloring and insoluble matters; the clear solution should then be decanted and placed in ½ fluid ounce vials, with closely-fitting glass stoppers (see *Liquor Gutta-perchæ*). This will be found very valuable as a local application to *irritated* and *abraded surfaces*, *chaps*, *small wounds*, etc., as it forms a kind of cuticle over the parts.

Dr. Maunoury recommends mixing 2 parts of chloride of zinc with 1 part of powdered gutta-percha, in a tube or porcelain dish, and gently heating the mixture over a lamp. The gutta-percha softens, the particles cohere in a spongy mass, which retains the chloride of zinc, and may be made into any convenient shape, which it retains on cooling. This he recommends as a manageable caustic, as it retains its consistence and flexibility, and can be easily inserted into the urethra, nostrils, fistulous or other passages, and, by its porosity, permits the exudation of the caustic, and thus opens a free passage for the result of the action of the caustic on the tissues. Other caustics or agents may be applied in the same way. Chrysarobin is well applied with solution of gutta-percha.

It has been extolled by dermatologists as an efficient application in certain *skin affections*, to prevent access of air and the formation of crusts, to lessen the quantity of secretions, and to limit the action of the medicaments employed. It has thus been employed in *smallpox* (to prevent pitting), in *erysipelas*, *psoriasis*, *herpes tonsurans*, *prurigo*, and certain *eczemas*.

Prof. J. M. Maisch proposed the following solution as preferable to collodion, in having no gloss or contractile power, and in its close resemblance to the skin: Take 1 part of the best commercial gutta-percha, cut it into small pieces, and, by agitation, dissolve it in 12 parts of chloroform; on standing for a day, all the coloring matter rises like a scum to the surface, leaving the solution clear; this may then be easily drawn off to the last drop. A wide glass tube, narrower at the bottom, and so arranged that both ends may be closed by corks, is the only instrument necessary; after the separation is complete, the upper cork must be removed, and the lower one loosened so as to allow the liquid to run out slowly. Gutta-percha is acted upon by the strong mineral acids, but not by sea water, alkalies, vegetable acids, or weak mineral acids, hence gutta-percha vessels are highly valuable.

Related Products and Preparation.—Several *guttas*, some of which are closely allied to caoutchouc, are used to adulterate gutta-percha, among which may be mentioned the following: *Gutta-soo-soo*—two kinds—one from Perek, the other, a caoutchouc, from Borneo, *Gutta-singgarip*, *Gutta-rambong*, and *Gutta-sundek* (*Gutta-putih*).

BALATA (GUM CHICLE).—This is a milky exudate, known in tropical America as *Chicle*, or *Tuno-gum*, derived from the Bully tree (*Mimusops globoso*, Gaertner), which grows along the Amazon and Orinoco rivers of South America. It is very much like gutta-percha, and is employed sometimes in plasters. Within recent years the demand for this substance has increased enormously in the United States, where the bulk is employed in making *chewing gum*.

GUTTA-PERCHA CEMENTS.—An improved cement for uniting the parts of boots and shoes, and in the manufacture of articles of dress in which cement is required, is made of 64 parts, by weight, of gutta-percha, 16 parts of caoutchouc, 8 parts of pitch, 4 parts of shellac, and 8 parts of oil. The ingredients are melted together, the caoutchouc having been previously dissolved. A cement for uniting sheet gutta-percha to silk or other fabrics, is composed of gutta-percha, 40 pounds; caoutchouc, 3 pounds; shellac, 3 pounds; Canada balsam, 14 pounds; liquid styrax, 35 pounds; gum mastic, 4 pounds; and oxide of lead, 1 pound. Another for uniting it to leather, as soles of shoes, etc., consists of gutta-percha, 50 pounds; Venice turpentine, 40 pounds; shellac, 4 pounds; caoutchouc, 1 pound; and liquid styrax, 5 pounds. A cement for repairing or patching shoes and boots has been in vogue among shoemakers. It is made by dissolving 1 ounce of raw gutta-percha in 1 pound of bisulphide of carbon, and then adding a piece of resin. The leather must be well buffed to make the cement adhere.

GYMNOCLADUS.—AMERICAN COFFEE-NUT.

The seeds and pulp of the pods of *Gymnocladus canadensis*, Lamarck.

Nat. Ord.—Leguminosæ.

COMMON NAMES: *American coffee-bean tree*, *Coffee tree*, *Kentucky mahogany*.

Botanical Source.—This is a slender and unarmed tree, attaining the height of 50 or 60 feet, with a trunk from 12 to 15 inches in diameter. For about 25 feet from the ground the trunk is straight and simple, and covered with a rough, scaly bark. The leaves are compound, unequally bipinnate, 2 or 3 feet long, and 15 to 20 inches wide; the leaflets 7 to 13 in number, ovate, acuminate, and dull-green, the single leaflets often occupying the place of some of the pinnæ. The flowers are large, regular, diœcious, whitish, in axillary racemes, succeeded by pods. Petals 5, oblong, equal, inserted on the summit of the calyx tube. Calyx tubular, 5-cleft, and equal. Stamens 10, short, distinct, inserted with the petals. Style 1. The legume is 8 to 10 inches long, 2 to 2½ inches wide, oblong, flattened, curving, pulpy within, and several-seeded. The seeds are from 2 to 4, quite hard, and somewhat egg-shaped, of a dark-olive color externally, slightly compressed, and about ¾ inch in length by ½ inch wide (W.—G.).

History and Chemical Composition.—This tree is indigenous to the United States, and is found growing in rich woods and along rivers and lakes in western New York, Ohio, Indiana, Kentucky, etc. It is known by several names, as *Coffee tree*, *Kentucky coffee tree*. The seeds were roasted and used by the earlier settlers instead of coffee. The trunk is naked for some distance above the ground, above which is a rather small but regular head, formed by a few, quite long branches. The wood is quite hard and strong, is reddish or light yellowish, rather fine grained, and susceptible of taking a very fine polish and presenting a most beautiful grained appearance; on this account it is highly prized in architecture and cabinet work. In our eastern cities it has been represented as a wood from Japan and brought most fabulous prices. The pulp and the seeds of the pods are the parts to be used; the former has some reputation as a fly poison. It is greenish and viscid. The active principle of these is taken up by alcohol, which gives a yellowish-brown tincture, or, if the pulp alone be used, a beautiful green, and, upon standing, crystals are deposited. The tincture has an unpleasant, bitterish taste, followed by a persistent pungent acrimony in the fauces. Rafinesque states that the leaves are purgative and contain a principle, *cysticine*, of a nauseous, bitter taste. The seeds are said to produce emesis. S. S. Mell (1887) obtained from the seeds a yellowish, saponifiable, fixed oil (specific gravity 0.919) to the extent of 10 per cent. Wax, resin and fat were extracted by ether, some tannin and a glucosid, burning to the taste and possessing a distinctive odor, were abstracted by alcohol. The seeds also contained mucilage, starch, and albuminoids (*Amer. Jour. Pharm.*, 1887, p. 230). J. H. Martin largely confirms these results, but found *saponin* in all parts of the plant, and concludes that to this principle the physiological activity of the plant is probably due. Tannic and gallic acids are absent in the seeds. The pulp surrounding it contains sugar, tartaric and citric acids, and probably saponin (*Amer. Jour. Pharm.*, 1892, p. 558). The carbohydrates of the fruit were investigated by W. E. Stone and W. H. Fest (*Amer. Chem. Jour.*, 1893, p. 660).

Action, Medical Uses, and Dosage.—The tincture of the pulp and pods, and in some instances of the bark also, has been used with benefit in *intermittent fever*. More recently it has been tried, and with advantage, in cases of abnormal states of the nervous centers, as indicated, among other symptoms, by impaired sense of touch and vision, numbness, dull headache, apathy, and formication. In one case of *locomotor ataxia* it proved decidedly beneficial, and is valuable in some of the more serious symptoms resulting from excessive *masturbation*. Recent reports (Dr. N. G. Vassar) confirm its value as a remedy for *spermatorrhœa*. Prof. Roberts Bartholow, M. D., investigated physiologically the purified tincture of the leaves as prepared for him by J. U. Lloyd and found it to be very marked in its qualities. It has likewise been recommended in *laryngeal cough* with chronic irritation of the mucous lining membrane of the air passages, in *erysipelas*, in all *fevers* presenting a typhoid condition, in *puerperal peritonitis*, and in the *exanthematous affections*. It is certainly deserving the attention of our practitioners. The tincture is best made by taking 2 ounces of the coarsely bruised seed and 1 ounce of the pulp, and adding to them 8 fluid ounces each of water and alcohol; let it macerate 12 or 14 days with frequent agitation, and then filter. One fluid drachm of this is to be added to 3 fluid ounces of water, of which the dose is a teaspoonful, to be repeated every 3 or 4 hours.

Related Species.—*Cercis canadensis*, Linné. *Nat. Ord.*—Leguminosæ. The *Red bud* or *Judas tree*, is a small tree growing in rich woods in the middle states. The flowers expand in early spring before the leaves come out. They are borne in lateral clusters and are of a pale-reddish color. They have an agreeably acid taste, and are often eaten by children. The leaves are simple, acute, cordate, and are supported on slender stalks. The fruit is a dry, brown, flat pod, which hangs on the branches during the winter. The name Judas tree is inapplicable, and the tree is so-called because its relative, the *Cercis siliquastrum*, abundant in Palestine, is said to have been the tree upon which Judas hanged himself. It only required a little further credulity to transfer the notion to the American species. The bark of the root is the preferred part, and is exceedingly astringent, even surpassing oak and hemlock. "When chewed it puckers the mucous membranes of the mouth almost as sensibly as the green fruit of the persimmon tree, or as the seed of the fruit of black haw (*Viburnum prunifolium*)" (Lloyd, in *Drugs and Medicines of North America*). Prof. J. U. Lloyd could detect neither alkaloid nor crystalline glucosid, the chief constituent being the tannin (*ibid.*, Vol. II, 124). The leaves and bark of this tree, especially the bark of the root, possess powerfully astringent properties, and may be administered in cases in which this class of agents is indicated, as in *diarrhœa* and *dysentery*, particularly in the chronic forms, and in *chronic catarrhal conditions*; also recommended as a local application in *chronic gonorrhœa*, *gleet*, *leucorrhœa*, and *chronic conjunctivitis*, and other affections attended with *mucous profluvia*.

GYNOCARDIA.—CHAULMOOGRA.

The seeds and oil of *Gynocardia odorata*, Robert Brown (*Chaulmoogra odorata*, Roxburgh; *Hydnocarpus odorata*, Lindley).

Nat. Ord.—Bixineæ.

COMMON NAMES: *Chaulmugra seeds, Chaulmogra.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 28.

Botanical Source, History, and Description.—This is a very large and handsome East Indian tree. The leaves are glossy, entire, and alternate; the flowers yellow and sweet-scented. The fruit is round, ash-colored, and when mature, averages in weight from 10 to 20 pounds. The numerous seeds are imbedded in its pulp, and contain an oil, which, according to Roxburgh, is mixed with fresh butter, and used by the natives as a remedy for cutaneous diseases. They are known as *Chaulmoogra* (or Chaulmugra), and are said, when powdered, to have been used with advantage in scrofula, skin diseases, and rheumatism, the dose being about 6 grains. The seeds are grayish, irregularly ovoid, compressed, somewhat angular and smooth, a little over an inch long, and have an oily taste and a peculiar, nauseous odor.

Chemical Composition.—*Chaulmugra oil* was obtained by pressure from the seeds about twenty years ago, and has attracted some little attention outside of India, where it has long been used. It is said that, in consequence of its high price, it is extensively adulterated by the natives of India, and so adroitly as to cause even the physicians in India to discontinue its use (*New Remedies*, 1879). This oil is granular, melts at 42° C. (107.6° F.); but after melting may be reduced much below this point without solidifying, and has, at 42° C. (107.6° F.), the specific gravity of 0.930. It has an acid reaction, an acrid taste, and a slight scammony-like odor. It is insoluble in water, partly soluble in alcohol, and, excepting impurities, seems to perfectly dissolve in ether, chloroform, carbon disulphide, and benzin. Mr. J. Moss (*Pharm. Jour. Trans.*, 1879, Vol. X, p. 251), found it to yield, upon the application of appropriate reagents, *palmitic acid;* a new acid, to which he gave the name, *gynocardic acid; hypogaic acid* (named from the seed of *Arachis hypogæa*), and *cocinic acid*. Of these four acids *palmitic* constitutes the largest proportion (63 per cent), altogether making 81 per cent, the weight of the oil. These acids exist in the form of glycerides, as fats, the first two acids also in a free condition. *Gynocardic acid* ($C_{14}H_{24}O_2$), however, is the important constituent (11.7 per cent), and gives the burning taste to the oil. Chaulmoogra oil strikes a green color with sulphuric acid.

Action, Medical Uses, and Dosage.—Chaulmugra oil is used both internally and externally in *leprosy*, *secondary syphilis*, *rheumatism*, *scrofula*, and in *phthisis*. The dose for an infant is 1 or 2 drops daily; for an adult, from 2 to 4 minims, repeated 3 times a day. Drachm doses are said to have been given without any unpleasant results. As a remedy for *leprosy*, it has been thought by some to give good results in the *macular* and *anæsthetic* forms (early stage), while other and equally good authorities pronounce it inoperative. The seeds, when powdered, are reputed more active than the oil. The oil has relieved the *dyspepsia* and *bronchitis* occurring in lepers. Externally, it has been successfully applied in the above-named diseases, likewise in *herpes*, *tinea*, *stiffness of joints*, *ulcers*, and various *cutaneous eruptions*. In the latter class it generally proves too irritating except in *eczemas* and *psoriasis*. It is said to destroy *pediculi* and the *itch insect*. It is usually triturated with from 4 to 6 parts of simple ointment, and thoroughly rubbed in with the palm of the hand, or with the fingers' ends. Moss recommends the following formula for its economical use: Take of chaulmugra oil, 2 parts; paraffin wax, at 41° C. (106° F.), 1 part, and ozokerine, 5 parts, and triturate thoroughly together. (Ozokerine is produced from ozokerite, or earth wax, and forms a tasteless and odorless basis for preparing ointments.) He also advises, as a more pleasant mode of administration, the use of perles or capsules, each containing the required dose. Children may take it in a little warm milk. It may also be given in emulsion with oil of almonds or glycerin. The powdered seeds are given in pills, from 3 to 6 grains being a dose. Salt meat, sweetmeats, spices, acids, and tobacco are strictly forbidden while taking this oil. Webster (*Dynam.*

Therap.), praises chaulmoogra oil in the *anemia of syphilis*, and states that by its action as a deobstruant, it averts indurations and banishes skin and mucous patches. He believes it to promise more than any other remedy if used early, to abort the constitutional effects of *syphilis*. Prof. Scudder mentions its internal and local use to allay itching and burning, being specially beneficial where the circulation is feeble and common sensation impaired.

Related Species.—*Hydnocarpus venenata*, Gærtner. Ceylon.

Hydnocarpus Wightiana, Blume. Western India. The seeds of both this and the preceding species yield an oil which may be used for the same purpose as *Chaulmugra oil*. It resembles the latter in odor and color, and strikes with sulphuric acid a blue coloration, not so pronounced, however, as that produced by Chaulmugra oil. This coloration is due to the presence of *gynocardic acid*, which Moss also found in this species (Dymock, *Mat. Med. of Western India*).

HÆMATOXYLON (U. S. P.)—HÆMATOXYLON.

"The heart-wood of *Hæmatoxylon campechianum*, Linné"—(*U. S. P.*).

Nat. Ord.—Leguminosæ.

Common Name: *Logwood.*

Illustrations: Woodville, *Med. Bot.*, 17; Bentley and Trimen, *Med. Plants*, 86.

Botanical Source.—This is a tree of from 20 to 25 feet in height, and occasionally reaching 40 or 50 feet. The trunk or stem is generally crooked and deformed, seldom exceeding 18 inches in diameter, and covered with a rough, ash-colored bark. The branches are somewhat flexuous, terete, and covered with whitish spots; in mountains and moist situations unarmed, but in localities where the tree is stunted in growth, furnished with sharp spines below the leaves. The leaves are alternate, from 2 to 4 from the same irregular, rough, tubercular prominence, pinnate, sometimes dividing, in a bipinnate manner, at the lowest pair of leaflets; the leaflets are 4-paired, shortly stalked, obovate, or obcordate. The flowers are yellow, slightly fragrant, on pedicels ½ inch in length, borne in axillary and subterminal racemes. The calyx is deeply 5-parted, brownish-purple, with thin membranous, deciduous, unequal lobes, and a short, green, campanulate tube. The petals are nearly equal, obovate, wedge-shaped at base, scarcely longer than the sepals, and of a lemon-yellowish color. Stamens 10, alternately short, inserted on the inside of the margin of the persistent tube of the calyx; filaments hairy at base; anthers ovate, without glands. Ovary lanceolate, compressed, 3-seeded, bearing a capillary style, which projects beyond the stamens and petals; stigma capitate and expanded. The pod or legume is flat, compressed, lanceolate, acuminate at both ends, 1-celled, 2-seeded, not opening at the sutures, but bursting in the middle longitudinally (L.).

Fig. 125.

Hæmatoxylon campechianum.

History and Description.—This tree grows in Jamaica, on the eastern shore of the bay of Campeachy, and in many of the West India Islands. The wood consists of a yellowish alburnum, and a dingy cherry-red inner wood, which last is the part used in medicine and the arts; it forms a useful commercial commodity, and is extensively used as a dye-stuff. It becomes darker-colored by exposure. Water or alcohol extracts its coloring matter, forming deep-purple solutions. Its aqueous solution yields a fine blue precipitate with lime-water, alum, and acetate of lead; a deep violet-blue with the higher salts of iron, and curdy flakes with solution of gelatin; sulphuric, nitric, hydrochloric, and acetic acids, and sulphate of copper also produce precipitates. Water is the menstruum usually employed to extract its virtues. A pound of the wood yields about 2 ounces of the extract. The medicinal article is thus described in the Pharmacopœia:

"Heavy, hard, externally purplish-black, internally brownish-red, and marked with irregular, concentric circles, splitting irregularly; odor faint, agreeable; taste sweetish, astringent. When chewed, it colors the saliva dark pink. Logwood is generally met with in the form of small chips or coarse powder of a dark brownish-red color, often with a greenish luster"—(*U. S. P.*).

Mr. Louis Siebold (*Brit. Pharm. Conf.*, 1887, [see *Amer. Jour. Pharm.*]), considers the logwood of San Domingo and Jamaica inferior to that of Campeachy or Honduras, and points out the great chemical difference between the commercial wood sold in logs, and that which comes to us ground or in chips, for the latter has mostly undergone a process of fermentation during which it is considerably modified, and loses its sweet taste. Howdver, for the purpose of testing water for traces of metals by means of logwood extract (see below), the fermented wood is preferable.

Chemical Composition.—Besides the usual plant constituents, logwood contains *tannin* (3.5 per cent, according to Chas. F. Kramer, *Amer. Jour. Pharm.*, 1882, p. 388); *phlobaphenes* (which are coloring matters produced by decomposition of tannin substance), and *hæmatoxylin* or *hæmatin*. The latter body was discovered by Chevreul in 1811, and obtained pure in 1842 by Erdmann. Commercial logwood extract often contains from 9 to 12 per cent of this principle which frequently crystallizes therefrom spontaneously in long needles. It is obtained by extraction with aqueous ether and crystallization from hot water containing reducing agents, *e. g.*, sulphurous acid or acid sulphites.

Hæmatoxylin ($C_{16}H_{14}O_6$, Erdmann), crystallizes with 3 molecules of water in the quadratic, with 1 molecule, in the rhombic system. It is not easily soluble in cold, but readily dissolves in hot water, alcohol, and in salts of alkaline reaction, *e. g.*, borax; from the latter solutions it can not be obtained crystallizable unless the solution is slightly acidified. Hæmatoxylin is very sensitive to light and air, turning reddish when exposed to light. When exposed to moist air or other oxidizers, it rapidly deliquesces, turns brown, and finally yields a colorless mass containing oxalic acid. By milder oxidation it is converted into *hæmateïn*. Solution of hæmatoxylin yields a black violet precipitate with ferric salts (ink), and is also precipitated by solutions of other metallic salts. The precipitates with lead and copper salts turn blue upon exposure to the air. When subjected to destructive distillation hæmatoxylin yields *pyrogallol* and *resorcin;* accordingly, a purple-colored *phtalein* (see *Aniline Dyes*), has been prepared by the interaction of 2 molecules of hæmatoxylin and 1 molecule of phtalic anhydride (E. A. Letts, *Berichte*, 1879). Hæmatoxylin undergoes a remarkable change with ammonia water in the presence of air. It is dissolved with rose-red, then purple-red color. The solution, by absorbing oxygen from the air becomes blackish-red, and upon evaporation, yields violet prismatic crystals of *hæmatein-ammonia* ($C_{16}H_{12}O_6.2NH_3$). These are soluble in water and alcohol. When heated to 130° C. (266° F.), ammonia is given off and *hæmatein* ($C_{16}H_{12}O_6$), is formed. Acetic acid likewise precipitates it from the aqueous solution of its ammonia compound. Another method of obtaining it is to add a few drops of nitric acid to an ethereal solution of hæmatoxylin. It forms a dark-violet, crystalline powder, soluble with difficulty in alcohol and glacial acetic acid, insoluble in chloroform and benzol. It dissolves at 20° C. (68° F.), in water at the rate of 6 in 10,000, and is about twice as soluble in ether. In alkalies it dissolves with blue color, which changes to brown. Hæmatoxylin has been proposed as a delicate test for ammonia; the presence of $\frac{1}{1000000}$ part of ammonia in water is indicated by an orange-red color assumed by blotting paper saturated with an alcoholic solution of hæmatoxylin (see Husemann and Hilger, *Pflanzenstoffe*). Arthur Weddell likewise recommends hæmatoxylin as a delicate test for calcium bicarbonate in water, and for the presence of lead (1 in 200,000), in the same medium, by the characteristic color reaction which takes place in the presence of air (*Amer. Jour. Pharm.*, 1884, p. 214). L. Siebold (*Amer. Jour. Pharm.*, 1887, p. 526), was able to detect even much smaller quantities of metals in potable water by this method. For the application of hæmatoxylin as an indicator in alkaloidal assay, see *Proc. Amer. Pharm. Assoc.*, 1896, p. 109.

Action, Medical Uses, and Dosage.—Logwood is a tonic and unirritating astringent, less constipating than many other astringents, and is useful in *hemorrhage from the uterus, lungs*, and *bowels*, in *old diarrhœas* and *dysenteries*, in *summer* *complaint of children*, and in *night-sweats*. A favorable preparation with many of the older practitioners in *cholera infantum*, after a proper employment of the syrup of rhubarb and potassa, is the following: Dissolve 2 drachms of extract of logwood in 4 fluid ounces of boiling water, to this solution add 2 fluid drachms of ammoniated tincture of opium, 3 fluid drachms of tincture of catechu, 1 fluid drachm of compound spirits of lavender, and 4 fluid ounces of simple syrup, or syrup of ginger. The dose is a teaspoonful every 3 or 4 hours. An infusion of logwood taken internally, and also used locally, in form of spray or injection, has effectually cured several cases of obstinate and offensive *ozœna*. In constitutions broken down by disease, dissipation, or the excessive use of mercury, the decoction of logwood, used freely in connection with the other treatment, will be found highly beneficial. Dose of the decoction, from 2 to 4 fluid ounces; of the extract, 5 to 30 grains. The use of logwood imparts a blood-red color to the stools and the urine. It should never be combined with chalk or lime-water, as they are incompatibles.

Red Ink.—A good red ink may be made as follows: Take of pernambuco wood, a Brazilian wood said to be derived from *Cæsalpinia echinata*, 4 ounces; diluted acetic acid, distilled water, of each, 16 ounces; boil together until 24 ounces remain. Then add 1 ounce of alum, evaporate the liquid to 16 ounces, dissolve 1 ounce of gum Arabic in it, strain, and to the cold liquid add 1 drachm of chloride of tin. This ink is preferable to the cochineal ink, being free from its bluish tint and more permanent.

Related Species.—ALGAROBILLA, the pod-like fruit of *Balsamocarpum brevifolium* of Chili. Contains a large proportion of *ellagic acid* and more than 60 per cent of tannin.

HAMAMELIS (U. S. P.)—HAMAMELIS.

"The leaves of *Hamamelis virginiana*, Linné, collected in autumn"—(*U. S. P.*). also the bark and twigs of same.

Nat. Ord.—Hamamelaceæ.

COMMON NAMES: *Witch-hazel, Winterbloom, Snapping hazelnut, Spotted alder*, etc.

Botanical Source.—This is an indigenous shrub, and consists of several crooked, branching trunks from the same root, from 4 to 6 inches in diameter, 10 or 12 feet in height, and covered with a smooth gray bark. The leaves are borne on short petioles, alternate, oval or obovate, acuminate, obliquely subcordate at base, margin crenate-dentate, scabrous, with minute elevated spots beneath, and from 3 to 5 inches long, two-thirds as wide. The flowers are yellow, on short pedicels 3 or 4 together in an involucrate, axillary, subsessile glomerule. The calyx is small, divided into 4 thick, oval, downy segments, with an involucel of 2 or 3 bracts at base. The petals, 4 in number, are yellow, ¾ of an inch long, linear, curled or twisted. Sterile stamens 4, scale-like, opposite the petals, alternating with the 4 fertile ones. Ovary ovate; styles 2, short; stigmas obtuse. The capsule or pod is nut-like, 2-celled, 2-beaked, opening loculicidally from the top; the outer coat separating from the inner, which incloses the oblong, black seeds, but soon bursts elastically into 2 pieces (W.—G.—R.).

Fig. 126.

Hamamelis virginiana.

History and Description.—This shrub grows in nearly all parts of the United States, especially in damp woods, flowering from September to November, when the leaves are falling, and maturing its seeds the next summer. The bark and leaves are the parts used in medicine; they possess a degree of fragrance, and, when chewed, are at first somewhat bitter, very sensibly astringent, and then leave a pungent sweetish taste, which remains for a considerable time. Water extracts their virtues. No analysis has been made of the leaves, though they are known to contain a bitter body and tannin. The bark and root probably contain a very small amount of volatile oil (see Drs. J. Marshall and H. C. Wood, in *Therap. Gaz.*, 1886, p. 295). Dr. Charles A. Lee (*Jour. Mat. Med.*, 1859, p. 200) found in the bark 5½ per cent of tannin, while H. K. Bowman (*Amer. Jour. Pharm.*, 1869, p. 194) records 8.10 per cent, and Walter B. Cheney (*ibid.*, 1886, p. 418) 6.75 per cent. No glucosid nor alkaloid was obtainable by the latter author or by others. F. Grüttner (*Archiv der Pharm.*, 1898, pp. 278–320) obtained from the bark 3 per cent of a crystallizable and optically active tannin (*hamamelitannin*, $C_{14}H_{14}O_9+5H_2O$), gallic acid, dextrose, fatty and waxy matter, including *phytosterin* ($C_{26}H_{44}O+H_2O$), etc. A preparation made by distilling water, or water containing some alcohol, from the green twigs and leaves of hamamelis is very popular under the term *Distilled Extract of Hamamelis*. The *U. S. P.* describes hamamelis leaves as follows: "Short-petiolate, about 10 Cm. (4 inches) long, obovate or oval, slightly heart-shaped, and oblique at the base, sinuate-toothed, thickish, nearly smooth; inodorous; taste astringent and bitter"—*U. S. P.*). The shoots are used as divining-rods to discover water and metals under ground, by certain adepts (?) in the occult arts.

Action, Medical Uses, and Dosage.—Witch-hazel is tonic and astringent. Some have pronounced it sedative also. The decoction of the bark is very useful in *hemoptysis*, *hematemesis*, and other *hemorrhages*, as well as in *diarrhœa*, *dysentery*, and *excessive mucous discharges*, with full, pale, and relaxed tissues. It has been employed with advantage in *incipient phthisis;* in which it is supposed to unite anodyne influences with its others. It is useful in the form of poultice in *swellings* and *tumors* of a painful character, as well as in external *inflammations*. The American Indians used it for this purpose. The decoction may be advantageously used as a wash or injection for *sore mouth*, *painful tumors*, *external inflammations*, *bowel complaints*, *prolapsus ani* and *uteri*, *leucorrhœa*, *gleet*, and *ophthalmia*.

Since the introduction of the distilled extract of witch-hazel and the specific hamamelis, the use of decoctions of the bark has been largely abandoned. The fluid extract has but little to recommend it. The particular field for hamamelis is in disorders involving the venous structures. Its most pronounced virtue is its stimulating and tonic action upon the venous coats, exhibited so markedly in its power over *varicoses*, *hemorrhoids*, *hemorrhages*, and other conditions due to relaxation of venous structures. The parts are usually pale and relaxed, though occasionally a deep redness, due to venous engorgement, is observed. Here, and especially as great pain is usually an accompaniment, belladonna may be associated with it. It is adapted to the whole venous system, overcoming debility, differing therein from such agents as act only upon localized vascular areas.

Prof. J. M. Scudder and others have found witch-hazel a valuable remedy in *passive hemorrhages* and *congestion*, especially in *epistaxis*, *hemorrhoids*, *phlegmasia dolens* (after acute phases have passed away), *phlebitis*, and *varicose veins*. He also found it valuable in *diarrhœa*, in *chronic pharyngitis*, and in *chronic uterine congestion*, where the cervix is enlarged without abnormal hardness, the os uteri being soft, open, and patulous, and perhaps *leucorrhœa* and some *prolapsus* present. It is specially adapted to diarrhœa with a tendency to or associated with passive hemorrhage. It also forms an excellent application to *chronic vascular conditions of mucous tissues*, and to old, flabby, fetid *ulcers*. Prof. A. J. Howe stated that in "several cases of *uterine hemorrhage*, all occurring within 2 years, he administered witch-hazel with success. In some instances, the cause of the flow, and the conditions upon which it depended, were unknown or rested on conjecture, yet the exhibition of the medicine was always followed by satisfactory results." Half-teaspoonful doses of specific hamamelis were mixed with water and repeated every few minutes while the flow lasted, and afterward every few hours to prevent a return of the hemorrhage. In *menorrhagia* and those wasting states so common after *abortion*, in the early months of pregnancy, he used no remedy that exerted such beneficial effects as witch-hazel. In *uterine hemorrhage* following delivery at full term, the remedy is probably not equal to ergot, but in the kind of cases referred to it is a safer agent. In *chronic diarrhœa* and *cholera infantum* it is a valuable medicine. Hamamelis, both internally and topically, arrests *oozing of blood* from mucous surfaces. This action is well shown in *non-inflammatory hematuria*. It is not the remedy for active hemorrhage, but for *passive bleeding*, as from the lungs, stomach, bowels, renal or genital organs its action is satisfactory.

Besides its control over actual hematuria, hamamelis is often serviceable in renal affections due chiefly to vascular relaxation. Thus in *diabetes insipidus* it has been of some value, but it is of greater service in *mucous profluvia of the urino-genital tract*. It is of benefit in *vesical catarrh*, with tenesmus, and in *irritation of the bladder*, due to enlarged and relaxed scrotal veins. It should be used both internally and locally to the scrotum. While it relieves *varicocele*, too much must not be expected of it in the way of a cure. In *female disorders* it is indicated by venous fullness and relaxation. Dull, aching, ovarian pain is relieved by hamamelis, and in *leucorrhœa*, with fullness of the pelvic veins and relaxation of the uterine and vaginal walls, its internal and external exhibition is of marked benefit. It relieves *ovarian* and *testicular congestion*. Hamamelis is of pronounced value in *hemorrhages into the eye ball*, and locally relieves *ecchymosis of the lids and conjunctiva*.

Hamamelis is justly popular as a remedy for *sprains*, *contusions*, *wounds*, *swellings*, etc. A solution of a few grains of asepsin in distilled hamamelis forms an elegant and efficient dressing for *burns*, *scalds*, *cuts*, *abrasions*, *crushed fingers*, etc. Ten grains of menthol to 4 fluid ounces of distilled hamamelis are also efficient in *burns* and *scalds* (Ellingwood). Glycerin and hamamelis, or Lloyd's hydrastis and hamamelis, equal parts, has rendered us excellent service in *irritated* and *inflammatory conditions of the external auditory meatus*, especially when due to irritation from the presence of *inspissated cerumen*. Locally, hamamelis forms an excellent soothing application for *chafing*, due to excessive discharges; it is likewise useful in *diffusive cutaneous inflammations*. Few agents are more grateful in various subacute forms of *sore throat*, also in sore throat with deep redness and great pain, and it is particularly soothing in *scarlatinal angina*. It is a very valuable aid, locally, in the treatment of *tonsilitis*, *phlegmonous ulceration of the throat*, *diphtheria*, and *acute catarrh*. *Chronic conjunctivitis*, with vascularity of the palpebral and ocular conjunctiva, has yielded to a decoction of equal parts of hamamelis (bark), hydrastis, and lobelia, boiling the first two ingredients, and adding the lobelia to the hot liquid. Cover, allow to cool, and strain. Hamamelis should not be neglected as a part of the treatment of *inflamed breasts*, and applied hot it gives great relief to the soreness of abdominal muscles and pelvic parts following *childbirth*. *Muscular soreness* and *aching* sensations, as of having been bruised, whether from colds, exposures, strains, bruises, or severe muscular action, are greatly relieved by the application of distilled hamamelis, either hot or cold, by means of compresses, while specific hamamelis may be given internally. It forms a good face wash for *burning of the skin*, for *tan* and *freckles*, for *dilated facial capillaries*, and a good application after shaving. Distilled hamamelis and Lloyd's colorless hydrastis form a safe and efficient injection for most cases of *gonorrhœa*. Witch-hazel enters into many of the ointments designed for application to *piles*. An ointment made with lard and a decoction of white oak bark, apple-tree bark, and witch-hazel has been successfully employed for this purpose. Dose of decoction of witch-hazel, from 2 to 4 fluid ounces, 3 or 4 times a day; of distilled hamamelis, 5 to 60 drops; of specific hamamelis, 1 to 30 drops.

Specific Indications and Uses.—Venous debility, with relaxation and fullness; pale mucous tissues (occasionally deep-red from venous engorgement, or deep-blue from venous stasis); mucous profluvia, with venous relaxation; passive hemorrhages; varicoses; capillary stasis; hemorrhoids, with full feeling; relaxed and painful sore throat; dull, aching pain in rectum, pelvis, or female organs; perineal relaxation, with fullness; muscular relaxation; muscular soreness and aching and bruised sensation, whether from cold, exposure, bruises, strains, or from physical exertion.

HEDEOMA (U. S. P.)—HEDEOMA.

"The leaves and tops of *Hedeoma pulegioides* (Linné), Persoon"—(*U. S. P.*): (*Melissa pulegioides*, Linné; *Cunila pulegioides*, Willdenow; *Ziziphora pulegioides*, Desfontaines).

Nat. Ord.—Labiatæ.

COMMON NAMES: *Pennyroyal*, *American pennyroyal*, *Tick-weed*, *Squawmint*.

ILLUSTRATIONS: Bentley and Trimen, *Med. Plants*, 200; Barton, *Med. Bot.*, 41.

Botanical Source.—This is an indigenous annual plant. It has a fibrous, yellowish root, an erect, branching, pubescent, rather angular stem, from 6 to 12 inches high. The leaves are ½ inch or more long, opposite, oblong, have 1 or 2 teeth on each side, are smooth above, rough below, narrowed at the base, and borne on short petioles; the floral leaves are similar. The flowers are quite small, light-blue, in 6-flowered, axillary whorls. Calyx ovoid or tubular; gibbous on the lower side near the base, with 13 striæ; upper lip 3-toothed; lower 2-cleft; throat hairy. The corolla tube is as long as the calyx, downy, and 2-lipped; upper lip erect, flat and notched at the apex; the lower spreading and 3-cleft, the lobes being nearly equal. Stamens 2, ascending and filiform; the cells of the anthers diverging. Seeds 4, and oblong (W.—G. L.).

Fig. 127.

Hedeoma pulegioides.

History, Description, and Chemical Composition.—This herb was placed by Linnæus in the genus *Melissa*, and afterward *Cunila*, from which it was removed by Persoon, and placed in the genus *Hedeoma*. It must not be confounded with *Mentha Pulegium*, Linné, or *European pennyroyal*, which has similar action and uses. It is a well-known plant, growing in barren woods and dry fields, and particularly in limestone countries, flowering from June to September and October, rendering the air fragrant for some distance around it. It is common to nearly all parts of the United States. It has a peculiar, aromatic odor, which, however, is very offensive to some persons, and a hot, pungent, aromatic taste. It imparts its virtues to boiling water by infusion; boiling destroys its activity by evaporating the volatile oil, on which its properties depend. The oil (see *Oleum Hedeomæ*), its chief constituent, may be obtained by distillation with water, and is often employed, or its tincture, instead of the herb itself; it is of a light-yellow color, and specific gravity ranging from 0.930 to 0.940. *Hedeoma thymoides*, Gray, a Texan plant, has similar properties. The official drug is thus described: "Leaves opposite, short-petioled, about 12 Mm. (½ inch) long, oblong-ovate, obscurely serrate, glandular beneath; branches roundish, quadrangular, hairy; flowers in small, axillary cymules, with a tubular-ovoid, bilabiate and five-toothed calyx, and a pale blue, spotted, bilabiate corolla, containing 2 sterile and 2 fertile, exserted stamens; odor strong, mint-like, taste warm and pungent"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Pennyroyal is a stimulant, diaphoretic, emmenagogue, and carminative. The warm infusion used freely, will promote perspiration, restore *suppressed lochia*, and excite the menstrual discharge when recently checked, especially by colds; it is often used by females for this last purpose, a large draught being taken at bedtime, the feet having been previously bathed in warm water. It is an excellent remedy for *common colds*. A gill of brewer's yeast added to the draught is reputed a safe and certain abortive. The warm infusion may likewise be employed with advantage in the *flatulent colic* of children. The oil, or its tincture, is also administered as a carminative and anti-emetic, and has been of benefit in *hysteria*, *whooping-cough*, *spasms*, etc. Hedeoma is accredited with galactagogue powers, but it acts best probably when diminished lactation is due to acute colds. Dr. M. H. Hennell (*Trans. Ohio E. M. Assoc.*, 1895, p. 31), justly extols the remedy in *flatulent colic*, not only to serve as an anti-spasmodic, but to act as a calmative of the nervous phenomena. He uses it extensively in threatened *convulsions* of children, in *hysteria* from menstrual derangements, in *puerperal septicæmia*, and to hasten or aid the eruptive process in the *exanthemata*. Dr. Hennell praises it especially as a remedy for *chronic amenorrhœa*, and gives the indications below named. It is likewise used as a rubefacient in *rheumatism*, and united with linseed oil, as an application to *burns* and *scalds*. Dose of the oil, from 2 to 10 drops; of a saturated tincture, 1 to 2 fluid drachms. The infusion may be freely administered. Dr. Toothacker (*Phila. Jour. of Hom.*, Vol. II, p. 655) reports a case of poisoning in a woman from one fluid drachm of oil of pennyroyal. The symptoms were: Severe headache, difficult swallowing, intense nausea, with severe retchings without emesis, intolerable bearing down, labor-like pains, abdominal tenderness, constipation, dyspnœa, limbs semiparalytic, and nervous weakness and prostration (Millspaugh's *Amer. Med. Plants*).

Specific Indications and Uses.—Amenorrhœa of long standing, with pallor and anemia, and dark circles about the eyes. Patient complains of languor and lassitude, takes cold easily, has pain in the back and limbs, and exhibits full, prominent veins (Hennell).

HEDERA.—Ivy.

The leaves, berries, and gum-resin of *Hedera Helix*, Linné.

Nat. Ord.—Araliaceæ.

Common Names: *Ivy, Common ivy.*

Botanical Source.—This is an evergreen creeper, with long and flexible stems and branches, which attach themselves to the earth, or trees, or walls, by numerous root-like fibers. The leaves are coriaceous, smooth, shining, dark-green, with veins petiolate, the lower ones 5-angled or 5-lobed, the upper or old ones ovate and acute. The flowers are greenish-white, disposed in numerous, simple, and downy umbels, forming a corymb. The berries are black, with a mealy pulp (W.—L.).

Fig. 128.

Hedera Helix.

History, Description, and Chemical Composition.—This plant is common all over Europe, and is cultivated in many parts of the United States; it flowers in September. The gum-resin (*Gummiresina Hederæ*, or *Ivy gum*), exudes from the incised bark, and comes to us in yellowish or red-brown, irregular pieces. The edges are translucent and of a garnet hue. It is acrid, faintly bitter, and when heated emits a pleasant, aromatic odor. The leaves and berries are the parts used. The former possess a peculiar, rather fragrant odor, and a nauseously bitter and astringent taste. The taste of the latter is somewhat acid, piquant, and terebinthine. A. Jandous (*Amer. Jour. Pharm.*, 1883, p. 371), reports the ivy berries to contain in their fleshy part 70 per cent of water, a dark-red coloring matter soluble in alcohol and water, resinous matter first tasting sweet, then sharp and bitter, and grape sugar, gum, albumin, and salts. The seeds contain a fatty oil of irritating taste and producing a green color with ferric chloride. The poisonous properties of the fruit are neither due to the resinous matter in the pulp, nor to the oil in the seeds.

A bitter substance believed to be an alkaloid and named *hederin*, was obtained from the seeds by Vendamme and Chevalier (see *Amer. Jour. Pharm.*, 1842, p. 172). Posselt, in 1849, isolated from the seeds two proximate principles, viz., crystallizable *hederic acid* ($C_{16}H_{26}O_4$, according to Davies, 1878), which Kingzett believed to be a glucosid, and amorphous *hederatannic acid.* (For details regarding these substances see Husemann and Hilger, *Pflanzenstoffe*, p, 968.) The bitter *hederin* is probably identical with *hederatannic acid.* The leaves of ivy have a peculiar fragrant odor and an astringent, bitter taste. Mr. F. A. Hartsen, in 1875, by extraction with 85 per cent alcohol, obtained therefrom in impure form, a glucosid resembling saponin, but differing from the latter by not being soluble in water. L. Vernet (*Jour. Pharm. Chim.*, 1881, p. 347), isolated this glucosid ($C_{32}H_{54}O_{11}$), which was later named *helixin* (Joulin, *Jour. Pharm. Chim.*, 1891, p. 215), by boiling out the bruised leaves with water repeatedly, then extracting them with alcohol, evaporating the latter, washing with cold benzin, and crystallizing from solution in boiling acetone. It forms silky needles melting at 233° C. (451.4° F.), insoluble in water, chloroform, and benzin, soluble in warm acetone, benzol, and ether; also in warm alkalies and hot alcohol. It reduces Fehling's solution only after being heated with diluted sulphuric acid, sugar, and a neutral, crystallizable substance ($C_{26}H_{44}O_6$), melting at 278° to 280° C. (532.4° to 536° F.), being formed. The latter is not fermentable with yeast; *helixigenin* is the name recorded for the helixin derivative in C. E. Sohn's *Dict. Active Principles of Plants*, 1894.

Action, Medical Uses, and Dosage.—The leaves are stimulating, and have been employed as an application to *issues;* and have likewise been efficient in *diseases of the skin*, *indolent ulcers*, *eczemas*, *itch*, etc., in the form of decoction, and applied locally; this will also destroy *vermin* in the hair, which, it is stated, is stained black by the application. They are reputed beneficial as a cataplasm in *glandular enlargements. Marasmus of children*, *rachitis*, and *pulmonary affections* have been benefited by the dried leaves in powder, in doses of 20 grains or more. The berries act as an emetic and cathartic, and were formerly esteemed in *febrile affections*, having been supposed to possess sudorific virtues. Associated with vinegar, they were considerably used during the *London plague*. The gum-resin has been used for *toothache*, *ulcerations*, *local pains*, and to control *excessive discharges*.

HELENIUM.—SNEEZEWORT.

The plant *Helenium autumnale*, Linné.

Nat. Ord.—Compositæ.

COMMON NAMES: *Sneezewort*, *Sneezeweed*, *Swamp sunflower*, *Wild sunflower*.

ILLUSTRATION: Meehan's *Native Flowers and Ferns*, II, 113.

Botanical Source.—This plant, likewise called Swamp, or False sunflower, is an indigenous, perennial herb, having a fibrous root, and several erect, branching, angular stems, 2 or 3 feet high, and strongly winged by the decurrent leaves. The leaves are alternate, smooth, or slightly pubescent, elliptic-lanceolate, more or less deeply serrate, and often sprinkled with bitter and aromatic resinous globules. The flowers are large, numerous, bright yellow, terminal in loose, showy corymbs, with flat, drooping, wedge-shaped rays, each ending in 3 obtuse teeth, longer than the large, globose disk. The involucre is small, reflexed, with the scales linear or subulate. The receptacle is globose or oblong, naked in the disk, and chaffy in the ray only. Achenia top-shaped and ribbed. Pappus of 5 thin and 1 nerved chaffy scales, the nerve extending into a bristle or point (G.—W.).

History and Chemical Composition.—Sneezewort is a plant common to the United States, growing in low, damp fields and meadows, and on alluvial river banks, flowering from August to October. It is nearly inodorous, with a rather acrimonious, amarous taste. It has been analyzed by F. J. Koch (*Amer. Jour. Pharm.*, 1874, p. 221). It contains a trace of tannin and volatile oil, malic acid, and, besides the ordinary plant principles, an amorphous glucosid to which the bitter taste of the herb is due. When boiled with diluted acid it splits into a bitter, non-crystalline body of acid reaction, and glucose. This glucosid is soluble in boiling water, alcohol, and ether.

Action, Medical Uses, and Dosage.—Tonic, diaphoretic, and errhine. Reputed valuable in *chills and fever* and other *febrile diseases*. The whole plant possesses errhine properties, but the flowers, particularly the florets of the disk, are the most active, and may be used, in powder, as a snuff, in *headache*, *incipient coryza*, *catarrh*, *deafness*, and other affections where errhines are desired.

Related Species.—*Helenium tenuifolium*, Nuttall. United States, from Georgia west to Texas and north to Kansas (for illustration, see Meehan's *Native Flowers and Ferns*, II, 37). This species is poisonous. According to Galloway (*Amer. Jour. Pharm.*, 1872), spasms, with delirium and unconsciousness, were produced in four negroes by this plant, while in animals it resulted in twitching of the muscles, violent convulsions, and death.

Helenium parviflorum, Nuttall.—Georgia. Properties similar to those of *Helenium autumnale*.

HELIANTHEMUM.—FROSTWORT.

The plant *Helianthemum canadense*, Michaux (*Cistus canadensis*, Linné).

Nat. Ord.—Cistaceæ.

COMMON NAMES: *Frostweed*, *Frostwort*, *Frostplant*, *Rock-rose*.

Botanical Source.—This plant is a perennial herb, with a simple, ascending downy stem, about 1 foot high, at length shrubby at base. The leaves are alternate, from 8 to 12 lines long, about one-fourth as wide, oblong, acute, lanceolate, erect, entire, subsessile, tomentose beneath, and without stipules. The flowers are large and bright yellow, few, in terminal corymbs; apetalous ones smaller, lateral, solitary or racemose, clustered in the axils of the leaves, and nearly sessile. The corolla, of the petaliferous flowers, are 1 inch wide, with 5 petals, crumpled in the bud, and fugacious. Calyx of the large flowers hairy-pubescent, and 5; of the small flowers, hoary. Stamens of the large flowers numerous and declinate; of the small flowers, few. Style short or none. Stigmas 3-lobed, scarcely distinct; capsule smooth, shining, triangular, 3-valved, 1-celled, opening at top, about 3 lines long; of the apetalous flowers not larger than a pin's head; the seeds are angular, few, and brown. The yellow flowers open in sunshine, and cast their petals by the next day (G.—W.).

History.—This plant grows throughout the United States in dry, sandy soils, and flowers from May to July. The large flowers make their appearance first and later in the season the smaller flowers are produced on the same or other plants. The whole plant is medicinal. The leaves and stems of the plant are covered with a white down, and Prof. Eaton, in his work on botany, says: "In November and December of 1816, I saw hundreds of these plants sending out broad, thin, curved ice crystals, about an inch in breadth, from near the roots. These were melted away by day, and renewed every morning for more than 25 days in succession." These spicules of ice are sent out from fissures in the bark of the plant near its base. The plant has a bitterish, astringent, slightly aromatic taste, and yields its properties to hot water.

Fig. 129

Helianthemum canadense.

Chemical Composition.—Analyzed in 1888 by W. Crutcher (*Amer. Jour. Pharm.*, 1888, p. 390), frostweed was found to contain tannin (10.8 per cent), wax, fatty and volatile oils. A white crystalline principle, thought to be a glucosid, was obtained in fine needles by treating an alcoholic extract with water and shaking out with benzol. These crystals were not further examined.

Action, Medical Uses, and Dosage.—This plant has long been used in practice as a valuable remedy for *scrofula*, in which disease it has been reported to have effected some astonishing cures. It is used in the form of decoction, syrup, or fluid extract; if taken in too large doses it will sometimes vomit. It is tonic and astringent, as well as antiscrofulous. In *secondary syphilis*, either alone, or in combination with corydalis and stillingia, it was formerly regarded as a most valuable remedy. In the form of infusion, it has also been found very serviceable in *chronic diarrhœa* and *dysentery*, especially when occurring among persons disposed to scrofula, also as a remedy in several forms of *cutaneous disease;* also as a gargle in *scarlatina* and *aphthous ulcerations*, and as a wash in *scrofulous ophthalmia*, *prurigo*, and other cutaneous diseases. Externally, a poultice of the leaves is applied to *scrofulous tumors and ulcers*. The fluid extract is the best form for internal use; dose, 1 or 2 fluid drachms, 3 or 4 times a day. (For a list of physiological phenomena produced by this plant, in small and large doses, consult Millspaugh's *Amer. Med. Plants*, Vol. I, p. 28.)

Related Species and Drugs.—*Helianthemum corymbosum*, or *Frostweed*, with an erect, branching, canescent stem; lance-oblong, alternate leaves, canescently tomentose beneath; flowers in crowded, fastigiate cymes; primary ones elongated, filiform pedicels, and with petals twice longer than the calyx; sepals villous-canescent, outer ones linear, obtuse; inner ones ovate, acute; is found growing in pine-barrens and sterile sands, in the southern and middle states. It possesses properties analogous to the preceding, and may be indiscriminately employed with it. F. J. Kruell, in 1874 (*Amer. Jour. Pharm.*), found it to contain resin, chlorophyll, gum, extractive, glucose, salts, and a large amount of tannin.

Helianthemum vulgare, Gaertner (*Cistus Helianthemum*, Linné). Europe. It has properties similar to the rock-rose.

LABDANUM, *Resina ladanum*.—This resinous exudate is derived from several species of *Cistus*, of the *Nat. Ord.*—Cistaceæ, especially the *Cistus creticus*, Linné; *Cistus ladaniferus*, Linné; and *Cistus cyprius*, Lamarck. These are handsome evergreen shrubs, natives of the Levant and Grecian Archipelago. The resin is collected from the branches by means of a leather instrument somewhat like a rake—called *labdanisterion*—the implement being drawn over the branches and leaves, and the product scraped off the leather, to which it adheres. It is then kneaded or mixed together with sand or other solid material. Two grades of labdanum are met in commerce. The first form, *cake labdanum*, occurs as dark-brown or blackish masses, becoming soft and sticky by the warmth of the hands. When freshly broken it has a grayish aspect, soon changing to a darker hue. The second form, *common labdanum*, comes in cylindrical sticks, or spiral pieces, which are hard, brittle, light, porous, and of a gray-black color. Unlike the purer grade, it does not soften by the heat of the hand. Both varieties are bitter, and have a balsamic, pleasant odor. The second grade is usually much adulterated or wholly artificial. Pure labdanum is fusible, and burns with a vivid flame, is nearly completely dissolved by alcohol, but insoluble in water. The poorer grades are said to be gathered from the hair of goats and wool of sheep, which are allowed to browse on the plants. *Cake labdanum*, according to Guibourt (*Hist. d. Drogues*, 1875, Vol. III, p. 675), contains of resin and a small amount of volatile oil, 86 per cent; wax, 7 per cent; extractive, 1 per cent; hair, sand, and other insoluble matter, 6 per cent. *Roll labdanum* yielded to Pelletier, sand, 72 per cent; and resin, but 20 per cent. Labdanum was formerly regarded diuretic and expectorant, and was employed in *bronchitis*, *leucorrhœa*, *catarrh*, *dysentery*, etc. It is now used only in plasters, and is nearly obsolete as a medicine. Owing to its agreeable aroma when burned, it was employed by the ancients for fumigating purposes.

HELIANTHUS.—SUNFLOWER.

The seeds and stems of *Helianthus annuus*, Linné.

Nat. Ord.—Compositæ.

COMMON NAME: *Sunflower.*

Botanical Source.—This is an annual plant, with an erect, rough stem, usually about 7 feet high, but which, under favorable circumstances, attains the height of 15 and even 20 feet. The leaves are large, cordate, and 3-nerved; the upper ones alternate, the lower ones opposite. Peduncles thickening upward. The flowers are large and nodding; the rays yellow; the disk dark-purple. The seeds are numerous and dark-purple when ripe. A splendid variety occurs with the flowers all radiate (W.).

History and Description.—This well-known plant is a native of South America, and is extensively cultivated in the gardens of this country on account of its beautiful, brilliant, yellow flowers, which appear in July and August. The ripe seeds are the parts used; they are of a purplish color externally, about 4 or 5 lines long, between 2 and 3 wide, 2-angled, margins parallel, apex somewhat pointed, the base truncate, compressed, with longitudinal convex surfaces, so as nearly to present 4 angles; internally the testa is whitish, and the kernel is whitish, oily, rather sweetish, and edible. They contain a fixed oil which may be obtained by expression. The leaves are large, and when carefully dried, may be made into cigars, very much resembling in flavor that of mild Spanish ones. The virtue of the seeds chiefly depends upon the fixed oil they contain.

The finely prepared fiber of the stalks is said to be used in China to adulterate silks. Sunflower plants are now planted to some extent in malarial quarters under the belief that they have a beneficial influence in warding off miasmata. Its action in this direction, if effective at all, is probably due to its power of absorbing large amounts of water from damp grounds.

Chemical Composition.—All parts of the plant are rich in mineral matters, 10.8 per cent of ash being yielded by the dry plant (Brandenburg). John found the fresh pith to contain 1.5 per cent of potassium nitrate, corresponding to 9 per cent of the dried pith. *Asparagin* occurs in the young plant (Dessaignes), and *inulin*, according to Braconnot, in the root (*Archiv der Pharm.*, 1859, p. 1). The kernels of the seeds yield 40 per cent of a limpid, fixed oil, *Sunflower oil*. It is colorless or pale-yellow, odorless and almost without taste. Its specific gravity is 0.926; and at —15° C. (+5° F.), it congeals. It is an excellent burning fluid, and the plants are largely cultivated in China and some other countries for the purpose of obtaining the oil, of which an acre of ground will yield between 200 and 300 pounds. Sunflower oil dries slowly. *Helianthic acid* ($C_7H_9O_4$), was obtained from the seeds by Ludwig and Kromayer (*Archiv der Pharm.*, 1859, p. 1). It dissolves in water and alcohol; the aqueous solution is colored intensely yellow by alkalies. With ferric salts it strikes a deep-green color, but is not precipitated by gelatin. Boiling with diluted acids liberates a sugar, reducing alkaline cupric tartrate solution. Its reactions show it to be a peculiar tannic acid, differing at least from caffeotannic acid. A sunflower of Algerian growth yielded, according to Chardon, a distinctive oleoresin (*Pharm. Jour. Trans.*, 1873, p. 322).

Action, Medical Uses, and Dosage.—Sunflower seeds and leaves are diuretic and expectorant, and have been used in *pulmonary affections* with considerable benefit. The following preparation has been of much efficacy in *bronchial* and *laryngeal affections*, and even in the *cough of phthisis;* it acts as a mild expectorant and diuretic: Take of sunflower seeds, bruised, 2 pounds; water, 5 gallons; boil the two together until but 3 gallons of liquid remain, then strain, add 12 pounds of sugar, and 1½ gallons of good Holland gin. The dose of this is from 2 fluid drachms to 2 fluid ounces, 3 or 4 times a day, or whenever tickling or irritation of the throat, or cough is excessive, or when expectoration is difficult. Various agents may be added to this preparation, according to indications, as tincture of stillingia, tincture of balsam of tolu, etc. An infusion of the pith of sunflower stem is diuretic, and may be used where this class of agents is indicated, also in many *febrile* and *inflammatory forms of disease;* it likewise makes a good local application in some forms of *acute ophthalmia*. The pith contains nitre, and has been recommended for the making of moxa; the quantity of nitre, however, varies, depending entirely upon the locality and character of soil in which the plant grows. The oil obtained from the seeds by expression, has been employed with benefit in *cough*, in *dysentery*, in *inflammation of the mucous coat of the bladder*, and in *disease of the kidneys*. To be given in doses of from 10 to 15 drops, 2 or 3 times a day. A teaspoonful of the oil taken at one dose, has produced active diuresis for four consecutive days, accompanied toward the termination with pain and debility in the lumbar region. The leaves are astringent.

Related Species.—*Actinomeris helianthoides*, Nuttall. *Gravel* or *Diabetes weed.*—This plant is diuretic and has been successfully employed in *chronic cystitis, dropsy*, and *gravel.*

Helianthus tuberosus, Linné. *Jerusalem artichoke.*—The tubers of this species resemble artichokes, and have been used as a substitute for potatoes. The carbohydrates of the tubers have been investigated repeatedly by O. Popp (1870 and 1878); Dieck and Tollens (*Jahresb. der Pharm.*, 1878, p. 81), and more recently by Ch. Tanret (*Jour. Pharm. Chim.*, 1893, p. 107). The latter author finds the juice of the tuber before its maturity to contain 16 per cent of the following carbohydrates: *Saccharose, inulin, pseudo-inulin, inulenin*, and two newly isolated substances, *helianthenin* and *synanthrin.* The formulæ of all these substances have the nucleus $C_{12}H_{10}O_{10}$ (also see *Amer. Jour. Pharm.*, 1893, p. 498). A small quantity of lævulose and dextrose is formed when the tuber ripens.

HELLEBORUS.—BLACK HELLEBORE.

The rhizome and rootlets of *Helleborus niger*, Linné.

Nat. Ord.—Ranunculaceæ.

COMMON NAMES: *Black hellebore, Christmas rose.*

ILLUSTRATIONS: Bentley and Trimen, *Med. Plants*, 2; Woodville, *Med. Bot.*, 169.

Fig. 130.

Helleborus niger.

Botanical Source.—Black hellebore has a black, perennial, tuberculated, horizontal, scaly root or rhizome, whitish internally, and sending off numerous, long, fleshy, brownish-yellow fibers, which become darker upon drying. Its leaves are large, radical, on cylindrical stalks from 4 to 8 inches long, pedate, of a deep-green color above, and paler and strongly reticulated beneath; leaflets 5 or more, 1 terminal, cuneate-obovate, entire and unequal at the base, and coarsely serrated near the point. The scape is shorter than the petiole, 1 or 2-flowered, with ovate lacerated bracts immediately beneath the calyx, and 5 or 10 inches high. The flowers are large and rose-like. The calyx consists of 5 large, ovate or roundish, spreading sepals, at first white, then rose-red, eventually becoming green. The petals are yellowish-green, tubular, shorter than the stamens, and narrowed to the base; stamens numerous; anthers yellow; capsules leathery; seeds many, arranged in 2 rows, elliptical, umbilicated, black, and glossy (L.).

History and Description.—Black hellebore inhabits the subalpine woodland regions in the middle and southern parts of Europe, flowering between December and February; it is also called *Christmas rose.* It is not the Melampodium of the ancients, so celebrated in mental diseases, which is now shown to be a distinct species, the *Helleborus orientalis*, and which probably possesses similar medicinal virtues, as well as do the roots of some other species of the same genus. Another species should be mentioned here on account of its rhizome having a commercial name liable to become confused with *Veratrum viride* (green hellebore). It is the *Helleborus viridis*, Linné. The commercial name of the drug (rhizome and rootlets), is *Radix hellebori viridis*, or *green hellebore root.* This species is regarded by some as more useful than the black hellebore, and has consequently obtained official recognition in Europe. The medicinal parts of hellebore are the radicles or root fibers, which are generally met with the rhizome attached. It is a many-headed root with a caudex or body seldom over ½ inch in thickness, and several inches long, horizontal, sometimes contorted, uneven, knotty, with transverse ridges, slightly striated longitudinally, its upper surface having the remains of the leaf and flower-stalks, and thickly beset upon the sides and under surface with fibers, which, when uninjured, are from 3 inches to a foot in length, 2 or 3 lines in diameter, dark brownish-black externally, whitish within, spongy, not woody, brittle, with a feeble odor, and a faint, bitter taste (C.). When fresh they are said to be very acrid and nauseous, occasioning, when chewed for a short time a pungent, numb sensation, resembling that which accompanies the eating or drinking of anything hot. Desiccation, as well as age, gradually lessens this acridity. Its properties are taken up by water or alcohol; long-continued heat diminishes its activity.

The rhizomes of *Adonis vernalis*, Linné, and *Actæa spicata*, Linné, of Europe, have been employed as adulterants of black hellebore.

Chemical Composition —The root and the root-leaves of the various species of Helleborus contain two glucosids, *helleborein*, which is a cardiac poison, also having drastic powers, and *helleborin*, a narcotic poison; also fatty oil, acrid resins, etc., but no tannin. *Helleborus viridis* is stated to yield a more active helleborein than *H niger;* the same plant yields the largest amount of helleborin (0.04 per cent). *Helleborein* was discovered in 1864 by Husemann and Marmé (*Ann. Chem. Pharm.*, Vol. CXXXV, p. 55). These authors also studied more closely the *helleborin* discovered in 1853 by Bastick (*Pharm. Jour. Trans.*). Both substances were carefully investigated quite recently by K. Thaeter (*Archiv der Pharm.*, 1898, pp. 414–424 . The isolation of the two substances from the root was effected by means of their opposite behavior toward water and ether, *helleborein* being freely soluble in water, but insoluble in ether, while *helleborin* is insoluble in water and soluble in ether.

HELLEBOREIN crystallizes from absolute alcohol in fine needles, which are not hygroscopic when pure; it is of a sweetish taste, and in powder form has sternutatory properties. Its aqueous solution is precipitated by mercurous nitrate, tannic acid, etc. On boiling with diluted acids, it is decomposed into sugar and dark blue flakes of *helleboretin*, which are insoluble in water and ether, but soluble in alcohol with violet color (Husemann and Marmé). K. Thaeter has quantitatively established the mechanism of this reaction, in which 2 molecules of dextrose and 3 molecules of acetic acid are formed, the equation being as follows: $C_{37}H_{56}O_{18}$ (*helleborein*) $+5H_2O = C_{19}H_{30}O_5$ (*helleboretin*) $+2C_6H_{12}O_6 + 3C_2H_4O_2$. *Helleboretin* is permanent toward hot diluted acids, and is a member of the fatty series of organic compounds. Concentrated nitric acid produces with helleboretin a characteristic deep-violet color which, on dilution with water, is permanent for some time. Thus the formation of blue flakes upon boiling with acids, and the subsequent color reaction with nitric acid may serve as a characteristic test for *helleborein*.

HELLEBORIN.—K. Thaeter confirmed all the properties found by Husemann and Marme for this substance, except its formula, for which he finds $(C_6H_{10}O)_n$, while his predecessors arrived at the formula $C_{36}H_{42}O_6$. This substance forms white, odorless, and tasteless needles, but in alcoholic solution they impart an acrid taste. It is insoluble in cold water, quite soluble in alcohol and chloroform. Prolonged boiling with diluted acids decomposes it into sugar and *helleboresin* $(C_{30}H_{38}O_4)$. *Helleborin* gives a characteristic violet-red color with concentrated sulphuric acid; when poured into water white flakes are precipitated.

Action, Medical Uses, and Dosage.—Black hellebore is a drastic cathartic, and is reputed to possess emmenagogue powers, but the latter is probably due to its purgative effects. In smaller doses it is a cardiac stimulant, and diuretic and anthelmintic properties are also ascribed to it. In large doses, it is a powerful poison, causing gastro-intestinal inflammation, dizziness, painful spasms, severe emesis, catharsis, heart failure, dilatation of the pupils, thirst with abdominal heat, cold sweats, convulsions, and even death. Death occurs from spasms and exhaustion. The recent root produces rubefaction, and sometimes blisters, when held in contact with the skin. Hellebore was formerly used in *palsy*, *insanity*, *apoplexy*, *dropsy*, *epilepsy*, etc., but is seldom used at present; occasionally it is found useful in *chlorosis*, *amenorrhœa*, etc. In nervous disorders it might still be used, if properly employed, in cases of *melancholia* and *mania* when due to gastro-hepatic disturbances, or in acute forms of *mental aberrations* due to menstrual wrongs. *Hysteria* and *hypochondria* may be benefited by it, especially when dependent upon abdominal wrongs. As an agent for *dropsy*, it is regarded as less useful than apocynum. It has been used to reduce dropsy through its purgative action, but since it has been found that small doses of the drug tend to stimulate the heart and increase diuresis, there is reason to believe that we have not yet fully appreciated the power of the drug. Dropsies due to atonic states of the bowels, serous effusion after inflammations, with deficient absorption, and *hydrothorax* and *anasarca* following the specific *eruptive diseases*, are specially mentioned as coming within its curative power. The dose for this purpose should be from a fraction of a drop to 5 drops of specific hellebore. Bryonia, apocynum, and digitalis act well with it.

The drug in small doses increases the force of the heart's contraction, slows the pulse, and increases arterial tension. Renal activity is increased under its action, and non-compensatory symptoms in *heart affections* have rapidly disappeared under the use of this drug. Prof. Scudder (*Spec. Med.*) suggests it as an emmenagogue when the patient is annoyed by heat flashes, burning of the surface of the thighs and nates, and sensitiveness of the pelvic and perineal tissues. It has been used in *bowel disorders* with jelly-like passages. The agent requires and deserves restudy. For the specific uses the minute dose is preferable. ℞ Specific helleborus niger gtt. v, aqua fl℥iv. Mix. Sig. Dose, a teaspoonful every 1, 2, or 3 hours. For its old uses as a drastic purgative, etc., the dose of the powder is from 5 to 10 grains; of the tincture, from 1 to 2 fluid drachms; of the extract, 2 to 5 grains.

Helleborein, besides possessing similar properties, has been found to be a depressant of the nervous functions, and to possess decided anæsthetic properties. From the fact that it has no apparent effect upon the pupil, nor affects the intraocular tension, it has been preferred by some over cocaine as a local anæsthetic in *eye diseases*, and is reputed more permanent in its effects than the latter. From 3 to 4 drops of a solution, representing in all from $\frac{1}{55}$ to $\frac{1}{40}$ grain, is thus employed. Owing to its powerful action upon the heart, it is not used subcutaneously to produce local anæsthesia.

Specific Indications and Uses.—(The minute doses only.) Dropsy; heavy feeling in head, with cold forehead and clammy sweat; amenorrhœa, with flashes of heat, burning of surface of thighs and buttocks, and pelvic and perineal sensitiveness; discharges of gelatinous mucus from the bowels.

Related Species.—*Helleborus fœtidus. Bear's foot.* This European perennial, of fetid odor, is the most active of the hellebores. The acrid, bitterish, and pungent leaves and stem-stalks, when chewed, excoriate the membranes of the mouth. It acts as a powerful emetic and purgative, and in large doses is a dangerous agent. It has been used in powder and decoction to expel *tapeworm*, and in *asthma*, *hypochondriasis*, and *hysteria*. Dose of the drug, from 5 to 20 grains; of the decoction (1 ʒ of drug to 8 fl℥ of water), a fluid ounce. It contains the same constituents as hellebore. Therapeutically, it is scarcely known in this country.

HEMIDESMUS.—INDIAN SARSAPARILLA.

The root of *Hemidesmus indicus*, Robert Brown (*Periploca emetica*, Retzius).

Nat. Ord.—Asclepiadaceæ.

COMMON NAMES: *Indian sarsaparilla*, *Kunnari.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 174.

Botanical Source.—This is a climbing plant with a long and slender root, with few ramifications, covered with rust-colored bark, and with twining, diffuse or climbing, woody, slender stems, from the thickness of a crow's quill to that of goose's, and nearly smooth. The leaves are opposite, on short petioles, entire, smooth, shining, and of firm texture; they vary much in shape and size, those of the young shoots that issue from old roots, being linear, acute, and striated down the middle with white; while the others are generally broad-lanceolate, sometimes ovate or oval. The stipules are 4-fold, small, on each side of each petiole, and caducous. The flowers are small, externally green, internally a deep-purple, in axillary, sessile racemes, which are imbricated with flowers, and then with scales like bracts. Calyx 5-cleft, with acute divisions; corolla flat, rotate, with oblong, pointed divisions, and rugose inside. Follicles long, slender, and spreading (L.—Ro.).

History, Description, and Chemical Composition.—This plant is the *Periploca indica* of Willdenow, and the *Asclepias pseudosarsa* of Roxburgh. It is common all over the peninsula of India. It has long been used as a medicine in

India, but was not known to the medical profession of this country and Europe, until its introduction by Dr. Ashburner, in 1831 (*Lond. and Edinb. Phys. Jour.*, Vol. LXV, p. 189). Its root is long, tortuous, cylindrical, rugose, furrowed longitudinally, and has its cortex divided by tranverse fissures into moniliform rings. It is brownish externally, has a feeble, bitter taste, and a peculiar aromatic odor, somewhat like that of sassafras, but which has been compared to that of new hay. The cortical portion has a corky consistence, and surrounds a ligneous meditullium. Mr. Garden (*Lond. Med. Gaz.*, 1837, p. 800) obtained from it a volatile, crystallizable acid, on which the taste, smell, and probably the medicinal properties depend. From an erroneous notion of the origin of the root, he called the acid the *smilasperic acid*, but it may with more propriety be termed *hemidesmic acid* or *hemidesmin* (P.) (also see *Amer. Jour. Pharm.*, Vol. XX, p. 289).

Action, Medical Uses, and Dosage.—Indian sarsaparilla has been successfully employed in *venereal diseases*, especially in cases where the South American sarsaparilla has proved inefficient. Dr. Ashburner says that it increases the appetite, acts as a diuretic, and improves the general health; "plumpness, clearness, and strength, succeeding to emaciation, muddiness, and debility." Likewise said to be useful in *affections of the kidneys*, *scrofula*, *cutaneous diseases*, and *thrush*. Notwithstanding these statements it is by no means so efficient and certain as many of our indigenous remedies. It is used in the form of infusion, as boiling dissipates its active volatile principle. Two ounces of the root may be infused in a pint of boiling water for an hour, the whole of which may be taken in the course of 24 hours. A syrup of hemidesmus is used for flavoring medicinal mixtures.

Related Species.—*Gymnema sylvestre*, Robert Brown (*Asclepias geminata*, Roxburgh). This asclepiadaceous climber is indigenous to India and Africa. The vine is woody and bears little yellow flowers. The root is nearly an inch, or about two-thirds of an inch, in thickness, and is covered with a red-brown, spongy bark. To the taste it is acrid and saline. The leaves of this plant are said to possess the peculiar property of temporarily obliterating the sense of taste for sweetness or bitterness, so that sugar does not taste sweet, and that quinine tastes like chalk (*Amer. Jour. Pharm.*, 1888, p. 339; also *ibid.*, 1848, p. 153). This property is thought to be due to an acid having some likeness to chrysophanic acid. It was isolated by D. Hooper, in 1887, and named by him *gymnemic acid*. The taste of sour, saline, and astringent substances is not altered by this principle. Dr. Hooper also found coloring matter, resins, albumen, various carbohydrates, tartaric acid, and a bitter neutral body. The powdered root is a remedy in India for *snake-bites*.

HEPATICA.—LIVERLEAF.

The leaves of *Anemone acutiloba*, Lawson, and *Anemone Hepatica*, Linné.

Nat. Ord.—Ranunculaceæ.

Common Names: *Liverleaf*, *Liverwort*, *Noble liverwort*, *American liverleaf*, *Kidney liverleaf* (*A. Hep.*), *Heart liverleaf* (*A. acut.*), *Hepatica*, etc.

Illustration: Lloyd's *Drugs and Med. of N. A.*, Plate V, Figs. 10 to 17.

Botanical Source.—I. Anemone Hepatica (*Hepatica americana* of De Candolle and *Hepatica triloba* of Willdenow). This is a perennial plant, the root of which consists of numerous strong fibers. The leaves are all radical, on long, hairy petioles, with 3 ovate, obtuse, or rounded, entire lobes, smooth, evergreen, coriaceous, cordate at base, the new ones appearing later than the flowers. The flowers appear almost as soon as the snow leaves the ground in the spring; are single, generally blue, sometimes white and flesh-colored, nodding at first, then erect, on hairy scapes, 3 or 4 inches long; by cultivation they become double. The involucre is simple and composed of 3 entire, ovate, obtuse bracts, resembling a calyx, and situated a little below the flower. The calyx consists of 2 or 3 rows of petaloid sepals; the stamens are awl-shaped; the anthers elliptic; and the achenia ovate, acute, and awnless (W.—G.).

Fig. 131.

Anemone Hepatica

II. Anemone acutiloba (*Hepatica acutiloba*) differs in having the leaves with 3 ovate and pointed lobes, or sometimes 5-lobed; leaves of the involucre acute or acutish (G.).

History and Description.—The *Anemone Hepatica* has been viewed as the only species of this genus, the differences observed as to color, form, etc., being looked upon as fortuitous. De Candolle, however, divided it into two species. These plants are common to the United States, growing in woods and upon elevated situations; the *A. Hepatica* (*H. americana*), which is the least common, being found, as Eaton states, on the side of hills exposed to the north, and the other on that facing the south. They both bear white, blue, or purplish flowers, which appear late in March or early in April, and are among the most beautiful and most sought-for of our vernal flowers. The entire plant is employed. It occurs in market in broken masses of leaves, sometimes intermixed with broken roots, and of a green color. It is odorless, and has a subastringent and viscid taste, and yields its virtues to water. The name *liverwort* sometimes erroneously applied to it, belongs to the cryptogam *Marchantia polymorpha*, and others of the same family. Undoubtedly it was the demand for the latter plant that led to the wonderful "hepatica boom" about the year 1880. In 1883, the consumption of liverleaf in this country alone was about 450,000 pounds. (For an exhaustive article on hepatica, the reader is referred to *Drugs and Medicines of North America*, by J. U. and C. G. Lloyd, Vol. I, pp. 37–54.) According to Prof. J. U. Lloyd, the blunt-lobed variety is seldom found in commerce, and does not form one-fiftieth part of that collected in America, the supply being almost wholly from the acute-lobed hepatica.

Fig. 132.

Anemone acutiloba.

Chemical Composition.—Rafinesque (1828) stated that the plant contained "tannin, mucilage, extractive," etc. C. B. Smith (1863) demonstrated the existence of tannin in the plant. Prof. J. U. Lloyd and Mr. Harter analyzed it, summing up the result as follows: "It contains none of the classes of active constituents found in medicinal plants, but consists of the usual constituents of plants, such as a tannin, gum, sugar, chlorophyll, and small amounts of a bland oleoresin (Harter, *Pharm. Record*, 1884). Of the substances named, none were in amount sufficient to render them conspicuous. It may be accepted that hepatica does not contain a single prominently marked constituent, and that few herbs present less decided peculiarities" (J. U. Lloyd, in *Drugs and Med. of N. A.*).

Action, Medical Uses, and Dosage.—A mild mucilaginous astringent. It has been used in infusion, taken freely in *fevers, hepatic complaints, bleeding from the lungs, coughs*, etc., but in severe cases it is unavailable. The infusion may be taken *ad libitum.*

HERACLEUM.—MASTERWORT.

The root of *Heracleum lanatum*, Linné.

Nat. Ord.—Umbelliferæ.

COMMON NAMES: *Masterwort, Cow-parsnip.*

Botanical Source.—This plant, sometimes called *Cow-parsnip*, has a large, spindle-shaped, perennial root, of a strong, disagreeable smell, from which arises a hollow, thick, furrowed, branching and pubescent stem, from 3 to 5 feet high, and often an inch or more in width at the base. The leaves are very large, on downy, channeled petioles, and ternately compound; the leaflets roundish-cordate, and unequally lobed; the lobes acuminate, almost glabrous above, and woolly underneath. The flowers are white, in huge umbels, often a foot broad, with deciduous involucres. Involucels long-pointed, lanceolate, and many-leaved. The calyx limb is composed of 5 small, acute teeth. The petals are obcordate, with the point inflexed, the outer larger and radiant, appearing deeply 2-cleft.

The fruit is compressed, oval, with a broad, flat margin, and 3 obtuse dorsal ribs to each carpel; intervals with single vittæ, and seeds flat (G.—W.—R.).

History, Description, and Chemical Composition.—Found growing in moist meadows and cultivated grounds from Labrador to Pennsylvania, and west to Oregon, flowering in June. The root is the part used; is somewhat analogous to parsley in appearance, has a strong, peculiar, unpleasant odor, and an ill-flavored acrimonious taste. The recent root and leaves, when placed in contact with the skin, irritate and inflame it; and that which inhabits very damp localities is considered poisonous (B.). The leaves and seeds have also been used medicinally. The root probably contains acrid principles, volatile oil, and resin. The plant is stated by Nuttall (*Amer. Jour. Pharm.*, 1836, Vol. VII, p. 281) to be hardly distinct from *Heracleum sphondylium*, Linné, of Europe and Asia. This plant is also known as *Cow-parsnip*, and has similar medicinal properties. The fruits of all species of Heracleum thus far analyzed, abound in volatile oil, free ethyl and methyl alcohol and solid hydrocarbons of the paraffine series. From *Heracleum giganteum*, Gutzeit obtained 2 per cent of volatile oil, which was differentiated into 10 per cent of a mixture of *ethyl-butyrate* and *acetate*, and 55 per cent of *hexyl-butyrate* and *octyl-acetate*. Besides, a crystallizable substance, *heraclin* ($C_{32}H_{22}O_{10}$), was obtained from the immature fruits. It is a colorless, odorless substance, melting at 185° C. (365° F.), insoluble in water, not easily soluble in ether, soluble in chloroform, boiling carbon disulphide (1:400) and in cold (1:700) and boiling (1:60) absolute alcohol (*Amer. Jour. Pharm.*, 1880, p. 136). The fruits of *Heracleum sphondylium* yielded to Zincke (*Diss.*, 1869), 0.3 per cent and to Möslinger (*Jahresb. der Pharm.*, 1876, p. 165), 0.8 to 0.9 per cent of a volatile oil. (For a review of its constituents, which are similar to those of *H. giganteum*, see Husemann and Hilger, *Pflanzenstoffe*.)

Action, Medical Uses, and Dosage.—Stimulant, antispasmodic, and carminative. Used in decoction in *flatulency* and *dyspepsia*, and 2 or 3 drachms of the powdered root, taken daily in *epilepsy*, and continued some time, with a strong infusion of the leaves and tops at night, has been found successful. Recent trials with a saturated tincture of the root seem to indicate that it has some power over epilepsy though the conditions in which it is specifically applicable have not yet been determined. Recommended also in *asthma*, *colic*, *amenorrhœa*, *dysmenorrhœa*, *palsy*, *apoplexy*, *intermittents*, etc., in doses of 1 drachm. The dose of a strong tincture (℥viii of root to Oj of alcohol), ranges from 5 to 60 minims.

Related Species.—*Imperatoria Ostruthium*. The rootstock of *Peucedanum Ostruthium*, Koch *Imperatoria Ostruthium*, Linné), *Nat. Ord.*—Umbelliferæ. *Masterwort*. This drug consists of a somewhat flattened, subconical rootstock, of about a finger's thickness, and ranging from 2 to 4 inches in length. Its surface is wrinkled, scarred, and warty; its upper portion has a finely annulated appearance. Its color externally is a deep brown-gray; internally dirty white. It has a large central pith, while its bark is thin, and all parts abound in resin cells of a brownish-yellow hue. Its taste is pungent, aromatic, and bitter, giving a prolonged sense of warmth to the mouth. Its odor is markedly balsamic, somewhat resembling angelica. Masterwort is scarcely at all used in America, and is noticed here chiefly on account of its having been used as an adulterant of aconite (Holmes). In former years it was much esteemed as a medicine, being known, on account of its extensive uses, as *divinum remedium*. It grows in the mountains of central and south Europe. It contains from 0.2 to 0.7 per cent of volatile oil. Osann and Wackenroder, in 1831, obtained from it *imperatorin*, a principle believed by R. Wagner 854) to be identical with *peucedanin*, obtained from *Peucedanum officinale*, Linné, an allied species, by Schlatter, in 1833. However, more recent authors (A. Jassoy, 1890) believe it to be identical with *ostruthin* (see below). *Peucedanin* forms colorless, rhombic prisms, or plates, or fine needles, which are odorless and tasteless when pure; they are insoluble in water, but soluble in ether, chloroform, and alcohol, the latter solution having a faintly bitter taste. The pure substance melts at 108° C. (226.4° F.) (P. Haensel, 1891). When concentrated hydrochloric acid solution is added to an alcoholic solution of *peucedanin*, the latter loses a methyl group and is quantitatively converted into *oreoselon* (Hlasiwetz and Weidel). The formulæ of the two compounds have been differently stated, but the researches of A. Jassoy (1890) and P. Haensel (1891), in Prof. Schmidt's laboratory, and those of M. Popper (1898), have demonstrated the formula of *peucedanin* to be $C_{14}H_{11}(OCH_3).O_3$, or $C_{15}H_{14}O_4$, while *oreoselon* was found by Hlasiwetz and Weidel (*Ann. Chem. Pharm.*, 1822, Vol. 174, p. 67) to have the (analogous) composition $C_{14}H_{11}(OH).O_3$, or $C_{14}H_{12}O_4$ (see *Archiv der Pharm.*, 1898, pp. 662–692). The latter substance is a crystallizable, tasteless body, hardly soluble in cold alcohol or ether, almost insoluble in cold water, better soluble in boiling water, soluble in chloroform, alkalies, and even concentrated mineral acids without undergoing chemical alteration. The melting point of the pure substance is stated to be 175° C. (347° F.) or 177° C. (351.5° F.). Another constituent of imperatoria is a colorless, odorless tasteless body, *ostruthin* ($C_{16}H_{20}O_3$, A. Jassoy, in *Archiv der Pharm.*, 1890, p. 544), which forms characteristic, rhombic crystals, insoluble in water, but soluble in alcohol and ether. It was obtained from the root, in 1874, by Gorup-Besanez (0.6 per cent). Alkalies dissolve it with beautiful blue fluorescence; weak acids precipitate from this solution *ostruthin* unchanged. Upon fusing it with caustic alkalies, Gorup-Besanez obtained a small yield of *resorcin*, and butyric and acetic acids. The same author found in this root *oxypeucedanin*, a bitter, crystallizable principle, insoluble in ether, soluble in chloroform, and previously observed by Erdmann in older roots of *Peucedanum officinale*. Heut (1874) found its melting point to be 140° C. (284° F.), a result confirmed by Jassoy and Haensel (1898). The root here considered is stimulant, and was formerly used locally in *indolent ulcers, buccal paralysis*, and *toothache*, the root being chewed in the latter instances; internally in *low fevers* and *inflammation, flatulence, colic, dyspepsia, delirium tremens, hysteria*, etc., and in other debilities, both general or local. It has not been used in Eclectic medicine.

HEUCHERA.—ALUM-ROOT.

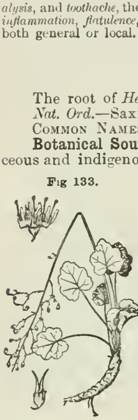
The root of *Heuchera americana*, Linné.

Nat. Ord.—Saxifrageæ.

COMMON NAMES: *Alum-root, American sanicle.*

Botanical Source.—This plant, sometimes called American sanicle, is herbaceous and indigenous, with a perennial, knotty, yellowish root. The leaves are all radical, on very long, downy petioles from 2 to 8 inches in length, roundish-cordate, hispidly pilose, about 7-lobed, and from 2 to 3½ inches in diameter; the lobes are short, roundish, and crenate-dentate, with dilated mucronate teeth. Many scapes or flower stems arise from the same root, from 2 to 4 feet high, erect, naked, viscid-pubescent in their upper part, terminating in loose, pyramidal, forked panicles, which are nearly one-third the length of the scape. The calyx is permanent, 5-cleft, campanulate, small, obovate, striated with very obtuse segments, and more conspicuous than the petals. The petals are purplish-white, or rose-colored, minute, spatulate, and inserted into the margin of the calyx, between its segments. The filaments are twice as long as the petals, yellowish, inserted opposite the segments of the calyx, persistent, and surmounted by small, red, globose anthers. Capsule ovate. Seeds minute, oblong, black, and very hispid (L.—W.—R.).

Fig 133.



Heuchera americana.

History, Description, and Chemical Composition.—This plant is a native of North America, and is found in shady, rocky woodlands from Connecticut to Illinois and southward, flowering from May to August. The root is the part used; it is perennial, yellowish, horizontal, somewhat flattened, rough and unequal, with an intensely astringent taste. It yields its medicinal virtues to water. It should be collected in September. Bowman (1869) found tannin present to the extent of 20 per cent, but Jos. C. Peacock (*Amer. Jour. Pharm.*, 1891, p. 172) found only 5.55 per cent tannin and 12.2 per cent phlobaphene. Roots collected in October were richest in tannin (19.66 per cent, calculated upon dry substance), and richest in starch granules (13.62 per cent) in March. Compare also Prof. E. S. Bastin, on the structure of *Heuchera americana* (*Amer. Jour. Pharm.*, 1894, p. 467). There are several species of Heuchera, the *Heuchera caulescens, H. pubescens*, and others which possess similar properties, and are often collected and sold with the roots of *H. americana*. *H. hispida*, Pursh; *H. parviflora*, Nuttall; and *H. cylindrica*, Douglas, are said by F. W. Anderson to be much employed by the hunters of the northwest as astringents to check the diarrhœa produced by the alkali-water of the plains. The root of *Mitella pentandra*, Hooker, belonging to the same natural order, is recommended by F. W. Anderson as being far superior to alum-root for this purpose (*Bot. Gaz.*, 1887, p. 65).

Action, Medical Uses, and Dosage.—Alum-root, as its name would indicate, is a powerful astringent of such intensity as seldom to be administered internally, yet it would undoubtedly prove useful in small doses, in all cases where astringents are indicated. An aqueous extract will be found very beneficial in *diarrhœa* and *dysentery* in the second stages, in *hemorrhages*, and other similar diseases. Externally the powdered root may be applied to *hemorrhages, epistaxis*, *wounds, foul and indolent ulcers*, etc. The decoction is useful in *aphthous sore mouth* and *soreness of the throat and fauces;* it may be used as a wash or gargle. Taken internally, in doses of a wineglass half full 3 or 4 times a day, it has been efficient in *diabetes*, and in *bleeding piles*, employing it, in this last complaint, by injection also. Equal parts of alum-root and black cohosh-root in decoction, form an excellent local application in *leucorrhœa* and *excoriation of the cervix uteri*. Some practitioners employ this root indiscriminately with that of the *Geranium maculatum;* it is, however, more powerfully astringent.

HIBISCUS ESCULENTUS.—OKRA.

The unripe fruit of the *Hibiscus esculentus*, Linné (*Abelmoschus esculentus* of Wight and Arnott).

Nat. Ord.—Malvaceæ.

COMMON NAMES: *Okra, Gombo, Bendee.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 36.

Botanical Source.—This plant is an herbaceous annual, with a stem somewhat woody at the base, attaining a height of from 3 to 6 feet, and being 3 or 4 inches thick, bearing alternate, serrate leaves of 3 varieties, angular, palmate, and subdigitate. The flowers are solitary, large, and showy; of a pale yellow, tinged at the base a dark crimson. The herbaceous portions of the plant are clothed with sharp bristles, and often bear purplish spots.

Description.—The gombo fruit is a pentagonal, narrow, cylindrical capsule, from 2 to 12 inches long, tapering at the base, and about 1 inch in diameter. It is often curved, and is covered with hairs, especially along the ridges. The pods contain several roundish or kidney-shaped smooth seeds in each of the several cells.

History.—Okra was well-known to the Spanish Moors and Persians, and as early as 1216 was described by a native Sevillian botanist, Abul-Abbas-el-Nebate, who states that the young and tender fruit was eaten with meat by the people of Egypt, who also employed it medicinally for its emollient properties (*Pharmacographia*). The Indian Pharmacopœia has an official decoction of the immature capsules to be employed as a demulcent diuretic in catarrhal affections of the urinary tract, as gonorrhœa, and in dysuria, and ardor urinæ. Okra is indigenous to tropical Africa, where the natives call it *bameea*, and to the West Indies, and is cultivated throughout the tropical and subtropical regions. It is raised on a large scale near Constantinople, where the fruit is employed on account of its demulcent properties. The fiber of the bark is used in the arts to make paper and ropes. Its fruit is valued chiefly, and especially in the southern states, for a mucilaginous substance, *gombine* (Landrin, *Jahresb. der Pharm.*, 1874, p. 172), which it imparts to soups, being often used in combination with tomatoes. It is also used for pickles. According to Porcher, the parched seeds are used by the negroes of South Carolina as a substitute for coffee.

Action and Medical Uses.—Okra is demulcent, mucilaginous, and the leaves are said to make an excellent emollient cataplasm. The seeds of the *H. Abelmoschus* (see below) were formerly considered a stomachic stimulant, antispasmodic, and nervine, but are now employed chiefly by the perfumer.

Related Species.—*Hibiscus Abelmoschus*, Linné. (*Abelmoschus moschatus*, Mœnch). An evergreen tree, introduced into tropical America, but indigenous to Egypt and southern Asia. The seeds, known as *grana moschata*, have a musk-like odor, and are warm and spicy to the taste. The odor resides in the testa of the seeds, and is more noticeable if the seeds be heated or rubbed. According to Ainslie, the seeds are used by the Arabs to impart a pleasant flavor to their coffee. They are also used to adulterate musk and employed in the making of perfumes. In Bombay they are used to protect woolens from the ravages of the moth, and rubbed to a paste with milk, employed to cure the *itch* (Dymock, *Mat. Med. of Western India*).

HIERACIUM.—HAWKWEED.

The root and leaves of *Hieracium venosum*, Linné.

Nat. Ord.—Compositæ.

COMMON NAMES: *Hawkweed, Veiny-leaved hawkweed, Rattlesnake weed, Striped bloodwort.*

Botanical Source.—This plant has a perennial root, with a stem or scape from 1 to 2 feet in height, dark-brown, slender, sometimes naked, sometimes with 1 or more glabrous, cauline leaves, forking above several times into a spreading, loose corymb, with an awl-shaped bract at each division. The radical leaves are obovate or oblong, somewhat acute, nearly entire, subsessile, thin and pale, purplish, and glaucous underneath, a little hairy above, often hairy along the midrib, marked with purple veins, and the first that unfold are close to the ground. The heads are very small, in a loose panicle on slender diverging peduncles, 12 to 20-flowered; the involucre glabrous, hispid at the base; the flowers bright-yellow; the achenia short, linear, and not tapering at the summit (G.—W.).

History and Description.—Hawkweed grows in many parts of the United States, but more commonly in the East and North, upon dry hills and in pine woods. It bears yellow flowers from May to July. The leaves and roots are employed; they are inodorous, with a bitter and astringent taste; they seem not to have been analyzed. Water extracts their virtues.

Action, Medical Uses, and Dosage.—This plant is tonic, astringent, and expectorant; it has been used in decoction in *scrofula*, *menorrhagia*, *hemoptysis*, and other *hemorrhages*. The powdered leaves and root, combined with bloodroot, have been used as a snuff in *polypus of the nose*. Said to be efficient against the *bites of poisonous snakes*, over which it undoubtedly has some power. The juice of the fresh leaves is recommended as a cure for *warts*. Dose, of the infusion or syrup, from 2 to 4 fluid ounces.

Related Species.—The following species of Hieracium have also been used to some extent in medicine, and, unless otherwise stated, have the same uses as the preceding plant.

Hieracium scabrum, Linné. *Rough hawkweed.*—Has been employed for the relief of *toothache*

Hieracium Gronovii, Linné. *Hairy hawkweed.*—Used like the preceding. Said to be fully as useful in *snake-bites* as *H. venosum*.

Hieracium murorum, Linné.—Astringent and faintly bitter. Vulnerary.

Hieracium pilosella, Linné.—Astringent and bitter.

HIPPOCASTANUM.—HORSE-CHESTNUT.

The bark and fruit of *Æsculus Hippocastanum*, Linné.

Nat. Ord.—Sapindaceæ.

COMMON NAME: *Horse-chestnut.*

Botanical Source.—The Æsculus Hippocastanum is a beautiful middle-sized, round-headed tree, 50 or 60 feet in height, with many branches, a rugose, tawny bark, and a white, not very firm wood. The leaves are opposite, digitate, long-stalked, and consist of 7 obovate-lanceolate, acuminate, bright-green, coarsely and irregularly serrated leaflets which diminish in size from the center. The flowers, which are pink-colored and white, are borne in terminal thyrses, or pyramidal racemes. The corolla is spreading and composed of 5 oblong, unguiculate, fringed, wavy petals, with a small reddish spot above each claw. The calyx is 5-toothed, bright-green, and campanulate. The stamens are 7 in number, and support reddish-brown, oblong anthers. The fruit is a prickly, thick, and tough capsule, 3-valved, 1 to 3-celled, with usually 2 large, deep chestnut-brown seeds, and a large broad space forming a hilum.

Fig. 134.

Æsculus Hippocastanum.

Description.—THE BARK. Horse-chestnut bark is of a gray color externally, showing leaf scars and wart-like excrescences sparingly distributed. The internal surface is whitish and smooth. The bark is thin, and throughout its internal structure presents a brown or brownish color. The inner bark has a rough, bitter taste, and is nearly odorless; and is tough and fibrous on fracture. It yields its properties to water and diluted alcohol. The aqueous infusion is bitter, fawn-colored, and non-astringent. Gelatin separates its tannic acid; iron gives a green precipitate; infusion of galls and tartar-emetic produce no effect upon it.

THE NUT, when dry, is subglobular, compressed, from 1 to 1½ inches in diameter, with a shining, chestnut-brown testa, marked by a reddish or yellowish-gray hilum, nearly an inch in diameter. In the middle of the hilum is a smaller spot, in the center of which is a slightly roughened elevation. Passing from the hilum around to the opposite surface may be observed an elevated ridge terminating in a bulbous extremity, and resting in a horseshoe-shaped depression. The surface of the nut is slightly corrugated. The internal portion is starchy, yellowish-white in color, and has an unpleasant, bitter taste. The nut has a slight, peculiar odor.

History.—Horse-chestnut is indigenous to certain parts of southern Asia (Persia, northern India), from whence it was conveyed into Europe. It is now common to many parts of the United States, where it grows rapidly, blossoming from April to July, and maturing its fruits in the autumnal months. It is extensively cultivated for shade and ornamentation in gardens and along sidewalks.

Chemical Composition.—All parts of the plant, especially the bark of the root, trunk, and branches, and the testa of the seeds, contain a peculiar *tannic acid*, which forms an uncrystallizable, nearly colorless mass, whose solutions turn red-brown when exposed to the air. Heating with diluted mineral acids to the temperature of boiling water produces a red *phlobaphene*, a substance which also occurs ready-formed in the bark and the leaves of the tree (Rochleder). *Æsculin* ($C_{15}H_{16}O_9$), discovered by Canzoneri and first obtained pure by Minor (1831), is a faintly bitter glucosid occurring principally in the bark, also in the testa of the seeds, but not in the leaves (F. O. Ray, *Amer. Jour. Pharm.*, 1886, p. 409). From 2 to 3 per cent have been obtained from the bark. It is a white, microcrystalline powder, soluble in 672 parts of cold and 12.5 parts of boiling water, and in 24 parts of boiling alcohol, but insoluble in absolute ether. *Æsculin* is distinguished by the blue fluorescence it displays in aqueous, but more markedly in alkaline solution. This glucosid is easily decomposed into its constituents, if it be heated above its melting point, 160° C. (320° F.), and also by the action of the ferment *emulsin* (see *Amygdalus*), or when boiling it with diluted acids, when it is decomposed into dextrose and *æsculetin* ($C_9H_6O_4$). The latter substance, which is also to be found in the bark, is a *dioxy-coumarin* ($C_6H_2[OH]_2CH:CH.CO.O$), and an isomer to *daphnetin*, a derivative of certain species of *Daphne*. *Æsculin* has been repeatedly demonstrated to be different from *gelsemic acid*, with which it was at one time supposed to be identical (see *Gelsemium*).

A crystallizable, bitter glucosid, *argyræscin* ($C_{27}H_{42}O_{12}$), found by Rochleder in the cotyledons of the seeds, occurs most largely shortly before maturity. A yellow coloring matter (*quercæscitrin* of Rochleder), occurs in the leaves of horse-chestnut, as well as in the cotyledons of the seeds, and especially in the flowers. More recently N. Rudolph (see *Amer. Jour. Pharm.*, 1894, p. 35), established its chemical relationship to other quercitrin-like bodies, and gave it the formula $C_{21}H_{22}O_{12}$, while *quercitrin* (of quercitrin bark), was found to contain 1 molecule less of water. Boiling with diluted acids decomposes the horse-chestnut quercitrin into *isodulcite* ($C_6H_{14}O_6$), and *quercetin* ($C_{15}H_{10}O_7$).

A variety of other substances, such as *æscic* and *capsulæscic acids*, *telæscin*, *fraxin*, etc., mostly intermediary products in the development of the different parts of the plant, have been isolated by Rochleder, for which see details in Husemann and Hilger, *Pflanzenstoffe*, p. 870. *Saponin* (*aphrodæscin* of Rochleder, 1858), is also a constituent of the seeds, and the latter have long been known to be useful in powder form for washing purposes and as a sternutatory (see *Pharm. Centralh.*, 1892, p. 687, and 1896, p. 163). A fatty oil (*Oleum Hippocastani*), has been obtained from the seeds in the amount of 0.1 per cent. It is of a rich yellow color, has a specific gravity of 0.927, and solidifies at a temperature of +1.25° C. (34.3° F.). The seeds also contain starch, and on this account attempts have been made to utilize horse-chestnut seeds as a food material, but these efforts have not met with success, owing to the difficulty of economically removing saponin from the seeds (see P. Soltsien, *Chem. Zeitung*, 1891, p. 1374).

In the seeds of *Æsculus Pavia*, Linné, the Red buckeye of the southern states, E. C. Batchelor (*Amer. Jour. Pharm.*, 1873, p. 145), found a poisonous glucosid, insoluble in ether and chloroform, soluble in hot alcohol, and freely soluble in cold water; this solution froths upon being shaken. The principle is not identical with the *argyræscin* and the *aphrodæscin* of Rochleder.

Action, Medical Uses, and Dosage.—Undoubtedly horse-chestnut acts upon the human system very much after the manner of buckeye (*Æsculus glabra*). By some, however, its power over the circulation is thought to be more pronounced, particularly its control over the portal vessels. The virtues formerly ascribed to the bark and nut are as follows: Horse-chestnut bark is tonic, astringent, febrifuge, narcotic, and antiseptic. In *intermittent fever* the bark has effected cures when given in doses of a teaspoonful 4 or 6 times a day. Ten grains of the powder of the rinds of the nuts have been asserted to be equivalent in narcotic power to three grains of opium. This claim, however, requires substantiation. *Gangrenous and ill-conditioned ulcers* have been benefited by a strong infusion of the bark. The whitish, central part of the nuts, when in powder, has been recommended as a sternutatory in some cases of *ophthalmia* and *headache*. The oil of horse-chestnuts is considered in Europe a valuable local application in *neuralgic* and *rheumatic affections;* it is made by exhausting the powdered horse-chestnut in ether, filtering and evaporating. Æsculin, in doses of from 5 to 30 grains, repeated 2 or 3 times a day, has proved beneficial in *periodical febrile affections*, and in *neuralgia of the internal viscera*. Of all the uses formerly made of hippocastanum, only the latter is recognized to-day, its power of controlling *neuralgia of the viscera*, and then only in cases of *abdominal plethora*. Specific medication has taught us that it is a remedy, not for active conditions, but for congestion and engorgement. It is indicated in general by capillary engorgement—a condition of stasis—with vascular fullness and sense of soreness, throbbing, and malaise all over the body. An uneasy, full, aching pain in the hepatic region is also an indication. Rectal disorders, such as *rectal irritation* and *hemorrhoids*, with marked congestion and a sense of constriction, as if closing spasmodically upon some foreign body, with itching, heat, pain, aching, or simple uneasiness, are fields in which hippocastanum exerts a specific influence. The pile-tumors are purple, large, do not bleed as a rule, but there is a sense of fullness, or spasm of the parts, and a free diarrhœa may be present. Not only does it relieve such rectal complaints, but cures disorders hinging upon them, such as *rectal neuralgia*, *proctitis*, etc., and the reflexes induced by them, proceeding from the rectal involvement. Among these reflex manifestations may be mentioned *dyspnœa*, *asthmatic seizures*, *dizziness*, *headache*, *backache*, and disturbed gastric functions amounting to veritable forms of *dyspepsia*. These conditions pass away when hippocastanum overcomes the rectal difficulties. Dose of specific horse-chestnut (prepared from the nut only), from ½ to 5 minims in water every 1 to 3 hours.

Specific Indications and Uses.—Visceral neuralgia, due to congestion; soreness of the whole body, with vascular fullness, throbbing, and general malaise; throbbing, fullness, and aching in the hepatic region; rectal uneasiness with burning or aching pain; sense of constriction, with itching; large, purple pile-tumors; uneasy sensations and reflex disturbances depending upon hemorrhoids or rectal vascular engorgement.

HIRUDO.—LEECH.

The *Sanguisuga medicinalis*, Savigny, and *Sanguisuga officinalis*, Savigny.

Class: Vermes. *Order:* Annulata. *Sub-order:* Apoda. *Family:* Hirudineæ.

Description.—The leech belongs to the class of *Vermes* in the Zoological arrangement, and order *Annulata*. This class is characterized by a more or less elongated body; soft skin, segmented and annulated; articulated members and wings absent, and blood red. The general zoological characters of the order are: "Jaws with 2 rows of pointed, numerous teeth, which are mutually inclined at an acute angle" (Brandt).

"Body elongated. Back convex. Belly flat. Extremities somewhat narrowed, furnished with disks or suckers; anterior extremity somewhat narrower than the posterior one. Rings from 90 to 100. Eyes represented by 10 blackish points.

Mouth triradiate. Jaws cartilaginous, armed with numerous cutting teeth. Anus small, placed on the dorsum of the last ring" (P.).

Two species of leeches are recognized in commerce, the *Sanguisuga officinalis* (*Hirudo officinalis*) and the *Sanguisuga medicinalis* (*Hirudo medicinalis*, Linne; *Hirudo provincialis*, Carena), though some excellent zoologists consider them to be only varieties of the same species. "Both have a soft extensile body composed of about 98 rings. They vary in length from 1½ to 6 inches when in repose, but can contract themselves to a third of their length, and stretch themselves out to nearly the double of it. They present along the back and flanks 6 continuous or interrupted stripes of a rusty or greenish-yellow color, by which they are easily distinguished from all other species that resemble them. They can attach themselves by both ends to adjacent objects by means of a particular apparatus. The *S. medicinalis* is distinguished by a dark-brown or greenish-brown back, with rusty stripes generally spotted with black, and a grayish or yellowish belly, also more or less speckled with black spots. The *S. officinalis* has a paler greenish-black back, less bright and unspotted stripes, often interrupted and intercommunicating, and a paler, more yellowish, or greenish unspotted belly. The former, commonly called the *English*, *German*, *Swedish*, or *Speckled leech*, is a native of Britain, Germany, Poland, Sweden, northern France, and European Russia. The latter, usually known as the *Hungary*, or *Green leech*, is a native of that country, and likewise of the south of France. Both species have 3 converging mandibles, furnished at their edge with minute sharp teeth, from 69 to 71 in number in each jaw in the Hungary leech, and from 79 to 90 in the other. By means of these teeth, when the skin is sucked in the mouth, it is pierced with a sawing motion, so as to present 3 incisions meeting in a common center. These incisions often penetrate through the whole thickness of the integuments into the cellular tissue. The animal becomes filled with blood in the course of 15 minutes, if it be vigorous, and draws about a drachm and a half" (Christison). The *American leech* (*Hirudo decora*, Say), is frequently used in this country, though it does not draw as much blood, by one-third, as the foreign leech. It has a back of a dark-green color, and having 3 rows of quadrangular dots running lengthwise, the central row being pale brownish-yellow, and the others quite black. The abdomen is also pale brownish-yellow, and interspersed with dark spots. It is ordinarily about 3 inches long, and occasionally longer. (For an account of the repulsive mode of collecting leeches in Greece, see *Amer. Druggist*, 1891, p. 81.)

Preservation.—There is considerable difficulty in preserving leeches, especially on a large scale, as they often die suddenly and in great numbers. Various means have been adopted to keep them healthy. The most common cause of their sickness and death is the formation of a slimy matter on their skin, and which they are in the habit of removing by drawing themselves through moss and small stones. Dr. Johnson names certain diseases as a cause of their death, and Brostat describes three epidemic disorders. Leeches are more liable to disease and mortality, when kept together in large quantities, than when preserved in small numbers. They should be kept in glass or earthenware jars, in clean rain or soft water, which should be changed every day or two, and at the bottom of which is placed some loose moss, pebbles, etc., for them to move among. "It is stated that the presence of metallic iron in water prevents it from becoming putrid. This influence is said to be very marked in water in which leeches are preserved, and renders the changing of the water unnecessary for very long periods. The slimy excretions of the animal appears to combine with the oxide of iron, which is constantly being formed." The jar in which the animals are kept should be covered with a thin cloth, and placed in a locality where the temperature is equable. A dead leech should be at once removed, and fresh water be immediately supplied to the remaining ones. M. Allchin has prepared a leech conservatory, in which the leeches were kept in a healthy state, and the water clear and sweet, without changing the water for 10 or 12 months. It consists of a glass tank with a movable glass cover, and arrangement for admitting air through a perforated metallic plate. Some coarse gravel is placed at the bottom of the tank, which is about half filled with water, and into it are put 1 plant of Valisneria, 10 water snails (*Planorbis corneus*), and about 100 leeches. A permanent balance of animal and vegetable life is thus obtained, and no necessity occurs for changing the water. It has been tried to propagate leeches in confinement, but in all these cases, after a few years, there remained only those which were placed in the water, and those just hatched. This depopulation of the artificial ponds in which they were kept has been attributed, by Dr. Berard, to the "enemies of the leech," or those animals which devour them, among which he names the pig, the otter, the mole, the hedgehog, the rat, water-shrew mice, teal, ducks, heron, fowls, serpents, toads, fresh-water shrimp, and other crustaceæ. The goose, aquatic toad, water-lizard, and frog he does not consider enemies of the leech. If these statements are found to be correct, they will aid materially in determining the best plan by which to preserve and propagate leeches artificially.

Artificial or *mechanical leeches* are now to be had. They are in reality small cupping instruments.

Action, Medical and Surgical Uses.—Leeches are occasionally used as a substitute for general blood-letting (which is scarcely ever now practiced) among children and delicate adults, or when it is required to abstract blood from some part whose locality or sensitiveness contraindicates the lancet or cupping. The abstraction of blood by means of leeching has, however, a decidedly different effect from that obtained by bleeding. A local impression may be made without seriously disturbing the whole system, as is the case in venesection. They are also very beneficial when applied with care to *hemorrhoidal tumors*, *prolapsed rectum*, *inflamed vulva*, etc., watching that they do not creep out of reach within any of the internal cavities of the body, as serious results might ensue. Salt is a speedy poison to the leech, and whenever one gets within the stomach, or other cavity beyond reach, the introduction of a strong solution of salt will destroy it. They are more commonly used in *local inflammations*, *bruises*, etc., in which they often render excellent service. In applying them, any hair growing on the part must be removed by shaving, and the part must be thoroughly cleansed by soap and water, followed by clear water. Should the leech not fasten quickly, various means have been advised to overcome this difficulty, as moistening the part with warm milk and water, sugar and water, or with a drop of blood, or by immersing the leech for a moment in porter. It has also been recommended to hold the leech in a dry cloth, direct its head to the selected part, and slowly withdraw it along the skin, thus forcing it to take hold in order to find a firm attachment. But it must be recollected that there are certain states of the body, in which the leech will not attach itself, or speedily perish if it does. In poisoning by nux vomica, strychnine, oxalic acid, etc., and where sulphur has been used, the leech dies if it abstracts blood. In order to hold leeches to any part of the body, they are placed in a narrow tube called a leech-glass, which confines them to one spot.

When it is desired to remove leeches from the skin, this may be accomplished readily by dropping a little salt upon them, which sickens them. The usual mode is to draw the leech gently through the thumb and index finger, in a direction from its tail to its head, thus forcing out the blood, and then place the animal in clean water, to remain there for several days before employing it again, frequently renewing the water. Soubeiran and Bouchardat recommend as the best plan, first, to sicken the leech by placing it in a solution of 8 parts of salt to 50 of water, then, holding it by the tail, to dip it into hot water, but which can be borne by the hand, and then to strip it by gently passing it between the fingers; the leech is then to be placed in fresh water, which should be changed every day. A little white sugar dissolved in the water will, it is said, speedily restore them to their original activity. When the hemorrhage from leech-bites is troublesome, or too long continued, it may be checked by applying tannic acid or other astringents, collodion, eau de Pagliari, or by a very superficial stitch with a fine sewing needle.

HOMATROPINÆ HYDROBROMAS.—HOMATROPINE HYDROBROMATE.

FORMULA: $C_{16}H_{21}NO_3.HBr$. MOLECULAR WEIGHT: 355.17.

Source and Preparation.—*Homatropine* (*Oxytoluyl-tropeïne*) is the most important of the tropeïnes (which see)—a series produced by heating *tropine* ($C_8H_{15}NO$) in the presence of diluted hydrochloric acid and certain organic acids.

Thus homatropine is prepared by the action of tropine upon mandelic (phenylglycolic) acid ($C_8H_8O_3$) (see article on homatropine by Prof. F. B. Power, in *Amer. Jour. Pharm.*, 1882, p. 145). Homatropine is an alkaloid, forming transparent, prismatic crystals (Merck, 1880), soluble in ether, alcohol, and chloroform, but less soluble in carbon disulphide, from a solution of which it readily crystallizes. A peculiarity of this alkaloid is that, though hygroscopic and extremely deliquescent, it dissolves with difficulty in water. The alkaloid forms salts with hydrochloric, hydrobromic, and sulphuric acids; also with picric acid. The most valuable salt of homatropine, therapeutically, is homatropine hydrobromate.

HOMATROPINE HYDROBROMATE ($C_{16}H_{21}NO_3.HBr.$) can be easily obtained in crystallized form by the action of hydrobromic acid upon crude homatropine and subsequent recrystallization from water.

Description and Tests.—Homatropine hydrobromate occurs in small, white, lustrous, non-hygroscopic crystals, soluble in 6 parts of water and 130 parts of alcohol. The *Br. Pharm.* (1898) for homatropine hydrobromate directs that the solutions should be neutral to litmus. The same authority demands that: "Heated on platinum foil it fuses and burns without leaving an appreciable residue. If 0.2 Cc. of chloroform be shaken with 1 Cc. of a 10 per cent aqueous solution, to which a solution of chlorine has been cautiously added, the chloroform will assume a brownish color. A 2 per cent aqueous solution yields no precipitate, nor does the cautious addition of solution of ammonia, previously diluted with twice its volume of water, but diluted solution of potassium hydroxide produces in it a white precipitate, soluble in excess of the reagent. Solution of iodine causes a brown, and test solution of mercuric chloride a white precipitate. If about 0.01 Gm. be dissolved in a little water, and the solution rendered alkaline with solution of ammonia, and shaken with chloroform, the separated chloroform will leave on evaporation a residue which will turn yellow and finally brick-red, when warmed with about 1.5 Cc. of a 2 per cent solution of mercuric chloride in a mixture of 5 volumes of alcohol (90 per cent), and 3 volumes of water. When treated with fuming nitric acid and potassium hydroxide, as described under 'Atropina,' no reddish-violet coloration is developed (distinction from atropine), the residue becoming reddish-yellow. It affords the reactions characteristic of hydrobromides" (*Br. Pharm.*, 1898). The sulphate, hydrochlorate, and salicylate of homatropine, each in white crystals, soluble in water and alcohol, are occasionally employed therapeutically.

Action, Medical Uses, and Dosage.—This salt acts very much like atropine, causing a quick, full dilatation of the pupil, but the paralyzing influence upon the muscles of accommodation is much less, and the effects of the agent more transient. Homatropine dilatation seldom lasts over 24 hours, and usually begins to diminish after a few hours, whereas atropine dilatation may persist for several days. Homatropine, after the instillation of large doses, imparts a bitter taste, but, unlike atropine, no dryness of the pharynx is induced. Homatropine hydrobromate is a safer agent than atropine, and does not produce such marked systemic disturbances as the latter. A 1 per cent solution is usually preferred for ophthalmic work. The solution is fairly permanent. Under the use of this drug pupillary dilatation takes place in from 15 to 25 minutes, reaches the maximum in about 1 hour, and usually disappears in about 6 hours; accommodation paresis occurs in ¾ to 1½ hours, and passes off before the dilatation is overcome. Instillation of this agent produces some smarting, and occasionally conjunctival irritation results, but these effects are less likely to occur than with atropine. Poisoning by homatropine and its salts should be treated by means of emetics and the stomach-pump, followed by tannin and animal charcoal, and emesis again resorted to. Then a cathartic dose of castor oil is advisable. Heat, stimulation, and artificial respiration should not be neglected. Hartridge advises a combination of cocaine and homatropine for producing quick maximum dilatation.

Foltz (Webster's *Dynam. Therap.*, p. 580) states that for use in middle-aged persons, the drug is all that can be desired, but for refractive troubles, particularly of children, with ciliary spasm, he regards it of little value. It is contraindicated in glaucoma. The agent is seldom used internally. However, homatropine is now by far the most commonly employed mydriatic for use in *refraction work*. For *ophthalmoscopic examinations* it has largely replaced atropine, as it has in estimating refraction in patients over 25 years of age. Homatropine is antagonistic to muscarine and pilocarpine. Homatropine hydrobromate has been successfully used in the *night-sweats of phthisis*. Doses of $\frac{1}{20}$ grain have been advised for this purpose, but the practice can not be strongly recommended. The dose of homatropine hydrobromate is from $\frac{1}{120}$ to $\frac{1}{60}$ grain; the maximum amount for a day being $\frac{1}{20}$ grain; as a collyrium, 3 to 4 grains to 1 fluid ounce of water.

Related Preparation.—MYDRINE. This is a white powder—a combination of the alkaloids homatropine and ephedrine—introduced into ocular therapeutics by Dr. Cattaneo, in 1895. It dissolves freely in water, and is employed chiefly in 10 per cent solution. It is promptly mydriatic, scarcely irritant, causing at first slight burning, and has no effect upon accommodation. Claimed to be quicker and more transient than other mydriatics, and consequently of marked value for diagnostic purposes.

HORDEUM.—BARLEY.

The decorticated seeds of *Hordeum distichon*, Linné.

COMMON NAMES: *Barley, Pearl barley.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 293.

Botanical Source.—There are several kinds of barley, the more general ones being the following: *Hordeum vulgare*, Linné, has an erect, smooth, fistular culm or stem, from 2 to 4 feet in height, with alternate, carinate, lanceolate, linear, and roughish leaves; the sheaths are auriculate at the throat. The flowers are all hermaphrodite and awned; the spikes thick, and about 3 inches long; the spikelets 3, all fertile, 1-flowered, with an awn-like rudiment at the base of the upper paleæ. Glumes 2, subulate, nearly equal, and awned. Paleæ 2 and herbaceous; the lower one lance-ovate, concave, and long awned; the upper obtusely acuminate, and bicarinate. The stamens are 3 in number; ovary hairy at the apex. Stigmas 2, sessile, somewhat terminal, and feathery. Scales 2, ciliated. Caryopsis adhering to the paleæ. Fruit or seeds in 4 rows (L.—W.).

Hordeum distichon, Linné, differs from the preceding by having a compressed spike or ear, with the lateral spikelets abortive and awnless; the spikelets on the edge only being fertile, and the fruit is disposed in 2 rows.

Hordeum hexastichon, Linné, has the fruit in 6 rows.

History and Description.—Barley is thought to be a native of central Asia, but the subject is involved in much uncertainty. The seeds are the parts employed. They are oblong-ovoid, with a furrow on one side running lengthwise, yellow outside, white internally, of a feeble odor, and a moderately saccharine taste. When the seeds are stripped of their husks, and made round by a particular process, it constitutes *pearl barley* (*Hordeum Perlatum*), which is the best form for use; when this is ground into a coarse flour it forms barley meal. Pearl barley occurs in subspherical or nearly ovoid grains, of a white, starchy aspect. Sometimes remaining portions of the husk give to it a yellowish cast. This is especially the case along the longitudinal groove. Its taste resembles that of the farinaceæ in general. When the seeds are but partially decorticated it is known as *hulled*, *Scotch*, or *pot barley*. When the entire grain is moistened and exposed in mass to a summer temperature until it begins to germinate, and is then devitalized at a definite stage of the germinating process, by a stronger heat, it is converted into MALT, which is extensively employed in making ale, beer, and porter During the process of making malt, the temperature rises appreciably, much carbon dioxide is given off, and the nitrogenized matter in the seeds undergoes a change, being in part converted into a peculiar ferment, called *diastase*. It has the power, peculiar to infusions of malt, of converting large quantities of starch into dextrin and a fermentable sugar, *maltose*. To obtain the greatest possible yield of *diastase* from a given amount of barley, at the same time reducing the loss of carbohydrates to a minimum, is the object of successful malting (see special works on brewing, etc., for details of this process).

Chemical Composition.—König (*Nahrungs und Genussmittel*, 3d ed., 1893, Vol. II, p. 467) gives the following percentage composition of barley seed, the results being the average of 766 recorded analyses of barley from many countries, including the United States: Water, 14.05; nitrogenous matter, 9.66; fatty matter, 1.93; sugar (*maltose*), 1.51; dextrin, 6.39; starch, 59.09; fibre, 4.95; ash, 2.42. The nitrogenous matter consists of *gluten casein*, *gluten-fibrin*, *mucedin*, and albumin. The gliadin contained in wheat being absent, it is therefore impossible to obtain gluten from barley (see *Avena*). Albumin varies in barley from 0.5 to 1.77 per cent. As regards carbohydrates, sugar is stated to predominate over dextrin in American barley. Stellwaag (1886) found the fatty matter in barley to consist of 13.62 per cent free fatty acids (containing *hordeic acid*, or *lauro-stearic acid* of Beckmann, 1855), 71.78 per cent neutral fats, 4.24 per cent *lecithin*, and 6.08 per cent *phytosterin*.

J. C. Lermer, in 1863 (Wittstein's *Vierteljahrsschrift*, Vol. XII, p. 4), made a comparative analysis of barley seeds and the malt obtained therefrom, and observed a loss in starch of 14.57 per cent, and an increase of sugar by 2.03 per cent, also the fatty oil became reduced in quantity, while dextrin, cellulose, and proteids remained constant. Mr. Frank X. Moerk has more recently (*Amer. Jour. Pharm.*, 1884, p. 366 and 465) made some diligent analyses of Canada barley as well as the malt prepared from it, to which articles the reader is referred. A peculiar, optically lævogyre carbohydrate, *sinistrin* (*synanthrose*), was found in hordeum by Kühnemann (1875). The ash of barley seeds contains chiefly phosphate of potassium, magnesium and calcium, and large amounts of silica (in the husks).

A peculiar principle has been found in barley seeds subsequent to the germinating process, by MM. Payen and Persoz, which they have named *diastase*. The same substance has likewise been found in the seeds of oats and wheat, and in the potato, but only after these have undergone germination. Diastase may be obtained by macerating ground malt in cold water, subjecting to pressure, and filtering and heating the liquid to the temperature of 70° C. (158° F.). Another nitrogenous body existing in the liquid is thus coagulated and removed. The liquid, being filtered again, is to be mixed with a sufficient quantity of alcohol to throw down the *diastase*. To obtain the diastase pure, it should be again dissolved in water, and thrown down by alcohol, and this ought to be repeated several times. Diastase thus obtained is solid, white, amorphous, insoluble in alcohol, but soluble in water and diluted alcohol. Its aqueous solution possesses neither acid or alkaline qualities, and has little taste. Diastase, after purification, is best obtained in the dry state by exposing it in thin layers to a current of air at about 43.3° C. (110° F.). Its aqueous solution is not precipitated, like that of starch, by lime, baryta, or acetate of lead; on keeping it becomes acid. Its most remarkable property is that of converting starch in the presence of water, at a temperature of about 50° C. (122° F.), into a peculiar sugar (*maltose*, $C_{12}H_{22}O_{11}$) and dextrin. It has no action upon either gum or sugar, and yet 1 part of it added to 2000 parts of starch, suspended in water, causes the starch globules speedily to burst, the teguments separating from the contained granulose, which readily undergoes this extraordinary conversion without any perceptible difference in the weight of the substance employed. Diastase has also been called *maltine*. A second ferment, *peptase*, forms during malting, whose action is to change the proteids into peptones and parapeptones, the beer depending upon the latter bodies for its (asserted) nutritive qualities (Wagner, *Handbuch der Chem. Technologie*, 1889, p. 901).

The different kinds of beer, ale, and porter are made from malt, with the addition of hops and other articles. Malt has a sweetish, mucilaginous, rather agreeable taste. An infusion of it at 71.1° C. (160° F.) completes the conversion of the starch into sugar and gum; yeast being then added at a temperature between 15.5° and 26.6° C. (60° and 80° F.), vinous fermentation takes place, carbonic acid gas is disengaged and alcohol formed. The sugar is the source of the alcohol existing in malt liquors, while the gummy dextrin is the cause of their viscidity, and the permanence of their effervescence and frothy top.

Action, Medical Uses, and Dosage.—Pearl barley in decoction is nutritive and demulcent, and, on account of its mild and unirritating qualities, is much used as an article of diet for the sick and convalescent, acting at the same time, if the barley itself be swallowed, as a gentle aperient. The decoction is employed for suspending powdered drugs insoluble in water, and also as a drink in *febrile diseases*, *catarrh*, *dysentery*, *inflammation of the bladder*, *gonorrhœa*, and *chronic mucous inflammations*. Combined with hops, or in the form of beer, ale, or porter, it forms a valuable tonic in many *chronic exhausting diseases*, and in convalescence. From

2 to 4 ounces of malt boiled in a quart of water, afford a more demulcent and nutritious liquor than barley, and is consequently better adapted to cases requiring a sustaining course of treatment. In making the decoction of barley, 2 ounces must first be washed with cold water, and all extraneous matters removed, then place the barley in ½ pint of water, boil for a short time, strain off the water, and throw it away, as this is only employed to remove mustiness, or any disagreeable flavor which the barley may have acquired. To the barley thus prepared, add 4 pints of boiling water, boil down to 2 pints, and strain. The decoction may have other articles added in the course of its preparation, varied to suit the taste of the patient, as sugar, sliced figs, raisins, liquorice-root, etc. It may be drank freely.

HUMULUS (U. S. P.)—HOPS.

"The strobiles of *Humulus Lupulus*, Linné"—(*U. S. P.*).

Nat. Ord.—Urticaceæ.

COMMON NAME: *Hop.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 230.

Botanical Source.—This plant has a perennial root, with many annual, angular stems, rough backward, with minute, reflexed hairs, twining around surrounding objects in a volute direction with the sun, and climbing to a great height. The leaves are opposite, on long, winding, rough petioles; the smaller ones cordate, the larger from 3 to 5-lobed; all are deep-green, serrated, veiny, and very rough. The flowering branches are axillary, angular, and rough. Stipules, 2 or 4, between the petioles, smooth, ovate, and reflexed. The flowers are numerous, axillary, and of a greenish color. Male flowers very numerous, panicled, yellowish-white; sepals 5, oblong, obtuse, spreading, concave; stamens short; anthers oblong, opening by 2 terminal pores. Female flowers pale-green, grow on a separate plant, in the form of an ament, having each pair of flowers supported by a bract, which is ovate, acute, and tubular at the base; sepals solitary, obtuse, smaller than the bracts, enfolding the ovary; ovary roundish and compressed; stigmas 2, long, subulate, and downy. The bracts enlarge into a persistent catkin or strobile, each bract inclosing a nut enveloped in its permanent bractlet, and some yellow, resinous grains (L.—B.).

Fig. 135.

Humulus Lupulus.

History and Description.—This plant is common in hedges and thickets in many parts of Europe, and grows spontaneously in various sections of the United States; said also to inhabit China and the Canary Islands. It is largely cultivated for its cones or strobiles, which are used medicinally, and in the manufacture of beer, ale, porter, etc. A few rows of the barren vines planted among the fertile ones, are said to be profitable by increasing the weight of the produce. The strobiles or cones are the parts employed; these are collected when thoroughly matured, properly desiccated, and then placed in large bags or pockets, and sold as *Hops.* They consist of ovate, membranous, semi-transparent, light-green scales, tinged more or less of a yellow color, which are glandular at their base, near which they develop 2 minute, globular, hard nuts or achenia of a bay-brown color, and which are covered with aromatic, superficial, globose, golden-yellow glands or grains. To these the name *lupulin* was given by Ives (*Amer. Jour. Science*, 1820, p. 302). The active properties of hops are owing to the lupulin, although the scales possess them also, but in an inferior degree. *Lupulin* (see *Lupulinum*), is procured by beating or rubbing the strobiles, and then sifting out the grains, which form about ⅙ part of the hops. The official description of hops is as follows:

"Ovate, about 3 Cm. (1¼ inch) long, consisting of a thin, hairy, undulated axis, and many obliquely-ovate, membranous scales, in the upper part reticulately veined, and toward the base parallel-veined, glandular, and surrounding a subglobular achene; color of the scales greenish, free from reddish or brownish spots; odor aromatic; taste bitter, aromatic and slightly astringent"—(*U. S. P.*).

Chemical Composition.—Boiling water takes up the virtues of hops; however, they are impaired by long-continued heat. The decoction turns litmus paper red, becomes deep-green with the salts of iron, and turbid with the solution of isinglass. A better solvent than water is diluted alcohol. By distillation with water, hops yield a limpid *volatile oil* (0.8 per cent, v. Wagner), lighter than water; Payen and Chevallier (1822) obtained from lupulin 2 per cent. The oil in part contains *humulene* (a sesquiterpene, $C_{15}H_{24}$), and unsaturated hydrocarbons not belonging to the terpene series. The formation of *butyric* and *valerianic acids*, observed in the distillation of old hops or lupulin with water, is not due to oxidation of the volatile oil (A. C. Chapman, *Pharm. Centralh.*, 1899, p. 73).

A *bitter* principle was obtained as an amorphous, water-soluble mass, by M. Isseib (*Archiv der Pharm.*, 1880, p. 345), by exhausting lupulin of its bitterness by cold water, abstracting the bitter, with some resin, by animal charcoal, abstracting with alcohol, and separating the bitter from the resin by means of ether, which dissolves the bitter part only. The bitter principle, upon boiling with diluted sulphuric acid, is resolved into brown, amorphous *lupuliretin* (also supposed to be an oxidation product of the volatile oil), and crystallizable *lupulic acid*. A *crystallizable*, bitter principle, called *hop-bitter acid*, was first obtained pure by Lermer in 1863 (*Dingl. Pol. Jour.*, Vol. CLXIX, p. 54), by an elaborate process. This substance is insoluble in water, soluble in alcohol, ether, chloroform, and other liquids, notably the volatile oil of hops. The same compound was more recently obtained by H. Bungener (*Amer. Jour. Pharm.*, 1884, p. 427, from *Pharm. Jour. Trans.*, 1883–4, p. 1008). Six kilograms of fresh lupulin from unsulphured hops were extracted with low-boiling petroleum ether, and yielded 400 Gm. (6.6 per cent), of crude *hop-bitter acid*. The pure substance melts at 92° to 93° C. (197.6° to 199.4° F.), and when exposed to the air, soon turns yellow, resinifies, and develops an odor of fatty acids and aldehydes. Oxidizers produce *valerianic acid* in considerable quantity.

The *resins* of hops were differentiated by Dr. Hayduck (see *Amer. Jour. Pharm.*, 1888, p. 25. into three resins, two of which are soluble in petroleum-ether and form ether-soluble copper salts. The *hop-bitter acid* aforementioned is spontaneously convertible into one of these two resins, namely, that which is not precipitated by lead acetate. These two resins, as well as the *hop-biter acid*, were established to be the principles antagonistic to lactic ferments, while the oil of hops does not possess such untiseptic properties. A peculiar tannin, called *humuli-tannic acid*, was found to be present in hops to the extent of 2 to 5 per cent (v. Wagner, 1853, and Etti, 1876). A crystallizable alkaloid was believed by Lermer to exist in hops, although Gresshoff (1887) established its absence in lupulin (see Flückiger, *Pharmacognosie*, 1891). In this connection, the nature of the poisonous, crystallizable substance abstracted by F. Davis from the green strobiles of hops with ether (*Pharm. Jour. Trans.*, 1886, Vol. XVIII, p. 20), probably deserves further investigation. Other constituents are: Wax (about 10 per cent in *lupulin*), chlorophyll, dextrose (3 per cent, by Griessmayer, 1874), *asparagine* (1 per cent, Bungener and Fries, *Amer. Jour. Pharm.*, 1886, p. 91), *trimethylamine* and *choline* ($C_2H_4[OH]N[CH_3]_3OH$), *lupuline* of Griessmayer, 1874); of the latter base, Griess and Harrow obtained from hops 0.02 per cent; diluted aqueous solutions of this substance dissolve comparatively large amounts of *hop resin*, producing an intensely bitter solution. (Also see *Lupulinum* for special points.)

Action, Medical Uses, and Dosage.—Hops are tonic, hypnotic, febrifuge, antilithic, and anthelmintic. Their tonic and anthelmintic properties are small, and probably depend upon their bitterness; they possess no antiperiodic virtues. Sometimes they cause diuresis, and are said to correct *lithic acid deposits*. They are principally used for their sedative or hypnotic action—producing sleep, removing restlessness, and abating pain, but which they often fail to accomplish. A pillow stuffed with hops has long been a popular remedy for procuring sleep. Hops, as well as lupulin, are useful in *delirium tremens* to allay the morbid excitement and vigilance, while at the same time it exerts its stomachic effects. It is extremely efficient in *dyspepsia* where restlessness and a brooding disposition are prominent features. *Fermentative dyspepsia*, with consequent eructations, often yields to hops or lupulin. Externally, in the form of a fomentation alone, or combined with boneset or other bitter herbs, hops have proved beneficial in *pneumonia, pleurisy, gastritis, enteritis;* also as an application to *painful swellings* or *tumors.* An ointment made by boiling 2 parts of stramonium leaves and 1 of hops, in lard, has proved an effectual application in *eczema, ulcers*, and *painful tumors.*

Lupulin exerts a more certain influence than hops, and should be preferred for internal use, as the dose is much less bulky. The properties here ascribed to hops are possessed by lupulin, and the conditions benefited by lupulin are also those in which hops act beneficially. The subject will be further discussed under *Lupulin* (see *Lupulinum*).

The decoction of hops is seldom employed. Ale, porter, and beer are frequently administered in cases of *debility* in the absence of inflammatory symptoms, as tonic, stimulant, and nutritive agents. (For specific indications see *Lupulinum.*)

HYDRANGEA.—HYDRANGEA.

The root of *Hydrangea arborescens*, Linné *(Hydrangea vulgaris*, Michaux and Pursh).

Nat. Ord.—Saxifragaceæ.

Common Names: *Seven barks, Wild hydrangea.*

Botanical Source.—This plant is the *Hydrangea vulgaris* of Michaux and Pursh. It is an indigenous shrub, smooth, or nearly so, attaining the height of 5 or 6 feet, with opposite, petiolate leaves, which are ovate, obtuse at the base, rarely cordate, acuminate, serrate-dentate, nearly smooth, and green on both sides. The flowers are often all fertile, numerous, small, white, becoming roseate, and borne in fastigiate cymes. The calyx tube is hemispherical, 8 or 10-ribbed, and coherent with the ovary; the limb 4 or 5-toothed, and persistent; the petals ovate and sessile; the stamens 8 or 10, and slender; the capsule crowned with the 2 divergent styles, 2-celled below, and opening by a foramen between the styles; and the seeds are numerous (W.—G.).

History and Description.—This elegant shrub grows abundantly in the southern, and middle-western states, in mountains and hills, and on rocks and near streams. The bark is rough, pealing off—each layer being of a different color, and which has probably given origin to the name "seven barks." It is quite common in the Susquehanna and Schuylkill valleys, and its flowers are often met with in bouquets in the markets of Philadelphia. The root is the part that has been employed. It is formed of numerous radicles, sometimes not larger than a goose-quill, and again half an inch or more in diameter, and of considerable length. These proceed from a caudex, which sends upward numerous divergent branches. When fresh, the root and stalks are very succulent, containing much water, and can easily be cut, and the root likewise contains a great deal of mucilage, with albumen and starch. When dry they are very tough and resistent, and exceedingly difficult to bruise or cut, hence they should be bruised while fresh, or which is better, cut into short transverse sections, which facilitates the drying. The bark of the dried root has a rather pungent, aromatic, not disagreeable taste, somewhat similar to that of cascarilla bark. The stalks contain a pith which is easily removed, and they are used in some parts of the country for pipe-stems.

Chemical Composition.—Mr. Joseph Laidley, of Richmond, Va. (*Amer. Jour. Pharm.*, 1852, p. 20), found the root to contain gum, albumen, starch, resin, and inorganic salts. It was subsequently analyzed by Jos. Baur (*ibid.*, 1881, p. 157), who found, in addition, probable indications of an alkaloid and a crystallizable body. A glucosid, *hydrangin*, fluorescing with opal-blue color in alkaline solution, was obtained later by C. S. Boudurant (*Amer. Jour. Pharm.*, 1887, p. 123). It forms star-like masses of crystals, soluble in ether and alcohol, and when treated with diluted acids, splits into grape sugar and a resinous body. Acids destroy the fluorescence. Sugar, saponin, several resins, fixed and volatile oils (2.28 per cent), and starch (7.28 per cent) were also found. Sulphur is a constituent of the volatile oil. Contrary to Baur's statement, no tannin was found. Mr. H. J. M. Schroeter (*Amer. Jour. Pharm.*, 1889, p. 117) obtained a yield of 0.08 per cent of *hydrangin*, for which he established the formula $C_{34}H_{25}O_{11}$, and found the melting point to be 228° C. (442.4° F.).

The root of *Hydrangea paniculata*, var. *grandiflora*, a shrub frequently cultivated in the northern and middle states, was analyzed quite recently (A. G. Luebert, *Amer. Jour. Pharm.*, 1898, p. 550). A glucosidal, crystallizable principle was obtained, melting at 178° C. (352.4° F.), and probably not identical with the *hydrangin* of Bondurant. The name *para-hydrangin* is suggested for this substance.

Action, Medical Uses, and Dosage.—This plant was introduced to the profession by Dr. S. W. Butler, of Burlington, N. J., as a remedy for the removal of *calculous* or *gravelly deposits in the bladder*, and for relieving the excruciating pain attendant on the passing of a calculus through the ureter; and from reports made, it certainly deserves a full and thorough investigation. The power of curing or dissolving stone in the bladder is not claimed for it; it is only while the deposits are small, when in that form of the disease known as *gravel*, that it is an efficient remedy; then by removing the nucleus, which, if allowed to remain in the organ, would increase in size and form stone, the disease is averted, and when employed at this stage, it is said to have proved beneficial in every instance, and as many as 120 calculi have been known to come from one person under the use of this remedy. The effect of the plant, Dr. Butler states, is to remove, by its own specific action on the bladder, such deposits as may be contained in that viscus, provided they are small enough to pass through the urethra. Thus it has chiefly an eliminatory action rather than any power to dissolve gravel. By its soothing action it relieves vesical and urethral irritation. Probably its greatest value lies in its power of preventing the formation of alkaline and phosphatic deposits. The former mode of using it was to prepare a concentrated syrup of it with sugar or honey, and give a teaspoonful 3 times a day. Now specific hydrangea, in doses of 5 to 30 drops, 3 times a day, preferably in hot water, or a simple decoction of the root to be taken freely are preferred. If taken in overdoses it will produce some unpleasant symptoms, as dizziness of the head, oppression of the chest, etc. It is a good remedy in *acute nephritis*. The leaves of hydrangea are said by Dr. Eoff to be tonic, sialagogue, cathartic, and diuretic. The specific hydrangea and fluid extract of hydrangea are principally used in the earthy deposits, as phosphates of calcium, ammonium, and magnesium, in alkaline urine, and in *chronic gleet*, and *mucous irritation of the bladder* in aged persons. Its alterative powers, chiefly due to its washing away of strumous and other unhealthy products, are not to be underrated. It is not without some value in *broncho-pulmonic affections*, relieving irritation; also in some forms of *gastric irritation*.

Specific Indications and Uses.—Vesical and urethral irritation, with gravelly deposits; difficult urination; bloody urine; deep-seated renal pain; hepatic pain; irritation of bronchial tract. It improves the nutrition of the urinary mucous tissues.

Preparation of Hydrangea.—LITHIATED HYDRANGEA. This specialty of the Lambert Pharmacal Co., of St. Louis, Mo., is a compound of fresh hydrangea and benzo-salicylate of lithium, prepared by special process. It is employed in renal and cystic affections, viz.: *Lithuria, gout, rheumatism, calculus, diabetes, cystitis*, and *vesical irritation*. The dose is from 1 to 2 fluid drachms, 4 times a day, preferably between meals.

HYDRARGYRI CHLORIDUM CORROSIVUM (U. S. P.)

CORROSIVE MERCURIC CHLORIDE.

FORMULA: $HgCl_2$. MOLECULAR WEIGHT: 270.54.

SYNONYMS: *Corrosive chloride of mercury, Corrosive sublimate, Hydrargyri perchloridum, Perchloride of mercury, Bichloride of mercury, Chloride of mercury, Corrosive muriate of mercury, Oxymuriate of mercury, Hydrargyrum muriaticum corrosivum, Hydrargyrum corrosivum sublimatum, Hydrargyri bichloridum, Mercurius sublimatus corrosivus, Sublimatum corrosivum, Sublimatus corrosivus, Chloruretum (Chloretum) hydrargyricum, Mercuric chloride.*

"Corrosive mercuric chloride should be kept in well stoppered bottles"—(*U. S. P.*).

Preparation.—"Take of persulphate of mercury, 20 ounces (av.); chloride of sodium, dried, 16 ounces (av.); black oxide of manganese, 1 ounce (av.). Reduce the persulphate of mercury and the chloride of sodium, each, to fine powder, and, having mixed them and the oxide of manganese thoroughly by trituration in a mortar, put the mixture into an apparatus adapted for sublimation, and apply sufficient heat to cause vapors of perchloride of mercury to rise into the less heated part of the apparatus which has been arranged for their condensation"—(*Br. Pharm.*).

Double decomposition takes place thus: $HgSO_4+2NaCl=HgCl_2+Na_2SO_4$. Any mercurous compound that may contaminate the mercuric sulphate, and any mercurous chloride generated during this process, are converted into mercuric chloride by the chlorine generated from the action of the manganese dioxide employed upon the sodium chloride. This process differs from the *U. S. P.* (1870) in the employment of an already prepared mercuric sulphate, and in the introduction of the manganese salt.

Description.—Mercuric chloride, when obtained by sublimation, forms in beautiful white, semitransparent masses, composed of very small prismatic needles. It has the specific gravity 5.14 to 5.42. In the light it becomes reduced, first to mercurous chloride (calomel), and finally to the metallic state. Its incompatibles are alkalies and their carbonates, tartar emetic, sulphide of potassium, soaps, albumen, iron, copper, lead, metallic mercury, vegetable substances containing tannic acid, etc. It is officially described as "heavy, colorless, rhombic crystals, or crystalline masses, odorless, and having an acrid and persistent, metallic taste; permanent in the air. Soluble, at 15° C. (59° F.), in 16 parts of water, and in 3 parts of alcohol, in 2 parts of boiling water, 1.2 parts of boiling alcohol, 4 parts of ether, and about 14 parts of glycerin. It fuses at 265° C. (509° F.) to a colorless liquid, and at about 300° C. (572° F.) it volatilizes in dense, white vapors, leaving no residue. The aqueous solution reddens blue litmus paper, but becomes neutral to litmus on the addition of sodium chloride. With ammonia water it yields a white precipitate; with an excess of hydrogen sulphide a black one; with potassium iodide T.S. a red one, soluble in an excess of the reagent; and with silver nitrate T.S. a white precipitate, insoluble in nitric acid"—(*U. S. P.*). The white precipitate produced in solutions of corrosive sublimate by ammonia water, has the composition $HgCl.NH_2$; the analogous precipitate produced in solutions of mercurous salts with ammonia water, is black. Mercuric chloride is easily reduced to insoluble mercurous chloride (calomel) by such reducing agents as sulphurous acid or stannous chloride. An excess of the latter reagent will further reduce the calomel formed to metallic mercury. The reactions involved are as follows: $2HgCl_2+SnCl_2=Hg_2Cl_2+SnCl_4$ and $Hg_2Cl_2+SnCl_2=Hg_2+SnCl_4$. Mercuric chloride forms crystallizable double salts with the chlorides of potassium, sodium, and ammonium, and also combines with hydrochloric acid. The *Alembroth Salt* of the alchemists was a mixture obtained by evaporating to dryness a solution of equal weights of mercuric chloride and ammonium chloride.

Tests.—"If a saturated, aqueous solution of the salt be heated nearly to boiling, then completely saturated with hydrogen sulphide, and allowed to stand for several hours in a well-corked flask, it should yield a colorless filtrate, which, on evaporation, should leave no residue (absence of many foreign salts). If the precipitated mercuric sulphide obtained in the last test be washed with water, then shaken for a few minutes with ammonia water, and filtered, the filtrate should be colorless, and, on the addition of a slight excess of hydrochloric acid, should afford neither a yellow color, nor a yellow precipitate (absence of arsenic)"—(*U. S. P.*). The presence of calomel (mercurous chloride) in corrosive sublimate is recognized by an insoluble residue being left upon dissolving in water, this residue turning black with ammonia water.

Action and Toxicology.—In this article the action of the mercurials in general will first be given, followed by such special statements as apply to individual members of the group. In the metallic state mercury is inert as a medicine, except when in a state of minute division; but its oxides and other compounds possess exceedingly active properties. Metallic mercury, undivided, may be taken in considerable amount, acting by its weight merely as a purgative. If, however, it be retained in the intestinal tract so as to form soluble salts, or if in prolonged contact with the skin, it will produce the constitutional effects. Thus the blue ointment and mercurial plaster have caused alarming symptoms. The vapor of metallic mercury is exceedingly poisonous. Murrell records an account of the wrecking, near Cadiz, of a vessel, and the recovery of several tons of quicksilver by the crew of an English man-of-war, whereby 200 of the crew were sickened, with 2 fatalities, besides the destruction of animals, fowls, and roaches, all in consequence of the rotting of the sacks containing the metal. From the vapors from a fire in the quicksilver mines at Idria, over 900 individuals residing in the vicinity were attacked with trembles.

Almost all the mercurial preparations act in the same way, possessing sialagogue, deobstruent, alterative, etc., properties, the character and degree of which are frequently diminished or augmented by the peculiar agents in combination with them. These effects, however, are rarely increased physiological effects, but pathological in character. Bartholow, in considering the action of the mercurials upon the glandular system, very properly observes that "these actions of mercury should not be regarded as a physiological stimulation of the intestinal glands, in the sense that the foods are stimulant to these organs. The action is pathological, and the products of the action are pathological" (*Mat. Med.*, p. 248). The mercurials, when long continued, and, in many instances but few doses, with some very susceptible constitutions, induce a succession of very serious symptoms, as emaciation, general debility, œdema, tremor of the limbs, diseased liver, pain in the bones, caries, palsy, ulcerations of the pharynx and other parts, gangrenous ulceration of the mouth and face, and a sort of scorbutic marasmus. It likewise occasionally produces a febrile condition of the system, with profound prostration (*mercurial erethism*), profuse perspiration, several forms of cutaneous disease, as eczema, herpes, inflammation or congestion of the eye, fauces, or peritoneum, nodes, enlargement of the inguinal, axillary, mesenteric, parotid, pancreatic, etc., glands, together with various painful and nervous attacks. It was introduced to the medical profession by the notorious Paracelsus.

The *modus operandi* of the mercurials is not well understood. In the stomach it probably forms an albuminate, which, though insoluble in water, is readily dissolved by chloride of sodium and by an excess of albumen. Minute doses are said to increase the red blood discs; large doses destroy the blood discs, reduce fibrin, and poison the heart. Mercurials have a special affinity for the glandular structures. This is well marked in its action upon the salivary glands. The former practice of "touching the gums," or producing profuse salivation (mercurial ptyalism), has been, largely through the stand taken by the Eclectic school, abandoned. This disagreeable condition, which formerly produced untold misery, exhibited itself in its worst form by an enormous increase of thick, ropy, albuminous saliva, subsequently becoming thin and watery, and amounting to several pints in a day. Then followed extensive ulceration, or gangrenous stomatitis of the cheeks and adjacent structures, with tender and swollen glands, sloughing of the cheek and gum, allowing the teeth to fall out and the jaw to become carious. Practical medicine has no greater stain upon her escutcheon than the memory of the horrors of acute mercurialism, as formerly practiced. So profound was the condition of *mercurial cachexia*, *hydrargism*, or *mercurial erethism* from continued doses of these drugs, that profound marasmus, anemia, and excessive purging soon led the victim to an untimely grave. This condition was frequently accompanied by the mercurial tremor, neuralgia, paralysis, or epileptiform convulsions. Scrofulous individuals and those laboring under renal affections are said to be more susceptible to the untoward action of the mercurials, while children are less readily salivated.

Artisans who are employed as gilders, and who work in looking-glass, thermometer, and barometer factories, and miners of quicksilver, are afflicted with a somewhat different form of mercurialism, marked features of which are prostration and anemia, mercurial fever, pustular or vesicular eruptions, jerky, stammering speech, convulsions, and particularly a peculiar form of muscular weakness denominated "the trembles." These tremors (or "shaking palsy") manifest themselves first in the upper limbs, then in the legs, and finally in the trunk. They are readily brought on, gradually increase in extent and severity, and are quite persistent and uncontrollable. The prehensile movements lack precision and the lower extremities, in walking, tremble as if strung on wires. For a graphic account of this condition, see Murrell's *Manual of Materia Medica and Therapeutics*, 1896, p. 204.)

Before the vigorous fight of the Eclectics against the mercurials as cholagogues, it was the prevailing opinion that these salts, particularly calomel, increased the natural secretions of the liver, thereby causing an augmented flow of bile. Reliable experimentation by several old school observers has proved the claims of our practitioners to be largely true. While it is still admitted by some that corrosive sublimate is slightly stimulant to the liver, the majority deny even to this salt cholagogue powers. That calomel has no such action is now universally acknowledged. If an increased flow of bile into the intestinal canal does take place under the action of the mercurial, it is caused, as with croton oil, by the reflex contraction of the gall-bladder and duct, due to the duodenal irritation produced. This is the view held by Bartholow, among others. The long-continued use of mercury has caused an altered biliary secretion, and has even checked hepatic activity.

Briefly, the distinctive effects, aside from the general mercurial impression, of mercury and its chief salts, are as follows: Metallic mercury, undivided is a mechanical purgative; in a divided state, as in gray powder, blue mass, and blue ointment, it becomes an active agent capable of all the untoward effects of this class of agents. Blue pill readily causes salivation, calomel less frequently. The general action of calomel closely resembles that of mercury in the divided state. Calomel probably passes for the most part into the intestines, where the alkaline secretions convert it into oxide of mercury. Mercuric chloride, mercuric iodide, mercuric cyanide, and mercuric nitrate are exceedingly energetic and toxic agents. Some of the mercurials, particularly the corrosive chloride and the biniodide are energetic germicides. The anthrax spores are destroyed by the first in a solution of 1 to 1000.

Taken internally, corrosive sublimate is an active, corrosive poison, acting very quickly, and producing in over-doses a coppery, metallic taste, and violent burning pain in the mouth, throat, œsophagus, and stomach; great difficulty of swallowing, sense of suffocation, nausea, violent vomiting, increased by everything taken into the stomach; the pain soon becomes diffused over the whole abdomen, which becomes very sensitive to pressure; violent purging, often of blood; great anxiety; flushed (occasionally pale), and even swollen countenance; restlessness; pulse quick, small, and contracted; cold sweats; burning thirst; short and laborious breathing; urine frequently suppressed; and finally stupor, coma, convulsive movements, partial paralysis, or paraplegia, and death. Fainting often precedes death. Sometimes before death ensues, if time enough has elapsed, there may be profuse salivation, ulceration of the mouth, fetor of the breath, and other secondary mercurial symptoms. The mouth and œsophagus appear whitish, as if having been painted with silver nitrate solution (Taylor). On inspection after death, the membranes of the mouth, throat, and œsophagus are softened and whitish or bluish-gray, and show marked inflammation, while the stomach and bowels will be found excessively inflamed, sometimes with patches of ulceration or gangrene. (Arsenic lesions are confined chiefly to the stomach and bowels.) Corrosive sublimate poisoning differs from arsenical poisoning in the metallic taste produced, in the violent symptoms almost immediately occurring, and in the evacuations being more often mixed with blood. If death is produced quickly, the symptoms closely resemble those of cholera; if several days elapse before death, the symptoms are more like dysentery, with violent tenesmus and shreddy, blood-mixed mucous discharges (Taylor, *Med. Juris.*).

In poisoning by corrosive sublimate, death may not take place for several days. Such cases may show a total inactivity of the renal organs. Death usually occurs in from 1 to 5 days, though it may occur earlier or later, having been known to take place in less than ½ hour. The smallest dose known to have killed (a child), is 3 grains; it is thought that from 3 to 5 grains or less will kill an adult (Taylor). Death may occur from the external application of the drug to tumors, ulcers, etc.; and serious symptoms have followed from the use of the solutions even when the skin is unbroken.

In the bodies of persons, who, during life had employed mercury or some of its preparations, either internally or externally, metallic mercury has been found, as in the bones, brain, pleura, liver, cellular tissue, lungs, kidneys, etc. It has also been detected in the secretions of patients who were under its influence, as in the perspiration, urine, saliva, bile, gastro-intestinal secretions, and in the fluids of ulcers. The salivation and gangrenous inflammation of the mouth occasioned by mercurials are best overcome by astringent infusions, as tincture of myrrh, both taken internally and used as a gargle, and the administration of chlorate of potassium. Its constitutional effects are best remedied by vegetable alteratives with iodide of potassium, tonics, attention to the excretions, malic acid, exercise, etc.; though it is rarely the case that a perfect recovery of health ensues where the system has suffered considerably from the effects of the mercury.

In the treatment of cases of poisoning by corrosive sublimate, the antidotes must be given promptly, without the least delay. Thus the white and yolks of eggs, well beaten with water; milk, or a mixture of wheat flour, oat-meal, or barley-meal, and water; these form a compound whose chemical action on the tissues are slight when compared with that of the poison. One egg is said to be required for every 4 grains of corrosive sublimate swallowed. The above, as well as mucilaginous draughts should be given freely until relief is afforded; and as soon as possible the stomach should be evacuated by the stomach-pump, and likewise be well washed out. Chemical antidotes, or those which decompose the poison, or form harmless compounds with it, should also be used, as a mixture of 2 parts of very fine iron filings, and 1 of fine zinc filings, which is said to reduce the corrosive sublimate to the metallic state; or, the hydrated sulphide of iron, which completely destroys the poisonous quality of the mercurial salt, if given within 10 or 15 minutes after it has been swallowed. After the poisonous symptoms have been overcome, any inflammation which may remain, must be treated on general principles.

Medical Uses and Dosage.—Mercury and its preparations have been little employed by Eclectic physicians, and have even been absolutely proscribed by many members of the Eclectic school. While it is true that the use of the drug has been discouraged by the teachers and writers of our school, it is also true that their ground of opposition is well taken, for these are drugs so pernicious in their effects, as ordinarily employed, that their abuse should be strongly guarded. They should only be used when the specific indications for their employment can be unmistakably pointed out. Therefore it is desirable that we reiterate what has been declared again and again by the *leaders and teachers* of the Eclectic school, that it is not the *use*, but the *abuse* of mercury to which objection is made. The earlier Eclectics, many of whom would not use mercury in any form, sought to find substitutes for the mercurials (as with podophyllin, etc., for hepatic disorders), for, as stated by Prof. King in the original preface to the *American Dispensatory* (p. 8), "there is no single remedy known to man which has produced a greater amount of mischief by its *indiscriminate* use than mercury; nor is there any other drug which has done one-hundredth part as much to create a prejudice against scientific medicine, to destroy the confidence of the community in its practitioners, and to repel them from the physicians to the nostrum dealer." That the Eclectic fathers were justified in their objections to the viciously injudicious employment of mercurials prevalent in regular medicine in the early days of our school, is now evident from the position taken by many of the most conspicuous old school authors of to-day, and by the very conservative use of the drug at present by old school physicians, as well as by their kindlier feelings toward their professional brethren, whose opinions relating to some problems in therapy do not agree with their own. In referring to the medical uses of the preparations of mercury, unless attention is called to Eclectic authority, the reader is to understand that the uses given in this work are in accordance with the authorities of the regular school, and are designed to give scientific information concerning a class of preparations we can do without or replace by better and more kindly remedies.

Corrosive sublimate is little used by Eclectic practitioners, either as an internal or external remedy. Nor is its use as extensive among allopathic practitioners as it was some years back. In fact, in reviewing the old school works upon practice and materia medica of the past and present, one is struck with the comparative conservatism in the use of these preparations as compared with former times. Corrosive sublimate has been employed as an alterative in *cutaneous*, *scrofulous*, and *rheumatic diseases*, *nervous disorders*, *diseases of the bones*, in *obstinate* [illegible], *acne*, and other eruptions on the face, etc. It was, however, more generally administered, and is still largely used in the treatment of *syphilitic maladies*. At the present day, besides its use in syphilis, it is advocated internally in *gastric ulcer*, to promote cicatrization and internally and locally in *diphtheria*. Murrell advises its use (1 grain to 10 fluid ounces of water; dose, 1 teaspoonful every hour), in *infantile diarrhœa* with green, slimy, offensive stools. Externally, it is the chief antiseptic agent for use as a germicide, being used more largely for that purpose than any other drug by these practitioners. It destroys *pediculi*, and in the form of solution or ointment is largely employed in *parasitic skin affections*, in *acne*, *pityriasis*, *chloasma*, *freckles*, *gonorrhœa*, *pruritis vulvæ*, in the treatment of *wounds*, and in general *surgical*, *gynæcological*, and *obstetrical manipulations*. (For a more detailed account of its employment by the old school profession, consult any "regular" materia medica.) The solutions employed for general antiseptic purposes should never be stronger than 1 in 2000. Solutions of 1 to 10,000 in vaginal injections during operations have produced violent toxic effects. Death has resulted from solutions of 1 to 1500 employed in surgical operations. Many fatalities have occurred from its employment even in dilutions of 1 to 6000, when used in the peritoneal cavity and in other operations on the viscera. Used in this way it frequently produces albuminuria. For these reasons, corrosive sublimate solutions are rarely used by Eclectic surgeons.

Internally, corrosive sublimate has been employed to some extent by Eclectic physicians. Prof. Scudder, who opposed its use chiefly because of the lack of discrimination on the part of physicians, believed that if rightly studied, mercury might fill a valuable place in medicine, but only in chronic cases (*Spec. Med.*, p. 179). He stated that if he were administering it, he would be guided by the small, contracted, elongated, and pointed tongue, of natural or more than usual degree of redness, with prominent papillæ. The urine should be of normal specific gravity, depositing no sediment, the lips of good color, the circulation good, and the skin elastic. He declared the mercurials were contraindicated by a pale mouth and tongue with absence of papillæ, pale and full fauces, tonsils, and palate, shiny red spots over the tongue, pallid, expressionless face, full lips, and increased secretion of saliva.

Prof. H. T. Webster advocates the use of corrosive sublimate 3x (adults) to 6x trituration (children), in 2-grain doses every 2 or 3 hours, for its effects upon the mucous membrane of the colon, the vitality of which has been impaired by long-continued inflammation in *chronic cholera infantum* and *dysentery*. *Ulcers of the colon* and *rectum* form, the evacuations are semipurulent, and convalescence lingering. Here he claims that it lessens the pain and tenesmus, checks the evacuations, and restores normal energy to the parts.

Externally, solutions of corrosive sublimate have been advised as a collyrium (1 to 1000 to 1 to 10,000), in various affections of the eye, as *ophthalmia neonatorum*, *acute catarrhal conjunctivitis*, *phlychtenular conjunctivitis*, *keratitis*, *xerosis*, *trachoma*, *lachrymal blenorrhœa*, and *hypopyon keratitis* (Foltz). *Corneal opacities* have resulted from its local use. Foltz employs $\frac{1}{100}$ to $\frac{1}{60}$ grain doses in *syphilitic eye disorders*. In *ear disorders* he advises internally $\frac{1}{200}$ to $\frac{1}{100}$ grain doses in *syphilitic suppurative otitis media*, and in *internal ear affections*. Washes (1 to 1000 to 1 to 4000) have been recommended in *suppurative otitis media*, *furuncles*, *diffuse otitis media*, and in operations for *mastoid disease*. A wash composed of solutions of borax and corrosive sublimate is asserted signally useful in the treatment of *cracks*, *fissures*, and other *sores* affecting the face, corners of the mouth, behind the ears, etc., in children. The ordinary doses of mercuric chloride range from $\frac{1}{16}$ to $\frac{1}{2}$ grain. The dose preferred by Webster is 2 grains of the 3x trituration for adults, and of the 6x trituration for children.

Yellow Wash (*Lotio Flava*), used as an application to *venereal*, *scrofulous*, and *phagedenic ulcers*, is prepared by adding 2 or 3 grains of corrosive sublimate to a fluid ounce of lime-water. When employed, it should be well shaken and used in the turbid state.

Specific Indications and Uses.—Tongue small, contracted, elongated, and pointed, and of normal color, or of increased redness, and prominent papillæ; urine must be normal in specific gravity and deposit no sediment; circulation good; lips of good color, and skin elastic (Scudder). Impaired mucous membrane of colon and rectum in chronic dysentery and cholera infantum, with ulceration, pain, tenesmus, and semipurulent discharges (Webster).

Mercury and Mercurial Compounds.—HYDRARGYRUM (*U. S. P.*), *Mercury, Quicksilver, Argentum vivum, Hydrargyrum vivum, Mercurius vivus.* Symbol: Hg. Atomic Weight: 199.8. Mercury often occurs in a native state, but it is met with more abundantly in the form of cinnabar, or sulphide of mercury. It is also met with, although rarely, in the form of an amalgam, in combination with gold and silver, also in the form of mercurous chloride, and in certain copper ores. The bulk of mercury comes from Almaden, Spain, and New Almaden California. Idria, in Austria, likewise furnishes it, as well as mines in China, Japan, Peru, etc. The process for obtaining pure mercury from its sulphide is very simple. The cinnabar ore is mixed with half its weight of lime, and then distilled in iron retorts. Mercury distills over, and the sulphide of calcium remains in the retort. At Idria, in Austria, and Almaden, in Spain, the ore is roasted, by which the sulphur is converted into sulphurous acid, and the mercury is volatilized and condensed in suitable apparatus. This is the process most generally employed. The mercury thus obtained is shipped in cylindrical iron flasks, holding about 75 pounds. The *U. S. P.* directs that "mercury should be kept in strong, well-stoppered bottles," and describes it as "a shining, silver-white metal, without odor or taste. It is liquid at the ordinary temperature, and easily divisible into spherical globules; but, when cooled to —39.38° C. (—38.88° F.), it forms a ductile, malleable mass. Specific gravity 13.5584 at 15° C. (59° F.). Insoluble in the ordinary solvents, also in concentrated hydrochloric acid, and, at common temperatures, in sulphuric acid; but it dissolves in the latter, when boiled with it, and is readily and completely soluble in nitric acid. At ordinary temperatures it volatilizes very slowly, more rapidly as the temperature increases, and at 357.25° C. (675.05° F.) it boils, and is completely volatilized, yielding a colorless and very poisonous vapor. When globules of mercury are dropped upon white paper, they should roll about freely, retaining their globular form, and leaving no streaks or traces. It should be perfectly dry and present a bright surface. On boiling 5 Gm. of mercury with 5 Cc. of water and 4.5 Gm. of sodium hyposulphite, in a test-tube, for about 1 minute, the mercury should not lose its luster, and should not acquire more than a slightly yellowish shade (absence of more than slight traces of foreign metals)"—(*U. S. P.*). Mercury, when frozen, has the specific gravity 14.931, and crystallizes in octahedra. Mercury is not altered by being kept under water, but its surface becomes gradually tarnished when exposed to the action of the air, becoming covered with a black oxide, especially when impure. In order to purify it for certain scientific purposes, *e. g.*, the making of barometers and thermometers, it must be redistilled. By this process such impurities as lead and tin remain in the residue. It may also be purified by digesting 100 parts of mercury for 3 days in 5 parts each of water and nitric acid, and subsequently washing it well with distilled water and drying it with bibulous paper; or the mercury is allowed to fall in a fine stream through a high column of diluted nitric acid (L. Meyer). Mercury combines with bromine, chlorine, iodine, oxygen, lead, phosphorus, sulphur, bismuth, arsenic, etc. Gold, silver, tin, cadmium, etc., combine with it when cold, forming alloys called *amalgams.* When heated in open air to near its boiling point, mercury unites with oxygen, producing the red oxide in scales. Mercury does not decompose water; but if boiled in this liquid it absorbs $\frac{1}{500}$ of its weight. Triturated with fat, or agitated for a great length of time with water, it is divided to such a degree as to lose its metallic luster, and then forms a blackish powder, which is the metal in a state of great division (*extinguished* or *killed*).

Two oxides of mercury are known, the higher (HgO) and lower (Hg_2O), and the two corresponding series of salts are known respectively as *mercuric* and *mercurous* compounds. All soluble compounds of mercury are poisonous, acid in reaction, and disagreeably metallic to the taste. White is the usual color of the normal salts, while the basic compounds are yellow. *Mercurous* salts form a white, insoluble precipitate with soluble chlorides (calomel), which turns black upon the addition of ammonia. They precipitate black with caustic potash or caustic soda, mercurous oxide (Hg_2O) being formed. *Mercuric* salts precipitate yellow with caustic potash or caustic soda. They yield a scarlet precipitate, mercuric iodide (HgI_2), if carefully added to solution of potassium iodide, but this precipitate dissolves in excess of the latter reagent.

Mercury, in combination with other substances, may be detected by dissolving the substance in nitric acid; in the solution place a piece of bright copper, and after some time remove it, and rub it with a clean paper, when, if mercury be present, a silvery stain will be found on the copper, which is removed by heat, and may be collected in a minute globule of quicksilver if the volatilization be conducted in a small glass tube. If a strong solution of iodide of potassium be added to a minute portion of any of the salts of mercury, placed on a clean, bright plate of copper, the mercury is immediately deposited in the metallic state, appearing as a silvery stain on the copper; no other metal is deposited by the same means. The solution of mercury previous to the application of this test, must be concentrated by evaporation (A. Morgan, *Pharm. Jour. and Trans.*, XI, 372). Any solid mercury compound may be recognized by mixing it with dry sodium carbonate, placing the mixture into a small, dry glass tube closed at the bottom and heating over a flame. The mercury will then be set free, and will collect at the colder part of the tube in the form of minute globules. In addition to its chemical and pharmaceutical uses, mercury is employed extensively for a variety of purposes, viz., the extraction of gold and silver from their ores by the process known as *amalgamation;* in electrolytic processes; in the manufacture of physical apparatus, such as barometers, thermometers, and mercury air pumps; in the form of amalgams in the making of mirrors, etc

Hydrargyrum Cum Creta (*U. S. P.*), *Mercury with chalk, Æthiops cretaceus.*—"Mercury, thirty-eight grammes (38 Gm.) [1 oz. av., 149 grs.]; clarified honey, ten grammes (10 Gm.) [154 grs.]; prepared chalk, fifty-seven grammes (57 Gm.) [2 ozs. av., 5 grs.]; water, a sufficient quantity to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Weigh the mercury and clarified honey successively into a strong bottle of the capacity of one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏], and add two cubic centimeters (2 Cc.) [33 ♏] of water. Cork the bottle, and shake it for about half an hour at a time, until the aggregate time of shaking reaches 10 hours, or until the globules of mercury are no longer visible under a lens magnifying 4 diameters. The shaking may be more conveniently performed by mechanical means. Rub the prepared chalk with water, in a mortar, to a thick, creamy paste, and, having added the contents of the bottle, washing the last portions in with a little water, triturate the whole to a uniform mixture. Finally dry the mixture, first between ample layers of bibulous paper, and afterward in a capsule, at the ordinary temperature, until it weighs one hundred grammes (100 Gm.) [3 oz. av., 231 grs.]. Then reduce it to a uniform powder, without trituration, and keep it in well-stoppered bottles, protected from light"—(*U. S. P.*). Mr. Francis Hemm (*Amer. Jour. Pharm.*, 1894, p. 391) states that the process is not suitable to the wants of the retail pharmacist.

Several methods have been devised for the preparation of this powder, but the official process above described is probably as efficient as any. It is based upon Squibb's succussion process. The *Br. Pharm.* employs 1 part of mercury and 2 parts of chalk, but excludes the honey. In this preparation the mercury becomes minutely divided, with, perhaps, a conversion of a very little of it into mercurous oxide. It forms a powder of a gray color, which effervesces when diluted acids are added to it. When acetic acid is added, an insoluble precipitate remains, which is dissolved by diluted nitric acid, and consists principally of mercury. The substance under consideration is officially described as "a light gray, rather damp powder, free from grittiness, without odor, and having a slightly sweetish taste. If a portion of the powder be digested with warm acetic acid, the chalk is dissolved with effervescence, leaving a residue of finely divided mercury. The filtrate should not become more than slightly opalescent on the addition of a few drops of hydrochloric acid (limit of mercurous oxide). If another portion of the powder be digested with warm, diluted hydrochloric acid, the filtrate should not be affected by hydrogen sulphide T. S., or by stannous chloride T. S. (absence of mercuric oxide)"—(*U. S. P.*). This salt is used as a laxative, cholagogue, and alterative (many prominent old school physicians deny it these properties), though it produces all the deleterious constitutional effects of mercury, by continued use. It has been used in *biliary derangements, strumous diseases, syphilis in infants, diarrhœa*, etc. The dose for an adult is from 5 to 10 or 20 grains, 1 or 2 times daily; to children from 1 to 3 grains. It may be given alone, in powder, or in combination with rhubarb, bicarbonate of sodium, or other compatible agents. Jonathan Hutchinson regards this as the best preparation of mercury for use in *syphilis*.

Hydrargyrum Cum Magnesia, *Mercury with magnesia*, is used in the same doses and for the same purposes as the preceding compound. It is prepared by triturating together the same as in the above, 1 part of mercury with 2 parts of carbonate of magnesium.

Massa Hydrargyri (*U. S. P.*), *Mass of mercury, Blue mass, Blue pill.*—(See *Massa Hydrargyri.*) Blue pill is used as an alterative, sialagogue, and purgative, and is said to be less irritating than the other mercurials. It has been used in *constipation, biliary derangement, syphilitic diseases*, and wherever it is desirable to bring the system under the influence of mercury. As an alterative, 2 or 3 grains are given daily, or on alternate days, bedtime being usually preferred for their administration. As a purgative and reputed cholagogue, the dose is from 1 to 3 pills, to be taken on going to bed; when thus given, it is customary to administer a dose of castor oil, infusion of senna, or other cathartic on the next morning, as recommended by Abernethy. To cause salivation, from 3 to 5 grains, taken in the morning, and twice this quantity at bedtime, in conjunction with opium to prevent purging, is usually prescribed. Blue pill is frequently associated with other purgatives, as rhubarb, aloes, jalap, colocynth, etc., also with quinine, antimony, or other agents, according to the indications to be fulfilled.

Hydrargyri Cyanidum (*U. S. P.*), *Mercuric cyanide, Hydrargyri cyanuretum*, (*U. S. P.*, 1850), *Cyanuret of mercury, Mercurius cyanatus* (or *borussicus*), *Cyanuretum hydrargyricum, Hydrargyrum borussicum, Cyanide of mercury, Prussiate of mercury, Bicyanide of mercury.* $Hg(CN)_2$ = 251.76.—"Mercuric cyanide should be kept in well-stoppered, dark amber-colored bottles"—(*U. S. P.*). It may be easily prepared by dissolving red precipitate (*Hydrargyrum oxidum rubrum*) in diluted hydrocyanic acid, filtering and evaporating to crystallization, thus: $HgO + 2HCN = H_2O + Hg(CN)_2$. (For its preparation from ferrocyanide of potassium and mercuric sulphate, see directions in *U. S. P.*, 1850.) "Colorless or white, prismatic crystals, odorless, and having a bitter, metallic taste (the salt is exceedingly poisonous); becoming dark-colored on exposure to light. Soluble at 15° C. (59° F.) in 12.8 parts of water, and in 15 parts of alcohol; in 3 parts of boiling water, and in 6 parts of boiling alcohol; very sparingly soluble in ether. When slowly heated in a glass tube, the salt decrepitates, and decomposes into metallic mercury and inflammable cyanogen gas, which burns with a purple flame. On further heating, the blackish residue, consisting of para-cyanogen with globules of metallic mercury, is wholly dissipated. If 1 part of the salt be gently heated with 1 part of iodine in a dry test-tube, it will afford at first a yellow sublimate which afterward becomes red, and above this a sublimate of colorless needle-shaped crystals will be formed. On adding hydrochloric acid to the aqueous solution of the salt, the odor of hydrocyanic acid is evolved. A 5 per cent aqueous solution of the salt should be neutral to litmus paper, and should not yield, on the gradual addition of a few drops of potassium iodide T. S., either a red or a reddish precipitate, soluble in an excess of the precipitant, nor should it yield a white precipitate with silver nitrate T. S. (absence of mercuric chloride"—(*U. S. P.*). Mercuric cyanide is a corrosive poison, combining also the poisonous effects of prussic acid, but has been used in *venereal diseases, humid squamous tetters, porrigo,* and other *cutaneous diseases*, as well as in some *chronic inflammations.* It has also been advocated in *diphtheria.* Its dose is from 1/16 to 1/8 grain, in pill form, with opium and crumb of bread. Chibret claims to have averted meningeal infection from *panophthalmitis* by washing the contents of the eye with a solution of mercuric cyanide (1 to 15,000). An ointment for external application in skin diseases, etc., may be made by rubbing together cyanide of mercury, 16 grains, with lard, 1 ounce, and oil of lemon, 15 drops. Not employed in Eclectic therapeutics.

Hydrargyrum Ammoniatum (*U. S. P.*), *Ammoniated mercury* ($NH_2HgCl = 251.18$), *White precipitate, Mercuric ammonium chloride, Mercur-ammonium chloride, Mercurius præcipitatus albus, Hydrargyrum præcipitatum album, Hydrargyri ammonio-chloridum, Hydrargyrum amido-chloridum, Hydrargyri amidato-bichloridum, Hydrargyrum ammoniato muriaticum, White oxide of mercury, Infusible white precipitate.*—"Corrosive mercuric chloride, in powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; ammonia water, distilled water, each, a sufficient quantity. Dissolve the corrosive mercuric chloride in two thousand cubic centimeters (2000 Cc.) [67 fl℥, 300 ♏] of warm distilled water, filter the solution, and allow it to cool. Pour the filtered liquid gradually, and with constant stirring, into one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏] of ammonia water, taking care that the latter shall remain in slight excess. Collect the precipitate on a filter, and, when the liquid has drained from it as much as possible, wash it with a mixture of four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of distilled water and twenty cubic centimeters (20 Cc.) [325 ♏] of ammonia water. Finally, dry the precipitate between sheets of bibulous paper in a dark place, at a temperature not exceeding 30° C. (86° F.). Keep the product in well-stoppered bottles, protected from light"—(*U. S. P.*). The washing directed in the *U. S. P.* process with ammonia water is for the purpose of removing the ammonium chloride. If water only be used, the washing must be quickly performed, and cold instead of hot water employed. This will prevent the change into a basic salt—*oxy-dimercur-ammonium chloride* ($NH_2HgOHgCl$), a lemon-yellow compound. If iodine and ammoniated mercury be triturated together, nitrogen iodide (iodamine), will gradually form and after a time the mixture "puffs up." But should iodine and alcohol both be present a dangerous explosion results.

Ammoniated mercury is officially described as occurring in "white, pulverulent pieces, or a white, amorphous powder, without odor, and having an earthy, afterward styptic and metallic taste. Permanent in the air. Almost insoluble in water or in alcohol. By prolonged washing with water, it is gradually decomposed, assuming a yellow color, and becoming converted into a basic salt. Readily soluble in warm hydrochloric, nitric, or acetic acid, and in a cold solution of ammonium carbonate. Also completely soluble in a cold solution of sodium hyposulphite, with the evolution of ammonia. When this solution is heated for a short time, red mercuric sulphide is separated, which, on protracted boiling, turns black. At a temperature below a red heat the salt is decomposed without fusion, and at a red heat it is wholly volatilized. When heated with potassium or sodium hydrate T.S., the salt turns yellow, and evolves vapor of ammonia. The solution of the salt in diluted nitric acid, gives with potassium iodide T.S. a red precipitate, with silver nitrate T.S. a white one. The salt should be soluble in hydrochloric acid without effervescence (absence of carbonate), and without leaving a residue (absence of mercurous salt). Its solution in acetic acid should not be rendered turbid by diluted sulphuric acid (absence of lead)"—(*U. S. P.*). The salt, when heated to a temperature below a red heat, forms ammonia, nitrogen, calomel, and water. Caustic ammonia does not alter it. White precipitate is used externally only, in *herpes, impetigo, porrigo,* and other *affections of the skin,* and in *ophthalmia tarsi.* One part of the salt to 12 parts of lard, or simple cerate, forms an ointment for application in the above-named maladies. Rarely employed in Eclectic practice, but is a constituent in the popular old Eclectic Ophthalmic Balsam.

Mercuric-diammonium chloride ($[NH_3]_2HgCl_2$), *Fusible white precipitate.*—This compound was at one time confused with ammoniated mercury (NH_2HgCl). It is produced by boiling the latter with ammonium chloride solution, or by precipitating mercuric nitrate with ammonium chloride and potassium carbonate. It differs from ammoniated mercury in *fusing* at a temperature less than redness.

Mercurius Solubilis Hahnemanni, *Soluble mercury of Hahnemann, Ammonio-nitrate of mercury, Hydrargyrum oxydulatum nigrum, Hydrargyrum oxydulatum nitricum ammoniatum.*—This compound is of a variable composition; according to Mitscherlich, it is trimercuroso-ammonium nitrate ($Hg_3HN.NO_3)_2.2H_2O$. This Hahnemannian preparation is a velvety black powder, with a slightly metallic taste. It is sublimable without decomposition and contains no globules of metallic mercury. Hahnemann discarded this preparation in favor of Mercurius vivus (*Am. Hom. Pharm.*, which see for methods of preparation).

Hydrargyri Subsulphas Flavus (*U. S. P.*), *Yellow mercuric subsulphate* ($Hg(HgO)_2SO_4$ = 727.14), *Basic mercuric sulphate, Turpeth mineral, Yellow subsulphate of mercury, Subsulphate of mercury, Tribasic sulphate of the oxide of mercury, Hydrargyri oxidum sulphuricum, Hydrargyri subsulphas, Mercurius emeticus flavus, Turpethum minerale, Hydrargyrum sulphuricum flavum, Sulphas hydrargyricus flavus, Hydrargyri sulphas flavus* (*U. S. P.*, 1870), *Oxy-mercuric sulphate.* This preparation may be obtained by triturating mercuric sulphate with hot water; the yellow powder resulting therefrom is to be well washed with distilled water, and then dried. The *U. S. P.* process first prepares the mercuric sulphate, and afterward the subsulphate, as follows: "Mercury, one hundred grammes (100 Gm.) [2 ozs. av., 231 grs.]; sulphuric acid, thirty cubic centimeters (30 Cc.) [487 ♏]; nitric acid, twenty-five cubic centimeters (25 Cc.) [406 ♏]; distilled water, a sufficient quantity. Upon the mercury, contained in a capacious flask, pour the sulphuric acid, previously mixed with fifteen cubic centimeters (15 Cc.) [243 ♏] of distilled water, then add, very gradually, the nitric acid, previously mixed with twenty-five cubic centimeters (25 Cc.) [406 ♏] of distilled water, and digest at a gentle heat until reddish fumes are no longer given off. Transfer the mixture to a porcelain capsule, and heat it on a sand-bath under a hood or in the open air, with frequent stirring, until a dry, white mass remains. Reduce this to a fine powder, and add it in small portions at a time, with constant stirring, to two thousand cubic centimeters (2000 Cc.) [67 fl℥, 301 ♏] of boiling distilled water. When all has been added, continue the boiling for 10 minutes; then allow the mixture to settle, decant the supernatant liquid, transfer the precipitate to a strainer, wash it with warm distilled water, until the washings no longer have an acid reaction, and dry it in a moderately warm place. Keep the product in well-stoppered bottles, protected from the light"—(*U. S. P.*). Boiling the mercury with sulphuric acid and hastening the process by nitric acid, results in the formation of mercuric sulphate. When this is added to boiling water, the basic or oxysulphate precipitates, while a corresponding quantity of sulphuric acid goes into solution. The temperature and quantity of the water influences the yield. About 75 per cent is realized. "A heavy, lemon-yellow powder, odorless and almost tasteless; permanent in the air. Soluble in about 2000 parts of water at 15° C. (59° F.), and in 600 parts of boiling water; insoluble in alcohol; readily soluble in nitric or hydrochloric acid. When heated, the salt turns red, becoming yellow again on cooling. At a red heat it is volatilized, evolving vapors of mercury and of sulphur dioxide, and leaving no residue. A solution of the salt in nitric or hydrochloric acid, diluted with water, gives with potassium iodide T.S. a red precipitate, and with barium chloride T.S. a white one. The salt should be completely soluble, in 10 parts of hydrochloric acid (absence of mercurous salt or of lead)"—(*U. S. P.*). Its aqueous solution is colorless. Its specific gravity is 6.444. Boiled with caustic soda or potash, a red precipitate is thrown down, while the solution contains sulphate of potassium. It was once employed as an emetic, in doses of from 3 to 5 grains, in *swelled testicle*, its nauseating and emetic action being supposed to promote absorption; it has also been recommended in *membranous croup*. In doses of from ¼ grain to ½ grain per day, it has been given as an alterative. One grain mixed with 5 or 6 grains of some mild powder, has been used as an errhine in *ophthalmic affections, chronic catarrh, cerebral difficulties*, etc.; it excites sneezing. One part of turpeth mineral triturated with 100 or 125 parts of lard, forms an ointment which has been used in frictions, in cases of *herpes, slightly inflammatory tetters*, etc. Like other mercurials, this is apt to cause salivation; and in improper doses acts as a violent poison. It is seldom used at the present day, and is even condemned as dangerous and superfluous by some of the old school authors.

HYDRARGYRI PERSULPHAS ($HgSO_4$). *Mercuric sulphate, Persulphate of mercury, Sulphate of mercury, Normal mercuric sulphate, Sulfas mercuricus, Hydrargyrum sulphuricum, Mercuricus vitriolatus.*—This salt is prepared by placing in a porcelain capsule, quicksilver, 10 ounces (av.), in 6 fluid ounces (Imp.), of commercial oil of vitriol; apply heat and constantly stir with a porcelain spatula until effervescence ceases, and nothing remains but a white and dry crystalline salt (Dub.). This accords with the *Br. Pharm.* process. The salt is a white, opaque solid, which becomes orange-colored at a dull red heat, but white on cooling; at a full red heat it is decomposed. Water decomposes it, producing turpeth mineral (which see), and a soluble persalt. It is not used as a medicine, but is employed in the manufacture of calomel, corrosive sublimate, and subsulphate (oxysulphate) of mercury.

HYDRARGYRI DIPERNITRAS, *Basic mercuric nitrate, Bibasic nitrate of mercury.*—Prepared by boiling mercury in strong nitric acid until the liquid, when diluted with water, ceases to yield a white precipitate (calomel) on the addition of a solution of common salt. Then concentrate until it has the sp. gr. 3.47. This liquor has an acrid, metallic taste, and colors the skin, when exposed to light, purplish red. By careful evaporation over concentrated sulphuric acid, crystals of the normal nitrate $(Hg[NO_3]_2)_2.H_2O$, are formed. When evaporated to crystallization, the bibasic nitrate $Hg_2O(NO_3)_2+2H_2O$, separates; if the crystals be washed with cold water, as long as it gives an acid reaction, a heavy yellow powder is obtained, which is a more basic nitrate of mercury ($Hg_8O_4[NO_3]_4$); this, when boiled in water, yields a brick-red powder, which is still more basic ($Hg_8O_5[NO_3]_2$). The bibasic nitrate of mercury is acrid and caustic, more so than the nitrate ($Hg[NO_3]_2$), and exerts an influence upon the system similar to that of corrosive sublimate, into which salt it becomes converted by the action of the alkaline chlorides in the alimentary canal. It is now seldom used.

HYDRARGYRI PHOSPHAS, *Mercurous phosphate, Phosphate of mercury, Protophosphate of mercury.*—This salt is made by triturating 8 parts of dry mercurous nitrate, in a porcelain mortar, with 16 parts of distilled water, in which is mixed 1 part of nitric acid, sp. gr. 1.20; to this is added about 60 parts of pure water, and the whole gently warmed until dissolved, filtered if necessary, the clear solution diluted with 8 times its weight of pure water, and then treated with a solution of crystallized sodium phosphate, so long as a precipitate is formed. Wash this carefully with water until it no longer gives an acid reaction, dry with a gentle heat, and keep in a closed bottle excluded from the light. It is a white, fine, crystalline, odorless, and tasteless powder. Heated it fuses, evolving oxygen and metallic mercury, and leaving a colorless, glacial mass, which is the phosphoric acid with a trifling quantity of mercury. It is insoluble in water, but is completely dissolved in nitric acid by the aid of heat. It has been highly spoken of as an efficient remedy in *secondary syphilis*, in doses of ½ grain or 1 grain in pill form. Phosphate of mercury 4½ grains, opium 3 grains, tartar emetic ½ grain, formed into 9 pills, with a sufficient quantity of conserve of roses, has been used with asserted advantage. One pill to be taken every night and morning.

HYDRARGYRI SULPHIDUM RUBRUM (HgS. Molecular weight: 231.78), *Red mercuric sulphide, Hydrargyri sulphuretum rubrum* (*U. S. P.*, 1870), *Sulphuret of mercury*; also known as [illegible] *lized*, or *Red sulphuret of mercury, Cinnabar, Vermilion, Paris red, Bisulphuret of mercury, Sulfuretum hydrargyricum, Hydrargyrum sulfuratum rubrum, Cinnabaris, Minium.*—This compound is found in large quantity in nature, and is the chief source from which mercury is prepared. The *U. S. P.* (1870), directed for its preparation: Gradually add to 8 troy ounces of melted sulphur, 40 troy ounces of mercury; stir continually, and heat until the mass commences to swell, then remove from the fire and cover the vessel closely to prevent its taking fire, and when cold, powder the mass and sublime it. Vermilion may also be prepared in the wet way by agitating mercury with a solution of sulphur in caustic potash. (For the details of Wittstein's process, see this Dispensatory, last edition.) When prepared by the first process, cinnabar forms in dark reddish-brown masses, composed of crystalline needles, which furnish a powder of a beautiful scarlet-red color. Prepared by the latter method, a fiery-red, soft, heavy powder is obtained, distinguishable from that prepared by sublimation, especially by its bright color. Cinnabar is odorless, tasteless, insoluble in water, alcohol, cold nitric acid (sp. gr. 1.2), cold hydrochloric acid, diluted sulphuric acid, and acetic acid. Hot nitric acid decomposes it, precipitating a portion of the sulphur, and converting the other portion into sulphuric acid, sulphate and nitrate of mercury; fuming nitric acid totally converts it into mercuric sulphate. Nitro-hydrochloric acid dissolves it with decomposition, sulphur being liberated and mercuric chloride and sulphuric acid being formed. Exposed to the light, it gradually acquires on the surface a gray tint, arising from the separation of the mercury and sulphur, both of which in their free state remain in admixture with the compound. Heated in a test-tube it acquires nearly a black color, and sublimes without fusing, to a shining iron-gray mass, becoming red on trituration; any adulterations in the cinnabar, as red lead, colcothar, chalk, or brick-dust, remain behind. If this residue yields on charcoal before the blow-pipe a bead of lead, red lead is present; but if it undergoes no change, either brick-dust or colcothar is present. If dragon's blood be present, it will color alcohol in which the cinnabar has been shaken. If the addition of a mineral acid causes effervescence, chalk is present. If cinnabar be boiled with acetic acid, iodide of potassium will give a yellow precipitate of iodide of lead in the filtrate, if red lead be present; and hydrogen sulphide a black precipitate. If it completely volatilizes upon heat *American vermilion* (basic lead chromate), is absent.

Cinnabar was formerly exhibited internally in *diseases of the skin, gout, chronic rheumatism*, and *worms*, in doses of from 10 to 20 grains, in pills, or incorporated in an electuary. It is at the present day rarely, if ever, used internally. In *syphilitic ulcerations* of the air passages, and in several *chronic cutaneous diseases*, it has been used as a fumigating agent, about ½ drachm being placed upon an iron plate heated to redness, and the vapors which are evolved being inhaled or directed upon the diseased parts. Owing to the irritating nature of the sulphurous vapor, the suboxide of mercury is preferred to cinnabar for fumigation.

HYDRARGYRI SULPHIDUM NIGRUM, *Black sulphide of mercury, Æthiops mineral, Hydrargyri sulphuretum nigrum, Black sulphuret of mercury, Amorphous sulphuret of mercury, Ethiops mineral, Hydrargyri sulphuretum cum sulphure*, etc.—It is procured by rubbing together, in a porcelain mortar, equal parts of mercury and washed flowers of sulphur (with the occasional addition of a few drops of water to prevent any dust from ascending), until they form a grayish-black powder, and neither mercury nor sulphur is visible with a magnifying glass; the labor is greatly diminished by employing diluted sulphide of ammonium instead of water. It is also formed by precipitating a solution of a mercuric salt with an excess of hydrogen sulphide gas. Black sulphide of mercury is a heavy, somewhat grayish-black, inodorous, tasteless, insoluble, amorphous powder, insoluble in water, hydrochloric acid, and diluted nitric acid, the latter taking up at the most only small traces of uncombined mercury. Heated in a test-tube, it first loses sulphur, which deposits on the cool portion of the tube, and partly combines with the oxygen of the air present, to sulphurous acid; then sulphide of mercury sublimes, and deposits itself as an iron-gray mass, becoming red when rubbed. If there is a residue, either the mercury or sulphur was impure, or charcoal may have been added. In composition it is undoubtedly black amorphous mercuric sulphide mixed with sulphur in excess.

Ethiops mineral was formerly employed as a diaphoretic, alterative, and vermifuge; in doses of from 5 grains to ½ drachm, 2 or 3 times a day, it has been used in *scrofulous* and *skin diseases*. It acts very mildly, and as stated by Dr. Duncan, may be continued for a considerable length of time in doses of several drachms without producing scarcely any sensible effect. It is seldom used, except in the form of ointment as an application to *itch, tetter*, and some other *cutaneous affections*.

HYDRARGYRI PROTONITRAS ($Hg_2[NO_3]_2$), *Protonitrate of mercury, Mercurous nitrate, Nitrate of mercury, Neutral nitrate of mercury.*—This salt is obtained by digesting excess of mercury in cold nitric acid until short prismatic crystals are formed. Nitrate of mercury may be distinguished from other nitrates by the white precipitate of calomel formed when it is dissolved in water and mixed with a soluble chloride, *e. g.*, sodium chloride. Nitrate of mercury is rarely used as a medicine, on account of its tendency to decompose. A solution of mercurous nitrate is one of the first steps in the preparation of citrine ointment. The composition of the salt after having been acted upon by the hot grease, is problematical, a portion of it probably being converted into mercuric nitrate, which change is accelerated by the free nitric acid. An ounce of the salt dissolved in ½ pint of distilled water, acidulated with 70 grains of nitric acid, and the solution made of sp. gr. 1.100, has been used as a mild caustic in *venereal ulcerations* and *growths*. Two parts of the salt to 50 of the lard, form an ointment which has been used in *lepra, psoriasis*, etc. In Eclectic practice brown citrine ointment has been used by Prof. Scudder and others in *chronic eczema, sycosis, barber's itch*, and some cases of *pruritis* (*Spec. Med.*)

HYDRARGYRI ET QUININÆ CHLORIDUM, *Chloride of mercury and quinine.*—Take 1 part of the bichloride of mercury, and 3 parts of hydrochlorate of quinine. Dissolve each separately in the least possible quantity of water, mix the solutions, filter, and dry the precipitate by a gentle heat. This has been used in *obstinate cutaneous diseases*, and in cases where it is desirable to produce the influence of quinine and mercury. The dose is from ½ grain to 1 grain, every 4 or 6 hours, in pill form with opium and crumb of bread.

HYDRARGYRI BORAS, *Borate of mercury.*—Rub together 11 parts of calomel and 13 parts of biborate of sodium, for about 15 minutes, then add small quantities of water from time to time, continuing the trituration throughout; then filter, wash the precipitate till the washings are tasteless, and dry. At one time recommended as a substitute for calomel, in doses of 2 grains daily, increasing gradually.

HYDRARGYRI BROMIDUM, *Mercurous bromide* (Hg_2Br_2), *Bromide of mercury.*—To a weak solution of mercurous nitrate add a solution of bromide of potassium so long as a precipitate falls· filter, wash, and dry by a gentle heat. It forms a white powder resembling calomel. This is given for the same purpose as the iodide of mercury, in doses of 1 grain per day, gradually increased. A *bibromide of mercury* (mercuric bromide [$HgBr_2$]), is made by mixing together equal parts of mercury and bromine; sublime the white powder formed by the mixture. It is white, soluble in water, alcohol, or ether; its solution gives a red or yellow precipitate with alkalies, and nitric or sulphuric acid decomposes it with evolution of vapors of bromine. It is a powerful poison, and has been recommended in *syphilis*, *lepra*, etc., in doses of $\frac{1}{20}$ grain, gradually increased to ¼ grain. It may be given in pill.

HYDRARGYRI ACETAS, *Acetate of mercury.*—It forms in rectangular tables and plates, having their angles frequently truncated. They are white, but become black on exposure to light are inodorous, of an acrid, metallic taste, and almost insoluble in water or alcohol. Heat decomposes it. It has been occasionally used in *syphilitic affections*, in doses of from 1 to 5 grains. One or 2 grains dissolved in water, has been used as a wash in obstinate cutaneous affections. This salt is seldom used.

HYDRARGYRI BENZOAS ($Hg[C_6H_5COO]_2+H_2O$), *Mercuric benzoate.*—A crystalline, white powder, tasteless and odorless, and formed by mutual decomposition between a mercuric compound and an alkali benzoate. It dissolves easily in alcohol, solution of common salt, but sparingly in water. It may be used by injection (1 in 1000 or 1 in 2000), into the urethra for *gonorrhœa*, or it may be hypodermatically administered. For the first purpose it is added to an equal amount of sodium chloride, and for subcutaneous uses, combined with cocaine and sodium chloride (Stukowenkow).

HYDRARGYRI CARBOLAS, *Mercuric carbolate* ($Hg[C_6H_5O]_2$), *Mercuric phenylate* (*phenate*), *Hydrargyrum phenylicum*, *Mercuric diphenate* (Merck's).—Caustic potash 56 parts, carbolic acid (liquefied), 188 parts. Dissolve by aid of heat in just enough alcohol to effect solution, and add, with continual stirring, corrosive sublimate (135 parts), dissolved in alcohol. Evaporate. The yellowish precipitate becomes nearly colorless as dryness approaches. Wash with water slightly acidulated with acetic acid, and crystallize from boiling alcohol. This compound forms stable, needle crystals, colorless, soluble in hot alcohol, alcoholic ether, ether, and glacial acetic acid; not soluble in alcohol and water. Reputed antisyphilitic. Dose, ⅛ to ¼ grain, twice a day. An inferior, less stable preparation, known also as mercuric phenate, is *basic mercuric phenate* ($HgOHOC_6H_5$) (Gamberini's).

HYDRARGYRUM BICHLORATUM CARBAMIDATUM SOLUTUM, *Solution of mercuric chloride and urea.*—This preparation quickly undergoes change, and is generally directed to be prepared extemporaneously. Dissolve mercuric chloride (1 Gm.) in hot water (100 Cc.); when cold, add urea (5 Gm.). Filter. Dose, 1 Cc., equal to ⅙ grain, once a day, hypodermatically, for *syphilis*.

HYDRARGYRUM FORMAMIDATUM SOLUTUM, *Solution of mercuric formamide.*—This is prepared by dissolving the oxide, freshly precipitated, from 10 Gm. of mercuric chloride, in enough formamide to dissolve it, and bringing the measure to 1000 Cc. with distilled water. Dose, 1 Cc. (16 minims), equal to ⅙ grain, hypodermatically, in *syphilis*.

HYDRARGYRUM PEPTONATUM SOLUTUM, *Solution of mercuric peptonate.*—Prepared by mixing aqueous solutions of mercuric chloride and dry peptone, filtering, and adding sodium chloride to the solution, and bringing the whole to the desired strength with water. The dose, hypodermatically, is 1 Cc., equal to ⅙ grain of mercuric chloride. *Gluten peptone sublimate*, in 1 per cent solution (25 per cent mercuric chloride), has been recommended as a substitute.

HYDRARGYRUM TANNICUM OXYDULATUM, *Mercurous tannate*, *Hydrargyri tannas.*—This was introduced by Lustgarten as possessing advantages over other mercurials in *syphilis*. It is prepared by precipitating freshly prepared mercurous nitrate with a strong solution of tannic acid. Three to 5-grain doses are administered daily until 150 grains have been taken. It is without taste or odor, insoluble in the common solvents, and yields its tannin to alcohol or water. It contains about 50 per cent of mercury.

HYDRARGYRI SALICYLAS, *Neutral*, or *Secondary mercuric salicylate.*—From mercuric chloride (27 parts), precipitate oxide of mercury, wash it well, and rub with water to a soft magma. Add salicylic acid (15 parts), heat on a water-bath, and shake frequently until the yellowness changes to snow-white. Wash the resulting salicylate with warm water to remove all free acid, drain, and dry. It forms an odorless, tasteless, non-crystalline salt, soluble in solution of sodium chloride, and in soda solution (a double salt forming), but not soluble in water or alcohol. It is administered in pill, the dose being ⅛ to ½ grain, three times a day, the dose being gradually increased to 1 to 1½ grains. Preferred by Aurajo and others, over other mercurials as an antiseptic and antisyphilitic.

HYDRARGYRI ET ZINCI CYANIDUM, *Mercuric and zinc cyanide* ($Zn_4Hg[CN]_{10}$).—An insoluble white powder, lauded by Lister as a non-poisonous antiseptic.

HYDRARGYRI OXYCYANIDUM, *Oxycyanide of mercury* ($Hg_2O[CN]_2$).—A solution in water (1 to 1500) of this compound is recommended as an antiseptic in ocular therapeutics.

Hydrargyri Pyroboras, *Mercury pyroborate* (HgB_4O_7).—An insoluble, non-crystalline, brown powder, recommended as a topical agent in *syphilitic* and other *ulcerations*.

Among other mercurials, the following are newer introductions for use in *syphilis: Thymolsulphate of mercury* ($[(C_{10}H_{13}O)Hg.Hg]_2SO_4$); *Thymolacetate of mercury* ($[C_{10}H_{13}O].Hg.Hg.C_2H_3O_2$); *Thymolnitrate of mercury* ($[C_{10}H_{13}O]Hg.HgNO_3$); *Naphtholate of mercury* (mercury 30.8 per cent), a yellow powder; and *Tribromphenol acetate of mercury*. *Hydrargyri sulphocyanas* or *Sulphocyanate of mercury* (sulphocyanide formerly), is employed in making the trinket, "*Pharaoh's Serpent.*"

HYDRARGYRI CHLORIDUM MITE (U. S. P.)—MILD MERCUROUS CHLORIDE.

"Obtained in the form of powder by the rapid condensation of the vapor of mercurous chloride. Mild mercurous chloride should be kept in dark amber-colored bottles"—(*U. S. P.*).

Formula: Hg_2Cl_2. Molecular Weight: 470.34.

Synonyms: *Calomel, Mild chloride of mercury, Hydrargyri subchloridum, Hydrargyri chloridum, Hydrargyrum chloratum dulce, Hydrargyrum muriaticum dulce, Chloruretum hydrargyrosum, Chloretum hydrargyrosum, Mercurius dulcis, Calomelas, Mercurous chloride, Subchloride (Submuriate) of mercury, Protochloride of mercury.*

Preparation.—Calomel is never prepared by the pharmacist. "Take of persulphate of mercury 10 ounces (av.), mercury 7 ounces (av.), chloride of sodium, dried, 5 ounces (av.), boiling distilled water a sufficiency. Moisten the persulphate of mercury with some of the water, and rub it and the mercury together until globules are no longer visible; add the chloride of sodium, and thoroughly mix the whole by continued trituration. Sublime by a suitable apparatus into a chamber of such size that the calomel, instead of adhering to its sides as a crystalline crust, shall fall as a fine powder on its floor. Wash this powder with boiling distilled water until the washings cease to be darkened by a drop of sulphhydrate of ammonium. Finally, dry at a temperature not exceeding 100° C. (212° F.)"—(*Br. Pharm.*, 1885).

In this process double decomposition takes place, as follows: $2NaCl+Hg_2SO_4=Na_2SO_4+Hg_2Cl_2$. Mercurous chloride sublimes, and if passed into a small receiver crystalline crusts or masses are obtained; if in a large receiver, as directed, a fine crystalline powder results. A still softer or finer powder may be obtained if a jet of steam be allowed to pass into the receiver, or, according to Soubeiran, if a blast of cold air be admitted. The best calomel is that produced by aid of the steam vapor, as this agent at the same time dissolves out any mercuric chloride which may be present, due to possible admixture of the mercurous sulphate employed with mercuric sulphate.

Description and Tests.—"A white, impalpable powder, becoming yellowish-white on being triturated with strong pressure, and showing only small, isolated crystals under a magnifying power of 100 diameters. It is odorless and tasteless, and permanent in the air. Insoluble in water, alcohol, or ether, and also in cold dilute acids. When strongly heated, it is wholly volatilized, without melting. In contact with calcium hydrate T.S., or with solutions of alkali hydrates, or with ammonia water the salt is blackened. When heated with dried sodium carbonate in a dry glass tube, it yields metallic mercury"—(*U. S. P.*). Calomel is incompatible with the alkalies, lime-water, and sulphide of potassium, which blacken it, forming the suboxide or black oxide of mercury (Hg_2O); also with antimony, copper, iron, lead, etc. It has been stated that if calomel be given at the same time with either common salt, nitrohydrochloric acid, or the alkaline chlorides, it may give rise to serious, if not fatal results. This is due to the calomel being soluble in aqueous solutions of alkali chlorides, especially in solution of chloride of ammonium at 40° to 50° C. (104° to 122° F.). When warmed for several hours to this temperature, 100 parts of sodium chloride, dissolved in 833 parts of water, form 0.33 parts of corrosive sublimate from 25 parts of calomel, (equal to 1.2 per cent) (Mialke, in A. M. Comey, *Dict. of Chem. Solubilities*, 1896). Likewise, calomel should never be given in connection with articles containing hydrocyanic acid, either in a free or latent condition, as it may be converted into the bicyanide of mercury, and mercuric chloride. The alkaline earths and carbonates (calcium carbonate excepted), and citric acid, convert it partially into corrosive sublimate. The same is effected when it is rubbed with sugar contaminated with lime, but not when lime-free. Calomel of a gray color contains free mercury. If cold water which has been agitated with it for some time gives, with sulphide of ammonium, a black precipitate, it contains corrosive sublimate. Ether, in this case, readily dissolves out the corrosive sublimate. In testing calomel for corrosive sublimate, it must not be treated with boiling water, since calomel is slowly decomposed with boiling water, corrosive sublimate being formed. After 1 hour's boiling of calomel with 20 Cc. of water, 2 Mgr. of corrosive sublimate were in solution (A. M. Comey, see above reference). "If 1 Gm. of the salt be shaken with 10 Cc. of water or alcohol, the respective filtrates should not be affected by hydrogen sulphide T.S., or silver nitrate T.S. (absence of mercuric chloride), nor should they leave any residue on evaporation (absence of other soluble impurities). On heating a portion of the salt, in a test-tube, with potassium or sodium hydrate T.S., it should not evolve the odor of ammonia; and if another portion be shaken with acetic acid, the filtrate should not be affected by hydrogen sulphide T.S., nor by silver nitrate T.S. (distinction from and absence of ammoniated mercury)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—(See remarks under *Hydrargyri Chloridum Corrosivum.*) Internally, calomel acts as a *purgative*, in doses of from 2 to 5 grains; on account of its uncertainty of action, it is usually given in combination with other purgatives, as jalap, senna, scammony, colocynth, etc. It has been much used as a purgative in *torpid states of the bowels*, in *torpor of the liver*, *deranged conditions of the biliary organs*, *jaundice*, some *febrile disorders*, *worms*, *dropsy*, and various *disordered conditions of the alimentary canal unaccompanied by inflammation*. Large doses of calomel, as 20 to 40 grains, every half hour or hour, are said to act as a *sedative*, and have been administered in *yellow fever*, *dysentery*, *Asiatic cholera*, *diseases of the liver*, etc. As an *alterative*, it has been exhibited in *chronic cutaneous diseases*, *glandular affections*, *hepatitis*, etc., in doses of from ½ to 1 grain every 1 or 2 days, as circumstances may require, with occasional doses of castor oil, or some mild saline laxative to keep the bowels free. As a *sialagogue*, it has been used in various forms of disease, as all *febrile*, *inflammatory*, *syphilitic*, and *chronic visceral diseases*, etc., in doses of 1, 2, or 3 grains, every 3 or 4 hours, usually combined with Dover's powder, or some other opiate, when there is no condition of the nervous system contraindicating the use of narcotics. Very few, however, use it at the present day for its sialagogue effects; and it may be said the number who use it for the preceding affections is becoming less and less as the years pass by. Calomel increases the action of the secreting organs; when its use is continued for a long time, according to the susceptibility of the patient's system, it produces the constitutional effects of mercury. Sometimes it produces nausea, griping, and great faintness. Large doses are always dangerous, as the agent is very uncertain in its action at all times; I have known as small a dose as 3 grains to cause phagedenic ulceration of the face and jaw (King). This kind of ulceration is by no means uncommon among patients under mercurial treatment. Combined with other remedies, calomel is said to increase their effects—hence, those who use it have combined it with antimonials to promote *diaphoresis;* and with squills to favor diuresis in *dropsical affections.* Many judicious physicians of the regular school now condemn the employment of calomel in acute hepatitis, hepatic cirrhosis, hepatic abscess, acute yellow atrophy of the liver, jaundice from gall-stones, yellow fever, remittent fever, many acute inflammatory disorders, such as pneumonia, pleurisy, endocarditis, pericarditis, peritonitis, meningitis, etc. Notwithstanding that it has been shown to actually lessen the biliary discharge, it is still considerably used in so-called "*bilious attacks.*" Externally, it has been used as a snuff combined with other substances, in *nasal polypus*, and *diseases of the Schneiderian membrane;* and blown into the eye in *chronic rheumatic* and *scrofulous ophthalmia*, and *spots on the cornea*. One part of calomel to 8 parts of lard, is said to form an excellent ointment in *porrigo favosa*, *herpes*, *impetigo*, *lepra*, *psoriasis*, and other *chronic skin diseases*. *Condylomata* are treated among other ways, by dusting them with calomel; likewise *herpes* and *irritation around the genitalia;* also used to diminish *exuberant granulations*, and it forms an ingredient of some cancer powders. One drachm of calomel added to a pint of lime-water forms the BLACK WASH (*Lotio Nigra*), which is a favorite application with some old school physicians, to all *syphilitic ulcers*. Sometimes the wash is made 2 or 4 times the strength of the above. For further remarks, see any standard "regular" materia medica.

In the Eclectic school of medicine calomel in minute doses has been recommended by Webster (*Dynam. Therap.*), in *lethargic states* characterized chiefly by a long-continued tired feeling, associated with marked diurnal drowsiness and nocturnal wakefulness. The patient, though apparently in good health, awakens tired in the morning, is averse to exertion of any kind, and retires at night still tired, and the drowsiness is of such a pronounced character as to require much effort to remain awake. Such a condition, he states, often follows malarial infection, though he does not consider that it depends upon such a cause. The trouble must be idiopathic and not dependent upon "sympathetic local trouble." The dose is 2 or 3 grains of the 3 x trituration, 3 times a day.

Calomel forms an excellent topical application in *corneal ulcer* of a sluggish character. It should be freely dusted upon the lesions. *Phlyctenular conjunctivitis* may be similarly treated. Foltz warns us that it should not be used when corneal ulcers are forming, or when they are enlarging. He uses calomel to provoke irritative action in *superficial corneal opacities*, thereby inducing reparative action. Calomel forms a good application in *syphilitic chancre* and *chancroid*, particularly the latter. Prof. J. M. Scudder employed it in such lesions when the sores were pale and coated with a pultaceous secretion. Dose of calomel for specific effects, 2 or 3 grains of the 3 x trituration, 3 times a day. Not employed by Eclectics as a purgative. The use of calomel internally or locally is contraindicated while taking iodide of potassium, lest it be converted into iodide and iodate of mercury.

Specific Indications and Uses.—(See under *Hydrargyri Chloridum Corrosivum* for general indications for the mercurials.) Tired, apathetic, or lethargic condition, with marked drowsiness in daytime, and sleeplessness at night. Locally, to sluggish corneal ulcers and pale chancroids covered with a pultaceous secretion.

HYDRARGYRI IODIDUM RUBRUM (U. S. P.)—RED MERCURIC IODIDE.

FORMULA: HgI_2. MOLECULAR WEIGHT: 452.86.

SYNONYMS: *Biniodide of mercury, Red iodide of mercury, Hydrargyri periodidum, Periodide of mercury, Deutiodide of mercury, Hydrargyri iodidi rubrum, Mercuric iodide, Ioduretum hydrargyricum, Deutoioduretum hydrargyri, Biniodidum hydrargyri, Mercurius iodatus ruber.*

Preparation.—"Corrosive mercuric chloride, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; potassium iodide, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; distilled water, a sufficient quantity. Dissolve the corrosive mercuric chloride and the potassium iodide, each, in eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of distilled water, and filter the solutions separately. Pour both solutions, simultaneously and in a thin stream, under constant and very active stirring, into two thousand cubic centimeters (2000 Cc.) [67 fl℥, 301 ♏] of distilled water. When the precipitate has subsided, decant the supernatant liquid, collect the precipitate on a filter, and wash it with cold distilled water, until the washings give not more than a slight opalescence with silver nitrate test solution. Finally, dry it in a dark place, between sheets of bibulous paper, at a temperature not exceeding 40° C. (104° F.). Keep the product in well-stoppered bottles, protected from light"—(*U. S. P.*).

Description and Tests.—Mercuric iodide (HgI_2) is remarkable for its being *dimorphous, i. e.*, occurring in two different physical modifications. The salt, as obtained by the official process (precipitation), is scarlet red; this is the stable modification, which may be obtained also in quadratic crystals by crystallization from hot alcohol and other solvents. Heat converts this salt into the unstable, yellow modification which assumes the form of rhombic prisms when the salt is subjected to sublimation. These crystals turn red again upon cooling, but should they retain their yellow color upon cooling, friction with a hard body will suddenly restore it. The official salt is described as "a scarlet-red, amorphous powder, odorless and tasteless; permanent in the air. Almost insoluble in water, but soluble in 130 parts of alcohol at 15° C. (59° F.), and in 15 parts of boiling alcohol; also soluble in a solution of potassium iodide, or of mercuric chloride, and in a solution of sodium hyposulphite. When heated to about 150° C. (302° F.), the salt becomes yellow, but again assumes a red color on cooling; at 238° C. (400.4° F.), it fuses to a dark yellow liquid, which, on cooling, forms a yellow, crystalline mass, and at higher temperatures, volatilizes without decomposition, leaving no residue. On heating the salt with potassium or sodium hydrate T.S., and adding a little sugar of milk, metallic mercury is precipitated. When it is heated with sulphuric acid and a little manganese dioxide, vapor of iodine is evolved. If the salt be dissolved in hot alcohol, the solution, after cooling, should be colorless; and when this solution is diluted with an equal volume of water, it should not redden blue litmus paper (absence of mercuric chloride). If about 0.5 Gm. of the salt be shaken with 10 Cc. of water, the filtered liquid should not become more than very slightly colored by hydrogen sulphide T.S., nor give more than a slight opalescence with silver nitrate T.S. (limit of soluble chlorides or iodides)"—(*U. S. P.*). Fixed oils, chloroform, carbon disulphide, mercuric solutions, potassium chloride, and some ammonium compounds dissolve it. Red iodide of mercury enters into the formation of Mayer's and Nessler's *Test Solutions* (see *List of Reagents*).

Action, Medical Uses, and Dosage.—Mercuric iodide is an active poison, nearly as powerful as corrosive sublimate. In doses of $\frac{1}{16}$ of a grain, carefully augmented to $\frac{1}{4}$ of a grain, it has been largely employed in *syphilitic* and *scrofulous affections*. This is the preparation usually selected by Eclectic physicians when a mercurial is to be employed in *constitutional syphilis*, and in *cutaneous*, *ocular*, and *aural affections*, depending on a syphilitic taint. Its use was particularly advocated by Prof. Howe. The minute doses are usually preferred. The indications are those given under mercuric chloride (which see). In diseases of the eye, of syphilitic origin, as in *syphilitic iritis*, it has given results when iodide of potassium has failed. Similar results are obtainable in *keratitis, choroiditis, choroido-retinitis*, etc. Locally, it has been employed chiefly as Panas' solution, as in *incipient trachoma*, and in *phlyctenular* and *catarrhal conjunctivitis*. This solution (mercuric iodide 1 part, absolute alcohol 400 parts, and distilled water 20,000 parts) is frequently employed as an irrigating fluid for use previous to operations upon the eye, as in *iridectomy*, *removal of cataract*, etc. *Diseases of the internal and middle ear*, when of specific origin, frequently yield to the judicious use of this drug.

Externally, a solution of it, 6 grains to a fluid ounce of distilled water, has been used as a lotion to *scrofulous* and *syphilitic ulcers*, etc. An ointment composed of 2 grains of mercuric iodide, 40 grains of cerate, and 20 grains of almond oil, has also been used in *obstinate ophthalmia tarsi*, with thickening of the meibomian glands, *opacity of the cornea, obstinate venereal ulcers, chronic cutaneous diseases*, etc. A drachm each, of mercuric iodide, lard, and olive oil, has been successfully employed as a caustic application to *lupus*. It is to be used in very small quantities at a time, being careful to place it only on a limited amount of diseased surface, repeating its application about once in every week, and extending its action from one part of the disease to another, as the cure progresses (Cazenave, *Ann. de Therap.*, 1852, p. 175). Mercuric iodide may be administered in pill, trituration, or in solution in alcohol, or ether, to be administered in water. The dose ranges from $\frac{1}{1000}$ grain to $\frac{1}{4}$ grain, the doses of $\frac{1}{200}$ to $\frac{1}{60}$ grain usually being preferred by our physicians.

Specific Indications and Uses.—(See *Hydrargyri Chloridum Corrosivum*, for indications for, and general action of, the mercurials.)

Related Preparation.—SOLUTION OF IODO-HYDRARGYRATE OF POTASSIUM.—A preparation was recommended by Dr. Channing, called *Solution of iodo-hydrargyrate of potassium*, which is said to be efficient in *chronic tuberculous affections, dyspepsia, chronic hepatitis* and *splenitis, ague-cake, anasarca, ascites, scrofulous* and *syphilitic diseases, leucorrhœa*, and *menstrual derangements*, some *cutaneous affections*, etc. It is prepared by dissolving 7 grains of iodide of potassium in 2 fluid ounces of distilled water, and then adding 9 grains of mercuric iodide. There will be about 16 grains of the iodo-hydrargyrate of potassium in this solution, with a slight excess of iodide of potassium. The dose is 2, 3, or 5 drops, repeated 3 times a day; it may be given largely diluted with water, or in some vegetable alterative syrup.

Related Salt.—HYDRARGYRI IODIDUM FLAVUM (*U. S. P.*), *Yellow mercurous iodide*. Hg_2I_2 =652.66). *Hydrargyri iodidum viride* (*Pharm.*, 1880), *Protiodide of mercury, Yellow* [illegible] *iodide of mercury, Hydrargyri subiodidum, Subiodide of mercury, Protoiodide of mercury*. [illegible] *mercury, Hydrargyri iodidum* (*U. S. P.*, 1850), *Hydrargyrum iodatum flavum, Joduretum hydrargyrosum, Hydrargyri proto-ioduretum.* "Mercury, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; nitric acid, potassium iodide, distilled water, alcohol, each, a sufficient quantity. Mix twenty cubic centimeters (20 Cc.) [325 ♏], each, of nitric acid and distilled water, and, when the liquid is cold, pour it upon the mercury contained in a small glass flask. Set the mixture aside in a cool and dark place, and agitate it occasionally, until the reaction ceases, and a little mercury still remains undissolved. Separate the crystals of mercurous nitrate, which will have formed, from the mother liquid, allow them to drain in a glass funnel, and dry them on bibulous paper, in a dark place. When the salt is dry, weigh off forty grammes (40 Gm. [1 oz. av., 180 grs.] of it, and dissolve it in one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of distilled water, to which ten cubic centimeters (10 Cc.) [162 ♏] of nitric acid had previously been added. Having prepared a solution of twenty-four grammes (24 Gm.) [370 grs.] of potassium iodide in 1000 cubic centimeters (1000 Cc.) [33 fl℥. 391 ♏] of distilled water, slowly pour the solution of potassium iodide into that of the mercurous nitrate, with constant stirring, allow the precipitate to subside, decant the supernatant liquid, and transfer the precipitate, together with the remainder of the liquid, to a filter. When the precipitate has drained, wash it with distilled water until the washings no longer have an acid reaction upon litmus paper, and afterward wash it with alcohol, as long as the clear, colorless washings give any color with hydrogen sulphide test-solution. Lastly, dry the product in a dark place, between sheets of bibulous paper, at a temperature not exceeding 40° C. (104° F.). Keep it in dark amber-colored vials, with the least possible exposure to light. Instead of weighing off forty grammes (40 Gm.) [1 oz. av., 180 grs.] of the mercurous nitrate as above directed, the whole of the crystallized salt may be taken and the amount of potassium iodide, etc., adjusted on the proportions given above"—(*U. S. P.*).

The process involved is represented by the equation: $2KI+Hg_2(NO_3)_2 \quad 2KNO_3+2\,HgI$). The potassium iodide must be added *to* (not the reverse) the solution of mercurous nitrate, to prevent the formation of mercuric iodide. The alcohol is employed to wash away traces of the mercuric iodide, should any be present. Its absence will be shown by the hydrogen sulphide test employed.

The official salt is "a bright yellow, amorphous powder, odorless and tasteless. By exposure to light it becomes darker, in proportion as it undergoes decomposition into metallic mercury and mercuric iodide. Almost insoluble in water, and wholly insoluble in alcohol or ether. When slowly and moderately heated, it assumes at first an orange and then a red color, becoming yellow again on cooling. When quickly and strongly heated, it is at first partially decomposed into mercury and mercuric iodide, and finally is completely volatilized. When it is heated with sulphuric acid and a little manganese dioxide, vapor of iodine is evolved. In contact with a solution of potassium iodide, the salt is decomposed into mercuric iodide, which dissolves, leaving a residue of metallic mercury. If 0.5 Gm. of the salt be shaken with 10 Cc. of alcohol, a portion of the filtrate should be scarcely affected by hydrogen sulphide T.S., nor should it produce more than a very faint, transient opalescence when dropped into water; and if 5 Cc. of the filtrate be evaporated from a white porcelain surface, not more than a very faint, red stain should remain (absence of more than traces of mercuric iodide)"—(*U. S. P.*).

(Compare *Hydrargyri Chloridum Corrosivum.*) Yellow iodide of mercury is a powerful irritant poison, but has been administered in small doses in *syphilis* and *scrofula*, especially when they occur in the same individual. The dose is ¾ to 1 grain per day, cautiously carrying it to 3 or 4 grains. Children of 6 months old require $\frac{1}{16}$ of a grain, gradually increased to ½ grain. It may be given in pill form, conjoined with some narcotic, as conium, opium, etc.; or, 1 part of the iodide may be dissolved in 48 parts of ether, of which solution, 12 drops contain about ¼ of a grain. It is now preferred by some physicians in the treatment of *constitutional syphilis*. It is seldom employed by Eclectic physicians. Prof. Webster, however, declares that the 3x trituration (dose 2 or 3 grains), has a specific action upon the larynx, making it a prompt remedy in *hoarseness* and *croup* (*Dynam. Therap.*, p. 407). An ointment used as a dressing for *strumo-syphilitic ulcers*, and as an application to *sycosis, lupus, rosacea*, and other *tubercular skin diseases*, is made by triturating together 6 ounces of the iodide with a mixture of white wax 2 ounces, lard 6 ounces.

HYDRARGYRI OXIDUM FLAVUM (U. S. P.)—YELLOW MERCURIC OXIDE.

FORMULA: HgO. MOLECULAR WEIGHT: 215.76.

SYNONYMS: *Mercuric oxide, Precipitated oxide of mercury, Hydrargyrum oxydatum præcipitatum* (*vel flavum*), *Yellow oxide of mercury.*

Preparation.—"Corrosive mercuric chloride, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; soda, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; distilled water, a sufficient quantity. Dissolve the corrosive mercuric chloride in one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of warm distilled water, and filter the solution. Dissolve the soda (which should contain 90 per cent of sodium hydrate), in one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of cold distilled water, and into this solution pour gradually, and with constant stirring, the solution of corrosive mercuric chloride. Allow the mixture to stand for an hour at a temperature of about 30° C. (86° F.), stirring frequently. Then decant the supernatant, clear liquid from the precipitate, and wash the latter repeatedly by the affusion and decantation of distilled water, using one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of water each time. Collect the precipitate on a strainer, and continue the washing with warm distilled water, until a small portion of the washings, when poured on a little mercuric chloride test-solution, no longer produces a yellowish turbidity at the line of contact of the two liquids. Then allow the precipitate to drain, and dry it between sheets of bibulous paper, in a dark place, at a temperature not exceeding 30° C. (86° F.). Keep the product in well-stoppered bottles, protected from the light"—(*U. S. P.*). This is Dr. Hoffman's process, and is represented by the following equation: $HgCl_2 + (NaOH)_2 = (NaCl)_2 + HgO + H_2O$. An excess of alkali is essential, that brown mercuric oxychloride be not formed and precipitated with the oxide; for this reason the corrosive chloride must be poured into the alkaline solution. The soda solution must be free from carbonate, else a brownish mercuric carbonate will be formed. If the temperature be too high the tendency is to form a reddish-colored salt, therefore it is best to operate at as low a temperature as practicable, to produce the bright-yellow oxide.

Description and Tests.—"A light orange-yellow, amorphous, heavy, impalpable powder, odorless, and having a somewhat metallic taste; permanent in the air, but turning darker on exposure to light. Almost insoluble in water, insoluble in alcohol, but readily and completely soluble in diluted hydrochloric or nitric acid, forming colorless solutions. When moderately heated, the salt assumes a red color. At red heat it is completely decomposed into oxygen and metallic mercury, and is finally volatilized, leaving no residue. If 0.5 Gm. of the oxide be digested on a water-bath for 15 minutes, with a solution of 1 Gm. of oxalic acid in 10 Cc. of water, it will be converted into white mercuric oxalate (distinction from red mercuric oxide). On dissolving 1 Gm. of the oxide in 100 Cc. of diluted nitric acid, the resulting solution should be clear, and should not afford more than a slight opalescence with silver nitrate T.S. (limit of chloride)"—(*U. S. P.*).

Action and Medical Uses.—This agent has not been employed in Eclectic practice as an internal medicine. It is, however, an important topical remedy in ocular therapeutics. For *ciliary blepharitis* the ointment is probably the best local application, especially in chronic cases. The dried scales should be softened and removed by means of an alkaline wash, as of potassium bicarbonate, and the lids dried. Then the ointment should be thoroughly applied to the margins of the lids. If too strong, marked irritation and conjunctival hyperemia may be produced. Foltz states that in *phlyctenular keratitis* in children it is indicated in nearly all cases (Webster's *Dynam. Therap.*). The ointment is also advised in *corneal maculæ, indolent corneal ulcers, conjunctival granulations, xerosis, episcleritis*, and *pannus*. Foltz declares it of negative value in *suppurative otitis media*, but has obtained good results from its use to heal the tympanic lesion after the cessation of the discharge. ℞ Yellow oxide of mercury, grs. xxx, petrolatum ℥j. Mix. An ointment containing 2 per cent each of the yellow oxide and morphine sulphate in connection with dry heat is reputed efficient in the early stage of *furuncular inflammation of the external auditory canal* (see also *Unguentum Hydrargyri Oxidi Flavi*).

Other Oxides of Mercury.—HYDRARGYRI OXIDUM RUBRUM (*U. S. P.*), *Red mercuric oxide, Peroxide of mercury, Red precipitate, Oxydum hydrargyricum, Hydrargyri nitrico-oxidum, Mercurius corrosivus ruber, Mercurius præcipitatus ruber, Red oxide of mercury, Deutoxide of mercury.* Formula HgO. Molecular weight: 215.76. Red mercuric oxide should be kept in well-stoppered bottles, protected from light. This preparation is obtained by dissolving mercury, 3 pounds, in nitric acid, 18 fluid ounces, and distilled water, 2 pints, with the aid of a gentle heat. Boil down the liquor and rub what remains to a powder. Put this into another very shallow vessel, and apply a gradual heat until red vapors cease to rise (*Lond.*). In this instance nitrate of mercury is first formed, and then decomposed by the aid of heat. A trace of nitrate is liable to remain if the heat is not sufficiently high; on the other hand, an excess of heat would cause decomposition of the oxide into mercury and oxygen, and consequent loss of oxide.

Officially described, it is in "heavy, orange-red, crystalline scales, or a crystalline powder, becoming more yellow the finer it is divided, odorless, and having a somewhat metallic taste, permanent in the air. Almost insoluble in water, insoluble in alcohol, but readily and completely soluble in diluted hydrochloric or nitric acid, forming colorless solutions. When heated to about 400° C. (752° F.), it becomes dark violet or almost black, but assumes its original color on cooling. At a red heat it is completely decomposed into oxygen and metallic mercury, and is finally volatilized, leaving no residue. If 0.5 Gm. of the oxide be digested, on a water-bath, with a solution of 1 Gm. of oxalic acid in 10 Cc. of water, it will not change color within 2 hours (distinction from yellow mercuric oxide). If a little of the oxide be strongly heated in a test-tube, the vapors should not redden moistened blue litmus paper (absence of nitrate). On dissolving 1 Gm. of the oxide in 100 Cc. of diluted nitric acid, the resulting solution should be clear, and should not afford more than a slight opalescence with silver nitrate T.S. (limit of chloride)"—(*U. S. P.*).

Red precipitate is a powerful irritant, and when taken internally, even in small doses, readily excites vomiting and purging; large doses cause gastro-enteritis. It is rarely employed internally on account of these dangerous effects, though it has been recommended in *syphilitic diseases.* The dose of it is from $\frac{1}{16}$ to $\frac{1}{2}$ grain, combined with $\frac{1}{2}$ grain of opium, in pill form, to be repeated once or twice a day. It is principally used externally, as an escharotic and stimulant, to reduce *fungous fleshy excrescences*, to *chancres*, to excite certain *syphilitic ulcerations*, and *indolent ulcers* generally, and principally to reduce *chronic ophthalmia*, maintained by the ulceration of the free margin of the eyelids. One part of the finely levigated powder of red precipitate, mixed with 8 parts of simple ointment, forms a stimulating application to *ulcers*, *chronic ophthalmia*, some *diseases of the skin*, etc. Mackenzie recommends 1 part of the powdered red precipitate to be triturated with 8 parts of white sugar, a portion of which may be blown into the eye, through a quill, in *opacity of the cornea.* In *syphilitic ulceration of the throat*, *uvula*, *tonsils*, etc., the following has been recommended as a fumigation: Mix together red precipitate, 2 drachms; frankincense, myrrh, each, 40 grains; camphor, 16 grains. Throw a portion of this on a hot shovel, and inhale the vapor. It must be remembered that it is capable of being absorbed, and of producing very serious accidents. Rarely employed in Eclectic practice.

HYDRARGYRI OXIDUM NIGRUM, *Hydrargyri suboxydum* (Hg_2O) *Suboxide of mercury*, *Mercurous oxide;* also called *Protoxide*, *Gray* or *Black oxide of mercury*, etc.—This oxide is prepared by treating 1 part of finely divided calomel in a porcelain mortar, with 1 part of solution of caustic potash, sp. gr. 1.233, which has previously been diluted with 3 parts of water; after rubbing together for about $\frac{1}{2}$ hour, throw it on a filter, protecting the residue as much as possible from the light, and wash with cold water as long as the filtrate exhibits an alkaline reaction; then dry at the ordinary temperature, and keep in a vessel excluded from the light. An excess of potassa is necessary to insure the entire decomposition of the mercurous chloride; and heat, during the process, must be carefully avoided, as it will cause the protoxide to separate into mercuric oxide and mercury. Nevertheless, with every precaution, a small portion will decompose, and during the washing and drying the black color becomes tinged with green.

Pure mercurous oxide (suboxide of mercury), should be quite black, but from the presence of a little mercuric oxide, it has generally a green tinge; it is very heavy, inodorous, without taste, insoluble in water, alcohol, or alkalies, but readily soluble in diluted nitric acid, and acetic acid. It is readily decomposed by light, becomes olive-colored, and is resolved into mercuric oxide and metallic mercury. Heated in a tube it acquires at first a red color, from decomposition into oxide and metal, it then becomes darker, separating into oxygen and metal, and volatilizes without leaving a residue. Its purity may be determined by this last experiment. Its solution in diluted hydrochloric acid should give no precipitate with either potassa, or oxalate of ammonium; if any red oxide had been dissolved, the potassa would throw it down as a reddish or yellowish hydrate; if calcium be present, the oxalate will give a white precipitate. It is one of the least irritating of the mercurial preparations, when pure, and, like them, produces constitutional effects, especially when its use is continued for a time. In doses of from $\frac{1}{4}$ grain to 1 grain per day, it acts as an alterative; 2 or 3 grains, repeated every 3 or 4 hours, will produce salivation. On account of its varying composition, and tendency to operate severely, owing to the presence of mercuric oxide, it is seldom exhibited internally. One part of the mercurous oxide, well rubbed up with 3 or 4 parts of lard, has been used as a substitute for mercurial ointment.

HYDRASTININÆ HYDROCHLORAS (U. S. P.)—HYDRASTININE HYDROCHLORATE.

FORMULA: $C_{11}H_{11}NO_2HCl$. MOLECULAR WEIGHT: 224.97.

"The hydrochlorate of an artificial alkaloid derived from hydrastine, the latter being a colorless alkaloid obtained from hydrastis. Hydrastinine hydrochlorate should be kept in well-stoppered vials"—(*U. S. P.*).

Source.—The colorless alkaloid of hydrastis, hydrastine, when oxidized by such agents as sulphuric acid and manganese dioxide combined, or with potassium permanganate, platinic chloride, or chromic acid, yields an artificial alkaloid known as hydrastinine, and an acid, *opianic acid* (M. Freund and W. Will, 1885; also see Schmidt and Wilhelm, 1888). Hydrastinine is introduced into the *Pharmacopœia* for the first time in the form of the hydrochlorate. Its pharmacopœial recognition, however, has not been followed by any considerable use and physicians neglect it in favor of natural preparations of hydrastis.

Description.—This new salt is officially described as follows: "Light-yellow, amorphous granules, or a pale-yellow, crystalline powder, odorless, and having a bitter, saline taste; deliquescent on exposure to damp air. Soluble at 15° C. 59° F.), in 0.3 part of water, and in 3 parts of alcohol; difficultly soluble in ether or chloroform. When heated to 173° C. (343.4° F.), the salt undergoes partial fusion, but does not liquefy. Upon ignition, it is consumed, leaving no residue. The salt has an acid reaction upon litmus paper. A dilute aqueous solution of the salt (up to about 1 in 100,000), has a decided blue fluorescence. The salt dissolves in sulphuric acid with effervescence, coloring the acid yellowish-red. An aqueous solution of the salt is not precipitated by ammonia water. An aqueous solution of the salt yields, with silver nitrate T.S., a white precipitate insoluble in nitric acid. On adding to 2 Cc. of an aqueous solution of the salt (1 in 100), an excess of bromine water, a yellow precipitate is produced, which is dissolved by ammonia water to a nearly colorless liquid (difference from hydrastine, with which the ammonia produced a brick-red precipitate)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Recent investigations of this body seem to indicate that paralysis (without tetanus) of the motor tract of the spinal marrow, is an effect of its physiological doses. Acting mainly upon the arterial walls, and less so upon the cardiac muscle, it increases arterial tension and slows the pulse, the latter effect being largely due to the irritation it produces of the pneumogastric nerve. Its chief use, and that for which it has been introduced, is in *hemorrhage from the uterus—menorrhagia, metrorrhagia*, etc., having been successfully treated with it. It has likewise been extolled in *endometritis* of a mild type, and *dysmenorrhœa* of a congestive form. The weight of testimony seems to favor the view that it acts upon the small arterial terminals in the uterine mucous surfaces, and that it possesses no oxytocic properties. On the other hand, there is good evidence that it produces strong tetanic contractions of the uterine muscles, producing abortion. Several abortions have thus been attributed to its use. It is asserted that it is preferable to ergot in controlling uterine hemorrhage. The astringent action of hydrastine was noticed by Prof. J. A. Jeançon in 1886 (see *Ec. Med. Jour.*, 1886, p. 586). Hydrastinine hydrochlorate is employed hypodermatically in doses of ½ to 1½ grain.

Specific Indications and Uses.—To control uterine hemorrhage, especially when due to congestion.

HYDRASTIS (U. S. P.)—HYDRASTIS.

"The rhizome and roots of *Hydrastis canadensis*, Linné"—(*U. S. P*).

Nat. Ord.—Ranunculaceæ.

Common Names: (See below.)

Illustrations: Lloyd's *Drugs and Med. of N. A.*, Pl. 8; Bentley and Trimen, *Med. Plants*, 1; Köhler's *Med. Pflanzen*, Pl. 180.

Fig. 136.

Dried rhizome of Hydrastis canadensis.

Botanical Source.—This indigenous plant has a perennial root or rhizome, which is tortuous, knotty, creeping, internally of a bright-yellow color, with numerous long fibers. The stem is erect, simple, herbaceous, rounded, pubescent upward, from 6 to 12 inches in height, becoming purplish, and bearing 2 unequal terminal leaves. The leaves are 2 only, alternate, palmate, with from 3 to 5 lobes, hairy, dark-green, cordate at base, veiny, the lower leaf petiolate, the other sessile, from 4 to 9 inches wide when full-grown, and the segments serrated. The flowers solitary, terminal, small, white or rose-colored, and borne on a peduncle about 2 inches in length. The calyx consists of 3 petaloid, deciduous, broadly-ovate, pale greenish-white, concave, slightly downy sepals, which fall away when the flower opens. The stamens are many, and longer than the pistils. Filaments flat, linear-lanceolate, and having the cells of an anther on their edge at the apex. Pistils several; ovary oval, glabrous and attenuated upward into a short style. Stigma obtuse and scarcely lobed. The fruit resembles a raspberry, is red, and consists of many little 2-seeded drupes collected into a globose head, each crowned with the persistent style; the seeds are nearly black, obovate, and polished, having a minute embryo at the base of a fleshy and oily albumen (L.—W.—G.).

History.—This plant is found growing in shady woods, in rich soil, and damp meadows, in different parts of the United States and Canada, but is more abundant west of the Alleghanies. From about 1847, and especially since the first appearance of the *Eclectic Dispensatory of the United States* (now *American Dispensatory*), in 1852, hydrastis has figured conspicuously among the leading Eclectic drugs, and few have been in greater esteem. This plant is well known to botanists as *Yellow puccoon* and *Orange root.* The present pharmacopœial name, *Golden seal*, was introduced by the Thomsonians, who employed the root to a limited extent. It has reference both to the color of the root and to its seal-like scars produced by the death of the stalk of the plant of the preceding year. It has several other common names, some of them applicable and some being shared by other plants, one in particular, *Yellow root*, being the commercial drug name for *Xanthorrhiza apiifolia.* Some of these common names are derived from some physical characteristics of the plant; others from its therapeutic uses; while still others have reference to its resemblance to other substances. The following are some of its popular appellatives: *Golden seal, Yellow puccoon, Yellow root, Orange root, Eye balm, Eye root, Ground raspberry, Indian paint, Yellow paint, Indian dye, Yellow eye, Jaundice root, Wild curcuma, Ohio curcuma, Curcuma, Golden root, Wild turmeric*, and *Indian turmeric.* In commerce, both golden seal and yellow root are the terms employed. The other names should be dropped, and only the name of golden seal, as recognized by the Pharmacopœia, should be retained. The scientific name *Hydrastis*, given it by Linnæus, on authority of Ellis, is a misnomer, derived from old English authorities, who supposed that the plant grew in boggy places, an error which also appears in Wood's *Class Book of Botany* (C. G. Lloyd), whereas the plant is never found in wet or boggy situations, on prairies, or in sterile soil, but rather in rich open woodlands, preferring a hillside richly strewn with leaf mold. An attempt, which unfortunately failed, was made by Miller, in 1759, to change the name to *Warneria*, in honor of Richard Warner, of Woodford, Essex, England.

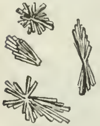
In our article on podophyllum, we call attention to the fact that that plant can not easily be exterminated by the advance of agriculture. With hydrastis, however, the opposite is true; the plant disappears as soon as the ground is disturbed by the settler. Once plentiful along the Ohio river banks, it is now found only in isolated spots, having suffered extermination as fast as the woodland yielded to the pioneer's axe. At present the geographical center of the plant is around Cincinnati. But four states now grow sufficient hydrastis to make it profitable for gathering for commercial use. These are Ohio, Indiana, Kentucky, and West Virginia. There is one redeeming feature, however, in the fact that in the mountainous parts of the states in which it grows, it is not very likely to disappear soon. These districts are inhabited by a class of individuals commonly known as "white trash," and also by negroes. They are perfectly contented to exist with the least possible exertion on their part, consequently they do not take kindly to cultivation of the soil. These virgin forests of the mountain contain an abundance of medicinal roots, among them hydrastis. While the plow exterminates it forever, simply digging the roots, as is done by these contented, happy root diggers, will never absolutely exhaust the resources of those regions. Hence, we may hope to have a moderate supply of this drug as long as these people are left to enjoy their seclusion; but it must grow scarcer each year, and, if the demand continues in medicine, increasingly more expensive.

Hydrastis is of very rapid growth, so much so that those who are searching for botanical specimens must be on the alert, as the plant, when favored by a continuance of warm weather during May, will, in a week or 10 days, send up a stem and open its blossom. This bloom is white and small, the stamens, on account of their whiteness, being the most conspicuous portion of the flower. The stem of the plant ranges from 6 inches to 1 foot in height, forking near the top, and each part of the division thus made, bears a roundish cordate leaf, each having from 5 to 7 lobes. These leaves, after the flowering periods, often become 6 or 8 inches broad, being but partly developed at the time of flowering. The lower leaf is the larger at this time, while the smaller is sessile at the base of the flower stem, enclosing the bud, and is but partially unfolded when the flower expands. A whole patch of hydrastis, for it grows in patches in rich, hilly woods, will not remain in bloom over a week. The fruit, consisting of several drupes aggregated together, known botanically as an *etærio*, matures in July. It resembles somewhat a red raspberry, though larger. Each of the drupes, which are from 8 to 10 in number, contains 1 round, shining, black seed, imbedded in a white, sweetish pulp.

Description.—The rhizome of hydrastis—the part employed in medicine—does not attain a very great size, for after from 4 to 6 years' growth, a gradual decay sets in at the end of the root remote from the stem. It consists of a crooked, knotty, wrinkled rootstock, 1 or 2 inches long, giving off a number of yellow fibers. The younger rhizomes are well marked on the upper surface with cup-like depressions, showing where the stems of the previous years were articulated. The cotyloid cavities become less marked as the rhizome advances in age, and it is from these seal-like depressions that the name, golden seal, is derived. Fresh hydrastis is vivid yellow, both within and without, but upon drying, becomes dull-brown. The best rhizome has a large amount of yellow juice, which, in drying may leave the interior yellow or orange-yellow, or, by aggregations of it, the central portion may assume a reddish hue. Dry hydrastis usually, however, is of a lemon-yellow color on fracture, if the root be not old. If old, it may be of a greenish-yellow hue, or even brown, the latter color being due to the disintegration of the yellow principles. Therefore, specimens of hydrastis, showing a greenish-brown or brown color, should be rejected as being of inferior quality. The juice was used by the Indians to color their clothing, and to stain their faces. Hydrastis has a peculiar odor and a bitter taste, added to which is a persistent acridity, which causes the abundant salivary flow following the chewing of the rhizome. Hydrastis loses about two-thirds of its weight by drying. Its virtues are imparted to water, glycerin, or alcohol. The official drug is thus described: "Rhizome about 4 Cm. (1½ inches) long and 6 Mm. (¼ inch) thick; oblique, with short branches, somewhat annulate and longitudinally wrinkled; externally brownish-gray; fracture short, waxy, bright reddish-yellow, with a thickish bark, about 10 narrow wood-wedges, broad medullary rays, and large pith. Roots thin, brittle, with a thick, yellow bark and subquadrangular, woody center. Odor slight, taste bitter"—(*U. S. P.*).

Chemical History and Composition.—The root of hydrastis contains the usual plant constituents, starch, albuminous matter, resin, sugar, fatty matter, inorganic salts, and three alkaloids, *berberine*, of yellow color, and *hydrastine* and *canadine*, both of which are white.

Fig. 137.



Crystals of Berberine, slightly magnified.

BERBERINE has received different names, according to the botanical sources in which it was discovered, and to this alkaloid the name *hydrastine* was first affixed. In 1824, Hüttenschmid found a yellow coloring matter in what he believed to be *Geoffroya inermis*, the Jamaica cabbage-tree, and gave it the name *jamaicine*. This substance, Wittstein (*Organic Principles of Plants*), accepts as berberine. In 1826, Chevallier and Pelletan found a rich yellow alkaloid in the bark of *Xanthoxylum Clava Herculis* (Hercules' club), which they named *xanthopicrite*. This was subsequently also proved identical with berberine. In 1828, C. S. Rafinesque, whose works were authority with the Eclectic fathers, stated in his *Medical Flora of the United States* (1828), that the constituents of Hydrastis canadensis were: "Amarin, extractive, several salts, and a peculiar principle, *hydrastine*, of a yellow color," taking pains to italicize the word *hydrastine*. Again, in 1830, Buchner and Herberger obtained from *Berberis vulgaris*, a purified yellow extract, which they named *berberine*. In 1839, Dr. George Kemp prepared a salt of berberine and picric acid, and was the first to class berberine among the alkaloids. This name at last superseded the terms *jamaicine*, *xanthopicrite*, and Rafinesque's *hydrastine*, although the latter name clung to it for a long time afterward. Even to this day, the name *hydrastine* is frequently preferred in America owing to the priority of the appellation given by Rafinesque, and, as an act of right, due to priority, it has been insisted upon by the earlier Eclectics. *Hydrastine* (*berberine*), was not the exact substance employed by the members of our school as a medicine, but rather a salt of the above was used—a hydrochlorate of hydrastine (muriate of hydrastine), which was called *hydrastine*, or *neutral hydrastine*. It was not shown to be a salt until after Durand (1851) gave a process for making a product similar to that which had long been prepared by Eclectic pharmacists and employed medicinally by Eclectic physicians. As late as 1862, Mr F. Mahla, of Chicago, proved this Eclectic hydrastine to be an alkaloidal salt, and showed that the base was *berberine*. Eclectic physicians, however, refused then to change the name of the medicinal salt, and to this day it frequently bear the old name, hydrastine.

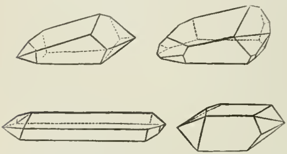
The demand for "concentrated medicines," or so-called "Eclectic concentrations," was the means of introducing *muriate of hydrastine* (*hydrochlorate of berberine*) into medicine. Arguing that if podophyllum yielded an active medicinal product by precipitation of its alcoholic preparations with water, the early Eclectics also thought that an active product could be thus obtained from hydrastis. Upon trial, a yellow, bitter, resinous body was obtained and put on the market as a "concentrated powder," under the name, *resinoid hydrastin*. It soon became evident that this resinous precipitate, or "resinoid," did not possess the medicinal qualities of the crude drug, hence a desire to further investigate led to the method of adding hydrochloric acid to the supernatant liquid after precipitation of the resinoid (which solution was shown to possess the major part of the active properties of the root), with the result of obtaining a very bitter, brilliant yellow precipitate. To distinguish it from the resinoid *hydrastin*, this yellow salt was called *hydrastin* (*hydrastine*) *neutral*, and was put on the market by three manufacturers under the following names: *Muriate of hydrastin*, *hydrastin neutral*, and *hydrastine*. The name *hydrastin neutral* being finally dropped, it entered the lists as *hydrastine*, *muriate of hydrastine*, and *hydrastin*, the resinoid of the latter name having gone out of market.

To recapitulate we find: (1) That the yellow alkaloid now known as *berberine* was the *hydrastine* of Rafinesque; (2) that the medicinal *hydrastine* of the Eclectic fathers was *hydrochlorate of berberine*, and was known to them as *hydrastine* or *neutral hydrastine*, or *muriate of hydrastin;* and still later as *hydrastin;* (3) that the name *hydrastin* originally referred to the resinous precipitate prepared by treating the alcoholic tincture with water and drying and powdering the precipitate. To make matters still worse a mixture of various substances supposed to represent all the peculiar constituents and virtues of hydrastis was named "*combined hydrastin*." This is the only drug now known simply as *hydrastin*, or combined principles *hydrastine*. Several berberine salts have been used in medicine. For further particulars concerning the early history of berberine, see J. U. and C. G. Lloyd (*D. and M. of N. A.*, Vol. I, p. 96.)

Berberine may be obtained by the following process, recommended by Mr. Wm. Procter, Jr.: "Take the root of Hydrastis canadensis, or of Berberis vulgaris, preferably the former, in coarse powder, exhaust it by repeated decoction or digestion in boiling water, and evaporate the filtered liquid to a soft extract. Treat this with stronger alcohol by digestion in a water-bath still, at several times until it is exhausted (or until a quart of alcohol has been employed for the extract from each pound of the root). Add to the tincture one-fourth of its bulk of water, distill off five-sixths of the alcohol, and add to the hot, watery residue an excess of diluted sulphuric acid, and allow it to cool. The sulphate of berberine crystallizes out, and if necessary, may be drained from the mother liquid, redissolved, in the smallest quantity of boiling water, and again crystallized. The sulphate of berberine thus obtained is dissolved in boiling water, and decomposed by the addition, in excess, of oxide of lead (freshly obtained by precipitation from the acetate or nitrate of lead by liquor potassa, and well washed), the solution being kept hot during the decomposition. When a drop of the hot, clear liquid will not be precipitated by baryta water or acetate of lead, the decomposition is finished. The solution should then be filtered off hot, evaporated, and set aside for crystallization" (*Amer. Jour. Pharm.*, 1864, p. 10).

The authors of *D. and M. of N. A.* prefer the preparation of berberine by the decomposition of berberine sulphate with a very slight excess of baryta water. *Berberine* ($C_{20}H_{17}NO_4$, J. Dyson Perrins, 1862) crystallizes in tufts of dark, brownred needles, soluble in water and alcohol, and practically insoluble in sulphuric ether, chloroform, carbon disulphide, and benzol. It forms crystallizable salts with acids, such as the hydrochlorate, the nitrate, the acid and the neutral sulphate (mono- and di-berberine sulphate), etc. It also forms a crystallizable compound with acetone, called *acetone berberine* ($C_{20}H_{17}NO_4.C_3H_6O$) (For the history and description of the salts. see *D. and M. of N. A.* The graphic formula of berberine was brought to light by W. H. Perkins. Jr., in 1890.

Fig. 138.



Crystals of Hydrastine, natural size.

HYDRASTINE, the principal white alkaloid of hydrastis, must not be confused with Rafinesque's *hydrastine* or with the Eclectic medicine *hydrastine muriate*. It was discovered in 1850, by Mr. Alfred B. Durand (*Amer. Jour. Pharm.*, Vol. XXIII, p. 13), who described it as being insoluble in water, sparingly so in cold ether and alcohol, more soluble in boiling ether, entirely soluble in chloroform and boiling alcohol, but speaks of the crystals as being of a brilliant yellow color, which was undoubtedly due to contamination with traces of berberine. Mr. J. Dyson Perrins (*Pharm. Jour Trans.*, May, 1862) was the first to obtain it white. Mr. F. Mahla, of Chicago, prepared it in 1863 (*Amer. Jour. Pharm.*, Vol. XXXV, p. 433), by adding aqua ammoniæ in slight excess to the mother liquor from which berberine was previously separated as hydrochlorate by the addition of hydrochloric acid. The crude hydrastine was then purified by recrystallization from alcohol. Also, see paper by Prof. F. B. Power, on the preparation of hydrastine in *Proc. Amer. Pharm. Assoc.*, 1884, p. 448. *Hydrastine* ($C_{21}H_{21}NO_6$, Freund and Will, *Ber. d. Deutsch. Chem. Ges.*, 1887, p. 88) is tasteless in the alkaline saliva; it forms salts with acids which, however, are not crystallizable. Its soluble salts are acrid, the hydrochlorate, and occasionally the citrate, being the preferred medicinal salts. Hydrastine salts in solution are decomposed by alkalies, which liberate the alkaloid as a precipitate. A fluorescent body has been found adhering to crystals of *hydrastine*, its effects are produced in the presence of alkalies (see *D. and M. of N. A.*, Vol. I, p. 143). The melting point of hydrastine, according to Prof. Power, is 132° C. (269.6° F.). By reduction with nascent hydrogen, this author obtained crystallizable *tetra-hydro-hydrastine*. *Hydrastine*, when oxidized in acid media, is converted into *opianic acid* ($C_6H_{10}O_6$) and *hydrastinine* ($C_{11}H_{11}NO_2$), Freund and Will, 1888; also see E. Schmidt and Wilhelm (*Archiv der Pharm.*, 1888, p. 353). In alkaline solution *methylamine* and *hemipinic* and *nicotinic acids* result. An interesting account of the chemical relationship between *hydrastine* and *narcotine* on the one hand, and *berberine* and *papaverine* on the other, is given by Dr. Alfred R. L. Dohme in the *Western Druggist*, 1895, p. 58. The statement made by Dr. Freund is also recorded, that hydrastine and berberine exist in the root of golden seal, most probably in the free state.

CANADINE ($C_{20}H_{21}NO_4$). In 1873, Mr. A. K. Hale (*Amer. Jour. Pharm.*, 1873, p. 247), announced the presence of a third alkaloid in hydrastis root, resembling berberine, but being darker in color, and behaving differently toward solvents. Mr. John C. Burt (*Amer. Jour. Pharm.*, 1875, p. 481), confirmed these observations. and gave additional reactions. Again, Mr. Herman Lerchen (*Amer. Jour. Pharm.*, 1879, p. 470), prepared the new base, naming it *xanthopuccine*, on account of the yellow color of the alkaloid as he obtained it. Lastly, F. Wilhelm, in Prof. Schmidt's laboratory, incidentally obtained minute quantities of a new alkaloid (*Archiv der Pharm.*, 1888, p. 345), which Prof. Schmidt named *canadine*, and which he believes to be identical with the third alkaloid of hydrastis obtained by his predecessors. More recently, Prof. Schmidt found *canadine* to be *tetra-hydro-berberine*, having the formula $C_{20}H_{21}NO_4$ (*Archiv der Pharm.*, 1894, pp. 136–154; also see resume by Mr. F. X. Moerk, in *Amer. Jour. Pharm.*, 1894, p. 304). *Canadine* forms an almost insoluble nitrate by means of which the alkaloid was obtained from hydrastis. The free base forms white, acicular crystals melting at 132.5° C. (270.5° F.). It is insoluble in water, soluble in alcohol, ether, chloroform, benzol, and hot petroleum-ether; the hydrochlorate and hydrobromate, especially in excess of acid, are not easily soluble, while the sulphate forms an exception, being soluble in water. When exposed to light, *canadine* gradually turns yellow, being converted into berberine, especially in sulphuric acid solution.

From the researches of Prof. Schmidt, it becomes probable that hydrastis root contains in addition several alkaloids related to those already known, but occurring only in minute quantity. (For a special dissertation on hydrastis, the reader is referred to Vol. I, of *D. and M. of N. A.*, by J. U. and C. G. Lloyd, from which publication is derived much of the botanical and chemical material embodied in this article on hydrastis.)

Medical History, Action, Uses, and Dosage.—For many years the salts of berberine and powdered hydrastis were the chief forms in which this drug was administered. At the present time these salts and the crude drug are but little used, and in this paper we shall confine ourselves principally to the liquid preparations of hydrastis—chief among which are the specific hydrastis and Lloyd's hydrastis. As there have been many preparations of this drug thrown on the market (since Lloyd's was introduced), under the name "colorless hydrastis," and accompanied by the statement that they are preparations of the white alkaloid *hydrastine*, it is but fair, in speaking of Lloyd's hydrastis, that we should state that it is not merely a solution of *hydrastine*, which is probably the least valuable constituent of hydrastis, but a preparation containing the *combined colorless constituents* of the drug. It is a well-known fact, though often overlooked by those who wish to make it appear that the alkaloidal constituents of a plant are alone the valuable and active therapeutic factors, that the combination or association of principles formed naturally in the plant, or held together naturally even when derived from the plant, more completely represents the crude drug than do the isolated and forcibly separated alkaloids, and that medicinal virtues are possessed by the former that can not be even approximated by the latter. Thus it is, that Lloyd's hydrastis is much superior as a remedy, than if it were merely a fluid preparation of the white alkaloid. From some experiments made by Prof. J. A. Jeançon (*Ec. Med. Jour.*, 1886, p. 586), with a concentrated solution of the associated colorless principles divested of the alkaloid, hydrastine, it was shown that marked therapeutic effects could be obtained from them alone. It acted principally as an astringent, gradually decreasing and finally arresting hypersecretion. As an intrauterine astringent he preferred it above all others. In determining its physiological effects, he administered it to animals in health, but could not observe any appreciable effect upon temperature, pulse, or respiratory apparatus. These physiological doses, however, produced constipation and anorexia. Thus, we observe, as is very frequently the case, a marked contrast between the almost negative physiological effects and the very positive therapeutic results. In this connection we can state that Prof. Lloyd has been led, from his great experience in observing the results of the uses of hydrastis, to seriously consider the advisability of excluding, to the great extent, the white alkaloid from Lloyd's Hydrastis. Reports, unquestionably reliable, indicate that it is often irritating and objectionable.

The whole drug, including the alkaloid hydrastine, appears to stimulate the respiratory and circulatory apparatus, imparting increased tone and power. Arterial tension is augmented, and blood pressure in the capillaries increased, rendering it valuable, like belladonna and ergot, in overcoming blood stasis. Its action upon the nervous system has been compared to that of strychnine (Ellingwood), though less energetic, but more permanent. Thus the tone imparted to the heart muscle is permanent, rather than intermittent or spasmodic (*ibid.*). The sensibility of the nerve endings is blunted by hydrastis in excessive doses, and in the lower animals large doses of the alkaloid have produced death. No such toxic action, however, has been observed upon man. Muscular nutrition is increased under the judicious administration of hydrastis, making it a valuable agent in *muscular debility*, and in altered states of the muscles, particularly of the unstriped variety.

It is a little singular that hydrastis was not mentioned by our earliest writers on indigenous materia medica, for it was in extensive use among certain of the aboriginal tribes of North America, being used both as a medicine and as a coloring material. Prof. Benjamin Smith Barton in his first edition of "*Collections for* *an Essay Toward a Materia Medica of the United States*" (1798), refers to the Cherokee use of it as a cure for cancer. Later, he calls attention to its properties as a bitter tonic, and as a local wash for ophthalmia From that time on it was endorsed by Rafinesque, Hand, Smith, and the various writers of the botanic and of the medical reform schools. The extensive range of uses given by the foregoing writers was not included in the first edition of the *American Dispensatory* (1852), Prof. King evidently believing the virtues of the drug to have been greatly overdrawn. He gave, however, a careful review of its properties and uses, and thus, for the first time, it became firmly established as an Eclectic medicine. At the present time it is a great favorite with Homœopathic practitioners and with a large proportion of Allopathic physicians. It was introduced into Homœopathic medicine by the late Prof. E. M. Hale, M. D., who was familiar with the Eclectic uses of the plant.

Hydrastis is bitter to the taste, and induces increased activity of the salivary glands. It sharpens the appetite and aids digestion when indicated. Schatz has shown that it increases contraction of the muscular fibers of arteries without affecting other muscular tissues of the tubular organs. He has also shown that it decreases congestion of the genito-urinary tract. Rutherford, who investigated it, concluded that it was a hepatic stimulant, and in less degree stimulant to the intestinal tract. Its power as a hepatic stimulant is, however, probably overrated, while as a stimulant of the gastric and intestinal mucous surfaces its action is marked. Hydrastis exerts its chief action upon the mucous and glandular structures, and to some extent, through its white alkaloid, upon the nervous system.

Hydrastis is a valuable drug in disordered states of the digestive apparatus, especially when functional in character. It is not adapted to all classes of cases, but is rather to be considered as indicated in disorders of a sub-acute character and in atonic states with increased flow of mucus. In *sub-acute and chronic inflammation with free secretion* it will be found to render good service. As a general bitter tonic it resembles, though does not equal calumba and gentian, but is more applicable to debilitated conditions of mucous tissues. Beginning at the mouth, its beneficial action may be traced throughout the alimentary canal. For *aphthous stomatitis* it is equaled only by coptis and phytolacca. It is not the remedy in this disorder when the mucous secretions are checked, but is best adapted to subacute forms, bordering on a chronic state. As a remedy for various *gastric disorders* it will take a leading place, especially if it be borne in mind that it is never beneficial, but on the contrary, does harm, in acute inflammatory conditions. When, however, the trouble is subacute and semi-chronic, and especially with mucorrhœa, or even secretion of pus, the drug will give good results. It is indicated in *gastric irritability*, relieving the irritation, and afterward restoring the tone of the parts. For years the powdered root was made into aqueous infusion, which, when cold, was employed with marked benefit, but now we have pleasanter preparations which give equally as good results without entailing the unpleasantness of swallowing a large quantity of bitter and crude medicine. Lloyd's hydrastis has proved an excellent form of administration in cases of "*ice water dyspepsia*," a diseased condition said to be peculiarly American, on account of the almost universal practice in this country of drinking ice water and iced tea. The hydrastis should be given in 10-drop doses, before each meal and at bedtime. *Chronic gastritis*, with increased secretion (*chronic gastric catarrh*), is often promptly met with this drug. It is very valuable in *gastric ulcer*. Several physicians have observed that it is a very useful remedy to exhibit in cases of gastric catarrh following the inordinate use of alcoholic stimulants. Prof. Bartholow, who among the "regulars," has made extensive use of hydrastis, goes so far as to state that in sufficient doses (tincture or fluid extract), it is probably the best substitute for alcoholic beverages when it is desired to abandon the use of spirituous stimulants. This statement is ridiculed by the therapeutic editor of the *National Dispensatory*. However, it is certain that it is valuable in any form of gastric disorder, no matter what its origin may be, if there be irritation, or subacute inflammatory symptoms *with increased secretion*—a condition of *atony*. In *chronic alcoholism* it may be associated with capsicum or strychnine, or both, together with a liberal quantity of beef tea and other easily digested food, regularly administered. Small doses of hydrastis will be found indicated in that form of *dyspepsia* exhibiting a belching of putrescent gases, and followed by a weakness, or sensation of "goneness" in the pit of the stomach. If great irritability of the stomach is present, minute doses of the fluid preparations or of hydrastine hydrochlorate are to be preferred. When there is less irritation and great inactivity, powdered hydrastis may be used. When the larger doses are employed it should be immediately after meals.

This drug is equally as beneficial in *catarrhal states of the intestines* and *gall ducts*. In *duodenal catarrh*, with jaundice, and in those forms of *catarrh of the biliary passages* due to accretions of inspissated bile mixed with crystallized cholesterin the remedy will be found serviceable if continued for a considerable length of time. Hydrastis should be remembered in *obstinate constipation*. It is especially useful in those disordered states due to *hepatic obstruction* or to *hepatic congestion*, accompanied or not with intestinal or biliary catarrh. The constipation best met with hydrastis is that hinging on atonic conditions of the intestinal glands, which may be gently stimulated to normal activity by small doses of either the specific preparation or Lloyd's hydrastis. Prof. King considered it a valuable tonic for enfeebled states of the alimentary tract in infants and children, and recommended it for the same purpose in convalescence from "severe attacks of *diarrhœa*, *dysentery*, and other debilitating maladies." Local application, with the internal use of hydrastis, has been resorted to in *hemorrhoids*, *fissured anus*, *ulcers* and *eczema of the anus*, and *prolapsed and ulcerated rectum*, with apparent benefit.

For the use of hydrastis in respiratory affections we insert the following from a previous article: "Golden seal is a valuable local agent in affections of the nose and throat. It acts as a subastringent tonic to the parts to which it is applied. Simple *catarrhal*, *follicular*, or *granular pharyngitis* is often cured by it. *Syphilitic ulcerations of the naso-pharyngeal passages* are relieved and often cured by it. The colorless hydrastis (Lloyd's) has a beneficial effect in the various forms of *sore throat*, *rhinitis*, and also *ulcerated* or *aphthous varieties of tonsillar*, *pharyngeal*, and *retro-pharyngeal catarrh*. *Subacute* and *naso-pharyngeal catarrh* where the mucous membranes are dry and parched, the secretions being altered in quantity and character, is cured by it. In *catarrhal hypertrophy* with profuse discharge and thickening of the Schneiderian membrane, this preparation is without an equal. It should be somewhat diluted, and is never the remedy for active, inflammatory lesions" (Felter). For that disagreeble state accompanying nasal and pharyngeal catarrh, in which the mucus forms in gelatinous masses and drops into the throat, hydrastis is probably without an equal. It should be applied locally and also administered internally. Locally, it is especially serviceable in subacute forms of *tonsilitis*, and occasionally in *diphtheria*. The drug is more especially indicated in catarrhal affections of any of the mucous membranes if there be also muscular debility.

In aural and ophthalmological practice this drug is a favorite local application. In the earlier history of its use as a medicine, infusion of the root, as employed by the Indians met by Captain Lewis, in 1804 (during the famous Lewis and Clark Expedition), and solutions of berberine salts, as used by the "Eclectic Fathers," were employed in various *ophthalmias*. These forms gave excellent results, the one objection to their employment being their staining qualities. At the present day these colored preparations are seldom used, but in their stead Lloyd's hydrastis gives fully as great satisfaction therapeutically, as well as being pleasant in taste and much more cleanly as a local application. It may be employed in the proportion of about 1 part in 10 or 20 of pure water in *conjunctival diseases*. It is only useful in superficial disorders of the eye, having no value in intraocular affections. It is valuable in all *conjunctival inflammations*, particularly so in the catarrhal forms. Foltz regards it as an excellent remedy in *follicular conjunctivitis*. *Superficial corneal ulcerations* are benefited by it, and in *ciliary blepharitis* it may be employed with confidence. It is well, however, in the latter disorder to wash the edges of the lids thoroughly with a weak solution of potassium bicarbonate, rinse well with pure water, and lastly apply the hydrastis lotion. It has been recommended and used with a degree of success in *trachomic lids*; but it is not nearly so effective in this complaint as the ointment of non-alcoholic thuja. The principal use of this drug in *ear diseases* has been for the cure of *purulent inflammation of the middle ear*, provided granulations do not exist. It may be employed here in both acute and chronic inflammations, and is especially indicated where the discharge is abundant. It may be dropped in the ear, or the ear may be cleansed with water to which a quantity of the medicine has been added. About 10 drops of solution (1 to 6 or 8) is about the proper amount to be employed when instilled into the aural aperture. Excellent results have been obtained by using it in this manner, mixed with specific hamamelis, to which water is added if too much smarting be produced. This combination has served us well in *eczema of the aural canal* and in *irritation* due to *inspissated cerumen*, the latter being readily softened by it.

Prof. Webster (*Dynam. Therap.*) calls attention to the use of specific hydrastis in cases of *myalgic tenderness and soreness.* He regards it as indicated where the unpleasant symptoms are masked during rest but aggravated by pressure and by motion. These myalgic symptoms may be due to various causes, often resulting as reflexes from *uterine, rectal*, and *prostatic disorders.* He also includes in the category of myalgic complaints, *headaches* resulting from reflexes in which the scalp-muscles are involved; *pectoral tenderness* due to lacerated cervix uteri; and the *muscular pains* caused by *anemia*, resulting from *uterine, hemorrhoidal*, and other *hemorrhages.* The dose recommended is from the fraction of a drop to 1 drop.

Taking advantage of the results of Prof. Schatz's investigation of the action of this drug on the circulation, several physicians have employed it in hemorrhagic conditions and in pathological states upon which hemorrhages are likely to depend. Schatz found it useful in *hemorrhage from uterine fibroids (myomata); congestive dysmenorrhœa; hemorrhage in virgins*, persisting even after the use of the curette; *hemorrhages from subinvolution, endometritis, metritis, parametritis, cicatrices, stenotic conditions*, and *climacteric hemorrhage.* Operations and other means had failed in the cases above mentioned, but hydrastis cured. The dose administered was 20 drops of the tincture 3 times daily. Too small a dose is without this controlling power over the walls of the vessels, according to Schatz, while large doses have an effect further than is desired. It is too slow a remedy for active *post-partum hemorrhage*, but may be employed for the control of *passive hemorrhage.* It is useful in *metrorrhagia.* Like ergot, it may be employed for the relief of chronic *cerebral hyperæmia*, and other forms of *cerebral engorgement.* Other observers have seen its beneficial action in the cure of *fungoid endometritis, lacerated cervix*, and *pelvic cellulitis.* Locally and internally, excellent results are obtained from hydrastis in *leucorrhœa*, both vaginal and uterine. For *gonorrhœa*, Lloyd's hydrastis probably enjoys a more extensive use as a local application than any other drug, and this use of it is not confined to Eclectic practitioners alone. For *gleet* it is equally as beneficial. For this purpose it may frequently be combined with aqueous thuja. Salts of zinc and lead, in very small amounts, may be added to the solution of hydrastis. If carefully employed, stricture as a result need never be feared. Other preparations of hydrastis will give good results, but their staining qualities condemn them. To Prof. John King must be accorded the first mention of this use of the drug. He also used it successfully in "*incipient stricture, spermatorrhœa*, and *inflammation and ulceration of the internal coat of the bladder.*" As a remedy for *cystitis*, it may be given internally, and used largely diluted to wash out the bladder. Prof. Jeançon, in discussing the concentrated solution of the associated principles of hydrastis (devoid of hydrastine), says: "Formerly, I used to apply locally a tampon or wad of absorbent cotton, well saturated with a solution of the double sulphate of alumina and copper, in cases of *cervical erosions* and *light papillary vegetations.* Now I apply the cotton saturated with the concentrated solution of these hydrastis substances, and find that the effect is all that can be desired. The eroded surface becomes smooth, the vegetations disappear, and a fine glistening layer of mucous structure soon makes its appearance."

Hydrastis has been used to some extent in *cutaneous diseases.* Prof Jeançon cured a stubborn case of *eczema of the scrotum* with it. Other cases of *eczema*, depending upon gastro-intestinal disturbances, have been cured by its internal exhibition alone. *Acne, seborrhœa sicca* or *oleosa, scrofula, acne rosacea, lupus, sycosis, boils, carbuncles*, and *ulcers*, when dependent upon gastric difficulties, have been greatly benefited and some cases cured by the internal use of the drug alone. The local use at the same time hastens the cure. Eczematous manifestations around the outlets of the body also yield to the kindly action of golden seal locally applied It has been said to cure *cancer*, though this use of the drug is overrated. Still.

many believe it to have a beneficial effect in prolonging life and in mitigating the severity of the disease. On this point Prof. Scudder remarks, "In some cases of cancer with sloughing of tissues, and in malignant ulceration, no application will do more to retard the progress of the disease than an infusion of the crude article or a solution of the alkaloid (*berberine*). It has been claimed that the internal administration of the remedy alone will prove curative. I am satisfied that in some cases this use of hydrastis will do much to relieve pain and lengthen life, even if it does not prove curative." Hale and others consider the long-continued use of hydrastis internally excellent in retarding *scirrhus of the breast*, when the tumor is hard and painful, but has not yet advanced to ulceration.

Hydrastis should be remembered in *convalescence from diseases* having excessive mucoid discharges, or where hemorrhage has played an important part. For *malarial disorders* it probably has but little to recommend it. It has been used as an anti-malarial drug, but as it has usually been employed with some of the cinchona alkaloids, the beneficial, or at least the antiperiodic effects were probably due to the latter. Hydrastis should not be overlooked, nevertheless, in convalescence from *general debility*, *protracted fevers*, *inflammatory affections*, and *nervous prostration*. Hence it is useful to combine with it capsicum, strychnine, nux vomica, iron salts, and quinine, when there are clear indications for their selection. *Prostrating night-sweats* are very often controlled by it. In hepatic and stomachic disorders it may be greatly aided by iris, phytolacca, bryonia, arnica, leptandra, chionanthus, and podophyllin, provided any of these are indicated. Powdered hydrastis and the extract are now seldom employed. The usual dose of specific hydrastis ranges from the fraction of a drop to 30 drops; of Lloyd's hydrastis, from 5 drops to 1 drachm; of infusion of hydrastis (℥i to aqua Oj) from ½ to 2 fluid ounces; locally, Lloyd's hydrastis, from full strength (ulcerated cervix uteri), to a dilution of 1 in 20 in water. Dose of the powder, from 10 to 30 grains; of the tincture, from 1 to 2 fluid drachms; of the hydro-alcoholic extract, from 2 to 5 grains; of the fluid extract, 10 to 60 minims; hydrastine (Eclectic), 1 to 6 grains; of hydrastinine hydrochlorate, ¼ to 1½ grains; berberine (see below), 2 to 20 grains; berberine hydrochlorate, 1 to 5 grains; berberine sulphate, 1 to 5 grains.

Specific Indications and Uses.—Hydrastis is specifically indicated in catarrhal states of the mucous membranes, when unaccompanied with acute inflammation. An apparent exception to this is in acute purulent otitis media, in which it is said to act better than in chronic conditions; gastric irritability; irritation of parts with feeble circulation; muscular tenderness and soreness, worse under pressure or on motion; passive hemorrhages from uterus and other pelvic tissues; skin diseases depending on a gastric abnormality, indicating hydrastis.

Related Drug.—*Cœlocline polycarpa*, A. De Candolle (*Unona polycarpa*, De Candolle), *Yellow-dye tree of Soudan*, *Berberine tree*. An African tree inhabiting Sierra Leone, Soudan, and other points in western Africa, which, when wounded, exudes a juice which leaves an indelible yellow stain upon linen, and tinges the saliva yellow. It is used as a yellow dye by the natives, and imparts both color and bitterness to water. Stenhouse has shown the coloring principle to be *berberine*. Medicinally, it has been used in decoction and powder by the inhabitants of Sierra Leone, as a topical dressing for *obstinate ulcerations*.

Preparation of Hydrastis.—LIQUID HYDRASTIS. This is a glycerin preparation introduced by the William S. Merrell Chemical Company, of Cincinnati, and is properly a specialty of this firm. Fluid hydrastis is employed both externally and internally.

Related Preparations.—BERBERINE AND ITS SALTS. *Berberina*, *Berberine*. For a description of *berberine* see above.) Berberine is an excellent tonic, and also appears to possess slightly laxative properties. It will be found to exert an efficient action upon all abnormal mucous tissues, and may be employed in cases where barberry or hydrastis is indicated. It may be used in powder, in doses of from 2 to 20 grains; or in water, to which citric, tartaric, or acetic acid has been added to aid its solution. *Acetate of berberine* will be found a very soluble salt, and of much efficacy.

BERBERINÆ HYDROCHLORAS, *Berberine hydrochlorate* (see above).—Hydrochlorate of berberine is a tonic, with an especial action on diseased mucous tissues; it possesses, in an eminent degree, the tonic virtues of the root, and was formerly much used, and is still employed, by some physicians as a substitute for it. It is more beneficial as a tonic during convalescence from *exhausting diseases*, such as *bilious* and *typhoid fevers*, *acute hepatitis*, *gastritis*, *enteritis*, *diarrhœa*, *dysentery*, etc. In *dyspepsia* and *chronic inflammation of the stomach* it is very valuable, and will be found of especial advantage in the treatment of persons who are intemperate, gradually removing the abnormal condition of the stomach, and in many instances destroying the appetite for liquor; it may be combined in these cases with sulphate of quinine, extract of quassia, or other bitter tonic. In *jaundice*, a combination of equal parts of hydrochlorate of berberine, extract of bayberry bark, and oleoresin of prickly ash bark, will often prove efficient. Combined with sulphate of quinine and extract of leptandra, it was once considered useful in *infantile remittent fever*. Equal parts of hydrochlorate of berberine, resin of caulophyllum, and extract of leptandra, form an excellent medicine for *aphthæ* and other *ulcerations of the mouth and throat*, in infants, as well as adults; it should be administered internally. A pill composed of 1 grain of hydrochlorate of berberine, $\frac{1}{20}$ of a grain of alcoholic extract of nux vomica, and sufficient oleoresin of ptelea to form a pill-mass, is found an efficient remedy for some forms of *dyspepsia*, and loss of appetite; 1 pill to be given for a dose, and repeated 3 times a day. Dose of hydrochlorate of berberine: For an adult, from 1 to 5 grains; for children, from $\frac{1}{2}$ a grain to 3 grains; and which may be repeated from 3 to 6 times a day, if required.

BERBERINÆ SULPHAS, *Berberine sulphate*.—Four grains of sulphate of berberine, dissolved in 1 fluid ounce of hot water, forms, when cold, an excellent collyrium in *purulent* and *phlyctenular conjunctivitis*, and an efficient injection in *otorrhœa*, *ozæna*, *leucorrhœa*, *catarrh of the bladder*, *chronic gonorrhœa*, *prostatorrhœa*, and *relaxed or enfeebled conditions of mucous membranes*. Staining of garments, etc., is an objection to the local use of berberine salts.

HYDROCOTYLE.—WATER PENNYWORT.

The entire plant of *Hydrocotyle Asiatica*, Linné.

Nat. Ord.—Umbelliferæ.

COMMON NAMES: *Water pennywort*, *Thick-leaved pennywort*, *Indian pennywort*, *Bevilacqua*.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 117.

Botanical Source and History.—The genus Hydrocotyle is an extensive family, comprising nearly 100 species that are found throughout the temperate world, consisting mostly of small, inconspicuous marsh herbs. The generic characters are: Flowers small, in simple umbels; petals 5, white, the points not inflexed; calyx margin wanting; fruit of 2 carpels, which are flattened laterally, 5-ribbed, and not furnished with oil-tubes.

Hydrocotyle Asiatica is a low, creeping plant, widely diffused over the warmer parts of the world, and abundantly met with in India, Cape of Good Hope, and Australia. The leaves are kidney-shaped, crenate, and the petioles attached at the base of the leaf.

In England the genus is represented by a single species, *H. vulgaris*, which is found growing in most parts of Europe. The leaves of this species are nearly orbicular, and about the size of an English penny; hence the common name "*pennywort*." The name "*sheep-rot*" is sometimes applied from the supposition that it causes the "rot" when eaten by sheep. The leaf-stalks are attached to the leaf-blade near the center of the under surface, a position comparatively rare among plants.

There are five American species of Hydrocotyle, all small herbs, growing in swamps. *H. umbellata* and *H. interrupta* have the leaves peltate; while in *H. Americana*, *H. ranunculoides*, and *H. repanda* the leaves are attached to the leaf-stalks at the base of the blades. *Hydrocotyle Americana* is the most common native species, and is found farther north than the others. It is a delicate, slender plant growing in damp, shady places; the leaves are thin and smooth, and are borne on short leaf-stalks; the minute white flowers are in close sessile umbels, in the axes of the leaves. The *Hydrocotyle vulgaris* and the 5 American species have properties probably similar to those of the *H. Asiatica*.

Medical History and Chemical Composition.—In 1852, Dr. Boileau, of India, having been for many years afflicted with leprosy, heard that the American plant, called *Chinchunchulli*, was of value. This plant was said to resemble the violet, and, while waiting for the arrival of a supply, the doctor experimented with *Hydrocotyle Asiatica*, and recovered. He subsequently used the remedy with other lepers. His experience was published, the plant being called *Bevilacqua*.

In 1853 or 1854, M. Jules Lepine continued the subject in the *Madras Gazette* (*Pharm. Jour. and Trans.*, 1853 and 1854), and confirmed the assertions of Dr. Boileau regarding its efficiency in leprosy. Before this, however, the plant is said to have occupied a place in the Indian Materia Medica. The composition of the plant is not known, beyond the experiments of Lepine, who decided that an oily substance, named by him *vellarin*, was the active medicinal principle. (See Christy, *New Commercial Plants*, 1885, p. 58.)

Action, Medical Uses, and Dosage. This plant should be ranked among the acronarcotic poisons, along with the Œnantha crocata, and the Cicutas. Boileau, Lepine, and others have found it useful as a remedy against *elephantiasis* of the Greeks (leprosy). Devergie, Cazenave, Waring, Hunter, etc., have derived benefit from it in *chronic eczema* and other *cutaneous maladies*, in *scrofula*, *secondary syphilis*, *ulcers*, and *chronic rheumatism*. It is an active agent, large amounts inducing headache, dizziness, and stupor, as well as bloody passages from the bowels. Itching of the skin is said to be occasioned by it also. As the root is very hygroscopic, and is not well preserved in powder, its best form for administration is in infusion, or syrup, 1 ounce of the root to 1 pint of fluid, and which may be given in doses of from ½ to 1 fluid ounce, repeated 3 or 4 times a day. An alcoholic extract may likewise be used in doses of from ¼ to ¾ of a grain. Notwithstanding the favorable reports concerning the efficiency of this plant, it has fallen into disuse, and is seldom employed at the present day.

The *Hydrocotyle gummifera*, growing in Brazil and in the Antilles, has been used in *hepatic* and *renal affections*.

HYOSCINÆ HYDROBROMAS (U. S. P.)—HYOSCINE HYDROBROMATE.

"The hydrobromate of an alkaloid obtained from Hyoscyamus. It should be kept in small, well-stoppered vials"—(*U. S. P.*).

FORMULA: $C_{17}H_{21}NO_4HBr+3H_2O$. MOLECULAR WEIGHT: 436.98.

Preparation.—The mother liquors from the preparation of hyoscyamine were found by Ladenburg, in 1880, to yield the syrupy alkaloid *hyoscine*. It is freed from hyoscyamine by producing the gold chloride double salts, and that of hyoscine is more soluble than its corresponding hyoscyamine salt, thereby allowing its separation. The melting point of the hyoscine salt is 198° C. (388.4° F.). The union of the alkaloid with hydrobromic acid yields *hyoscine hydrobromate*.

Description.—"Colorless, transparent, rhombic crystals, odorless, and having an acrid, slightly bitter taste; permanent in the air. Soluble, at 15° C. (59° F.), in 1.9 parts of water, and in 13 parts of alcohol; very slightly soluble in ether or chloroform. When heated to 100° C. (212° F.), the salt loses its water of crystallization, and fuses to a thick, syrupy mass, which becomes quite fluid at 160° C. (320° F.). When ignited, it is consumed, leaving no residue. The salt is neutral to litmus paper. Addition of ammonia water to the aqueous solution of the salt (1 in 60) produces no change, but sodium or potassium hydrate T.S., causes a white turbidity. Addition of silver nitrate T.S. to the aqueous solution produces a yellowish-white precipitate, which is insoluble in nitric acid, but, when filtered off and washed, is soluble in ammonia water diluted with its own volume of water. If 5 drops of fuming nitric acid be added to 0.01 Gm. of the salt, in a small porcelain capsule, and the mixture be evaporated to dryness on a water-bath, a scarcely tinted residue will be left, which, when treated, after cooling, with a few drops of an alcoholic solution of potassium hydrate, will assume a violet color"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—(See *Hyoscyamus*.)

HYOSCYAMINÆ HYDROBROMAS (U. S. P.)—HYOSCYAMINE HYDROBROMATE.

"The hydrobromate of an alkaloid obtained from Hyoscyamus. It should be kept in small, well-stoppered vials"—(*U. S. P.*).

FORMULA: $C_{17}H_{23}NO_3HBr$. MOLECULAR WEIGHT: 369.14.

SYNONYM: *Hyoscyaminum hydrobromicum*.

Description.—"A yellowish-white, amorphous, resin-like mass, or prismatic crystals, having, particularly when damp, a tobacco-like odor, and an acrid, nauseous, and bitter taste; deliquescent on exposure to air. Soluble, at 15° C. (59° F.), in about 0.3 part of water, 2 parts of alcohol, 3000 parts of ether, or 250 parts of chloroform. At 78° C. (172.4° F.), the salt melts, forming a nearly colorless liquid. When ignited, it is consumed, leaving no residue. The salt is neutral to litmus paper. An aqueous solution of the salt is not precipitated by platinic chloride T.S. (difference from most other alkaloids). With gold chloride T.S. it yields a precipitate which, when recrystallized from a small quantity of boiling water acidulated with hydrochloric acid, is deposited, on cooling, in minute, lustrous, golden-yellow scales (difference from atropine). The aqueous solution of the salt yields, with silver nitrate T.S., a yellowish-white precipitate, which is insoluble in nitric acid; but, when filtered off and washed, is soluble in ammonia water diluted with its own volume of water"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—(See *Hyoscyamus.*)

HYOSCYAMINÆ SULPHAS (U. S. P.)—HYOSCYAMINE SULPHATE.

"The neutral sulphate of an alkaloid obtained from Hyoscyamus. It should be kept in small, well-stoppered vials"—(*U. S. P.*).

FORMULA: $(C_{17}H_{23}NO_3)_2H_2SO_4$. MOLECULAR WEIGHT: 674.58.

Preparation.—Carefully neutralize an alcoholic solution of hyoscyamine with diluted sulphuric acid and evaporate in the cold. It may also be obtained by slowly concentrating the diluted sulphuric acid solution of hyoscyamine over concentrated sulphuric acid. It is claimed by some that this salt forms in small crystals, but Ladenburg maintains that only hyoscine salts and not those of hyoscyamine are crystallizable. As found in market both lines of salts are somewhat colored, but when pure are white or colorless.

Description.—"White, indistinct crystals, or a white powder, without odor, and having a bitter, acrid taste; deliquescent in damp air. Soluble, at 15° C. (59° F.), in 0.5 part of water, and in 2.5 parts of alcohol; very slightly soluble in ether or chloroform. At 140° to 160° C. (284° to 320° F.) the salt melts, and, upon ignition, is consumed, leaving no residue. The salt is neutral to litmus paper. An aqueous solution of the salt is not precipitated by platinic chloride T.S. (difference from most other alkaloids). With gold chloride T.S. it yields a precipitate which, when recrystallized from a small quantity of boiling water acidulated with hydrochloric acid, is deposited, on cooling, in minute, lustrous, golden-yellow scales (difference from atropine). The aqueous solution of the salt yields, with barium chloride T.S., a white precipitate insoluble in hydrochloric acid"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—(See *Hyoscyamus.*)

HYOSCYAMUS (U. S. P.)—HYOSCYAMUS.

"The leaves and flowering tops of *Hyoscyamus niger*, Linné," "collected from plants of the second year's growth"—(*U. S. P.*). Also the seeds of *Hyoscyamus niger*, Linné.

Nat. Ord.—Solanaceæ.

COMMON NAME: *Henbane.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 194.

Botanical Source.—Henbane is a biennial plant, with a long, spindle-shaped, thick and corrugated root, of an internal, whitish color, and externally brown. The stem is from 6 inches to 2 feet high, erect, tapering scarcely branched, and covered closely with long, weak hairs, tipped with a minute black gland. The leaves are large, oblong, acute, alternate, coarsely and unequally sinuated, occasionally somewhat decurrent, stem-clasping at the base, pale dull-green, and slightly pubescent, with long, glandular hairs upon the midrib. The flowers are numerous, axillary, subsolitary, nearly sessile, and embosomed in the uppermost leaves, than which they are much shorter. The corolla is of a dull, dirty yellow, strongly netted with purple veins, deep-purple at the orifice, funnel-shaped, with a somewhat erect, 5-lobed limb; lobes rounded, spreading, the 2 anterior a little smaller than the others, and separated at base by a deep slit in the tube. Calyx villous, funnel-shaped, 5-lobed, regular, wider than the corolla, to whose tube it is equal in length and persistent; each lobe is ovate and acute, with an open æstivation. Stamens 5, declinate, straight, shorter than the corolla, the 3 lower longer than the others, filaments pubescent, inserted about the middle of the tube of the corolla, and inclined; anthers cordate and purple. The ovary is nearly round, shining, pale-green, 2-celled, with numerous ovules, adhering to the dissepiment; style filiform, declinate, and purple at the apex; stigma blunt, round, and capitate. The fruit is an ovate, 2-celled capsule, opening transversely by a convex lid. The seeds are many, small, obovate, and brownish (L.—B.). The whole plant has a disagreeable, fetid odor, and a repulsive appearance.

Fig. 139.

Hyoscyamus niger.

History.—Henbane is an European herb, naturalized in this country, growing in waste grounds and commons, and flowering from June to September. Botanists are divided as to whether it is an annual or biennial plant. All parts of the plant are medicinal, but the leaves and seeds are the parts usually employed; the former should be collected at the time of its flowering, and the latter when perfectly matured. The leaves of the second year's growth of the plant are reputed more active than those of the first year; when fresh they abound in a viscid juice, and when bruised have a nauseously rank, narcotic smell, and an acrid, oleaginous, disagreeable taste. Upon drying, the smell and taste are almost destroyed. The leaves impart their properties to diluted alcohol; water, alcohol, ether, fixed or volatile oils also take up a portion of their virtues. The aqueous infusion is tasteless, light-yellow, and has the taste and odor of the plant. The leaves should be kept in a dry situation on account of their tendency to absorb moisture.

Description.— HYOSCYAMUS (*U. S. P.*). "Leaves ovate, or ovate-oblong, up to 25 Cm. (10 inches) long and 10 Cm. (4 inches) broad; sinuate-toothed, the teeth large, oblong or triangular; grayish-green, and, particularly on the lower surface, glandular-hairy; midrib prominent; flowers nearly sessile, with an urn-shaped, 5-toothed calyx, and a light yellow, purple-veined corolla; odor heavy, narcotic; taste bitter and somewhat acrid"—(*U. S. P.*). For a microscopical examination of powdered hyoscyamus leaves, see Prof. S. E. Jeliffe, in *Druggists' Circular*, 1899, p. 74.

HYOSCYAMI SEMEN. *Hyoscyamus seeds.*—The seeds were official in the *U. S. P.*, 1870. They are employed for the production of the alkaloid, *hyoscyamine.* They are small, numerous, oval, obtuse, or somewhat reniform, compressed, finely dotted, of a yellowish-gray color, and having the same taste and odor as the leaves, but with oiliness. The interior is whitish, displaying within the albumen a figure 9-shaped embryo. The concavity of the seed is marked by the hilum.

Chemical Composition.—According to Morries, an empyreumatic and highly poisonous oil is obtainable by the destructive distillation of henbane (*Edin. Med. and Surg. Jour.*, Vol. XXXIX, p. 379), The chief constituents of hyoscyamus seeds, besides fixed oil and fatty matter, gum, starch, albuminous matter, etc., are two alkaloids, *hyoscyamine* and *hyoscine*, the latter having been recognized, in 1880, by Ladenburg (*Lieb. Ann.*, Vol. CCVI, p. 279), and previously (1876) observed by Buchheim, and called by him *sikeranine.* Mr. F. Mahla obtained nearly 2 per cent of nitrate of potassium from the leaves of henbane (*Amer. Jour. Pharm.*, 1859, p. 402).

HYOSCYAMINE ($C_{17}H_{23}NO_3$, Ladenburg), was found in henbane (impure) by Peschier (1821) and by Payen (1824), and subsequently purified by Geiger and Hesse (1833). It is more abundant in the seeds than in the herb, the latter when fresh, yielding 0.14 to 0.16 per cent; in the fresh seeds Wadgymar (*Proc. Amer. Pharm. Assoc.*, 1867, p. 404), found as high as 0.52 per cent of the alkaloid. (For a summary review of the various methods pursued in isolating hyoscyamine, see Husemann and Hilger, *Pflanzenstoffe*, p. 1181.) In purest form it is obtainable from its (purified) gold double chloride (Ladenburg). Pure *hyoscyamine* crystallizes in tufts or stellate, silky needles of an acrid, unpleasant taste; when impure it is an amorphous, deliquescent mass, having a nauseating, narcotic, tobacco-like smell. It dissolves sparingly in cold, more readily in hot water, is soluble in alcohol, ether, chloroform, benzol, and amyl alcohol. Its melting point is 108.5° C. (227.3° F.). *Hyoscyamine* is strongly basic and forms crystallizable salts with acids. In aqueous solution it is very unstable, being decomposed by heat, especially when heated with alkalies, ammonia then being liberated. Ladenburg proved it to be an isomer of *atropine* (which see), yielding the same decomposition products (*tropine* and *tropic acid*) as atropine when heated with diluted hydrochloric acid or baryta water. From solutions of its salts, hyoscyamine is but incompletely precipitated by caustic alkalies or carbonates; it forms precipitates with auric chloride, tincture of iodine, tannic acid, and other alkaloidal reagents. The platinic double chloride is more soluble than that of atropine. This behavior permits its isolation from commercial (impure) atropine. Hyoscyamine is identical with *duboisine* from *Duboisia myoporoides* (Ladenburg), and is likewise identical with *daturine* (see Merck's *Index*, 1896). Hyoscyamine is an active poison, as are its salts; a minute quantity of it placed within the eye, causes a persistent dilatation of the pupil.

Hyoscine ($C_{17}H_{21}NO_4$, O. Hesse and E. Schmidt). This base was obtained by Ladenburg from commercial semi-liquid brown hyoscyamine by dissolving it in water, precipitating with gold chloride, and recrystallizing from hot water, from which solution hyoscine gold chloride first precipitates, and the base is then easily regenerated. *Hyoscine* forms an amorphous, semi-liquid mass, not easily soluble in water, easily soluble in alcohol and ether. It yields crystallizable salts with acids, and on warming with baryta water at a temperature of 60° C. (140° F.) is decomposed into *tropic acid* ($C_9H_{10}O_3$), and *pseudo-tropine* ($C_8H_{15}NO$). A water soluble hyoscine was recently found by O. Hesse to be obtainable in comparatively large quantities from the flowers of *Datura alba*, an ornamental plant cultivated in southern Germany (*Druggists' Circular*, 1899, p. 85).

Action, Medical Uses, and Dosage.—Hyoscyamus is a powerful narcotic, and is dangerously poisonous, though fatalities from it or its alkaloids are rare. In fact, the physiological action of henbane and its bases scarcely differs from that of stramonium and belladonna and their alkaloids, except in degree. It produces the same dryness of the mouth, flushing of the face, pupillary dilatation, quickened cardiac and respiratory action, illusions, hallucinations, and delirium occasioned by belladonna, only in a lesser degree. No difference is observable in the action of hyoscyamine and atropine upon the mechanism of accommodation and upon the movements of the lungs and heart. Hyoscyamine is more hypnotic and less apt to cause delirium than atropine. The dilatation of the pupils, which, however, does not always take place under hyoscyamine, is caused by stimulation of the sympathetic nerves. When death occurs from hyoscyamus or its alkaloids it is due to respiratory paralysis. The alkaloids are eliminated by the kidneys. In large doses, but insufficient to produce death, the tendency of hyoscyamus is to produce general paralysis of the nervous structures. One patient lost her memory from being poisoned with it. Among the ill effects of hyoscyamus are: Deranged vision, dilatation of the pupils, giddiness, general excitation, fullness of pulse, flushing of the face, weight in the head, headache, loss of muscular control, with tremulousness, mental confusion, incoherency or loss of speech, somnolency, furious delirium, unconsciousness, coma, irresponsiveness of the pupils to light, cold sweat, small, frequent, and feeble pulse, and deep and labored respiration. Tetanic rigidity may be present a portion of the time and sometimes convulsions, as well as nausea, vomiting, and intestinal pain and purging. The treatment of poisoning by hyoscyamus is that indicated under *Belladonna*. Chloral is especially recommended for poisoning by hyoscine. Autopsies reveal gastro-intestinal inflammation from poisoning by this drug.

When $\frac{1}{15}$ of a grain of sulphate of hyoscyamine has been subcutaneously injected hyoscyamine has been detected in the urine 22 minutes afterward. If enough be injected to cause complete dryness of the tongue and hard and soft palates, the pulse will increase temporarily in frequency, volume, and power; if this effect upon the tongue is not produced, the pulse will be lessened in frequency without diminution of its volume and force, and giddiness, somnolency, and dilatation of the pupils will accompany, the patient frequently acting as if intoxicated (Harley). (Compare *Atropinæ Sulphas* and *Duboisia*.)

Hyoscyamus is a cerebro-spinal stimulant, or in the Eclectic meaning of the term, a cerebro-spinal sedative. It relieves pain and promotes sleep. *Nervous irritation*, without congestion, high fever, or disturbance of the circulation in the cerebrum is the key-note to its use. Functional disturbances are those best relieved by the smaller doses of hyoscyamus. In medicinal doses it is anodyne, hypnotic, calmative, and antispasmodic; allaying pain, soothing excitability, inducing sleep, and arresting spasm. It does not produce constipation like opium, but has a tendency to act as a laxative. Its sedative effect upon the sympathetic nervous system requires larger doses to produce, and it is more transient and less powerful than belladonna; its most prominent effects are excessive giddiness and somnolency, which is caused by belladonna in only a very secondary degree. Hyoscyamus is a far safer agent for children and old people than opium. It favors the restoration of the normal functions when impaired through nerve irritability or debility. In this way it often favors the action of the special sedatives. If there is irritation of the gastro-intestinal tract it improves the action of the bitter tonics. As a remedy for pain it is less efficient than opium, and usually requires larger doses. Unlike the latter, it does not restrain the secretions.

Hyoscyamus is usually given in cases where opium disagrees, or where constipation must be avoided; in *neuralgic* and all *spasmodic affections*, as *renal*, *uterine*, *hepatic* and *flatulent colic*, *asthma*, *gout*, *rheumatism*, *chronic cough*, *irritations of the urinary organs*, and *inflammatory cases* attended with nervous excitability and not with high fever. On account of not producing headache, it is preferred to opium in *hepatic* and *renal inflammations*, and to relieve pain and lessen cough in *pulmonic affections*. In *bronchitis* with short, dry, explosive cough, it is a very useful agent, and in *pneumonia* we have obtained prompt results from small doses, when a condition of sub-delirium with widely dilated pupils was present. Dry, irritative *cough* and the troublesome nervous cough, so-called, aggravated by lying down, are indications for hyoscyamus. As a cough remedy, it is frequently given with syrup of wild cherry, and in this form renders excellent service in *phthisis*. It often renders good service in *spasmodic asthma*, and it should be remembered as an important remedy in *whooping-cough*.

Hyoscyamus is a remedy for *spasm* and *pain*—particularly for *spasmodic pain*. When there is nervous irritation, feeble circulation, and tendency to mental aberrations, it is particularly useful in the *neuralgia of exhaustion*, *syphilitic bone-pains*, *dysmenorrhœa*, particularly when neuralgic, *menstrual headache*, *headache of debility*, and the *pains of herpes zoster*, *pains in the liver*, *kidneys*, *bladder*, *ovaries*, etc. All these cases when showing anemia and nervous depression, will yield to hyoscyamus or its alkaloids. *Great unrest*, with debility, is relieved by this drug. Hyoscyamus is an excellent agent in *irritable conditions of the bladder and urethra*, where nerve force is low, and should therefore find a place in urinal urging, tenesmic voiding, and in nocturnal as well as diurnal *incontinence*. It is a urethral sedative, and combined with camphor (pill) has long been employed to relieve *urethral irritation* after the passing of bougies, catheters, sounds, and divulsors. The pains of *hemorrhoids* are frequently relieved by this agent. Hyoscyamus is frequently combined with active cathartics, as scammony, colocynth, aloes, resin of podophyllin, etc., without impairing their energy, not only for preventing tormina, but because it renders their action more efficient.

The great field for hyoscyamus and its alkaloids is in *nervous affections*, and here its principal employment is to cause sleep, or remove irregular nervous action. They are useful in *irritable conditions of the brain* and *heart*, with palpitation, and in certain cases of *epilepsy*, *chorea*, *senile* and *mercurial tremors*, and *enuresis*. Brown-Sequard says that hyoscyamus should be used instead of belladonna or opium, in cases of *paraplegia*, with symptoms of irritation of the spinal cord, where sleeplessness is present. To force sleep in *insomnia*, narcotic doses are required, and, as a rule, such an action is undesirable, and other agents are better for this purpose. But to allay irritability, upon which sleeplessness often depends, or to relieve restlessness and dreaming during sleep, no drug is more efficient than hyoscyamus, in small doses. It is often useful in children's diseases for this purpose. In fractional doses, it is an excellent calmative in *typhomania of typhoid fever*. It is serviceable in *hysteria*, with frequent voiding of small quantities of urine. Fractional doses of hyoscyamus, frequently administered are useful in "*puerperal convulsions*, associated with a nervous condition bordering on mania" (Locke).

Few remedies have been more valued in the treatment of the various forms of *insanity* than hyoscyamus and its alkaloids. It is especially useful in *mania*, both acute and chronic, larger doses being usually required in the latter form. The cases most benefited are those exhibiting great excitation, with a tendency to destructiveness, *delusional insanity*, *epileptic mania*, and *recurrent mania*. Prof. Webster mentions as a strong indication for hyoscyamus the garrulousness and quarrelsomeness exhibited by the insane. Nervous disturbances manifested by low muttering delirium, or by singing and talkativeness during fevers, are frequently relieved by small doses of this agent. Hyoscyamus has been declared useless in *delirium tremens*, but there is abundant reliable evidence to prove that it is an exceedingly useful agent when that malady is not of the most active character, and the victim is given to low muttering delirium. Here stimulant doses sufficient to sustain the nervous system should be given.

Hyoscyamus should not be overlooked as a calmative in *nymphomania*, particularly if due to childbirth, when there is evidently more delirium than sexual passion; the circulation is feeble, the pulse quick and small, the brain active, and the patient may have been disturbed with unpleasant dreams. *Puerperal mania*, due to exhaustion and weakness, is often controlled by hyoscyamus. It acts well in the *insomnia* of exhaustion, where there is continual agitation and nervous unrest. Hyoscyamus is especially valuable to control the nervous phenomena following fevers and other exhausting diseases. Nervous heart action is amenable to it, as is also tumultuous heart-action, with valvular insufficiency.

Where the fresh leaves can be obtained, they are employed in fomentation, or bruised, as an external application to allay the *inflammatory* and *painful condition* of *ulcers* and *tumors*, as well as to relieve *nervous headache*, and the pain in *gouty*, *neuralgic*, *rheumatic*, and similar affections. An ointment of hyoscyamus extract (ʒj to petrolatum ℥j), is useful to relieve pain in *hemorrhoids*, *cancer*, etc. A liniment for *glandular swellings* may be made by mixing together, extract of henbane, 1 drachm; white soap, 4 drachms, and linseed oil, 12 fluid ounces; to be applied 2 or 3 times a day with considerable friction. Dose of the powdered leaves, from 2 to 10 grains; of the tincture, from 30 drops to 2 fluid drachms; and of the alcoholic extract, which is the only extract that should be used, from $\frac{1}{2}$ to 2 grains, which may be cautiously increased, according to its effects; of specific hyoscyamus, fraction of a drop to 20 drops. It should be remembered that the administration should begin with the smaller doses, and that patients become tolerant of its action so that enormous doses may be given. For the specific action, however, only small doses are required.

Hyoscyamine and Hyoscine (Scopolamine).—The two alkaloids of hyoscyamus—*hyoscyamine* and *hyoscine*—or their salts, chiefly the hydrobromates, are frequently given in the nervous disorders above mentioned, hyoscyamine salts being preferred to those of hyoscine, as the latter are said to sometimes produce mental excitation. From the fact that much of the so-called "amorphous hyoscyamine," the most active kind, is frequently largely contaminated with hyoscine it has been extremely difficult to determine the exact field of action of each, or the proper doses. Hyoscine is much more active than hyoscyamine, the ordinary hypodermatic dose ranging from $\frac{1}{300}$ to $\frac{1}{100}$ grain, though even in these doses it should be cautiously employed. The hydrobromate of hyoscyamine may be given in much larger doses. Hyoscine hydrobromate and hyoscyamine hydrobromate have been especially employed in *acute mania*, *epileptic mania*, *delusional insanity*, *chronic dementia*, *chronic alcoholism*, *paralysis agitans*, *sexual excitation* with *seminal emissions* ($\frac{1}{120}$ to $\frac{1}{80}$ grain at bedtime), *nymphomania*, *whooping-cough*, *enteralgia*, *spasmodic asthma*, *spasmodic torticollis*, *facial neuralgia*, *insomnia*, *profuse sweating*, *tetany*, *tetanus*, *neurasthenia of hypochondriasis*, etc. Hyoscine has been used to cure the *morphine habit*.

As a mydriatic, hyoscine is more powerful and more prompt than atropine, but the dilatation produced is less prolonged; accommodation, however, is slowly recovered. The hydrobromate is the form generally employed, being used in the cases in which atropine is apparently indicated, but when the latter gives rise to atropine irritation. The solutions generally employed are those containing from 2 to 4 to 8 grains to the ounce of distilled water. Scopolamine (see *Scopolia atropoides*), is now recognized as practically identical with hyoscine, the *German Pharmacopœia* having adopted the name *Scopolamin Hydrobromate* for hyoscine hydrobromate, from the fact that most of the hyoscine is now prepared from *Scopolia atropoides*, it yielding larger amounts than other hyoscine-yielding species. One drop of a 1 to 3000 aqueous solution of scopolamine hydrobromate produces complete dilatation of the pupils in $\frac{1}{4}$ hour, and maintains the dilatation for 2 days. A drop of 1 to 20,000 aqueous solution will produce a partial dilatation in 20 minutes (Murrell). Scopolamine may be employed for *accommodation paralysis* by applying 1 drop only by means of a glass rod. For examining for *errors of refraction* 1 drop of a solution of about $\frac{1}{4}$ grain to 1 fluid ounce of water is preferred. The lids should be rubbed outward to prevent the fluid from entering the ducts. Several cases of most profound poisoning have resulted from the use of even weak solutions of this mydriatic, therefore its action should be closely watched (Prof. W. B. Scudder, M. D.).

The leaves of hyoscyamus in infusion, or the extract dissolved in water, were formerly used locally to the eye before operating for *cataract*, in order to dilate the pupil, which is usually effected in 3 or 4 hours, without any subsequent injury to the eye. This was succeeded by the use of hyoscyamine and its salts, which have now given way to hyoscine hydrobromate; occasionally hyoscine hydriodate is used for the same purpose.

As to the dosage of the alkaloids, hyoscamine and hyoscine and their salts, there has been much variance, particularly in regard to the former, which in commerce is often of greatly variable strength. Hyoscyamine has been given in doses as large as 1 grain, but the ordinary commencing dose should not be larger than $\frac{1}{6}$ grain, gradually increased until the desired action is obtained. Hyoscyamine sulphate, $\frac{1}{130}$ to $\frac{1}{40}$ grain; by instillation into eye, $\frac{1}{40}$ to $\frac{1}{20}$ grain; hyoscyamine hydrobromate, $\frac{1}{150}$ to $\frac{1}{50}$ grain; by instillatiou into the eye, $\frac{1}{40}$ to $\frac{1}{20}$ grain; hyoscine hydrobromate, $\frac{1}{150}$ to $\frac{1}{80}$ grain; to eye, $\frac{1}{2}$ to 1 per cent solution; hypodermatically, $\frac{1}{300}$ to $\frac{1}{100}$ grain. As a general rule the hypodermatic dose of these salts is one-half or less than one-half as small as when given by mouth. Particularly should care be exercised in the case of the hyoscine salts, the preferred doses of of which are those of $\frac{1}{300}$ to $\frac{1}{100}$ grain.

Specific Indications and Uses.—Nervous irritability, with unrest and insomnia; face flushed and pupils dilated; fright, terror, restlessness in sleep; loquaciousness; busy delirium of a low muttering character, or with singing, talkativeness, amusing hallucinations and illusions, etc.; garrulousness; destructiveness; sharp, dry, nervous cough, worse upon assuming a recumbent position; muscular spasms; choking sensations; rapid and palpitating cardiac action.

Preparations Containing Hyoscyamus.—Balsamum Tranquillans. The *French Codex* has a preparation of the above name made by treating narcotic and aromatic plants with olive oil to extract their active constituents. It is used as a local application for *pain*. A modified preparation has been used in this country. Take 60 grains of each of the alcoholic extracts of belladonna, hyoscyamus, conium, and stramonium, and 24 grains of aqueous extract of opium. Add 2 fluid ounces of boiling water to soften the extracts, and add olive oil, 8 fluid ounces. Digest with moderate heat until the water is dissipated, and filter. Add to the filtrate 20 minims each of the essential oils of lavender, sage, peppermint, thyme, wormwood, and rue. It is a good application in *earache*, a few drops being introduced upon cotton into the external auditory meatus. Care should be observed in its use.

Oleum Hyoscyami Compositum (N. F.), *Compound oil of hyoscyamus, Balsamum tranquillans.*—"Oil of absinth, oil of lavender, oil of rosemary, oil of sage, oil of thyme, of each, 2 drops; infused oil of hyoscyamus (F. 279), one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Mix them. *Note.*—Oil of absinth is the volatile oil of *Artemisia Absinthium*, Linné (wormwood), and oil of sage is the volatile oil of *Salvia officinalis*, Linne. Infused oil of hyoscyamus is the *Oleum Hyoscyami* of the *German Pharmacopœia*. The *Baume Tranquille* (*Balsamum Tranquillans*) of the *Codex* is a more complex preparation, not identical with the above, but possessing about the same properties" (*Nat. Form.*). This and the preceding preparation may be employed as embrocations for the relief of *neuralgic*, *myalgic* and *rheumatic pains*.

HYPERICUM.—ST. JOHN'S WORT.

The leaves and flowering tops of *Hypericum perforatum*, Linné.

Nat. Ord.—Hypericaceæ.

COMMON NAME: *St. John's wort.*

ILLUSTRATION: Johnson's *Med. Bot. of N. A.*, Fig. 112.

Fig. 140.

Hypericum perforatum.

Botanical Source.—This plant has a perennial, woody, tufted, fusiform, tortuous, somewhat creeping root. Its stem is 2-edged, branchiate, erect above, curved below, branched, and from 1 to 2 feet high. The leaves are very numerous, elliptical or ovate, obtuse, opposite, entire, marked with pellucid dots, of a pale-green color, from 6 to 10 lines long, one-third as wide, the ramial leaves being much smaller. The flowers are numerous, of a bright-yellow color, and borne in dense, forked, terminal panicles. The calyx is persistent; and the sepals are 5, acute, lanceolate, connected at the base, with 5 dark-colored glands. Petals 5, twice as long as the sepals, ovate, obtuse, yellow, dotted, and streaked with black or dark purple. Stamens numerous, united at base, divided into 3 sets, with small anthers. Styles 3, short, erect,; stigmas small. The capsule is roundish, 3-celled and 3-valved; the seeds numerous, small, and roundish. The whole herb is dark-green, with a powerful scent when rubbed, and stain the fingers dark-purple, from the great abundance of colored essential oil (L.—W.).

History and Chemical Composition.—St. John's wort is an herb abundantly growing in this country and Europe, and proving exceedingly annoying to farmers. The flowers appear from June to August. It has a peculiar, terebinthine odor, and a balsamic, bitterish, rather astringent taste. It imparts its properties to water, alcohol, ether, oils, or alkaline solutions. Other species of Hypericum are possessed of medicinal properties, notably the *Hypericum sarothra*, Michaux, *pine-weed* or *orange-grass*, growing in sands, which has aperient qualities. An allied plant, the *Ascyrum crux-Andreæ*, Linné, or *St. Andrew's cross*, has been locally applied to glandular indurations and swellings. Hypericum contains a volatile oil, a resin, tannic acid and coloring matter (Blair, *Amer. Jour. Pharm.*, Vol. II, p. 23). Pectin is also present. The red coloring principle is a resinous body known as *hypericum red*. The odor of this principle is similar to that of the flowers. Karl Dieterich (*Pharm. Centralh.*, 1891, p. 683) macerated the flowers with 90 per cent alcohol, and obtained a tincture of a rich red color, containing a mixture of two coloring matters, a yellow principle soluble in petroleum ether, and a red coloring matter, insoluble in this solvent. The red principle, in solid form, was a resinous mass of a green lustre, soluble in alcohol with red color, and resembling *carthamin red;* insoluble in fatty, but soluble in ethereal oils. Acids dissolve it with red, alkalies, chloroform, benzol and carbon disulphide with green color. The substance does not possess any advantage over other indicators in alkalimetry. When exposed to air in thin layers, it turns greenish at once. The aqueous extractive matter of the flowers contains calcium, magnesium, potassium, and oxalic, sulphuric and carbonic acids.

Action, Medical Uses, and Dosage.—Astringent, sedative, and diuretic. Used in *suppression of the urine*, *chronic urinary affections*, in *diarrhœa*, *dysentery*, *worms*, *jaundice*, *menorrhagia*, *hysteria*, *nervous affections* with depression, *hemoptysis*, and other *hemorrhages*. Hypericum has undoubted power over the nervous system, and particularly the spinal cord. Homœopathic physicians regard it as the arnica of that structure. It is used. in *injuries of the spine* and in lacerated and punctured *wounds* of the limbs to prevent tetanic complications and to relieve the excruciating pains of such injuries (Scudder). It is highly valued by Webster in *spinal irritation* when, upon gentle pressure upon the spinous processes of the vertebræ, burning pain is elicited. Throbbing of the whole body in nervous individuals, fever being absent, is said to be a good indication for hypericum. The usual method of administration is: ℞ Tincture of hypericum, gtt. x to xxx; aqua, fl℥iv. Mix. Sig. Teaspoonful every 1 or 2 hours. Externally, hypericum may be used in fomentation, or used as an ointment for dispelling hard *tumors, caked breasts, bruises, ecchymosis, swellings, ulcers*, etc. The blossoms, infused in sweet oil or bear's oil, by means of exposure to the sun, make a fine, red balsamic ointment for *wounds, ulcers, swellings, tumors*, etc. A very excellent ointment for *tumors, ecchymosed conditions*, etc., may be made by adding to 1 pound of lard, ½ pound of the recent tops and flowers of St. John's wort, and ½ pound of fresh stramonium leaves; bruise all together, expose to a gentle heat for an hour, and strain. Dose of the powder, from ½ to 2 drachms; of the infusion, from 1 to 2 fluid ounces. The dose of the strong tincture is from ½ to 10 minims. The saturated tincture of the fresh herb (℥viii to alcohol, 76 per cent, Oj) is nearly as valuable as that of arnica for *bruises*, etc., and may be substituted for it in many instances.

Specific Indications and Uses.—Spinal injuries, shocks, or concussions; throbbing of the whole body without fever; spinal irritation, eliciting tenderness and burning pain upon slight pressure; spinal injuries, and lacerated and punctured wounds of the extremities, with excruciating pain; hysteria; locally to wounds, contusions, etc.

HYSSOPUS.—HYSSOP.

The flowering tops and leaves of *Hyssopus officinalis*, Linné.

Nat. Ord.—Labiatæ.

COMMON NAME: *Hyssop*.

Botanical Source.—Hyssop is a perennial herb. Its stems are quadrangular, woody at the base, spreading, very much branched, and 1 foot or 2 in height; the branches are rod-like. The leaves are opposite, sessile, usually oblong-linear, or lanceolate, sometimes elliptical, sometimes narrower, acute, entire, punctate, green on each side, rather thick, and 1-ribbed underneath. The flowers are bluish-purple, seldom white, and borne in racemose, second whorls, consisting of from 6 to 15 flowers. The floral leaves are like those of the stem, but smaller. Outer bracts lanceolate-linear, acute, scarcely shorter than the calyx. Upper lip of the corolla erect, flat, emarginate; lower lip trifid, spreading, with the middle lobe larger. Stamens 4, protruding, and diverging; anthers with linear divaricating cells (L. W.).

History and Chemical Composition.—Hyssop inhabits Europe and this country, being raised principally in gardens. It flowers in July. The tops and leaves are the medicinal parts; their odor is pleasantly fragrant, and their taste hot, spicy and somewhat bitter, which properties are due to a volatile aromatic oil, which rises in distillation both with water and with alcohol.

This *oil of hyssop* is limpid, neutral, and of a pale yellow or greenish-yellow color, camphoraceous in taste, neutral in reaction, and in odor resembling hyssop. Alcohol freely dissolves it. Its specific gravity is 0.88 to 0.98. It is an oxygenated oil, or, according to Stenhouse, a mixture of several such oils (Husemann and Hilger). Trommsdorf has shown Herberger's (1829) *hyssopin* to be merely an impure sulphate of calcium. Hyssop also contains fat, tannin, resin, mucilage and sugar. Water, by infusion, or alcohol extracts the active virtues of hyssop. It is said to contain some bitter principle and sulphur. In Mexico the *Salvia axillaris*, Sesse, is called *hyssop*.

Action, Medical Uses, and Dosage.—Stimulant, aromatic, carminative and tonic. Principally used in *quinsy* and other *sore throats*, as a gargle, combined with sage and alum, in infusion sweetened with honey. Also recommended in *asthma, coughs*, and other affections of the chest, as an expectorant. The leaves, applied to *bruises*, speedily relieve the pain, and disperse every spot or mark from the parts affected. The infusion (herb, ʒiv to aqua Oj) may be given freely; the volatile oil, in doses of 1 or 2 drops.

ICHTHYOCOLLA (U. S. P.)—ISINGLASS.

"The swimming-bladder of *Acipenser Huso*, Linné, and of other species of *Acipenser*"—(*U. S. P.*).

Class: Pisces. *Order:* Sturiones.

Source and History.—Isinglass is an almost pure gelatin, being usually procured from the *air-bags*, *sounds*, or *swimming-bladders* of various fishes, chief among which are those furnishing *Russian isinglass.* These are mainly the *belugo* (*Acipenser Huso*, Linné), the *sterlet* (*Acipenser ruthenus*, Linné), the *osseter* (*Acipenser Güldenstädti*, Ratzeburg), and the *sewruga*, or *starred sturgeon* (*Acipenser stellatus*, Pallas). These sounds are membranous sacs situated under the spine, in the middle of the back, and above the center of gravity. In most fishes they connect with the stomach or œsophagus by the pneumatic duct; these sacs are filled with air, containing about 80 per cent of oxygen, and are composed of a firm, silvery external coat, and two thin and delicate internal coats. The sounds are removed from the fish, cut open, carefully washed, and then exposed to the air to dry; then, after being dampened to soften them, they are made into rolls about half an inch in diameter, and folded between three pegs, into the shape of a horseshoe, heart, or lyre (*long* and *short staple*), or folded in the manner book-binders fold printed sheets of paper (*book isinglass*), or dried in single sheets (*sheet isinglass*). When the sound is rolled out it is termed *ribbon isinglass.* The internal membrane of the sounds is thin and insoluble. Sometimes isinglass is reduced to small shreds, when it will be scarcely possible for the eye to distinguish the inferior from the finer kinds; the latter may be known by their whiteness, freedom from unpleasant fishy odor, solubility in water, and translucency of the jelly obtained on cooling from its hot solution. The above are the best forms; the sheet isinglass is superior to any; an ounce of water will dissolve 10 grains of it, leaving hardly any insoluble matter, and furnishing an excellent jelly.

There are other kinds of an inferior character, as the *cake isinglass,* which is in cakes or round pieces, having an unpleasant smell, and a tawny color, and which is principally used by artists. The *Samovey isinglass* is prepared in Russia from the *Silurus glanis*, but it is not so pure as those named above. Isinglass is also made in the eastern states, in this country, from the sounds of the *hake* (*Gadus merluccius*, Linné) and *cod* (*Gadus Morrhua* Linné, or *Morrhua americana*), and other fishes. It is in long, flat pieces, known as *ribbon isinglass*, is very pure, being almost wholly soluble in water, but its piscatory flavor is an objection to its use for domestic or pharmaceutical purposes. A very inferior isinglass is prepared in Brazil from the sounds of fish (*lump isinglass* and *honeycomb isinglass*), and in the East Indies (*purses* and *leaves*, P.) (*Amer. Jour. Pharm.*, Vol. XVIII, p. 54). A variety of fish glue, apparently procured from the natatory bladder of the yellow sturgeon, but unfit for pharmaceutical purposes, has been met with in commerce in France. It swells up in water and is only partially dissolved. Isinglass prepared from the air-bags of large fishes, when unopened, is known as *pipe* or *purse isinglass.*

When American isinglass, in solution, is thinly spread on cotton cloth, previously oiled and dried, it forms a very pure article, in clear, delicate laminæ, but having a piscatory smell, and is known as "*transparent* or *refined glass.*" The so-called *Chinese* or *Japanese isinglass* is the vegetable product of certain algæ (see *Agar Agar*).

Description and Chemical Composition.—"In separate sheets, sometimes rolled, of a horny or pearly appearance; whitish or yellowish, semi-transparent, iridescent, inodorous, insipid; almost entirely soluble in boiling water and in boiling diluted alcohol. A solution of isinglass in 24 parts of boiling water forms, on cooling, a transparent jelly"—(*U. S. P.*).

Isinglass is sometimes kept in thin, very fine cuttings, in which form it is more readily dissolved by boiling water. Isinglass is chiefly a very pure gelatin—that known as *glutin* (see *Gelatin*). The best kinds are white, transparent, glistening, odorless and tasteless; the poorer varieties are colored, opaque, and have either a fishy taste or smell. It is soluble in weak acidulous and alkaline liquids, and in water at 100° C. (212° F.), forming with the latter, when strained and cooled, a pure animal jelly. It is not dissolved by alcohol, ether, nor by water at 15.5° C. (60° F.), but with this latter it expands and becomes soft. Tannic acid added to its solution occasions a tough, gelatinous precipitate, tannate of gelatin. When boiled with caustic potash, or with concentrated mineral acids, it is decomposed, forming *sugar of gelatin* or *glycocoll* (*amido-acetic acid*), $C_2H_3(NH_2)O_2$, which is in large transparent crystals, very sweet, soluble in water, and forming beautifully crystallized salts with acids. John found 100 parts of the purest isinglass to consist of 70 parts of gelatin, 16 of *osmazome*,* 2.5 of membrane insoluble in boiling water, 4 of free organic acid salts of potassium, sodium and phosphate of calcium, and 7 parts of moisture. Mr. R. Baird (*Amer. Jour. Pharm.*, 1888, p. 608) found the ash in three samples of Russian isinglass to vary from 0.4 to 0.6 per cent, while in two specimens of American isinglass the ash amounted to 2.17 and 2.40 per cent. Prof. W. T. Wenzell (*Amer. Jour. Pharm.*, 1894, p. 447) recommends the use of American isinglass for the quantitative determination of tannin, in place of the hide-powder usually employed.

Action, Medical Uses, and Dosage.—Isinglass is seldom used in medicine, except as a nutritive. It is used as a diet, in the form of jelly, or added to other jellies, to give them a tremulous appearance. It has proved very useful for *scrofulous* and *consumptive patients.* I have used the following preparation in *incontinence of urine*, both in children and adults, in many instances, and have found it a useful as well as agreeable remedy, proving serviceable when other means had failed: Take of isinglass (*long staple*), 1 roll; boil it in 1 pint of water till it is dissolved, then strain, add 1 pint of sweet milk, put it again over the fire, and remove it just as ebullition commences; then sweeten with loaf sugar, and grate nutmeg upon it. When made it very much resembles custard. Of this, a tumblerful may be taken 3 or 4 times a day by an adult (K.). Isinglass is employed in the arts for various purposes, for clarifying or fining wines, beer, coffee, syrups, etc., and is a constituent of court-plaster. Three drachms form a proper jelly with a pint of water.

Cements.—An excellent cement, called ARMENIAN or DIAMOND CEMENT, is made with isinglass, which is valuable for mending glass, china, and porcelain vessels, which are not to be exposed to heat and moisture. It is made by sprinkling water upon 2 drachms of isinglass, allowing it to stand until softened, then adding as much proof-spirit as will rather more than cover it, then dissolving with a moderate heat. Have previously prepared, a solution made by dissolving 1 drachm of gum mastic in 2 or 3 fluid drachms of alcohol. Mix the two solutions, and stir in 1 drachm of gum ammoniacum, previously reduced to a fine powder, and rubbed down with a little water. Evaporate, if necessary, on a water-bath to a proper consistence. Keep the cement thus prepared in a vial. When required for use plunge the bottle in warm water, and keep it there until the cement becomes fluid; then apply it with a stick or small hard brush to the edges of the broken vessel, previously warmed. Compress the pieces firmly together until cold, taking care to make the contact perfect, and using a very thin layer of cement. When properly applied, the cement is almost, if not quite, as strong as the glass or china itself.

A cement for stoneware may be made by softening gelatin in cold water, warming and adding recently slaked lime enough to render the mass sufficiently thick for the purpose. A thin coating of this cement is to be spread while warm over the gently heated surfaces of fracture of the articles, and dried under strong pressure.

ICHTHYOLUM.—ICHTHYOL.

FORMULA: $C_{28}H_{36}S_3O_6(NH_4)_2$. MOLECULAR WEIGHT: 598.88.

SYNONYMS: *Ammonium ichthyol sulphonate, Ammonium ichthyol.*

Source and Preparation.—In the Tyrolese Mountains of Europe are found immense deposits of a bituminous mineral containing the fossilized remains of fishes and sea animals of a pre-historic period. If this mineral be subjected to destructive distillation, it yields a transparent, crude oil, of a brownish-yellow color, and a peculiar, penetrating, pungent odor. It has a density of 0.865 and boils between 100° C. and 255° C. (212° F. and 401° F.). The crude oil is mixed with strong sulphuric acid in excess, whereby it becomes ichthyolsulphonic acid When the reaction has ceased the mixture is treated repeatedly with a strong solution of common salt, to remove the remaining sulphuric and sulphurous acids, when the ichthyolsulphonic acid, in form of a dark mass, separates. If the acid be saturated with ammonia, ammonium ichthyolsulphonate is formed.

Ichthyol the ammonium salt), is a syrupy liquid of a reddish-brown color, and a bituminous taste and odor. It contains as much as 10 per cent of sulphur.

---

* *Osmazome*, according to Gmelin (*Handbook of Chemistry*, translated by Watts, London, 1871 Vol XVIII, p. 71), was obtained by Thenard by exhausting flesh with water, evaporating the extract, treating the residue with alcohol and evaporating the alcoholic liquid.

Water dissolves it, forming a clear, red-brown fluid, of faintly acid reaction. It is but partially soluble in ether or alcohol, but when these are mixed, volume for volume, complete solution is effected. The aqueous solution yields a tarry layer of the free acid upon the addition of hydrochloric acid. When dried by the heat of a water-bath, it loses nearly half (45 per cent) of its weight. Ichthyol puffs up when heated, and carbonizes, and if the heat be continued sufficiently long it completely volatilizes, leaving no residue. It mixes readily with fats and petrolatum in any proportion. (For a more detailed description of ichthyol and related preparations, see *Pharm. Centralhalle*, 1883, pp. 113 and 477; and 1886, p. 115.)

Action, Medical Uses, and Dosage.—Owing to the presence of the sulphur contained in it, several dermatologists were led to the use of ichthyol in *skin affections*. For a time it was extensively used in almost every form of skin disease, as well as applied to *wounds* and other accidental lesions. *Rheumatic joints, gouty conditions*, and *sprains* were treated with it, as were *tonsillar enlargements* and other *glandular hypertrophies*. Internally, it was employed for the relief of *throat disorders* and *digestive derangements*, particularly those of a fermentative type, but its intolerable odor and taste have led to its abandonment for the latter types of disease. Active germicidal properties are attributed to it, and its use is now largely confined to cutaneous maladies, in which it appears to be no more successful than other bodies of a like nature, the extraordinary properties first attributed to it being given but little credence at the present time. It appears, however, to give fair results in *erysipelas*. The chief skin diseases in which it has been employed are *ulcerations, chilblains, frost-bites, contusions, urticaria, burns, scalds, acne, eczema, psoriasis*, and *entertrigo*. A pomade of 1 part of ichthyol, 2 parts of lanolin, and 6 parts of sweet almond oil, is said to have been signally useful in *smallpox*. As an inhalation, a 25 per cent aqueous solution of ichthyol may be employed; internally, from 1 to 20 minims may be given in milk or capsules; as an ointment, it may be used with lanolin or petrolatum in strengths ranging from 22 to 50 per cent.

Related Compounds.—OTHER ICHTHYOLS. When the term *ichthyol* alone is used it refers to *ammonium ichthyol*. There are, however, several other compounds of *ichthyolsulphonic* (*sulphoichthyolic*) *acid*, known respectively as *sodium ichthyol, lithium ichthyol, zinc ichthyol, mercury ichthyol*, etc., prepared by saturation of the acid with either the oxides or carbonates of these elements. The sodium salt is the one prepared for pill administration. It dissolves in water, and is alkaline in character. These ichthyols are all tar-like, brown or black masses.

THIOLUM OR THIOL.—This drug, obtained by E. Jacobsen by a patented process, occurs in two forms, the dry, *thiolum siccum*, and the fluid, *thiolum liquidum*, the latter containing about 40 per cent of dry thiol. The latter is a deep-brown, syrupy preparation, really a neutral solution of thiol in water, It has a peculiar odor resembling that of so-called Russia leather. Its density is 1.080 to 1.081. It is freely soluble in water and glycerin, with the first forming a frothy solution when agitated. The dry form is prepared by evaporation of the liquid thiol. Pure thiol is a dark-brown, non-hygroscopic powder, soluble in water. This agent has been employed for precisely the same conditions as ichthyol, a solution, or ointment, or occasionally the dry powder being applied. The advantage claimed over the former is the absence of odor. From 5 to 10 drops of the fluid, or 1 to 2 grains of the powder have been administered in *rheumatic complaints*.

TUMENOLUM, TUMENOL.—Tumenol is a dark-colored, syrupy fluid obtained from the purified oils from bituminous shale, by acting upon them with strong sulphuric acid. It is a mixture of sulphonic acids and sulphones. *Tumenol oil* consists of the sulphones separated from a caustic soda solution of tumenol, by means of ether. It is a thick, deep-yellow fluid, soluble in benzol and ether, but does not dissolve in water, unless *tumenol sulphonic acid* be present. A caustic soda solution of tumenol precipitates, upon the addition of hydrochloric acid, a dark-colored, bitterish powder, *tumenol sulphonic acid*. *Crude tumenol* (*tumenol venale*), is a soft, tough, resinous mass of a brown color and without odor, composed of tumenolsulphonic acid and tumenol sulphone. A lotion containing 10 per cent of tumenol and equal quantities of glycerin (or water), alcohol, and ether, has been highly endorsed by Neisser (1891), to control the *itching of prurigo, eczema*, and *parasitic*, as well as other *affections of the skin*. *Eczematous forms of skin disorders* appear to be best influenced by it.

ICHTHALBIN, *Ichthyol albuminate*.—A form of ichthyol for internal use, prepared by precipitating ichthyol with fresh albumen. Prolonged heating or washing of the precipitate removes the ichthyol taste and odor. This is an odorless and nearly tasteless, grayish-brown powder, insoluble in water and acid media, but soluble in alkaline media. It is slowly dissolved by the intestinal secretions. Claimed to be more valuable than ichthyol for internal use, but can not supplant it as an external remedy. Said to disinfect and regulate the action of the bowels, improve the appetite, and increase assimilation. The dose ranges from 5 to 30 grains, directly before meals; for children, the smaller doses should be given, mixed with powdered chocolate. It has been used in *intestinal atony* and *catarrh, rachitis, scrofula, anemia*, etc.

IGNATIA.—IGNATIA.

The seed of *Strychnos Ignatia*, Lindley (*Ignatia amara*, Linne filius; *Strychnos Ignatii*, Bergius; *Strychnos philippensis*, Blanco; *Ignatiana philippinica*, Loureiro).

Nat. Ord.—Loganiaceæ.

COMMON NAMES AND SYNONYMS: *St. Ignatius bean, Bean of St. Ignatius; Faba Ignatii, Semen Ignatiæ.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 179.

Botanical Source.—*Strychnos Ignatia* of Lindley, is a branching tree, with long, tapering, smooth, scrambling branches. The leaves are ovate, acute, petiolate, veiny, smooth, and a span long. Hooks none. Panicles small, axillary, 3 to 5-flowered, with short, round, rigid pedicels. The flowers are very long, nodding, white, smelling like Jasmine. The fruit is smooth, pear-shaped, the size of an ordinary apple or a Bonchretien pear; seeds about 20, somewhat angular, about 12 lines long, and imbedded in a pulp (L.).

Fig. 141.

Bean of St. Ignatius; fruit of Strychnos Ignatia.

History and Description.—This tree is indigenous to the Philippine Islands. Its seeds, the St. Ignatius bean of commerce, are about the size of olives, rounded and convex on one side, and somewhat angular on the other, pale brownish externally, with a bluish-gray tint, greenish-brown internally. Their substance is hard, compact, and horn-like. They are inodorous and of an exceedingly bitter taste.

Chemical Composition.—The St. Ignatius bean yields its properties to water, but alcohol is its best solvent. Pelletier and Caventou, in 1818, found it to contain the constituents of nux vomica only in different proportions. These chemists found 1.2 per cent of strychnine and little brucine. On the other hand, however, F. F. Mayer, in New York (*Amer. Jour. Pharm.*, 1863, Vol. 36, p. 219), found it to yield twice to three times as much brucine as of strychnine. More recently, B. Sundblom, in Prof. Flückiger's laboratory (*Archiv der Pharm.*, 1889, Vol. 227, p. 145), obtained from the seeds 0.178 per cent of strychnine and 0.278 per cent of brucine. (For details regarding these alkaloids, see *Nux Vomica.*) The alkaloids were observed by Pelletier and Caventou to occur in natural combination with *igasuric acid*, a substance identified by Höhn (*Archiv der Pharm.*, 1873, Vol. CCII, p. 137) as an iron-greening tannic acid. Mr. Jas. M. Caldwell (*Amer. Jour. Pharm.*, 1857, Vol. XXIX, p. 294) notes the absence of starch from the seeds, while albuminous matter is present to the amount of about 10 per cent (*Pharmacographia*). Prof. Flückiger (*Archiv der Pharm.*, 1889), examining authentic specimens of other parts of the tree, found in the bark of the stem 0.52 per cent of total alkaloids, strychnine predominating, while in the wood of the stem brucine was in larger amount. The root contains considerably less alkaloid, while the leaves are free from it.

Action, Medical Uses, and Dosage.—The action and uses of ignatia are very similar to those of nux vomica, but more energetic. It appears also to possess an influence over the nervous system of a tonic and stimulating character, not belonging to nux vomica or strychnine. It is never a remedy for conditions of excitation of the nervous system, but its key-note is *atony;* it is the remedy for *nervous debility*, and all that that term implies, being one of the best of nerve stimulants and nerve tonics. It was early recognized in this work as a remedy for *nervous debility, amenorrhœa, chlorosis*, etc. As a rule, the dose of ignatia administered is too large, a depressing headache often resulting from its immoderate use. The preparation mostly employed in our school is specific ignatia, of which from 5 to 10 drops should be added to 4 fluid ounces of water, and the solution be administered in teaspoonful doses every 2 or 3 hours. Bearing in mind the condition of *nervous atony*, it may be successfully administered in *anemia*, where the patient is cold, and especially when coldness of the extremities is one of the distressing features of the menopause. It should be thought of in anemic states of the brain, and particularly in those cases where the patient exhibits *hysterical, melancholic*, or *hypochondriacal demonstrations*. It is a remedy for digestive disorders, such as *atonic dyspepsia* and *chronic catarrh of the stomach*, with atony, and *gastralgia* or *gastrodynia*. The *sick headache of debility* is relieved by it. Shifting, dragging, boring, or darting pains, deeply seated in the loins or lumbar region, are those benefited by ignatia. It is an important remedy in *atonic reproductive disorders*. Eclectics have not found it to be especially adapted to females only, as have the Homœopaths, who declare it the remedy for women, while nux and strychnine are remedies for men. *Sexual coldness* in both sexes, *impotence* in the male and *sterility* in the female are remedied many times by the judicious administration of ignatia. The deep-seated pelvic pains of women, particularly *ovarian pains* and *uterine colic* are especially relieved by ignatia, which is also indicated in *menstrual disorders* with colic-like pains, heavy dragging of the ovaries, and an abnormally large and heavy womb. If added to these pelvic weaknesses, the general nervous system is greatly debilitated, there are wandering pelvic pains or pain in the right hypochondrium with constipation, *neuralgia* in other parts of the body, twitching of the facial muscles, a tendency to paralysis, and choreic and epileptiform symptoms, associated with a disposition to grieve over one's condition, the indications for ignatia are still stronger. But to obtain beneficial effects the dose must be small.

Ignatia has shown itself useful in atonic states of the eyes and ears. *Atonic visual asthenopia* and *catarrhal conjunctivitis*, with palpebral twitchings and a sensation as of dust in the member, are relieved by doses of $\frac{1}{10}$ to $\frac{1}{6}$ drop of specific ignatia, while $\frac{1}{5}$-drop doses have proved useful in the *tinnitus* and *impaired hearing* depending upon general atony of the system (Foltz).

The dose of ignatia (powdered) may range from $\frac{1}{10}$ to $\frac{1}{2}$ grain; of the alcoholic extract, from $\frac{1}{20}$ to $\frac{1}{8}$ grain; of specific ignatia, from $\frac{1}{10}$ to $\frac{1}{5}$ drop; of the tincture, from $\frac{1}{5}$ to 2 minims. The treatment of poisoning by ignatia is identical with that of strychnine, which see.

Specific Indications and Uses.—General nervous atony; disposition to grieve; dull, deep-seated, dragging pain in loins, back, or right hypochondrium; hysterical, choreic, epileptoid, or hypochondriacal manifestation, due to debility; dysmenorrhœa, with colicky pains and heavy womb; sexual frigidity, impotence, and sterility; wandering pelvic pains; coldness of extremities; muscular twitchings, particularly of face and eyelids; dull hearing, due to general atony; nervous depression; burning of the soles of the feet; congestive headache.

ILEX OPACA.—AMERICAN HOLLY.

The leaves of *Ilex opaca*, Aiton.
Nat. Ord.—Aquifoliaceæ.
COMMON NAME: *American holly*.

Botanical Source.—This tree rises from 20 to 40 feet in height, having leaves which are alternate, coriaceous, evergreen, smooth, and shining, flat, oval, acute at the end, and the wavy margins armed with strong, scattered, spiny teeth. The flowers are small, greenish-white, arranged in scattered clusters along the base of the young branches, and borne from the axils of the leaves. The calyx is persistent; the calyx-teeth acute. The corolla is rotate, monopetalous, and 4-cleft; the stamens erect and alternate with the divisions. The ovary is globular, and 4-celled. Stigmas 4, subsessile, and obtuse. The fruit is a red, globular berry of 4 cells; the nutlets are 4 and striate (G.—W.).

Fig. 142.

Ilex opaca.

History and Chemical Composition.—The holly is found growing throughout the United States from Maine to Louisiana, in moist woodlands, and flowering in June. It is quite common to the Atlantic states, especially New Jersey. The viscid substance of the inner bark, like the mistletoe berry, furnishes an adhesive material known as *bird* The berries are about as large as a whortleberry, of a red color, and an acrid, bitterish taste. The leaves are the medicinal parts. They have a bitter, somewhat harsh taste, but no odor, and yield their virtues to water or alcohol. They are believed to contain *ilicin* (see *Related Species*), wax, gum, salts, etc. (For the preparation of Rousseau's *ilicin*, see this *Dispensatory*, last revision.) Mr. D. P. Pancoast (*Amer. Jour. Pharm.*, 1856, Vol. XXVIII, p. 315) prepared from the leaves of American holly an aqueous decoction from which the bitterness was removed by charcoal, and subsequently abstracted from the latter by alcohol. An amorphous, non-hygroscopic, intensely bitter mass resulted upon evaporation of the solvent, partially soluble in water, and completely soluble in alcohol and ether. It could not be obtained in the crystallized state. By the same process the author isolated from the berries a crystallizable, very bitter principle, soluble in ether, water, and alcohol. Acids precipitate it from aqueous solution. The fruit contains tannin. Mr. Walter A. Smith (*Amer. Jour. Pharm.*, 1887, p. 230) obtained from the leaves, by extraction with benzin, a volatile oil of an acrid, mustard-like odor, and also identified a glucosid. The leaves contained 4.5 per cent of ash.

Action, Medical Uses, and Dosage.—Holly leaves are tonic and febrifuge; said to be very efficient in the treatment of *intermittent fevers*, in doses of 60 grains of their powder administered 1 or 2 hours previous to the chill. The infusion has also proved beneficial in *icterus*, *pleuritis*. *catarrh*, *variola*, *arthritis*, etc. The berries are said to be emeto-cathartic and cholagogue; from 8 to 15 of them will act as a hydragogue. According to Dr. Rousseau, ilicin acts decidedly upon the spleen, liver, and pancreas, producing a sedative effect, and is a cheap substitute for quinine. Its dose is 10 grains in pill form, gradually increased to 30 grains.

Related Species.—*Ilex aquifolium*, Linné, *European holly*, together with several other species in this country, possess properties similar to those of American holly. Dr. F. Moldenhauer has found in the leaves a crystalline yellow coloring matter, which is scarce in the leaves when they are collected in January, but abundant when gathered in August. It is soluble in alcohol or hot water, but insoluble in ether or cold water, loses its color at 185° C. (365° F.), and fuses at 197.7° C. (388° F.), decomposing slightly above this temperature. He gave it the name *ilixanthin* ($C_{17}H_{22}O_{11}$). He also isolated from the aqueous extract the crystallizable calcium salt of a syrupy acid, *ilicic acid*. *Ilicin* is the bitter principle upon which the febrifuge properties of the leaves depend; it has not been obtained as yet in a pure state. The leaves have been used in *intermittent fevers* and *rheumatism*, and the berries in *dropsy*. The leaves produce gastric heat, nausea, and colic. The berries have emeto-cathartic properties.

Ilex Cassine, Walter (*Ilex vomitoria*, of Aiton), or *South Sea tea*, an evergreen shrub, growing in the southern states, is the *Cassine* of the Indians. It is also known as *Cassena*, *Yaupon*, or *Youpon*. A liquid, called *black drink*, is prepared by boiling the toasted leaves in water; in the performance of their religious rites, and on great occasions when in council, the men only are permitted to drink this, for the purpose of cleansing their systems. The leaves have a rough, aromatic taste, no odor, and in large doses their decoction causes active emesis, catharsis, and diuresis; in small quantity it greatly increases the urinary discharge. A few leaves of this plant lessen the injurious influence of saline water, and it is used for this purpose by persons along the sea shore in North Carolina. According to the analysis of Dr. F. P. Venable (*Amer. Jour. Pharm.*, 1885, p. 390), the dried leaves contain 0.32 per cent of *caffeine*, 7.39 per cent of tannin, and 5.75 per cent of ash. Mr. Henry M. Smith (*Amer. Jour. Pharm.*, 1872, p. 216) found 0.011 per cent of a volatile oil, 3.4 per cent of resin, and 0.122 per cent of caffeine. (For a detailed and exhaustive article on *Ilex Cassine* see monograph by Edwin M. Hale, M. D., *Bulletin No.* 14, Division of Botany, U. S. Department of Agriculture.)

Ilex glabra. *Ink berry*.—Sandy grounds from New England to Florida. Employed chiefly for ornamentation, and was at one time used in *intermittent fevers*.

Ilex Dahoon, Walter; *Dahoon holly*, and *Ilex myrtifolia*, Walter; both of southern states, are also known as *Cassena*.

Ilex paraguayensis, St. Hilaire; Argentine Republic, and Brazil.—This tree yields *Paraguay tea* or *Yerba maté*, *St. Bartholomew's tea* or *Jesuit's tea*, which is consumed in immense quantities in South America in place of Chinese tea. Its effects are said to more nearly resemble coca than tea. The plant grows along water courses, and from December to August collecting parties gather the leaves which, after a preparatory torrification to enhance their aroma, are powdered and enter into commerce and are sold to be prepared by infusion like common tea. Their chief constituent is caffeine, which exists in quantities varying from 0.2 per cent to 1.8 per cent, the average yield (Peckolt) being 0.64 per cent. Tannin (*matétannic acid*) is present in amounts of from 10 to 16 per cent (A. Robbins, *Amer. Jour. Pharm.*, 1878, p. 273). The leaves are most aromatic just before the fruit is ripe. Volatile oil, a stearopten, and a crystallizable acid, *mateviridic acid*, have also been obtained from the leaves. The infusion of Paraguay tea is diuretic and sudorific, and in excessive doses acts as a drastic purgative. For an interesting article on *maté* or Paraguay tea, see Th. Peckolt, *Amer. Jour. Pharm.*, 1883, p. 570.

Fig. 143.

Ilex glabra.

ILLICIUM (U. S. P.)—ILLICIUM.

The fruit of *Illicium verum*, Hooker.

Nat. Ord.—Magnoliaceæ.

Common Names and Synonyms: *Star-anise, Star-anise fruit, Chinese anise; Semen badiana, Anisi stellata fructus.*

Illustration: Bentley and Trimen, *Med. Plants*, 10.

Botanical Source and History.—The plant bearing star-anise is a small tree or shrub, indigenous to southwestern China, growing in the mountainous elevations of Yunnan. The shrub attains a height of from 8 to 12 feet, and has entire, lanceolate, evergreen leaves, which are pellucid-punctate. The flowers are polypetalous and of a greenish-yellow color. The fruit is described below. This plant was introduced into Japan by the followers of Buddha, and planted near their temples.

Description.—The *U. S. P.* describes star-anise of commerce as follows, giving also the distinctive differences between it and the poisonous fruit of *Illicium anisatum*, Linné: "The fruit is pedunculate and consists of 8 stellately-arranged carpels, which are boat-shaped, about 10 Mm. ($\frac{3}{8}$ inch) long, rather woody, wrinkled, straight-beaked, brown, dehiscent on the upper suture, internally reddish-brown, glossy, and containing a single, flattish, oval, glossy, brownish-yellow seed; odor anise-like; taste of the carpels sweet and aromatic, and of the seeds oily. Star-anise should not be confounded with the very similar but poisonous fruit of *Illicium anisatum*, Linné (*Illicium religiosum*, Siebold), the carpels of which are more woody, shriveled, and have a thin, mostly curved beak, a faint, clove-like odor, and an unpleasant taste"—(*U. S. P.*). This last poisonous fruit is sometimes found as a dangerous admixture to true star-anise.

Chemical Composition.—The seeds contain, according to Meissner (1818), some volatile oil, resin, and a large amount of fixed oil. The fruit (without the seeds) contains volatile oil, resin, fat, tannin, pectin and mucilage. The volatile oil (*oil of star-anise*), amounts to about 4 to 5 per cent, and is almost identical with *oil of anise* (from *Pimpinella Anisum*, Linné). Star-anise oil (from Chinese fruit) according to Schimmel & Co.'s *Semi-annual Report* (October, 1893), has the specific gravity at 15° C. (59° F.), of 0.980 to 0.990, and its known constituents are *pinene, anethol, phellandrene, safrol*, and *hydro-quinone-ethyl-ether*, while only *anethol* ($C_6H_4[OCH_3][CH:CHCH_3]$) and *pinene* ($[C_{10}H_{16}]$) (Fluckiger, *Pharmacognosie*, 1891) are given as the constituents of *anise oil*, which has the same density as *star-anise oil*. J. F. Eykmann (1888) detected the poisonous *sikimin* in the fruit, while Schlegel found a crystalline principle of a pronounced odor of musk. He also found *saponin* in the watery extract (*Amer. Jour. Pharm.*, 1885, p. 426).

Action, Medical Uses, and Dosage.—Both the seeds and oil of star-anise possess the stimulant, diuretic, carminative, and slightly anodyne properties of anise. Locally applied and internally administered, they have been used for *abdominal pains*, particularly when associated with flatus, and in *bronchitis*, and locally alone in *earache* and *rheumatic complaints*. The dose of the powder is from 10 to 20 grains; of the oil, from 1 to 10 drops. Oil of star-anise is largely employed to impart a flavor to spirits, especially in France, Germany and Italy.

Related Species.—*Illicium anisatum*, Linné (*Illicium religiosum*, Siebold). This fruit was until quite recently (1880) considered identical with the preceding, the shrub bearing which was also known as *Illicium anisatum*, Loureiro, until it was determined by Hooker (1888) to be a distinct species, to which the name *Illicium verum*, Hooker, was applied. *Illicium religiosum* is indigenous to the eastern portion of Asia, and is cultivated in Japan, where the plant is known as *sikimi* (*shikimi*). Eykmann found in the seeds a crystalline, poisonous, non-glucosidal, non-alkaloidal body, *sikimin*, soluble in hot water, alcohol, and chloroform. For an account of the analysis, see *Amer. Jour. Pharm.*, 1881, p. 407. The volatile oil (*oil of star-anise*, from Japanese fruit), according to Schimmel & Co., contains *safrol*, and has a density of 0.984 to 0.994 at 15° C. (59° F.). The fruit is described above. It is highly poisonous, and attention was drawn to this fruit through cases of poisoning which occurred in the Netherlands, in 1880, as also in Japan, their native country. Fatalities in children have resulted from the ingestion of the seeds, the toxic symptoms being vomiting, convulsions resembling those of epilepsy, with frothing at the mouth, loss of consciousness, dilated pupils, and the face excessively cyanotic.

Illicium parviflorum, Michaux.—Georgia, Florida, and Carolina, in the hill districts. This species has yellow blossoms, the fruit is 8-carpelled, and has the taste of sassafras. They are poisonous. Barral *Amer. Jour. Pharm.*, 1890, p. 330), isolated a toxic glucosid from the seeds. The properties are thought to resemble those of *shikimi* (*Illicium religiosum*, Siebold).

Illicium floridanum, Ellis; *Stink-bush*, *Poison-bay.*—An evergreen shrub, growing from Florida along the Gulf of Mexico coast to Louisiana, and bearing purple flowers. The fruit is 13-carpelled, and has a disagreeable, anise odor resembling somewhat that of turpentine. Both fruit and leaves are poisonous. The fruit, leaves, and bark of this species are aromatic, the first being occasionally substituted for anise, the last for cascarilla. (See Henry C. C. Maisch, *Amer. Jour. Pharm.*, 1885, pp. 228 and 278, for a histological and chemical study of this plant.

Illicium majus, Hooker filius et Thomson.—Malay Peninsula. Fruit 11 or 13-carpelled, blackish-brown in color, and has a taste like mace.

Illicium Griffithii, Hooker filius et Thomson.—Bengal. Fruit 13-carpelled. Taste bitter and acrid, like bay-leaves and cubebs.

IMPATIENS.—JEWELWEED.

The plants *Impatiens pallida*, Nuttall, and *Impatiens fulva*, Nuttall.

Nat. Ord.—Geraniaceæ.

Common Names: I. (*Impatiens pallida*), *Balsam jewelweed*, *Balsam weed*, *Pale touch-me-not.* II. (*Impatiens fulva*), *Speckled jewels*, *Spotted touch-me-not.*

Botanical Source.—*Impatiens pallida* is an indigenous annual plant having a smooth, succulent, tender, subpellucid, branching stem, with tumid joints, growing from 2 to 4 feet in height. The leaves are oblong-ovate, coarsely and obtusely serrate, teeth mucronate, from 2 to 5 inches long, petiolate, and about two-thirds as wide. The flowers are large, pale-yellow, sparingly maculate, and mostly in pairs; the peduncles, 2 to 4-flowered and elongated. The sepals are apparparently but 4, the 2 upper united, the lowest gibbous, dilated-conical, broader than long, with a very short, recurved spur. The petals are apparently 2, unequal-sided and 2-lobed, each consisting of a pair united. Stamens 5, short; anthers opening on the inner face, connivent over the stigma. Ovary 5-celled; stigma sessile. Capsules oblong-cylindric, an inch long, 5-valved, bursting at the slightest touch when ripe, and scattering the anatropous seeds (W.—G.).

Fig. 144.

Impatiens pallida.

Impatiens fulva is the most common variety; its leaves are rhombic-ovate, obtusish, coarsely and obtusely serrate, with teeth mucronate. The flowers are smaller than in the previous one, deep-orange, maculate, with many brown spots; lower gibbous sepals acutely conical, longer than broad, with an elongated, recurved spur.

Impatiens balsamina, the *Garden balsam*, or *Ladies' slippers*, is spontaneous about gardens; its leaves are lanceolate, serrate, upper ones alternate; peduncles clustered and 1-flowered; spur shorter than the flowers. The flowers are red, white, purple, pink, flesh-color, and scarlet; sometimes they are double. This is an exotic plant, a native of the East Indies, and cultivated as a beautiful garden annual. Its height is from 1 to 5 feet (W.—G.).

Fig. 145.

Impatiens fulva.

History.—These plants grow throughout the United States, in moist, shady places, and along rills, in rich soil, flowering from July to September. The *I. pallida* is most common northward and westward, and the *I. fulva* southward. Both plants possess similar properties. The leaves are astringent. The whole plants are used medicinally, and impart their virtues to water. They contain a yellow coloring matter, but have not been chemically studied.

Action, Medical Uses, and Dosage.—They are aperient and diuretic; a decoction is recommended in *jaundice*, *hepatitis*, and *dropsy*. The juice is said to remove *warts*, cure *ringworms*, *salt-rheum*, etc., and to cleanse foul *ulcers;* or it may be applied for these purposes in the form of a poultice boiled in milk. The bruised plants or the juice applied to parts *poisoned by rhus*, give prompt relief. It also gives relief from the effects of stinging nettle. The recent plant boiled in lard, forms an excellent ointment for *piles*.

INDIGO.—INDIGO.

A blue dye-stuff obtained from several species of *Indigofera*.

Nat. Ord.—Leguminosæ.

SYNONYMS: *Indicum, Pigmentum indicum.*

Source and History.—The plants furnishing indigo are quite numerous; chief among them are *Indigofera tinctoria*, Linné, cultivated in India and the East India Islands; *Indigofera Anil*, Linné, growing in the West Indies, Central and South America, and *Indigofera argentea*, Linné, cultivated in Egypt and the French colonies in Africa. To these sources is to be added the commercial product called *Woad*, prepared from the leaves of *Isatis tinctoria* and *I. lusitanica* (*Nat. Ord.*—Cruciferæ), plants which were formerly much cultivated in France and Germany, and supplied the demand for indigo before it was introduced into Europe from foreign countries.

Indigo-blue does not pre-exist as such in these plants. . It is developed by the decomposition of the bitter glucosid *indican* ($C_{26}H_{31}NO_{17}$), a colorless chromogene existing therein. This substance also occurs sometimes in pathological urine. When acted upon by diluted acids or ferments, it is said to absorb water and to be hydrolyzed into *indigo-blue* ($C_{16}H_{10}N_2O_2$), and a saccharine principle *indiglucin* ($C_6H_{10}O_6$), which undergoes further decomposition by fermentation. However, oxidation also plays an important part in the production of indigo-blue. The plants are collected during the flowering season, and are kept immersed in water in soaking vats or cisterns. At a temperature of about 30° C. (86° F.), fermentation soon sets in, lasting from 12 to 15 hours. When the liquid becomes of a yellowish-green color, it is drawn off and stirred briskly for about 3 hours. The liquid now turns deep blue, and the indigo, being insoluble in water, and of a greater specific gravity, soon falls to the bottom. The supernatant liquid is removed, the thick indigo sediment is heated to the boiling point of water to prevent further fermentation, then strained, pressed, and cut into cubical blocks and carefully dried. Three hundred kilograms of the indigo plant yield about 1 kilogram of indigo (S. P. Sadtler, *Handbook of Industrial Organic Chemistry*, 2d ed., 1895).

Description and Chemical Composition.—Commercial indigo occurs in hard, porous, brittle lumps or cubes of a dark-blue color and devoid of taste or odor. Indigo which is firm, dense, not easily broken, and which has a dull or greenish or grayish hue, is of inferior quality. Its specific gravity varies between 1.32 and 1.45. Commercial indigo contains from 20 to 80 per cent of *indigo-blue*, the average being about 45 per cent; the remainder consists of *indigo-brown*, *indigo-red*, *indigo-gluten*, water, and varying quantities of mineral matters. The ash should not amount to more than 8 per cent. When indigo is rubbed with a hard and smooth body, the surface of friction assumes a copper-like lustre. Heated to 287.7° C. (550° F.), indigo sublimes as a violet-colored vapor, although not without decomposition, and condenses on cool surfaces in the form of small, acicular crystals of a copper hue. Indigo-blue is not affected by the ordinary solvents, such as water, alcohol, ether, diluted acids and alkalies. It can be crystallized, however, from aniline and oil of turpentine, and is also soluble in chloroform, glacial acetic acid, paraffine, castor oil, nitrobenzene, phenol, and similar solvents. Concentrated, especially fuming sulphuric acid, readily dissolves indigo, forming deep-blue solutions. According to the relative quantities of indigo and sulphuric acid, and the temperature maintained in the reaction, either *indigo-monosulphonic* (*sulpho-purpuric*) *acid* ($C_{16}H_9[SO_3H]N_2O_2$), or *indigo-disulphonic* (*sulphindigotic*) *acid* ($C_{16}H_8[SO_3H]_2N_2O_2$), may be obtained. The *monosulphonic acid* is insoluble in water; its sodium salt is soluble, and is called *indigo-purple* or *red-indigo carmine*. The *disulphonic acid* is soluble in water, and is the substance commercially termed *Saxony blue* or *Chemnitz blue*. The sodium or potassium salt of this acid is the true *indigo-carmine* or *soluble indigo* of commerce, and occurs in the form of a pasty mass or as a powder; in the latter case it obtains the commercial name *indigotine* (S. P. Sadtler, *Handbook*, 1895, p. 447). The name *indigotin* is also often given in text-books to the pure *indigo-blue* ($C_{16}H_{10}N_2O_2$).

Indigo-blue is converted by oxidizers, *e. g.*, nitric acid, into yellow-red, crystallizable *isatin* ($C_{16}H_{10}N_2O_4$), which, when distilled with caustic potash, yields *aniline*

($C_6H_5NH_2$). When indigo is acted upon by reducing agents in alkaline solution, *e. g.*, by dextrose, or sulphurous acid, or hydrogen sulphide, zinc, etc., a solution of a yellow color is yielded, containing alkali-soluble *indigo-white* ($C_{16}H\ N\ O$). This solution, exposed to the air, precipitates *indigo-blue* again. This reaction is made use of in dyeing; the cloth, being saturated with the alkaline solution containing *indigo-white*, is exposed to the air, whereby the indigo-blue formed is firmly fixed in the fiber.

Action, Medical Uses, and Dosage.—Indigo and its preparations when administered, have imparted a blue color to the cutaneous and renal secretions. Large doses cause gastro-intestinal irritation, debility, and nervous derangements. The sulphate is reputed an active emmenagogue, and indigo was several years ago tested as a remedy for *epilepsy*, but has been abandoned as inefficient and even detrimental. The dose may be stated at from 1 to 20 grains.

Synthetical Indigo.—Within the last 20 years, several syntheses of indigo-blue and its derivatives have been accomplished. An important stepping-stone to this feat was the synthesis of *Indol* (C_8H_7N) (the skeleton substance of indigo), by Baeyer and Emmerling, in 1869. The first synthesis of indigo by Baeyer (*Ber. d. Deutsch. Chem. Ges.*, 1880, p. 2254), was accomplished by converting *ortho-nitro-cinnamic acid* ($C_6H_4NO_2.CH{:}CH.COOH$) into *ortho-nitro phenyl propiolic acid* ($C_6H_4[NO_2].CC{:}COOH.$), and this into *indigo-blue* through the reducing agency of sugar in alkaline solution. The graphic formula of *indigo-blue* ($C_6H_4.NH.CO{:}C-C{:}CO.NH.C_6H_4$), elucidated by the researches of Prof. Baeyer and his co workers, suggests to him an analogy with that of the *Azo dyes* (which see). More recently additional syntheses of indigo were effected simultaneously by L. Lederer and K. Heumann (see *Chemiker Zeitung*, 1890, Oct. 1st and Oct. 8th; also see *Amer. Jour. Pharm.*, 1890, p. 614); likewise some methods for the direct synthesis of *indigo-carmine* are on record (see A. Haas, in *Amer. Jour. Pharm.*, 1891, p. 406, and B. Heymann, in Prof. Sadtler's *Handbook*, 1895, p. 452).

Related Species and Product.—In addition to the plants above mentioned, indigo is probably yielded also by the following plants: *Gymnema tingens*, Sprengel, Hindustan; *Polygonum tinctorium*, Linné, China; *Wrightia tinctoria*, Robert Brown, Hindustan; and *Galega tinctoria*. Prof. H. Molisch (*Amer. Jour. Pharm.*, 1893, p. 494), detects the presence of *indican* in plants by boiling some fragments of the latter in a test-tube with a diluted solution of aqua ammoniæ, and in another experiment with diluted hydrochloric acid, filtering, cooling, and agitating with chloroform, which assumes a blue color if indican is present.

Crescentia cujete.—South America. The fruit of this plant contains a blue body resembling indigo, and *crescentinic acid* (G. Peckolt, *Pharm. Rundschau*, 1884).

INFUSA.—INFUSIONS.

Infusions are solutions of vegetable principles in water. The addition of any alcoholic mixture is only made in cases where the medicinal action of the liquor itself is desired, or to act as a preservative. Clear, soft water, as river, rain, or distilled water should be used in the preparation of infusions; hard, or limestone water, from springs or wells, or water holding saline substances in solution, is unfit for this purpose, as such water is apt to occasion precipitates. Drugs containing volatile active constituents, or which are deteriorated by a temperature somewhat elevated, or which contain a principle not desired, and which is not readily dissolved by water at a low degree of heat, are better made into infusions by cold instead of hot water.

Infusions form a very expeditious and convenient mode of exhibiting many medicines, as the most of them readily yield their active constituents in this way without requiring to be very finely divided. The principal objection to them is the difficulty of keeping them for any length of time, in consequence of which they require to be prepared off-handed, and in limited quantity at a time. Mugs containing a movable diaphragm are now much in use for the preparation of infusions. The diaphragm extends to one-third or one-half of the depth of the mug, and contains the vegetable remedy, while the jar is filled with hot or cold water as may be required. A constant circulation is kept up in the fluid by the increased density of the impregnated water carrying it to the bottom, while its place is occupied by the less impregnated fluid, and this continues until the remedy is exhausted of its active soluble principles.

In making infusions with boiling water, starch and other principles are often taken up, whose presence disposes to acidity or moldiness, or perhaps favors reactions which materially impair the infusions; on this account percolation by cold water is often preferable, as it avoids these inconveniences, beside which these infusions have a less tendency to spoil than those made at a boiling temperature. The process of percolation or displacement by cold water, affords infusions of very great strength, and is preferred to any other mode; it requires, however, that the articles should be more finely powdered, as a general thing, than is customary in preparing infusions in the ordinary way. When of too great strength, the infusion may be reduced by dilution with water. Very excellent infusions may be prepared with many medicinal herbs, roots, or barks, by percolating with a fluid composed of 3 parts of water and 1 part of glycerin.

Infusions are better when prepared in glazed earthenware or porcelain vessels fitted with covers, than when prepared in metallic vessels, on account of a liability to chemical alteration from metallic influence, and which frequently impairs the preparation. Infusions containing acids, or saline substances, should always be prepared and kept in glass or china vessels.

In the preparation of infusions, the reactions of agents should always be kept in view. Thus, infusion of *chamomile flowers* yields precipitates with nitrate of silver, sulphate of iron, gelatin, yellow Peruvian bark, tincture of chloride of iron, corrosive sublimate, and the acetates of lead. Infusion of *horseradish* undergoes rapid decomposition, and is precipitated with acetate of lead, infusion of galls, nitrate of silver, corrosive sublimate, and the alkaline carbonates. Infusion of *cloves* is precipitated by the soluble salts of antimony, zinc, iron, silver, lead, and by lime-water. Infusion of *cascarilla* is precipitated by infusion of galls, acetates of lead, sulphates of zinc and iron, nitrate of silver, and lime-water. Infusion of *yellow Peruvian bark* is incompatible with potassium, sodium, and ammonium hydroxides and carbonates, lime, magnesia, tannic and gallic acids, and vegetables containing these acids, tartaric acid, oxalic acid, and the soluble tartrates and oxalates. It also affords precipitates with other agents, which, however, do not always injure its efficiency or active principle, as corrosive sublimate, arsenous acid, tartar emetic, gelatinous solutions, soluble salts of iron, silver, and zinc, and many vegetable solutions, as those of cloves, chamomile, calumba, cascarilla, galls, horseradish, catechu, digitalis, senna, orange-peel, rhubarb, valerian, and simaruba. Infusions of *senna*, *gentian*, *rhubarb*, and *calumba*, are better made with cold water. When boiling water is added to *calumba* it takes up the starch, and the infusion spoils rapidly. It should be made with cold water, then boiled, and filtered to separate albuminous matter. Infusion of *digitalis* is precipitated by acetate of lead, sulphate of iron, and infusion of cinchona (*Lond.*—Phillips, *Pharm. Jour. and Trans.*, 1855, Vol. XIV, pp. 339, 438, 439, 403, 486).

As nearly all vegetable medicines are occasionally administered in the form of infusion, it would be useless to enter into an especial relation of them, further than already explained in the above general rules. They are more commonly prescribed as secondary or auxiliary measures, and are left for the nurse or family to prepare. However, there are a few compound infusions, some of which are of a spiritous nature, which it may be advisable to describe on account of their extensive employment and superior efficiency in the diseases for which they are recommended.

The *U. S. P.* general method is as follows: "An ordinary infusion, the strength of which is not directed by the physician, nor specified by the Pharmacopœia, shall be prepared by the following formula: Take of the substance, coarsely comminuted, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; boiling water, one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Put the substance into a suitable vessel provided with a cover, pour upon it the boiling water, cover the vessel tightly, and let it stand for half an hour. Then strain, and pass enough water through the strainer to make the infusion measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. *Caution.*—The strength of infusions of energetic or powerful substances should be specially prescribed by the physician"—(*U. S. P.*).

We give place to formulas for several infusions according to the *British Pharmacopœia*, and a number official in the *U. S. P.*, 1870.

INFUSUM EUPATORII (*U. S. P.*, 1870), *Infusion of thoroughwort.*—Dried boneset, or thoroughwort, 1 troy ounce; boiling water, 1 pint. Macerate 2 hours. Strain. Dose, as an emetic, take freely in tepid condition; as a tonic, use cold in 1 or 2 fluid-ounce doses.

Infusum Picis Liquidæ (*U. S. P.*, 1870), *Infusion of tar, Tar water.*—Tar, 1 pint; water, 4 pints. Mix, agitate frequently throughout 24 hours, pour off infusion, and filter. Dose, as a diuretic, 1 or 2 pints daily. Locally, as a lotion in *skin diseases*, and as a bladder-wash in *chronic cystitis*.

Infusum Spigeliæ (*U. S. P.*, 1870), *Infusion of spigelia.*—Spigelia, ½ troy ounce; boiling water, 1 pint. Macerate 2 hours. Strain. Dose, for young child, ½ to 1 fluid ounce, night and morning; for adult, 2 to 6 fluid ounces.

Infusum Salviæ (*U. S. P.*, 1870), *Infusion of sage.*—Sage, ½ troy ounce; boiling water, 1 pint. Macerate ½ hour. Strain. Dose, 1 fluid ounce. Valuable in *spermatorrhœa* and *night-sweats*. Locally, as a mouth-wash, or vehicle for other topical agents.

INFUSUM ANTHEMIDIS.—INFUSION OF CHAMOMILE.

Synonym: *Infusum chamomillæ romanæ.*

Preparation.—Infuse, in a closed vessel for 15 minutes, ½ ounce (av.) of chamomile flowers in 10 fluid ounces (Imp.) of boiling distilled water. Strain. This accords with the *Br. Pharm.*, 1885.

Action, Medical Uses, and Dosage.—(See *Anthemis.*) A useful preparation in the *bowel troubles of dentition*. Dose, ½ to 2 fluid ounces, smaller doses being given to children. It is emetic when warm; tonic and nervine when cold.

INFUSUM APII COMPOSITUM.—COMPOUND INFUSION OF PARSLEY.

Preparation.—Take of parsley roots and seeds, coarsely bruised, carbonate of iron, each, 4 ounces; horseradish root, in small pieces, 2 ounces; juniper berries, squill, white mustard seed, mandrake root, and queen of the meadow, of each, finely bruised, 1 ounce; good cider, 6 quarts. Boil the cider and pour it on the rest of the articles mixed together in an earthen vessel; cover the vessel, and digest with a gentle heat for 24 hours.

The cider should not be hard, nor too new, but sparkling and pleasantly tart, and, after digestion by heat, it should be allowed to remain upon the articles without straining it off. By this course, the liquid becomes still further impregnated with the properties of the medicines.

Action, Medical Uses, and Dosage.—This is a most excellent preparation in several varieties of *dropsy*, for which alone it is used. It increases the action of the kidneys, regulates the bowels, improves the digestive functions, and promotes activity of the absorbent vessels. The dose is 1 or 2 fluid ounces, 3 times a day. In the summer season, half the above quantity may be made at one time, as otherwise it becomes very sour and moldy. It should always be used immediately after its preparation (J. King).

INFUSUM AURANTII COMPOSITUM.—COMPOUND INFUSION OF ORANGE PEEL.

Preparation.—Infuse, in a closed vessel for 15 minutes, ¼ ounce (av.) of bitter orange peel (cut small); 56 grains of fresh lemon peel (cut small), and 28 grains of bruised cloves, in 10 fluid ounces (Imp.) of boiling distilled water. Strain—(*Br. Pharm.*).

Action, Medical Uses, and Dosage.—Used chiefly as a carminative. Dose, ½ to 2 fluid ounces.

INFUSUM BUCHU.—INFUSION OF BUCHU.

Synonyms: *Infusum diosmæ, Infusum barosmæ.*

Preparation.—Infuse, in a closed vessel, for 30 minutes, ½ ounce (av.) of bruised buchu leaves, in 10 fluid ounces (Imp.) of boiling water. Strain.

Action, Medical Uses, and Dosage.—(See *Buchu.*) One of the best forms in which to employ buchu. Dose, ½ to 2 fluid ounces.

INFUSUM CALUMBÆ.—INFUSION OF CALUMBA.

SYNONYM: *Infusion of columbo.*

Preparation.—Macerate, in a closed vessel, for 30 minutes, ½ ounce (av.) of calumba root (cut small), in 10 fluid ounces (Imp.) of cold water. Strain. When made with boiling water the preparation is mucilaginous, and is not believed to keep so well. T. Greenish, however, states that the contrary is true, and directs that cold water be first used, thus getting rid of the starch, and afterward bringing the infusion to the boiling point, by means of which the albumen is coagulated. Greenish's views are not generally accepted, for according to the weight of evidence, the infusion made by means of cold water is most permanent.

Action, Medical Uses, and Dosage.—(See *Calumba.*) Dose, 1 to 2 fluid ounces, before meals.

INFUSUM CARYOPHYLLI.—INFUSION OF CLOVES.

Preparation.—Macerate, in a closed vessel, for 30 minutes, ¼ ounce (av.) of bruised cloves in 10 fluid ounces (Imp.) of boiling distilled water. Strain—(*Br. Pharm.*).

Action, Medical Uses, and Dosage.—(See *Caryophyllus.*) Carminative. Used chiefly in the *nausea of debility*, and in pains induced by *flatulence.*

INFUSUM CATECHU.—INFUSION OF CATECHU.

SYNONYMS: *Compound infusion of catechu*, *Infusum catechu compositum* (*U. S. P.*, 1870).

Preparation.—Infuse, in a closed vessel, for 30 minutes, 160 grains (av.) of coarsely powdered catechu, and 30 grains (av.) of bruised cinnamon bark, in 10 fluid ounces (Imp.) of boiling distilled water. Strain. This accords with the *Br. Pharm.*

Action, Medical Uses, and Dosage.—(See *Catechu.*) Used chiefly in *non-irritant diarrhœa.* Dose, 1 to 3 fluid ounces.

INFUSUM CINCHONÆ (U. S. P.)—INFUSION OF CINCHONA.

SYNONYM: *Acid infusion of cinchona.*

Preparation.—"Cinchona, in No. 40 powder, sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; aromatic sulphuric acid, ten cubic centimeters (10 Cc.) [162 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the acid with five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of water, and moisten the powder with thirty cubic centimeters (30 Cc.) [1 fl℥, 7 ♏] of the mixture; pack it firmly in a conical glass percolator, and gradually pour upon it, first, the remainder of the mixture, and afterward water, until the infusion measures one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

The *Br. Pharm.* directs red cinchona bark. Yellow bark is preferable for this preparation, although the *U. S. P.* permits any good cinchona. This preparation represents a solution of the cinchona alkaloids in the form of sulphates, and is an efficient preparation.

Action, Medical Uses, and Dosage.—(See *Cinchona.*) Used mostly as a tonic. Dose, 2 fluid ounces, 3 times a day.

INFUSUM CUSSO.—INFUSION OF KOUSSO.

SYNONYMS: *Infusum brayeræ* (*U. S. P.*, 1880), *Infusion of brayera.*

Preparation.—Infuse, in a closed vessel for 15 minutes, ½ ounce of coarsely powdered kousso in 8 fluid ounces (Imp.) of boiling distilled water. Do not strain. This accords with the *Br. Pharm.*

The *U. S. P.*, 1870, directed brayera, No. 20 powder, 6 parts; boiling water, 100 parts. The *National Formulary* directs as follows:

INFUSUM BRAYERÆ (N. F.) (*U. S. P.*, 1880), *Infusion of brayera.—Formulary number*, 191: "Brayera, in No. 20 powder, sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; boiling water, one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Pour the boiling water upon the brayera, and let it macerate in a covered vessel until cool. The infusion should be dispensed without straining"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—As a vermifuge, this infusion should be taken fasting, one-half the quantity being given an hour before the second portion, the flowers being swallowed with the infusion. This is the original Abyssinian method of administering cusso.

INFUSUM DIGITALIS (U. S. P.)—INFUSION OF DIGITALIS.

Preparation.—"Digitalis, bruised, fifteen grammes (15 Gm.) [232 grs.]; alcohol, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; cinnamon water, one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏]; boiling water, five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]; cold water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Upon the digitalis, contained in a suitable vessel, pour the boiling water, and allow it to macerate until the mixture is cold. Then strain, add the alcohol and cinnamon water to the strained liquid, and pass enough cold water through the residue on the strainer to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

The cinnamon in this preparation is merely added to flavor the infusion, while the alcohol tends to preserve it. Infusion of digitalis throws down a precipitate on standing several hours.

Action, Medical Uses, and Dosage.—(See *Digitalis.*) Infusion of digitalis is the most efficient preparation of foxglove, and is particularly applicable when a diuretic action is desired. It should be remembered that digitalis acts slowly and the infusion should not be pushed too fast, lest an over action result from it a day or two after its administration. Dose, 1 to 4 fluid drachms, 3 times a day, carefully watching its action.

INFUSUM EPIGÆÆ COMPOSITUM.—COMPOUND INFUSION OF TRAILING ARBUTUS.

SYNONYM: *Diuretic compound.*

Preparation.—Take of trailing arbutus, queen of the meadow root, dwarf-elder bark, marshmallow root, each, coarsely bruised, ½ ounce; boiling water, good Holland gin, of each, 1 pint; honey, a sufficient quantity. Pour the boiling water and gin on the plants, and digest them with gentle heat, in a close-covered vessel, for 6 hours; then remove from the fire, strain, and add sufficient honey to render it pleasantly sweet.

Action, Medical Uses, and Dosage.—This is a very valuable remedy in *gravel*, in *chronic catarrh of the bladder*, *suppression of urine*, *high colored* or *scalding urine*, *inflammation of the urethra*, and other *disorders of the urinary organs*. In *oxalic deposits*, however, it is of no utility. The dose is about 2 fluid ounces, 3 or 4 times a day; in severe cases, this dose may be given every hour until relief is obtained, after which every 3 or 4 hours. In cases of gravel, a corresponding quantity of wild carrot root and seed may be advantageously added to the articles (J. King

INFUSUM ERGOTÆ.—INFUSION OF ERGOT.

Preparation.—Infuse, in a closed vessel for 30 minutes, ¼ ounce (av.) of coarsely powdered ergot in 10 fluid ounces (Imp.) of boiling distilled water. Strain—*Br. Pharm.*

Action, Medical Uses, and Dosage.—About 10 grains of ergot are contained in a fluid ounce of this infusion, the dose of which is from 1 to 2 fluid ounces. It is used as a parturient.

INFUSUM GENTIANÆ COMPOSITUM.—COMPOUND INFUSION OF GENTIAN.

Preparation.—"Gentian, in moderately coarse powder, ½ troy ounce; bitter orange peel, in moderately coarse powder, coriander, in moderately coarse powder, of each, 60 grains; alcohol, 2 fluid ounces; water, a sufficient quantity. Mix the alcohol with 14 fluid ounces of water, and, having moistened the mixed powders with 3 fluid drachms of the menstruum, pack them firmly in a conical percolator, and gradually pour upon them, first, the remainder of the menstruum, and afterward water, until the filtered liquid measures a pint"—(*U. S. P.*, 1870).

The following accords with the *Br. Pharm.:* Infuse, in a closed vessel for 30 minutes, 55 grains each of sliced gentian root and bitter orange peel (cut small), and ¼ ounce (av.) of fresh lemon peel (cut small) in 10 fluid ounces (Imp.) of boiling distilled water. Strain.

The formula of the *U. S. P.*, 1870, is to be preferred to that of the latter, as it is a more efficient product, and, on account of the alcohol it contains, is much more easily preserved.

Action, Medical Uses, and Dosage.—Stomachic and tonic. Dose, ½ to 1 fluid ounce, 3 times a day.

Related Infusion.—INFUSUM GENTIANÆ COMPOSITUM FORTIUS (N. F.), *Stronger compound infusion of gentian. Formulary number*, 192: "Gentian, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; coriander, thirty-five grammes (35 Gm.) [1 oz. av., 93 grs.]; bitter orange peel, thirty-five grammes (35 Gm.) [1 oz. av., 93 grs.]; diluted alcohol (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Reduce the drugs to a moderately coarse (No. 40) powder, moisten it with diluted alcohol, pack it in a percolator, and percolate with diluted alcohol, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] are obtained. *Note.*—When *Infusum gentianæ compositum* is prescribed, mix 1 volume of this preparation with 3 volumes of water"—(*Nat. Form.*).

INFUSUM GERANII COMPOSITUM.—COMPOUND INFUSION OF CRANESBILL.

Preparation.—Take of cranesbill, witch-hazel, black cohosh, and golden seal, each, coarsely bruised, ½ ounce; boiling water, 2 pints. Mix the articles together, and digest with a gentle heat, in a closed vessel, for 2 hours; remove from the fire and strain. If required, alum, 1 drachm, may be added.

Action, Medical Uses, and Dosage.—This forms an efficient astringent wash in aphthous and other *diseases of the mouth and throat*, when unaccompanied with inflammation; and is also useful as an injection in *leucorrhœa*, *prolapsus ani*, and *prolapsus uteri*. Without the alum, this infusion may be administered internally in doses of from 1 fluid drachm to ½ fluid ounce, repeated 3 or 4 times a day, and will prove efficient in *chronic diarrhœa* and *dysentery*, in *passive hemorrhages*, in *hemorrhoids*, and in *debilitated conditions of the venous system* (J. King).

INFUSUM HYDRASTIS COMPOSITUM.—COMPOUND INFUSION OF GOLDEN SEAL.

Preparation.—Take of golden seal, blue cohosh, witch-hazel, of each, in powder, ½ ounce; boiling water, 1 pint; pulverized alum, 1 drachm; honey, a sufficient quantity. Add the plants to the boiling water, and digest with a gentle heat, in a closed vessel, for ½ hour, remove from the fire, strain, add the alum, and sufficient honey to thoroughly sweeten the infusion.

Action, Medical Uses, and Dosage.—This infusion is very valuable as a wash or gargle in various forms of *sore mouth* and *ulcerated sore throat*. Without the alum, it may also be employed internally in the same cases as named in the preceding article (J. King). Dose, ½ to 1 fluid ounce.

INFUSUM JABORANDI.—INFUSION OF JABORANDI.

Preparation.—Infuse, in a closed vessel, for 30 minutes, ½ ounce (av.) of jaborandi (cut small), in 10 fluid ounces (Imp.) of boiling distilled water. Strain—(*Br. Pharm.*).

Action, Medical Uses, and Dosage.—(See *Pilocarpus.*) The large doses necessary render this infusion somewhat apt to provoke nausea and vomiting, though it well represents the virtues of jaborandi. Dose, ½ to 2 fluid ounces.

INFUSUM KRAMERIÆ.—INFUSION OF RHATANY.

Preparation.—Infuse, in a closed vessel, for 30 minutes, ½ ounce (av.) of rhatany-root (No. 40 powder), in 10 fluid ounces (Imp.) of boiling distilled water. Strain—(*Br. Pharm.*). Each fluid ounce contains 23 grains; that of the *U. S. P.*, 1870, contained 30 grains.

Action, Medical Uses, and Dosage.—(See *Krameria.*) Useful in *passive hemorrhages* and *mucous profluvia.* Dose, ½ to 2 fluid ounces.

INFUSUM LINI.—INFUSION OF LINSEED.

SYNONYMS: *Infusum lini compositum* (*U. S. P.*, 1870), *Infusion of flaxseed.*

Preparation.—Infuse, in a closed vessel, for 2 hours, 150 grains (av.) of linseed (whole), and 50 grains (av.) of liquorice-root (No. 20 powder), in 10 fluid ounces (Imp.) of boiling distilled water. Strain—(*Br. Pharm.*). The *U. S. P.*, 1870, process directed flaxseed, ½ troy ounce; bruised liquorice-root, 120 grains, and boiling water, 1 pint. Macerate 2 hours and strain. The linseed should not be bruised, else the swelling of the seed will prevent straining, and as the mucilage is in the testa of the seed, bruising is wholly unnecessary.

Action, Medical Uses, and Dosage.—(See *Lini Farina.*) Useful in *acute respiratory disorders*, but the liquorice impairs its usefulness in intestinal inflammations. It may be freely used for the administration of magnesium sulphate and quinine salts, though it is employed chiefly for coloring and flavoring purposes. *Buccal and faucial inflammations* and *ulcerations* may be washed with it, and given internally, through the sulphuric acid contained in it, it exerts some control over *colliquative sweats.* Dose, 1 to 4 fluid ounces.

Related Preparation.—INFUSUM ROSÆ COMPOSITUM (N. F.), *Compound infusion of rose. Formulary number*, 193: "Red rose, thirteen grammes (13 Gm.) [201 grs.]; diluted sulphuric acid (*U. S. P.*), nine cubic centimeters (9 Cc.) [146 ♏]; sugar, forty grammes (40 Gm.) [1 oz av., 180 grs.]; boiling water, one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Pour the boiling water upon the rose, in a glass or porcelain vessel, add the acid, cover the vessel, and macerate for an hour. Then dissolve the sugar in the liquid and strain.

INFUSUM LUPULI.—INFUSION OF HOP.

SYNONYM: *Infusum humuli* (*U. S. P.*, 1870).

Preparation.—Infuse, in a closed vessel, for 1 hour, ½ ounce (av.) of hops i 10 fluid ounces (Imp.) of boiling distilled water. Strain—(*Br. Pharm.*).

Action, Medical Uses, and Dosage.—(See *Humulus.*) An efficient form for the administration of hops. Dose, ½ to 2 fluid ounces.

INFUSUM PRUNI VIRGINIANÆ (U. S. P.)—INFUSION OF WILD CHERRY.

Preparation.—"Wild cherry, in No. 20 powder, forty grammes (40 Gm.) [1 oz av., 180 grs.]; water, a sufficient quantity to make one thousand cubic centimeters

(1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏] of water, and macerate for 1 hour; then pack it firmly in a conical glass percolator, and gradually pour water upon it until the infusion measures one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*

On account of the volatile character of the active constituents of wild cherry, cold water only should be used in preparing an infusion of it. A transparent, wine-colored infusion, pleasantly bitter, and possessing the well-known flavor of bitter almonds.

Action, Medical Uses, and Dosage.—(See *Prunus virginiana.*) Sedative and tonic. Dose, 1 to 3 fluid ounces, 3 or 4 times a day.

INFUSUM QUASSIÆ.—INFUSION OF QUASSIA.

Preparation.—Macerate, in a closed vessel for 30 minutes, 55 grains of quassia wood (in chips) in 10 fluid ounces of cold distilled water. Strain—(*Br. Pharm.*). Warm water is equally or more effective for the preparation of this infusion. The above process of the *Br. Pharm.* yields an infusion of only one-fourth of the strength which might be had by employing the *U. S. P.* general method.

Action, Medical Uses, and Dosage.—A pure, bitter stomachic tonic. Dose, ½ to 2 fluid ounces.

INFUSUM SALVIÆ COMPOSITUM.—COMPOUND INFUSION OF SAGE.

Preparation.—Take of sage leaves, hyssop leaves, of each, 1 ounce; boiling water, 2 pints; pulverized borax, 1 drachm. Place the herbs in the boiling water, allow them to digest for ½ hour, then strain and add the borax.

Action and Medical Uses.—This infusion is employed as a wash and gargle in *aphthæ*, *sore throat*, and *quinsy*, when accompanied with inflammation.

INFUSUM SENNÆ.—INFUSION OF SENNA.

Preparation.—Infuse, in a closed vessel for 30 minutes, 1 ounce (av.) of senna and 28 grains of sliced ginger in 10 fluid ounces (Imp.) of boiling distilled water. Strain—(*Br. Pharm.*). The *U. S. P.*, 1870, directed senna, 1 troy ounce; bruised coriander, 60 grains; boiling water, 1 pint. Macerate 1 hour. Strain. Infusion of senna, when exposed to the atmosphere, precipitates a yellow deposit, which is said to increase its tendency to gripe.

Action, Medical Uses, and Dosage.—(See *Senna.*) Dose, 1 to 4 fluid ounces.

INFUSUM SENNÆ COMPOSITUM (U. S. P.)—COMPOUND INFUSION OF SENNA.

SYNONYM: *Black draught.*

Preparation.—"Senna, sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; manna, one hundred and twenty grammes (120 Gm.) [4 ozs. av., 102 grs.]; magnesium sulphate, one hundred and twenty grammes (120 Gm.) [4 ozs. av., 102 grs]; fennel, bruised, twenty grammes (20 Gm.) [309 grs.]; boiling water, eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏]; cold water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Upon the senna and fennel, contained in a suitable vessel, pour the boiling water, and macerate until the mixture is cold. Then strain with expression, dissolve in the infusion the magnesium sulphate and manna, and again strain. Lastly, add enough cold water through the strainer containing the senna and fennel to make the infusion measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

This is the famous *black draught*, and should not be confounded with *black drop*, or vinegar of opium (*Acetum Opii*). These names should be dropped from medical literature, as much harm has and may still result from confusing the one with the other. The infusion should not be allowed to macerate too long, lest an increased griping result from its use. The addition of the fennel is for the purpose of lessening its tendency to gripe.

Action, Medical Uses, and Dosage.—(See *Senna*.) Purgative. Dose, 1 to 4 fluid ounces every 1 or 2 hours until catharsis occurs.

INFUSUM VALERIANÆ. INFUSION OF VALERIAN.

Preparation.—Infuse in a closed vessel for 1 hour, ¼ ounce (av.) of bruised valerian rhizome in 10 fluid drachms (Imp.) of boiling distilled water. Strain —*Br. Pharm.*

Action, Medical Uses, and Dosage.—(See *Valeriana*.) Dose, ½ to 2 fluid ounces.

INJECTIO APOMORPHINÆ HYPODERMICA.—HYPODERMIC INJECTION OF APOMORPHINE.

Preparation.—"Take of apomorphine hydrochlorate, 2 grains; camphor water, 100 minims. Dissolve and filter. The solution should be made as required for use. Dose, by subcutaneous injection, 2 to 8 minims"—(*Br. Pharm.*). Equal to about 1/25 to 1/6 grain of apomorphine hydrochlorate.

INJECTIO ERGOTINI HYPODERMICA.—HYPODERMIC INJECTION OF ERGOTIN.

Preparation.—"Take of ergotin, 100 grains (or 1 part); camphor water, 200 fluid grains (or 2 fluid parts). Dissolve by stirring them together. The solution should be made as required for use. Dose, by subcutaneous injection, 3 to 10 minims"—(*Br. Pharm.*). Equal to about 1 to 3½ grains of ergotin.

INJECTIO MORPHINÆ HYPODERMICA.—HYPODERMIC INJECTION OF MORPHINE.

Preparation.—"Take of hydrochlorate of morphine, 92 grains; solution of ammonia, acetic acid, distilled water, of each, a sufficiency. Dissolve the hydrochlorate of morphine in 2 ounces of distilled water, aiding the solution by gently heating; then add solution of ammonia so as to precipitate the morphine, and render the liquid slightly alkaline; allow it to cool; collect the precipitate on a filter, wash it with distilled water, and allow it to drain; then transfer the morphine to a small porcelain dish with about an ounce of distilled water, apply heat gently, and carefully add acetic acid until the morphine is dissolved, and a very slightly acid solution is formed. Add now sufficient distilled water to make the solution measure exactly 2 fluid ounces. Filter and preserve the product in a stoppered bottle excluded from the light"—(*Br. Pharm.*).

Description. This is a slightly acid, clear solution, free from any solid particles when freshly prepared. When kept, it slowly disintegrates, acquiring a brownish color, crystals of morphine being gradually deposited. To prevent this change, Squibb recommended 1/6 per cent of pure carbolic acid; Johnson, sulphurous acid (5 drops to the fluid ounce, Jennings); and Limousin, 1/5 per cent of salicylic acid. "A fluid drachm of it, rendered slightly alkaline by the addition of solution of ammonia, yields a precipitate of morphine which, after being washed and dried, should weigh 4.25 grains, corresponding to 6 grains of acetate of morphine"—(*Br. Pharm.*).

Dose, by subcutaneous injection, from 1 to 6 minims (1/12 to ½ grain) beginning with the smaller doses.

INULA (U. S. P.)—INULA.

"The root of *Inula Helenium*, Linné"—(*U. S. P.*) (*Corvisartia Helenium*, Mérat). *Nat. Ord.*—Compositæ.

Common Names: *Elecampane*, *Scabwort*.

Illustrations: Millspaugh, *Amer. Med. Plants*, Pl. 81; Bentley and Trimen, *Med. Plants*, 150; Woodville, *Med. Bot.*, 26.

Botanical Source.—Elecampane has a thick, tap-shaped, branching, aromatic, and perennial root, with a thick, leafy, round, furrowed, solid stem, from 4 to 6 feet high, branched and downy above. The leaves are large, ovate, serrate, veiny, smooth, of a dark-green color above, downy and hoary beneath, with a fleshy midrib; radical ones petiolated, from 1 to 3 feet in length, by 6 or 12 inches wide; cauline ones sessile and amplexicaul. The flower-heads are large, radiated, solitary at the downy summits of the branches, 2 inches broad, and of a bright-yellow color. The involucre is hemispherical; the outer scales broad, recurved, leafy, and finely downy on both sides; the inner ones linear. The florets of the ray are numerous, pistillate, long, and narrow, in 1 row, and terminate in 3 unequal teeth; the disk-florets are numerous, perfect, tubular, and 5-toothed, and the anthers have 2 bristles at the base. Ovary oblong. Achenia quadrangular and smooth; pappus simple and roughish. The receptacle is reticulated, and not quite smooth or naked (L.—W.—G.—T.).

Fig. 146.

Inula Helenium, with root.

History and Description—Elecampane is common to Europe, and cultivated in this country, growing in pastures, along roadsides, etc., flowering from July to September. The root, which is the part used, should be gathered in the second year of its development, and during the fall months. When recent it is quite thick, spindle-shaped, dividing, with many delicate fibers; its color is yellowish-gray externally. Iodine colors the root brown, and the infusion is changed to a green color by the addition of ferric chloride. The *U. S. P.* describes *Inula* as follows: "In transverse, concave slices or longitudinal sections, with overlapping bark, externally wrinkled and brown; flexible in damp weather; when dry, breaking with a short fracture; internally grayish, fleshy, slightly radiate, and dotted with numerous shining, yellowish-brown resin-cells; free from starch; odor peculiar, aromatic; taste bitter and pungent"—(*U. S. P.*).

Chemical Composition.—The following percentage composition of inula is recorded in Hager's *Handbuch der Pharm. Praxis*, Vol. II, 1886. p. 76: "*Inulin*, 30 to 40; a trace of volatile oil; *inula* (*alant*) *camphor*, or *helenin*, a crystallizable, volatile substance, 0.5; wax, 0.3; acrid soft resin, 2; glutinous bitter extractive, 33; protein bodies, 12.5; cellulose, 9.6; potassium and calcium salts. *Inulin* ($6C_6H_{10}O_5 + H_2O$, Kiliani, 1881), an isomer of starch, was discovered in elecampane by Val. Rose, in 1804, and was called by him *alantin*. Sometimes it is also termed *helenin*. It is a fine, white, starchy powder, very hygroscopic, tasteless, and inodorous; its specific gravity is 1.356. Iodine gives it a yellow color, which distinguishes it from starch, and also renders it insoluble in water. It is soluble in boiling water, from which it is deposited as the solution cools. It is insoluble in alcohol. Diluted acids, upon heating, transform it into *lævulose*, the intermediary products, *metinulin* and *lævulin* ($C_6H_{10}O_5$), being formed. Ferments, *e. g.*, diastase, yeast, emulsin, saliva, have but a slight sugar-forming effect upon inulin (Dragendorff, 1870; also see Husemann and Hilger, *Pflanzenstoffe*, 1882, Vol. I, p. 142). The researches of Kiliani made it probable that inulin is chemically the anhydride of lævulose (see *Amer. Jour. Pharm.*, 1881, pp. 188 and 469). Its solution in boiling water produces left-handed rotation upon a ray of polarized light. It melts near 165° C. (229° F.), gives off water, and leaves a scaly, sweetish, gummy mass.

readily soluble in water. Concentrated nitric acid, heated with it, converts it into oxalic acid. Diluted nitric acid, by oxidation, changes it into formic, oxalic glycolic, and racemic acids. Inulin does not reduce Fehling's solution, nor does it undergo fermentation. It may be prepared in abundance also from dandelion roots, and those of the dahlia and other roots of the *Compositæ*, when dug up in the autumn. Roots dug in the autumn yield over twice the amount (44 per cent, Dragendorff) yielded by spring roots. In the spring of the year a portion of the inulin seems to have been changed into lævulin, mucilage, sugar, and several glucosids.

Alant camphor (*helenin*) was observed in the root of elecampane as early as 1760, by Léfebure and others (see Husemann and Hilger), as it sometimes crystallizes on old roots. J. Kalien (*Ber. d. Deutsch. Chem. Ges.*, 1873 and 1876), has shown this volatile substance, which he obtained by distillation of the root with water, to be composed of needle-like crystals of *alantic anhydride* ($C_{15}H_{20}O_2$), melting at 66° C. (150.8° F.); *alantol* ($C_{10}H_{16}O$), an aromatic liquid; *alant camphor* proper ($C_{10}H_{16}O$), the latter a white substance melting at 64° C. (147.2° F.), of a mint-like, aromatic odor; and *helenin* (C_6H_8O), an odorless, bitterish, crystallizable principle, with melting point at 110° C. (230° F.).

Action, Medical Uses, and Dosage.—Elecampane is an aromatic stimulant and tonic, and is said to be expectorant, emmenagogue, diuretic, and diaphoretic. It is much used in *chronic pulmonary affections*, *weakness of the digestive organs*, *hepatic torpor*, *atonic dyspepsia*, with flatus, and internally and externally in *tetter*, *itch*, and other *cutaneous diseases*. When added to the compound syrup of spikenard, it should be exhausted by boiling alcohol, and the tincture added to the syrup, instead of boiling it with the other articles, as is usually done. The alcoholic extract, combined with powdered extract of liquorice, benzoic acid, sanguinaria, and morphine, forms a lozenge or pill very valuable in *chronic catarrhal*, *bronchial*, and all *pulmonary irritations*. One drop of the oil of stillingia may be added to each lozenge for *bronchial and laryngeal affections*. *Night-sweats* are relieved by inula, as are some cases of *humid asthma*, and, by its tonic properties, it tends to sustain the strength of the patient in chronic disorders of the respiratory tract. Helenin is accredited with a fatal action upon the tubercle bacillus by Korab, Blocq, and others. Inula is somewhat slow in action, and should be used for quite a time to get its full action. That it is an important remedy in irritation of the trachea and bronchiæ is now well established. It is adapted to cases with free and abundant expectoration, teasing cough, and pain beneath the sternum, conditions frequent in *la grippe*, and the severer forms of *colds*.

An efficient preparation is that recommended by Prof. Locke (*Syllab. of Mat. Med.*): ℞ Elecampane, ℥i; boiling water, 1 pint. Boil until but 8 ounces remain; add ½ pound of white sugar. *Chronic vesical catarrh* has yielded to the kindly action of elecampane. Both acute and chronic disorders may be treated with inula. It is also useful in *leucorrhœa*, and is especially effective in *catarrhal endometritis*, with discharge of glairy mucus. Dose of the powder, from 20 grains to 1 drachm; of the infusion, from 1 to 2 fluid ounces; syrup, 1 to 4 fluid drachms; specific inula, 5 to 40 drops; fluid extract, 10 to 60 drops; helenin, $\frac{1}{12}$ to ¼ grain. Elecampane should be restudied in reference to its action in catarrhal affections of the respiratory organs, and especially in relation to the kind of cough which is mentioned above.

Specific Indications and Uses.—Cough, of a teasing, persistent character, accompanied with substernal pain, and profuse secretion; atony of abdominal viscera, with engorgement and relaxation; catarrhal discharges.

Related Species. *Inula squarrosa*, Bernhardi *Inula Conyza*, De Candolle; *Conyza squarrosa*, Linné). Herb used in Europe. Diuretic and emmenagogue, and, when charred, employed as an insecticide.

Pulicaria dysenterica, Gaertner (*Inula dysenterica*, Linné), *Fleawort.*—Properties like those of the preceding species.

Carlina acaulis, Linné. *Carline thistle.*—Europe. The root, which is unpleasant in odor, and sweet, hot, and finally bitter to the taste, is the part employed. It contains volatile oil and resin. Diuretic and emmenagogue; large doses cathartic. The decoction or powder has been used in *amenorrhœa*, *impotence*, *glossal paralysis*, and in *typhoid states* of acute maladies. Dose of powdered root, from 10 to 20 grains, best administered in decoction. It appears to strongly influence the sexual organs of both male and female.

IODOFORMUM (U. S. P.)—IODOFORM.

FORMULA: CHI_3. MOLECULAR WEIGHT: 392.56.

"Iodoform should be kept in well-stoppered bottles, in a cool and dark place"—(*U. S. P.*).

History and Preparation.—Iodoform was discovered, in 1822, by Serullas, and introduced into medicine by Glover and Bouchardat, in 1837. Its composition was determined by Dumas (1834). It is formed when iodine, in the presence of caustic alkalies, or alkaline carbonates, acts upon a variety of substances, such as alcohol or acetone, aldehyde, lactic acid, acetic ether, and other readily saponifiable ethers. Gum, dextrin, and sugars, in aqueous solution, as well as albumen, casein, fibrin, and other proteid compounds in alkaline solutions, also give rise to iodoform when properly acted upon by iodine.

Iodoform may be prepared by heating an alcoholic solution of iodide of potassium to 40° C. (104° F.), then adding and stirring in successive quantities of chlorinated lime, until the dark-red color of the liquid is removed. On standing, crystals of iodoform and iodate of calcium are precipitated. Treat these with boiling alcohol of 90 per cent; the iodoform only is dissolved, and is deposited in crystals as the solution cools.

Suillot and Raynaud (1889) devised a process now largely employed in France, and by which an exceptionally pure product (the "*absolute iodoform*" of Casthélaz) is produced. It is prepared directly from *kelp* (ash of sea weeds), which is lixiviated; a definite quantity of potassium or sodium iodide prepared therefrom (say 25 parts); and acetone (3 parts), and caustic soda (1 part), both in solution in water (500 to 1000 parts), are added. Sodium hypochlorite solution is then added, drop by drop, as long as a precipitate of iodoform occurs. Filhol's method is favorably received, and gives a large yield (72 per cent). It is essentially as follows: Into a long-necked flask, with a long supply tube are introduced crystallized sodium carbonate (2 parts), water (10 parts), and alcohol (1 part). The mixture is then gradually and slowly heated to between 60° and 80° C. (140° to 176° F.). Then iodine (1 part) is added in fractional portions until the color is discharged. The solution is allowed to cool and the crystals collected upon a filter. The filtrate is then warmed, sodium carbonate (2 parts) and alcohol (1 part) added, and chlorine gas passed rapidly into the solution as long as iodoform is precipitated. More iodoform may be obtained by repeating this treatment of the filtrate. (For a review of some of the earlier methods of preparing iodoform, see *Pharm. Centralhalle*, 1882, p. 419.)

Description and Tests.—Iodoform is officially described as occurring in "small, lemon-yellow, lustrous crystals of the hexagonal system, having a peculiar, very penetrating and persistent odor, somewhat resembling that of saffron and iodine, and an unpleasant, slightly sweetish, and iodine-like taste. Specific gravity 2.000, at 15° C. (59° F.). Very slightly soluble in water, to which it, however, imparts its odor and taste. Soluble in about 52 parts of alcohol at 15° C. (59° F.), in about 12 parts of boiling alcohol, and in 5.2 parts of ether. Very soluble in chloroform, benzin, and fixed and volatile oils. Iodoform is slightly volatile even at ordinary temperatures, and in boiling water distills slowly over with its vapor. At about 115° C. (239° F.), it melts to a brown liquid, and at a higher temperature emits vapors of iodine, leaving behind a carbonaceous mass, which, upon full combustion, should be completely dissipated (absence of fixed impurities). On digesting about 0.1 Gm. of iodoform with 5 Cc. of a 5 per cent solution of potassium hydrate in alcohol, and then slightly supersaturating with diluted nitric acid, the liquid will be rendered blue by starch T.S. The solutions in neutral solvents are neutral to litmus paper. If 2 Gm. of iodoform be thoroughly shaken with 10 Cc. of water, the filtrate should be colorless and free from bitter taste (absence of soluble yellow coloring matters, picric acid, etc.), should not affect the color of litmus paper (absence of free acids), and should remain unaffected by silver nitrate T.S. (absence of soluble iodides)"—(*U. S. P.*).

Iodoform is somewhat unctuous to the touch. The aromatic oils of peppermint, anise, fennel, and others, as well as balsam of Peru and coumarin, have been said to mask its unpleasant odor, from 3 to 5 drops of oil of peppermint being recommended to disguise an ounce of iodoform in ointments or mixtures. Our experience is to the effect that none of them accomplish the purpose. Even though they cover the odor in mass, on exposure the rank odor of iodoform asserts itself. In this connection it may be said that Johnson and Johnson have introduced an *iodurct of carbon*, under the name *iodoform odorless*, which is claimed to be fully as efficient as ordinary iodoform, and free from all odor. Analysis by Prof. S. P. Sadtler gave 95.20 per cent iodine. To remove the odor from the hands, utensils, and instruments, first apply a few drops of oil of turpentine, and afterward thorougly wash with water and soap (see also *Iodoformum Aromatisatum*). Iodoform solutions, when exposed to sunlight, liberate iodine. The latter is contained in iodoform to the extent of 98.69 per cent. Gentle heat decomposes it into iodine and hydriodic acid. It is partially decomposed when boiled with solution of potassa, yielding iodide and formate of potassium. It is not likely to contain many impurities. Its chemical decomposition is analogous to that of chloroform.

Action, Medical Uses, and Dosage.—Ordinarily iodoform, when applied to the sound or broken skin, wounds, ulcers, and mucous membranes, is non-irritating, and acts as a topical anæsthetic. Occasionally, however, serious poisoning occurs from its absorption, and death has been known to result from such applications. Among the symptoms thus produced are drowsiness and stupor, meningitis, delirium, progressive emaciation, high fever, sphincter paralysis, and death. Occasionally an eczematous eruption is caused by it, or an erythema or papular eruption may appear. In one case under our treatment, after the removal of an encysted bullet from the knee, and the dressing of the wound with a 10 per cent iodoform gauze of standard make, an erythematous redness followed in 24 hours, succeeded in 2 days by an extensive and painful eruption of vesicles, filled with a deep, orange-colored serum. Considerable constitutional infection accompanied, with a rise in the temperature of 2 degrees. The whole knee was involved, and had the appearance of a large, rough-skinned orange. The lesion spread rapidly wherever the viscid serum touched the sound surface. It resisted ordinary treatment with sodium bicarbonate, borax, etc., until dusted with bismuth subnitrate, when healing took place rapidly. Applied to the rectum in suppository, iodoform so far blunts sensibility as to allow unconscious defecation. Iodoform, when employed in large quantities for packing, may become an encapsulated foreign body, and eventually gives rise to an iodoform "abscess," the contents of which are iodoform and mucus (Murrell). Chorea, suicidal mania, and profuse diarrhœa have followed the local use of iodoform. Internally, small doses (5 or 6 grains, or less) improve the appetite, and iodine quickly appears in the urine and saliva, escaping from the former as an iodide of sodium with a small portion of iodate. The symptoms produced by toxic doses are the following: Faintness, giddiness, headache, mental confusion, drowsiness, burning gastric pain, delirium, convulsions, unconsciousness, a quickened or slowed, small pulse, cold, livid skin with profuse perspiration, and general paralysis (Taylor, *Med. Juris.*, from *Br. Med. Jour.*, 1882).

In iodoform poisoning, the use of the drug should be stopped and the alkaline carbonates employed locally and internally together with the internal administration of bromide of potassium, acetate of potassium, or lemonade. As a rule, iodoform should not be used in conjunction with carbolic acid. Fatty degeneration of the kidneys, liver, and heart has been found after death from iodoform.

Iodoform has been used to some extent as an internal medicine. M. Righini (1862) stated that the inhalation of its ethereal solution is of great service in retarding the progress of phthisis. Foxwell, of Birmingham, England, now regards it as almost specific in the treatment of *phthisis.* From 1-grain pills, 6 times a day, he claims greater results than from any drug or combination he has employed. He has administered as high as 50 grains per day for long periods without ill results. The effects reported by Foxwell are: Soothing of nervous erethism, lessening of cough and expectoration, increased nutrition, and improvement of physical signs. Murrell, who endorses Foxwell's treatment in the main, in *phthisis* and *winter-cough*, found that in some cases the large doses had to be abandoned on account of the strong odor imparted to the breath, and the nausea and vomiting induced (Murrell, *Mat. Med.*, 1896). It is said to be very efficient in checking *pulmonary hemorrhage* in *tuberculosis of the lungs.* Internally, in the dose of 1 to 3 grains, 3 times a day, in pill form, it was formerly regarded useful in *goitre, scrofula. rachitis, glandular tumors, menstrual derangements, affections of the bladder*, etc, but is now seldom employed for these affections. It is, however, valued by some as an alterative in the same-sized doses, in *syphilis* and in *syphilitic neuralgia*.

Iodoform is best known as an antiseptic surgical dressing for use in *operations*, and as an application in various forms of *ulcerations*, syphilitic and otherwise. Few agents are more useful in the treatment of ulcerated, granulated, or abraded surfaces, than a solution of 1 part of iodoform in 4 parts of glycerin (Locke). In venereal diseases, barring its odor, which may be masked, however, it is one of the most useful of applications. *Soft chancres* readily yield to it, as do many painful *phagedenic ulcers*. For these purposes, the pure iodoform in small amount may be dusted upon the ulcers, or the powder proposed by Prof. Locke may be employed. It is composed of iodoform, 100 parts; thymol, 1 part, and sugar of milk, 200 parts. It is exceedingly useful in *syphilitic fissure of the tongue, syphilitic pharyngeal ulcers*, and *simple* or *syphilitic ozena*. It is without a superior in *hospital gangrene, gangrenous vulvitis, aphthous vulvitis* of debilitated children, and in ointment, to temporarily relieve *pruritis vulvæ*. It forms the chief application to *suppurating buboes*. A good form of exhibition is that given by Murrell: R Iodoform, ʒj; oil of eucalyptus, fl℥j; soft and hard petrolatum, of each, ℥ijss. Mix. In venereal diseases, the more irritable and painful the lesions, the more effectual is iodoform. *Gonorrhœa* and *gleet* may be well treated with iodoform, bougies containing that drug and oil of eucalyptus, being the preferable form for use. It is better adapted to *gonorrhœa of the female*. However, iodoform is less effectual in this class of diseases than other forms of treatment. *Chordee* is palliated by it. A 20 per cent ointment is reported to have subdued pain and swelling in *acute orchitis*. *Vaginismus* and other forms of *vaginal hyperæsthesia* are relieved by iodoform.

An ointment of 30 to 60 grains of iodoform to an ounce of lard or petrolatum, has been successfully applied to *tumors* and in certain dry forms of *skin diseases*, and especially of syphilitic origin. *Ringworm* is said to be cured by it. In suppository form with cacao butter (iodoform, grs. xxx; cacao butter, ℥j. Mix. Make 6 suppositories), it has proved beneficial in *cancer of the uterus*. *Cancer of the breast* and other *carcinomata* are also benefited by it. Its advantages are that it relieves pain, corrects the offensive odor, retards destruction of tissues, and conserves the strength of the patient. It does not arrest the secretions as does opium. An ointment (1 part to 15 of petrolatum) forms a good application in *cracked nipples*. The parts, however, should be thoroughly washed before suckling the child. *Painful chronic ulcers* should be first destroyed with nitric acid, and then treated with iodoform. Iodoform in ointment or suppository is exceedingly useful to subdue pain and promote healing in *rectal ulcers, hemorrhoids*, and *painful anal fissures*. It aids greatly by rendering defecation painless. Iodoform forms a good dressing after the opening of *boils* and *carbuncles*. The latter are said to have been aborted by the injection of an ethereal solution of iodoform.

An emulsion of iodoform has been employed for injecting *cold abscesses* and *tubercular caries* (Billroth), and in the treatment of *cystitis*. A solution of iodoform in ether or glycerin has been lauded by some as an injection for *empyema, abscesses*, and *joint affections*, all of *tuberculous character*. A collodion solution has been employed topically to *inflammatory swellings, chronic arthritis, localized neuralgias, goitre, swollen cervical*, and other *lymphatic glands*, and for the absorption of *peritoneal, pleuritic*, and *pericardial effusions*. A saturated chloroformic solution gives relief in various *superficial neuralgias*. A turpentine solution (4 per cent), inhaling from 3 to 5 drops, has been advised in *bronchiectasis* and in *laryngeal* and *pulmonic tuberculosis*. Murrell recommends the following powder for insufflation in *laryngeal phthisis:* R Iodoform, boric acid, aa ʒij; menthol, grs. x; phosphate of calcium, q. s., ℥j. All in fine powder. Mix.

Iodoform is largely used in the treatment of *simple, surgical, gunshot*, and *infected wounds*. For such purposes, the powder or the gauze are generally preferred. It relieves pain and promotes healing. As little should be used as will accomplish the desired purpose, and never should more than 30 grains be used at one dressing. Neither should its application be too frequent. Good drainage should be insured, and the parts should not be too snugly bandaged. Iodoform gauze should be preferred in *operations upon the intestines*, and *peritoneal* and other *cavities*.

Iodoform is an important agent in *nasal*, *ocular*, and *aural diseases*. As an insufflation powder, a combination of iodoform and tannic acid is effectual in *ozena*, *post-nasal catarrh*, and in *soft nasal hypertrophies*. A first decimal trituration dusted upon the lids with a soft brush, is useful in *granular conjunctivitis* (Locke). In eye disorders a 5 to 10 per cent ointment or an impalpable powder should be employed. Aged persons are sometimes toxically impressed by its application in ocular affections. Iodoform may be used after *operations upon the eye* or *appendages*, in *ciliary blepharitis*, *simple* and *serpiginous corneal ulcers*, *hypopyon keratitis*, *purulent conjunctivitis*, *pannus*, *ophthalmia neonatorum*, *phlyctenular conjunctivitis*, *palpebral ulcers*, and *conjunctival gumma*. Iodoform is employed in *suppurative ear affections*, particularly after the active phases have passed. The powder or gauze may be used after *operations upon the aural canal*. Foltz (*Dynam. Therap.*) declares the "pale mucous membrane" the indication for iodoform, and in *suppurative otitis media* prefers a mixture of equal parts of boric acid and iodoform. If eye or ear disorders are of syphilitic origin its use is particularly commended.

Various combinations of iodoform are employed locally, besides those already mentioned. The following are useful forms: (1) ANTISEPTIC POWDER: Iodoform 11 parts, bismuth subnitrate 4, salicylic acid 4, camphor 1 (Cavazini). (2) ANTISEPTIC PASTE: Iodoform 1 part, oil of camphor 4, salicylic acid 4, starch, a sufficient quantity to form a stiff paste. (3) INHALANT: Iodoform 1 part, oil of turpentine 8. (4) EMULSION: Iodoform 10 parts, glycerin 8, distilled water 2, tragacanth 5. This may be shaken with water in any quantity desired.

Ointments of iodoform (with petrolatum), usually contain from 5 to 10 per cent of the drug. With it may be incorporated some of the deodorants mentioned, particularly oil of camphor or eucalyptus. Glycerin solutions contain from 5 to 30 per cent; ether solutions, from 5 to 25 per cent; oleaginous solutions (olive oil), 10 to 25 per cent; flexible collodion solutions, 5 to 10 per cent; iodoform gauze, from 10 to 50 per cent, the former being generally preferred; trituration in milk sugar, 10 per cent. The dose of iodoform ranges from ½ grain to 3 grains, in pill.

Other Iodoform Preparations.—CARBASUS IODOFORMATA (N. F.), *Iodoform gauze. Formulary number*, 18: "Iodoform, ten grammes (10 Gm.) [154 grs.]; ether (*U. S. P.*), forty grammes (40 Gm.) [1 oz. av., 180 grs.]; alcohol, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; tincture of benzoin (*U. S. P.*), five grammes (5 Gm.) [77 grs.]; glycerin, five grammes (5 Gm.) [77 grs.]; gauze muslin, a sufficient quantity. Dissolve the iodoform in the ether, then add the alcohol, tincture of benzoin, and glycerin. Immerse in a weighed quantity of this solution, contained in a suitable vessel, the exact amount of gauze muslin required to absorb the whole of it, to produce a product of a prescribed percentage of iodoform, work it about with a pestle so as to impregnate it uniformly; then take it out, and hang it up to dry, in a horizontal position, and in a dark place. Lastly, wrap it in paraffin paper and preserve it in air-tight receptacles. *Note.*—To calculate the amount of muslin and of iodoform solution required to obtain a product approximately of any required percentage of iodoform, let x denote this required percentage. Then take of the above iodoform solution ten (10) times this quantity (or 10 x). Also multiply the required percentage (x) by three (3), divide the resulting product by two (2), and subtract the quotient from one hundred (100). The remainder represents the number of parts by weight of gauze muslin to be used. Regarding the most suitable kind of gauze muslin, see note to *Carbasus Carbolata* (F. 17)"—(*Nat. Form.*).

IODOFORMUM AROMATISATUM (N. F.), *Aromatized iodoform, Deodorized iodoform.*—"Iodoform, 25 parts; cumarin, 1 part. Mix them intimately by trituration. *Note.*—Should cumarin not be available, or should it be objectionable to the patient, the odor of iodoform may also be more or less masked by many essential oils, for instance those of peppermint, cloves, cinnamon, citronella, bergamot, sassafras, eucalyptus, etc. Another efficient covering agent is freshly roasted and powdered coffee. The odor of iodoform may be removed from the hands or any utensil which it has come in contact with, by washing them with an aqueous solution of tannic acid"—(*Nat. Form.*, 1st ed.).

Related Compounds.—ARISTOL, *Annidalin*, *Dithymol diiodide* ($C_{20}H_{24}O_2I_2$). An iodoform substitute preferred on account of its comparative lack of odor. It contains 45.8 per cent of iodine. It is a bulky, deep reddish-brown, amorphous powder, without taste, but having a peculiar and slightly aromatic odor, suggestive of iodine. Water and glycerin do not dissolve it, but it is readily dissolved by chloroform, ether, and collodion. Alcohol dissolves it with difficulty. Caustic alkalies do not effect its solution, though it is taken up by the fixed and essential oils, vaseline, petrolatum, etc. Sulphuric acid, heat, and light decompose it. Aristol is produced by the interaction of a solution of thymol in caustic soda solution and a solution of iodine in an aqueous solution of potassium iodide. Mr. George M. Beringer (*Amer. Jour. Pharm.*, 1891, p. 175) found commercial aristol to conform to the following formula, $C_{20}H_{24}I_2O_2 \, 2H_2O$, thus holding 6.14 per cent of water. Annidalin was originally one of the names applied to aristol, but it is chemically a dithymol diiodide. Aristol is employed as a cicatrizant and substitute for iodoform, consequently the conditions requiring its use need not be repeated. Some prefer it to iodoform. Foltz speaks highly of aristol, in dry powder, in *acute, subacute,* and *chronic suppurative otitis media,* and in *moist eczema of the external auditory canal,* with great itching. An ointment of aristol may be used upon *corneal ulcers,* after active inflammation has been subdued; and in *interstitial keratitis,* after subsidence of the acute phases it assists in clearing the cornea. In powder and ointment it has given good results in *phlyctenular conjunctivitis.* A 1 per cent solution in almond oil has been used by injection with apparently good results in *pulmonary tuberculosis.*

Carvacrol Iodide ($C_{13}H_{13}OI$).—A yellow-brown powder, which decomposes above the boiling point of water. It results when, in the manufacture of aristol, carvacrol is substituted for thymol.

Xeroform, *Tribromphenol-bismuth* ($C_6H_2Br_3O—Bi—O$).—A new substitute for iodoform, greater efficiency being claimed for it, besides its comparative lack of odor and the capability of being sterilized without decomposition at 110° C. (230° F.). (For its preparation, see *Pharm. Centralhalle,* 1895, p. 309.) It is a neutral, greenish-yellow, fine powder, tasteless, and having but a faint carbolic acid odor. It is not decomposed by light. Acids and bases decompose it, especially when heated. The claims made for it are: It is antibacterial, rendering poisonous toxines and ptomaines innocuous, and being itself non-poisonous; it limits and prevents the secretion of pus. It is desiccant, deodorant, analgesic, hemostatic, and promotes granulation and cicatrization. Bulk for bulk, it has greater covering power than iodoform. Having first thoroughly cleansed the parts, it should be applied exactly like iodoform. It is particularly claimed of value in *moist eczemas,* even when produced by iodoform. Success has been reported from its use in *fresh* and *infected wounds, old ulcerations, varicose ulcerations, suppurating buboes, abscesses, burns, chancroids, paronychiæ, boils, sycosis, pruritic affections, impetigo, nasal* and *aural diseases, antral disease,* and in *gynæcological disorders.* Its application is sometimes irritating at first, but this is said soon to pass off.

Europhen, *Diisobutyl-ortho-cresol-iodide* ($C_{22}H_{31}O_2I$).—Prepared like aristol, the thymol being substituted by isobutyl-ortho-cresol. A soft, fine, and light, non-crystalline, yellow powder, having a feeble, saffron-like odor, but no taste. Alcohol, chloroform, ether, collodion, and the fixed oils dissolve it, while in glycerin and water it is insoluble. It is much lighter than iodoform, being five times as bulky. When heated to 110° C. (230° F.), it yields a transparent, brown liquid. When dry, it is permanent. When moistened, it splits into iodine, and an iodine compound, which is soluble. Iodine is also set free by the alkalies and their carbonates. Light and heat decompose its solutions. Europhen contains 27.9 per cent of iodine. The general applications of this body are those of iodoform, being regarded by some as superior in certain *eye, ear,* and *nose affections,* and in various forms of *skin diseases, wounds,* and in *specific* and *non-specific ulcerations.*

Antiseptin, *Boro-thymol-zinc-iodide.*—Radlauer, who introduced this remedy, claimed it to be a definite chemical compound, but, according to F. Goldmann (*Pharm. Centralhalle,* 1891, p. 499), it is a mixture of zinc sulphate (85 parts), boric acid (10 parts), thymol (2.5 parts), and zinc iodide (2.5 parts).

Antiseptol, *Cinchonine iodosulphate,* or *Cinchonine herapathite.*—A compound of varying composition, according to methods of preparation. Usually a reddish-brown, light powder, containing 50 per cent of iodine, soluble in chloroform and alcohol, but not in water. It is prepared by precipitating cinchonine sulphate by means of solution of iodine in potassium iodide (Yvon, *Amer. Jour. Pharm.,* 1890, p. 493). Solutions of it are employed upon *wounds, ulcers,* and *hemorrhoids.*

Iodol, *Tetraiodo-pyrrol, Pyrrol tetriodide* (C_4I_4NH).—Introduced, in 1885, by Ciamician and Silber. Iodine is allowed to react with pyrrol in alcoholic (or methyl alcohol) solution. Upon the addition of water, iodol separates in crystalline, yellow flocculi. It may also be obtained as directed for aristol, substituting pyrrol for thymol. A bulky, pale-yellow, shining, crystalline powder, without odor or taste when pure. It contains 88.97 per cent of iodine. Water scarcely dissolves it, diluted alcohol but slightly, ether, alcohol, and the fixed oils freely dissolve it. Its solution in alcohol is miscible with glycerin. At the temperature of boiling water, it remains permanent, but at and above 145° C. (293° F.), decomposition takes place, iodine is given off, and the iodol burns without leaving a residue. Upon treatment with sulphuric acid, iodol turns green (see *Amer. Jour. Pharm.,* 1885, p. 605). It should not be confounded with *Iodal,* a substance resembling chloral in its action upon animals (Rabuteau), and prepared by acting upon a mixture of nitric acid and alcohol with iodine. Iodal is decomposed by alkalies, yielding formic acid and iodoform. Iodol is antiseptic and a substitute for iodoform. Its external use is reported to have produced toxic symptoms. Internally, in 2 or 3-grain doses, it has been employed in *diabetes mellitus, scrofula,* and *syphilis.* Applied locally, to *wounds, chancroids, ulcers, condylomata,* and *fungous growths;* and, by insufflation, in *laryngeal tuberculosis* and atrophic forms of *nasal* and *pharyngeal catarrh.*

Iodol has also been employed in *catarrhal eye affections,* but is said to be undesirable in *phlyctenular conjunctivitis.* It is more irritating in traumatic and ulcerated ear affections than iodoform. According to Foltz, it does not produce healthy granulations, and he declares it less efficient than boric acid in *purulent inflammation of the middle ear.* It is, however, said to be useful in *carious suppuration of the external auditory canal.* Dose, 2 to 20 grains.

Losophan (Losophane), *Tri-iodo-metacresol* ($C_6HI_3OH.CH_3$).—This body was introduced in 1892, and contains 78.39 per cent of iodine. It is prepared by the action of iodine upon meta-oxy-toluic acid ($C_6H_3.OH.CH_3.COOH$) in the presence of the calculated quantity of caustic alkali or alkaline carbonate. It forms white or colorless needles, without odor, and melting at 121.5° C. (250.7° F.). Ether, chloroform, benzol, and the fixed oils, when warmed to 60° C. (140° F.), dissolve it. Alcohol dissolves it with difficulty; in water it is insoluble. It is used for the same purposes as iodoform.

SOZOIODOLE, *Sozoiodol*, *Sozoiodolic acid*, *Diiodo-para-phenol sulphonic acid* ($C_6H_2.OH.I_2.SO_3H.+3H_2O$).—A compound containing 52.8 per cent of iodine. The potassium salt is prepared by the action of concentrated sulphuric acid upon phenol (carbolic acid), *para-phenol sulphonic acid* being formed. This is converted into the potassium salt, and the calculated amount of iodo-chloride is added, whereby the *sozoiodole-potassium* is precipitated as a crystalline substance, soluble with difficulty in water. It is then purified by recrystallization (Ostermayer, *Pharm. Centralhalle*, 1888, p. 534). Sozoiodolic acid occurs in small, prismatic needle-crystals, easily soluble in water, alcohol, or glycerin. With metallic bases it forms acid and neutral salts, the former of which constitute the medicinal salts generally employed. The four which have come into more prominent use are the following: (1) *Sozoiodole-sodium* (*Sodium sozoiodolate*), in colorless, inodorous, astringent-sweetish needles, soluble in water (1 in 20) in alcohol, and warm glycerin. This is the preparation known simply as SOZOIODOLE. It is non-toxic, antiseptic, and desiccant, and has a wide application in *venereal disorders*, in *ophthalmology*, in *affections of the nose and throat*, and in all cases requiring antiseptic treatment. It is used in powder of 1 to 10, or pure; and in solutions of 1 to 12 to 1 to 50 of solvent. (2) *Sozoiodole-potassium* (*Potassium sozoiodolate*), a white, light, inodorous powder, hardly soluble in warm alcohol, but soluble in water (1 in 100). Properties similar to the sodium compound; unlike the latter, it swells up when heated on platinum foil, similar to the phenomenon known as the "Pharaoh's Serpent." (3) *Sozoiodole-zinc* (*Zinc sozoiodolate*). Delicate, prismatic needle-crystals, colorless, odorless, soluble in glycerin and alcohol, and in 25 parts of water. More astringent than the preceding, and being more irritant and liable to prove escharotic in concentration, must be used in greater dilution. Specially applicable in *gonorrhœa*. Employed in powder, salve, or solution of strength ranging from 1 to 5 to 1 to 100. (4) *Sozoiodole mercury* (*Mercury sozoiodolate*). Very fine, orange-yellow powder, insoluble in water or alcohol, but dissolving in water (1 in 200) upon the addition of salt or hydrochloric acid. Caustic in concentrated form, and the only poisonous salt of the group. Employed like other mercury compounds, and as a general antiseptic like iodoform. Used in strengths of from 1 to 200 to pure, in powder, salve, or solution. These salts are odorless, non-toxic (except the mercury salt), soluble in one or more of the common solvents, non-decomposable by light, and in from 10 to 25 per cent triturations are claimed to have about the same power as pure iodoform. (For their detailed description, see *Pharm. Centralhalle*, 1890, p. 335.)

SOZAL, *Aluminum paraphenylsulphonate* (*Sozonate*) ($[C_6H_4[OH]SO_3]_6Al_2$).—Formed by double decomposition between barium paraphenolsulphonate and aluminum sulphate, or by dissolving aluminum hydrate in paraphenolsulphonic acid. It forms astringent, crystalline granules having a faint phenol odor. It is quite stable and forms permanent solutions with water, alcohol, or glycerin. It is one of the proposed antiseptic substitutes for iodoform.

SULPHAMINOL, *Thioxydiphenylamine* ($C_{12}H_9OS_2N$). *Metaoxydiphenylamine*, boiled with caustic soda solution and sulphur, filtered, and treated with ammonium chloride, yields a precipitate of sulphaminol. It is a light-yellow powder, tasteless and odorless, easily soluble in alcohol, glacial acetic acid, and alkali solutions, insoluble in water. Combined in solution with guaiacol, menthol, eucalyptol, and creosote, under the names of sulphaminol guaiacol, sulphaminol menthol, etc., it has been employed in *tubercular affections of the larynx*.

THIOPHENE (C_4H_4S).—An oily, colorless, mobile liquid, boiling at 84° C. (183.2° F.), a regular constituent of commercial coal-tar benzol (Victor Meyer, 1883), and isolated therefrom by agitation with strong sulphuric acid. It does not mix with water. Two of its compounds have been medicinally employed. Sodium thiophene sulphonate ($C_4H_3S.NaSO_3$) is a crystalline white powder containing of sulphur about 34 per cent. Thiophene diiodide ($C_4H_2I_2S.$) contains 9.5 per cent of sulphur and 75.6 per cent of iodine, and forms plate-like crystals soluble in the common solvents except water. It is volatile, and melts at 40.5° C. (104° F.). It is proposed as an iodoform substitute.

NOSOPHEN, *Tetraiodophenolphthalein* ($[C_6H_2I_2.OH]_2$:C:C_6H_4CO.O or $C_{20}H_{10}I_4O_4$).—This is an odorless iodine compound intended chiefly as an antiseptic powder—a substitute for iodoform. It has greater covering power than the latter. It is a tasteless, pale, yellowish-gray powder, containing 61.8 per cent of iodine. Nosophen is insoluble in water and acids, and feebly soluble in alcohol, while chloroform and ether dissolve it freely. Heating with strong sulphuric or hydrochloric acid decomposes it, iodine being liberated. Concentrated alkalies and diluted acids, however, do not decompose it, even upon boiling. It forms salts with sodium (antinosine), bismuth (eudoxine), mercury, zinc, etc. It is non-poisonous, possesses bactericidal, anæsthetic, antihemorrhagic, and desiccating properties, and may be used in a great variety of troubles, both locally and internally, in which iodoform is employed. It is used chiefly, however, in powder, as a topical agent. The dose is $\frac{1}{8}$ grain to 8 grains, but the bismuth salt (eudoxine) is preferred for internal administration.

ANTINOSINE is the sodium salt of nosophen, and is used chiefly in 1 to 5 per cent solutions, in antiseptic irrigations. It is a dark-blue amorphous powder, freely soluble in water and alcohol; also soluble in glycerin. It is not permanent, like nosophen, owing to the action of the atmospheric carbon dioxide. It has no odor, and is said to be non-irritant and non-poisonous.

EUDOXINE is the bismuth salt of nosophen. It is a tasteless and odorless, reddish-brown powder, containing 52.9 per cent of iodine and 14.5 per cent of bismuth. It is insoluble and non-poisonous. Alkalies decompose it, nosophen and bismuth oxide resulting. It has been recommended in the *bowel disorders of infants.* Eudoxine is the salt of tetra-iodo-phenol-phtalein, and is preferred for internal administration. Dose, ⅛ grain (very young infants), to 8 grains, 3 times a day.

IODUM (U. S. P.)—IODINE.

SYMBOL: I. ATOMIC WEIGHT: 126.53.

A non-metallic element obtained from *kelp,* and as a by-product from the mother liquor of Chili saltpeter. It should "be kept in glass-stoppered bottles, in a cool place"—(*U. S. P.*).

History and Source.—Iodine was discovered, in 1812, by M. Courtois, a saltpeter manufacturer of Paris; and, in 1820, its medicinal virtues were first made known by Dr. Coindet, Sr., of Geneva. It is prepared from the ashes of sea weeds, occurring on the coasts of France, Ireland, Scotland, Japan, etc. The ashes are of a dark color, and are known by the name of *kelp.* They contain about 0.2 per cent of iodine. It also occurs in sponge. The amount of iodine present in the different algæ varies according to the species. Mr. James Wheeler (1882) found comparatively large amounts of iodine in *Laminaria flexicaulis* and *L. saccharina.* According to L. Van Itallie (1889) about 0.01 per cent of iodine is contained in *Fucus vesiculosus* and *Chondrus crispus.* The occurrence of iodine in the beds of Chili saltpeter is also traceable to a probable marine origin.

Probably all varieties of *Gadus* (codfish) contain it in their livers—a maximum of 1 part in 60,000 (Mitchell Bird, 1882)—and the liver of *Raja clavata* and *R. batis* are said to contain even more than the cod-liver. Traces of iodine have been found in the liquids of *Julus fœtidissimus,* crabs, starfish, salted herrings, etc.

Its presence in minerals and natural waters is frequent. It has been found combined with mercury and silver, in the *cerussite* of Catorce, Mexico; in very small quantity in Silesian zinc ore; in the salt of Hall, Tyrol; in native nitrate of sodium; in Silesian coal; in the distillation products of coal; in the Jura limestones near Lyons and Montpellier; in clay, vegetable mold, sulphur, cinnabar, iron, and manganese minerals, gypsum, white chalk, etc. It has likewise been detected in rain and fresh water, and in various mineral waters, in different parts of the globe. The salt brines, left in the manufacture of salt and of bromine in West Virginia, were shown by Prof. Mallet (see *Amer. Jour. Pharm.*, 1881, p. 606) to contain considerable quantities of iodine.

Preparation.—Iodine is commonly prepared from kelp, which is lixiviated in water, the solution concentrated by evaporation, and the various salts of sodium and potassium deposited, whereby a dark-colored mother liquor is left, called *iodine lye.* Sulphuric acid is added to this to acidulate it, and to liberate carbonic acid, sulphurous acid, and hydrogen sulphide gas, while sulphur is deposited, and hydriodic acid is formed in solution. The acidulated lye is now introduced into a leaden still, and heated to 60° C. (140° F.) when manganese dioxide is gradually added; a leaden head is then adapted, heat is applied, iodine is evolved, and is collected into a series of glass receivers, on the inner surface of which it condenses. The following reaction takes place: $2IH+MnO_2+H_2SO_4 = MnSO_4+2H_2O+I_2$.

Soubeiran states that iodine may also be obtained from the mother liquor by the following process: Add sulphate of copper to the mother water so long as a white precipitate of cuprous iodide (Cu_2I_2) is thrown down, while part of the iodine remains in the fluid. Then treat the supernatant liquid with more of the sulphate, together with iron filings. The iron, taking the place of the copper in the solution, sets that metal free, and the metal, in the act of evolution, unites with the iodine in the fluid, so that more iodide of copper is formed. When this iodide is mixed with dioxide of manganese and sulphuric acid, a moderate heat decomposes it, and iodine is sublimed.

The crude iodine is purified to some extent by resublimation, but must undergo additional purification to get rid of traces of iodine chloride, bromide, or cyanide. For this purpose it is recommended by F. Musset (1890) to melt it under a concentrated layer of potassium iodide solution, allowing to cool, and washing out the iodine cake with water. Another method, that of Stas, to obtain pure iodine from potassium iodide solution, is to oxidize part of the iodide to iodate in such proportion that upon subsequent acidulation with sulphuric acid, iodine is precipitated according to the following equation: $KIO_3 + {}_5KI + {}_3H_2SO_4$ ${}_3K_2SO_4 + {}_3H_2O + I_6$. According to C. Meineke (*Chemiker Zeitung*, 1892, p. 1219 and 1230), an exceptionally pure iodine is yielded by this method. This author prefers the use of potassium permanganate as an oxidizer.

Description.—Iodine is usually sold in small scales, or rhombic plates; occasionally in solid masses. It is heavy, friable, dry, grayish-black or bluish-black in color, has a shining appearance, a peculiar, unpleasant, and irritating odor, and a sharp, acrid taste. It is brittle and easily pulverized, fuses at 114° C. (237.2° F.), boils at 175° C. (347° F.), though its vapor rises with that of boiling water. "As it fuses it is gradually dissipated in the form of a purplish vapor, leaving no residue"—(*U. S. P.*). At common temperatures it slowly evaporates. Its specific gravity is 4.948 at 17° C. (62.6° F.)—(*U. S. P.*). It stains the skin a deep brown, which slowly disappears, and, if the contact be prolonged, will destroy the soft textures of the body. Vegetable colors are slowly discharged by it. "Soluble in about 5000 parts of water, and in 10 parts of alcohol at 15° C. (59° F.) with a brown color; also freely soluble in ether, and in a solution of potassium iodide with a brown color; and in chloroform or carbon disulphide with a violet color"—(*U. S. P.*). According to W. Duncan (*Amer. Jour. Pharm.*, 1892, p. 100), the solubility of iodine in chloroform is limited to 1:56.6 at 10° C. F. Dietze (*Amer. Jour. Pharm.*, 1898, p. 574) states that its solubility in water is (on the average) 1:3600 at ordinary temperature, and 1:2200 at 30° C. (86° F.). It is soluble in water containing syrup of orange, and 6 ounces of water to which 2 grains of tannic acid are added, will dissolve 10 grains of iodine. In saline solutions it is much more soluble, and freely so in solutions of chloride of sodium, nitrate of ammonium, or iodide of potassium. It is very soluble in benzene, glycerin, or the volatile oils, but with some of them, especially those from the coniferous tribe of plants, considerable heat is evolved, brisk effervescence ensues, and much of the iodine is discharged in vapor. With castor oil, a 20 per cent solution of iodine may be obtained, which has the advantage of being miscible with alcohol (*Amer. Jour. Pharm.*, 1885, p. 435).

Iodized oil of juniper (iodine, ½ drachm, oil of juniper, 1 ounce, the iodine to be added gradually until the whole is added) possesses all the properties of the tincture of iodine, and its use is not attended with discoloration of the cuticle. Iodine unites with oxygen or hydrogen to form acids, also with sulphur, phosphorus, carbon, chlorine, etc., and readily unites with metals, such as copper, iron, silver, etc. Its characteristic reaction is that with starch. This substance, if converted by boiling with water into soluble starch, forms a blue precipitate with it, of such intensity that iodine may easily be detected in 450,000 parts of water. To effect this the iodine must be free, which may be obtained by adding a little nitric acid to the suspected solutions, and the solutions must be cold (see also *Amylum*). Iodine is easily mixed with fatty substances; it is apt to escape from the surface of ointments, unless united with iodide of potassium, which impedes this result. The combination of iodine with hydrogen forms a gaseous acid, called *hydriodic acid* (IH), and that with oxygen forms two acids, the *iodic* (IO_3H) and *per-iodic acids* (IO_4H). The preparation known as *colorless tincture of iodine* is a solution of iodine in combination, and will be considered in its proper place.

Tests.—"With starch T.S. it produces a dark-blue color. A solution of iodine in chloroform should be perfectly clear and limpid (absence of moisture). To determine the presence of cyanogen, chlorine, or bromine, proceed as follows: Triturate 0.5 Gm. of finely powdered iodine with 20 Cc. of water, and filter off the solution. To one-half of this solution, in a test-tube, carefully add decinormal sodium hyposulphite V.S., until the solution is just decolorized. Then add a few drops of ferrous sulphate T.S., and subsequently a little sodium hydrate T.S., and heat the mixture gently. On now adding a slight excess of hydrochloric acid, the liquid should not assume a blue color (absence of iodine cyanide). To the other half of the aqueous filtrate, in a test-tube, add a slight excess of silver nitrate T.S., shake actively, allow the precipitate to subside, and, having poured off the clear, supernatant liquid completely, shake the precipitate with a mixture of 1 Cc. of ammonia water and 9 Cc. of water, and filter. Upon the addition of a slight excess of nitric acid to the filtrate, not more than a slight opalescence should make its appearance (limit of chlorine or bromine). If 0.32 Gm. of iodine, together with 1 Gm. of potassium iodide, be dissolved in 20 Cc. of water, and the solution mixed with a few drops of starch T.S., it should require not less than 25 Cc. of decinormal sodium hyposulphite T.S. to discharge the blue or greenish color of the liquid (corresponding to at least 98.85 per cent of pure iodine)"—(*U. S. P.*). (For a detailed list of tests and the mode of their application, see this *Dispensatory*, preceding edition.)

Action, Medical Uses, and Dosage.—In large doses, iodine is an irritant and corrosive poison, stimulating the mucous membranes, liver, and absorbent glands, exciting the sexual organs, and producing debility of the digestive functions, muscular weakness, and emaciation. This influence upon the system, in which its poisonous effects are developed, is termed *iodism*. Its symptoms are fever, violent vomiting and purging, great thirst, palpitation, extreme restlessness, rapid emaciation, acute, epigastric pain, cramps, small and frequent pulse, violent priapism, trembling, occasional syncope, etc. These symptoms vary in different persons, and have even terminated fatally. From 4 to 6 grains have produced these symptoms, hence it should never be administered in large doses, and when these effects appear, the medicine should at once be stopped. (For further consideration of iodism, see *Potassii Iodidum.*)

In small, or medicinal doses, iodine is a stimulant, tonic, alterative, diuretic, emmenagogue, and diaphoretic. It affects especially the absorbent and glandular system, and its results vary according to the dose, combination, etc. It has been detected in the urine soon after being swallowed, also in the saliva, perspiration, milk, and blood, and always in the form of hydriodic acid, or an iodide. It is supposed to undergo conversion in the stomach into hydriodic acid, and is thus absorbed. In proper doses, iodine improves the appetite and digestion, stimulates to some extent excretion and secretion, proves diuretic, and increases strength. It probably does not stimulate blood-making nor nutrition, but it materially assists in the removal of worn-out tissues—in fact, increases retrograde metamorphosis. There is a difference of action in preparations of iodine; those which act especially by iodine in a free state, or in which it is readily set free, are not eliminated from the economy, as tincture of iodine, iodide of iron, and iodide of calcium, and should be administered in small doses. On the other hand, those which are eliminated, as iodide of potassium, or of sodium, may be given in large doses. These not only convey into the excretions metallic substances that may have been in the system for a long time, but, as with iodide of potassium, they produce the influences peculiar to the base; with the iodide of potassium we observe the diuretic and sialagogue influence of the alkali (Bouchardat's *Ann. de Thérap.*, 1869, p. 184). Iodine and some of its preparations will occasionally produce salivation, soreness of the mouth, coryza, and often pustular eruptions. Under its influence, *enlarged glands* are brought to their normal size, and *strumous ulcers* gradually healed. Occasionally it has caused a rapid and permanent wasting away of the mammæ or testicles, and again, after a lapse of time, these organs have recovered their original development.

Iodine is employed medicinally in various forms of disease, in some of which it produces astonishingly beneficial results, this being especially true in diseases involving the lymphatic structures. The diseases in which it appears to be more generally efficient are *bronchocele*, *glandular obstructions*, *scrofula*, *syphilis*, *mercurio-syphilis*, *strumous ophthalmia*, *ozena*, *ulcers of the teguments*, *enlargement of the external absorbent glands*, *chronic enlargement of the liver and spleen*, *mamma*, *testes*, and *uterus*, *ovarian tumors*, *leucorrhœa*, *amenorrhœa*, *dysmenorrhœa*, *caries*, *paralysis*, *chorea*, *rheumatism*, and, in fact, the majority of *diseases of a hypertrophical*, *strumous*, or *cachectic character*. In *bronchocele*, it is most serviceable in the early congestive stage, or in the middle stage of gelatiniform effusion; in the indurated stage of the thyroid gland it is of little benefit. In this affection its use should be continued uninterruptedly for at least five weeks, and if no good effects appear, it may be laid aside. The compound solution of iodine is generally preferred in doses of 5 to 10 drops, 3 times a day. Iodine has been injected into the gland with apparent benefit, but this practice is not generally commended. Prof. J. M. Scudder (*Spec. Med.*) advised small doses of iodine in *sexual debility:* ℞ Tincture of iodine, gtt. xx; simple syrup, fl℥iv. Dose, 1 teaspoonful 4 times a day, preferably after meals and at bedtime.

Iodine is not a cumulative medicine, like lead, digitalis, etc., hence, whenever its effects approach iodism, a suspension of its use will gradually remove them; however, at the present time, these effects are not so often observed as among its early investigators. Yet, as some persons are very susceptible to its influence, the approach of iodism should be carefully watched, and its symptoms checked. In *chronic diarrhœa* and *dysentery*, *cholera infantum*, *colliquative diarrhœa of phthisis*, and *scrofulous diseases*, Prof. King found the following a superior remedy: Take of iodine, $1\frac{1}{2}$ grains; sulphate of morphine, $\frac{1}{8}$ grain; extract of geranium, 20 grains; triturate thoroughly together in a mortar, form into a pill-mass with simple syrup or extract of liquorice, and divide into 10 pills; of these 1 pill may be given every 1 or 2 hours to an adult. In *hepatic* and *splenic affections*, dried extract of leptandra may be substituted for the extract of geranium. In the *Mexican diarrhœa*, he succeeded in curing every case in which the following preparation was employed: Take of iodine, $1\frac{1}{2}$ grains; tannic acid, 10 grains; distilled water, 5 fluid drachms. Mix together. For an adult, give 1 fluid drachm every 2 hours, in syrup of ginger, or cinnamon water, to be continued daily. Iodine is contraindicated in cerebral congestion and tendency to apoplexy, in menorrhagia, in disordered stomach or bowels, or wherever local diseases become attended with symptomatic fever, or with incidental febrile affections.

Externally, iodine is used in the form of ointment for *strumous ulcers*, *ophthalmia*, and some *cutaneous diseases*, as *lupus*, *favus*, *acne*, *psoriasis*, etc. With collodion it forms a good application for *frost-bites*. Subcutaneous injections of iodine around the wound, have been found successful in *bites of some snakes* and other *poisonous wounds*. A *caustic iodine solution* (Lugol's) is recommended as an application to stimulate or destroy *soft* and *fungous granulations*, and as a remedy for *noli-me-tangere*. (See *Lugol's Solution*.)

Drs. R. Druitt and B. W. Richardson recommended the vapor from iodine as a deodorizer and disinfectant. Powdered iodine, or a strong tincture of iodine is placed in open vessels in various parts of a room, so that the air therein becomes impregnated with the vapor. This is recommended in cases of *smallpox*, *typhoid* and other *fevers*, or wherever the atmosphere of a room requires purification, as where there are sinks, sick-chairs, closets, etc. The air thus purified becomes fresh and agreeable to the sense of smell. Inhalations of vapor from iodine have been highly spoken of in the treatment of *phthisis* (palliative only), *chronic laryngitis* and *bronchitis*, and in *aphonia;* the atmosphere of the patient's room to be impregnated with the vapor, so that it can be constantly inhaled day and night. Dr. J. Waring Curran, in the treatment of *diphtheria*, recommended a fluid drachm, of a compound composed of iodine, iodide of potassium, each, 4 grains; alcohol, 4 fluid drachms; water, 4 fluid drachms—which he adds to a pint of vinegar in which a handful of sage has been boiled; this is placed in a teapot or an inhaler, and kept hot over a spirit lamp, and the vapor is inhaled 10 or 12 times a day, for 10 or 12 minutes each time. The dose of the iodine solution must be steadily increased until it reaches $\frac{1}{2}$ fluid ounce for each inhalation. The tincture, in 2 or 3-drop doses, in syrup of lemon, is said to improve the condition in *diphtheria*. In *erysipelatous inflammations* it has been advised to paint the inflamed surface with a strong tincture; likewise, in *chilblains* and *cutaneous scrofula*. *Boils* may be aborted by painting with tincture of iodine, which application is also useful in *carbuncles*, though a dilution (1 part to 3 or 4 of water) is less painful, arrests destruction of tissues, and removes the decayed parts. Locally, iodine is useful in *chronic uterine engorgement*, *chronic indurations of the cervix uteri*, *uterine ulcerations*, *leucorrhœa*, *nævi*, *pharyngeal granulations* and *ulcers*, *spina bifida*, and the tincture or compound tincture gives relief in *laryngeal ulcerations*, for which the vapor has been less efficiently employed. The topical application of iodine is frequently resorted to in *chronic rheumatism* and *neuralgia*, and applied to the chest in *chronic pleurisy* to promote the absorption of plastic exudations. An ointment of iodine is of value in *hydrarthrosis*. Applied in *smallpox* it is said to prevent in a measure the full development of the pustules, and thereby prevent extensive pitting. Iodine is an excellent application to *buboes*, and if applied early may abort them; it is likewise of value in *syphilitic ulcerations of the tonsils and fauces*, and *in swelling of the gums* and *loosening of the teeth*. *Ringworm*, *corns*, and *felons* are often benefited by iodine

A solution of iodine (grs. j), in glycerin (fl℥j), forms a good application in *purulent nasal discharges*, as *ozena.* The tincture, diluted with three times its volume of water, has been recommended as an injection in *hydrocele*, after removal of the effused fluid, to stimulate the tunica vaginalis to adhesive inflammation. These injections have also been advised in *ovarian cysts*, *dropsy of the joints*, *hernia*, *indolent abscess*, *cavities*, *sinuses*, *fistula in ano*, etc.

Iodine in strong solution has been successfully employed in *blepharitis ciliaris* and in *conjunctivitis*. An adhesive iodine paint is used at Moorfield's Ophthalmic Hospital, as an application to *chronic inflammations of the eyelids;* the mastic prevents the paint from spreading on the more delicate structures in the neighborhood; take of alcohol, 2 fluid drachms; spirit of nitric ether, 4 fluid drachms; mastic, ½ drachm; iodine to saturation. Mix. The vapor of tincture of iodine with camphor, applied by Politzer's method, is said to improve *non suppurative otitis media*. Occasionally painting the tincture on the mastoid region relieves in *mastoid disease*, and the same applied to the attic of the tympanum checks suppurative action in those parts. The compound tincture is applied after opening the sac of *hematoma auris*, and according to Foltz (*Dynam. Therap.*, p. 628), a mixture of glycerin 10 parts, and iodine 1 part, is excellent for the cure of that morbid action giving rise in the canal and fundus of the ear to *aggregations of epithelium and pus* of a tenacious character.

Iodine may be kept in a state of solution when added to mixtures in the form of tincture, by the addition of syrup of orange peel, or a few grains of tannic acid. When given internally to females it is apt to increase the quantity of the menstrual discharge and sometimes to multiply the periods of its appearance; if the symptoms are not very severe or alarming, but little interference will be required, as they will cease after a short time; where this is demanded, a cessation of the use of the remedy will most generally suffice. In the employment of iodine, if the urine is passed in quantity, and on examination is found to contain iodine, and the strength and appetite of the patient gradually return, it may be considered indicative of a beneficial therapeutic influence, and its use should be continued. Dose of iodine, in substance, ½ grain, 2 or 3 times a day, in pill form; of the tincture, from 5 to 15 drops, twice a day. The best forms for internal use are the compound tincture and compound solution. Some prefer the 3 x trituration. When given in powder, it should be united with opium or hyoscyamus, and formed into a pill with the extract of liquorice. In poisoning by iodine, first evacuate the stomach, by giving an emetic in starch water, and afterward administer freely starch water, starch paste, flour, or arrow-root in water.

Related Preparations.—Iodized Phenol. Dr. Percy Boulton introduced to the profession a colorless solution of iodine and carbolic acid, as possessing stimulant and antiseptic properties in a marked degree. It has been found useful as a local application (by injection, gargle, lotion, or spray inhalation), in *sore throat*, *diphtheria*, *ozena*, *otorrhœa*, *purulent ophthalmia*, *foul* and *indolent ulcers*, *leucorrhœa*, *ulceration of the cervix uteri*, *internal hemorrhoids*, *laryngeal*, and *bronchial affections*, etc. In some instances it will require to be diluted with water, and when the spray is to be inhaled, the glycerin may be omitted, and the mixture be diluted to the required extent with water. Its formula is as follows: Take of compound tincture of iodine, 45 minims; crystals of carbolic acid (liquefied), 6 minims; glycerin, 8 fluid drachms; distilled water, 5 fluid ounces. Mix. The color disappears in from 8 hours to 10 days, depending upon the temperature; the mixture should be kept in a dark place. See also formula of *Acidum Carbolicum Iodatum* [*Nat. Form.*], p. 41, which preparation has similar uses to the preceding.

Methynol.—This agent was introduced by Prof. J. A. Jeançon, M. D., according to whom it is "a compound of the sodium salts of a systematic series of iodo-phenol acids, in which the hydrogen of iodo-phenol is progressively substituted with iodine, carboxyl, and hydrocarbon groups, and in which the iodine preponderates. The use of methynol is indicated in all forms of *venous congestion* of the skin or of the mucous membranes of the body; in all forms of *ulceration*, of whatever origin; in infiltrated states of the tissues, whether due to stoppage of the venous current and dilation of the lymphatic vessels, or to local obstruction by *tumoral masses*, etc. In action this substance is highly stimulating to vascular activity without having the least effect on the heart. It acts also as an antiseptic and powerful germicide, its two qualities combining to produce healthy circulation and absorption of infiltrated substances, also destroying the more or less noxious matter, formed in the stagnant, unhealthy tissues. The use of methynol promptly produces healthy granulations in *indolent ulcers*, checking suppuration and invigorating the enfeebled tissues; new and invigorating substance is the result. In *piles*, *condylomata*, *pruritis ani* (itching piles), it is equally efficient. In *vulvar* or *vaginal hypersecretions*, in *catarrhal states of the primæ viæ*, as well as in that of the uterine cervix, its action is both prompt and effective. *Old sore shins* are readily healed by daily applications of methynol. In *pruritis vulvæ* and *prurigo*, *porrigo*, and *intertrigo*, the itching gives way after several applications of this drug; and most of the squamous and nodular affections of the skin are removed by it. Methynol can be applied with a soft sponge, or with a camel's hair pencil, after the affected surfaces have first been cleaned with castile soap or borax water. Cavities lined with diseased mucous membranes have to be treated with proper-sized cotton tampons, which are allowed to remain 1 or 2 hours, as the case requires. There is very seldom any pain produced by the application of the drug. Should the affected surface be too irritable, methynol should be applied only after the parts have been first treated with a solution of cocaine hydrochlorate. As the drug is not poisonous, it can be safely used (properly diluted) upon the buccal, nasal, pharyngeal, and laryngeal mucous membranes. In *tumors* or *tumoral masses*, it may be injected without producing any harm; beginning with 5 drops of the methynol mixed with about 1 drachm of castor oil or almond oil, as an injection, and gradually increasing the quantity of the drug. An ointment of methynol with petrolatum or kindred substances, can readily be formed by mixing the ingredients in the proportion desired. The following is a desirable prescription: R Methynol, 1 ounce; petrolatum, 3 ounces. Mix together by rubbing in a mortar, or on a pill slab, with a spatula" (Prof. J. A. Jeançon, M. D.).

IPECACUANHA (U. S. P.)—IPECAC.

"The root of *Cephaëlis Ipecacuanha* (Brotero) A. Richard"—(*U. S. P.*). *Cephaëlis emetica*, Persoon; *Callicocca Ipecacuanha*, Brotero; *Uragoga Ipecacuanha*, Baillon; *Psychotria Ipecacuanha*, Müller-Argoviensis.

Nat. Ord.—Rubiaceæ.

COMMON NAMES: *Ipecac, Ipecacuanha.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 145.

Botanical Source—Cephaëlis Ipecacuanha is a small plant, with a perennial root, descending obliquely into the ground, from 4 to 6 inches long, simple, or divided into a few diverging branches, about as thick as a goose-quill, ringed, when fresh pale-brown, when dry umber-colored, blackish-umber-colored, or grayish brown; the cortical integument with a reddish, resinous, glittering fracture, and readily separating from a central woody axis. The stem is suffruticose, from 2 to 3 feet long, ascending, often rooting near the ground, smooth and cinereous at the base, and downy and green near the apex. The leaves are rarely more than 4 or 6 on a stem, oblong-ovate, acute, roughish with hairs, from 3 to 4 inches long, from 1 to 2 broad; those at the top of the stem are opposite, those toward the base alternate. Petioles short and downy. Stipules erect, appressed, membranous, deciduous, and 4 to 6-cleft. Peduncles solitary, axillary, downy, erect when in flower, reflexed when in fruit, and about 1½ inches long. The flowers are small, white, in semiglobose heads, of 8, 12, or more; the involucre is 1-leaved, spreading, deeply 4 to 6-parted, with obovate, acuminate, ciliated segments. Bracts to each flower 1, obovate-oblong, acute, and downy. Calyx minute, obovate, whitish, adhering to the ovary, with 5 bluntish, short teeth. The corolla is white, funnel-shaped, the tube cylindrical, downy on the outside and at the orifice, the limb shorter than the tube, with 5 ovate, reflexed segments. Stamens 5; filaments filiform, white and smooth; anthers linear, longer than the filaments, projecting a little beyond the corolla. Ovary with a fleshy disc at the apex; style filiform; stigmas 2, linear The berry is ovate, obtuse, about the size of a kidney-bean, at first purple, afterward violet-black, 2-celled, 2-seeded, with a longitudinal, fleshy partition. Nucules plano-convex and furrowed on the flat side (L.).

Fig. 147.

Cephaëlis Ipecacuanha, with root

History.—Ipecacuanha inhabits Brazil, in moist, shady situations, and is also found in other sections of South America, generally between 7° and 20° south latitude (*Ed.*), flowering from December to March, and maturing in fruit between April and June. The root, which is the official part, is gathered by the natives from January to April, who, after removing the stem from it, wash it and dry it by exposure to the sun's rays. (For details regarding its cultivation and collection, see article in *Western Druggist*, 1897, p. 346.) It is principally imported from

Rio Janeiro, in barrels, seroons, and large packages. The bark of the root is its most active part.

Description.—"About 10 Cm. (4 inches) long, and 4 or 5 Mm. (⅙ to ⅕ inch) thick; mostly simple, contorted, dull grayish-brown or blackish, finely wrinkled; closely and irregularly annulated, and often transversely fissured; bark thick, brittle, brownish, easily separated from the thin, whitish, tough, ligneous portion; odor slight, peculiar, nauseous; taste bitterish, acrid, nauseating. When ipecac is sound and free from moldiness, its quality is proportionate to the thickness of the bark, and the thinness of the ligneous portion"—(*U. S. P.*). Commercial ipecacuanha roots are sometimes distinguished as the grayish-black, the grayish-red, and the grayish-white varieties. The true variety is called *Rio ipecac* commercially.

Ipecacuanha root, when whole, is so characteristic, that it is hardly liable to adulteration. A variety known as the *Carthagena*, *New Granada*, or *Columbian ipecac* (*Cephaëlis acuminata*, Karsten), is larger, less markedly annulated, and shows a larger number of more conspicuous medullary rays than the ordinary drug. The name *radix antidysenterica*, was formerly applied to ipecacuanha root. The powder of the genuine article is of a grayish-yellow color, with a faint, bitterish, obscurely acrid taste, and a weak, musty, peculiar odor, which becomes stronger and nauseating during the process of pulverization; in some persons it excites sternutation, in others a difficulty of breathing resembling asthma. It yields its properties to water, and still better to alcohol, spirits, or wines. Boiling impairs its virtues. As regards the detection of adulterants of ipecacuanha, see article on the microscopic examination of ipecac root and its possible adulterants in powder form, by Dr. Alfred Schneider (*Amer. Druggist*, 1897, p. 3). Likewise, some microscopical and chemical criteria for true ipecac root were laid down by Prof. Tschirch and F. Lüdtke (*Archiv der Pharm.*, 1888, p. 441).

Chemical Composition.—While the root of the ipecacuanha plant is the only official part, its active, emetic principle has been shown to exist also in other parts of the plant, *e. g.*, the stems and the leaves (Hooper, 1892), but not in the seeds (Flückiger, *Pharmacognosie*, 1891). In 1817 Pelletier and Magendie isolated from true ipecac root an alkaloid which they called *emetine*, but the fact that they obtained 16 per cent of this principle demonstrates their product to have been merely a concentrated extract. Upon further experimentation, however, Pelletier succeeded in obtaining a pure alkaloidal product in the amount of 60 grains to the pound, which corresponds to somewhat less than 1 per cent. Subsequently, the chemistry of ipecacuanha root was elaborated by Reich (1863), Lefort (1869), Podwissotzky (1879), and others. H. Kunz, in 1887 (*Jahresb. der Pharm.*, 1887, p. 416), found for emetine the formula $C_{30}H_{40}N_2O_5$, which is now generally adopted as correct. Kunz also established the dyad nature of the alkaloid *emetine* in its saturation power with acids, which in 1890 was confirmed by Blunt (*Pharm. Jour. Trans.*, 1890, Vol. XX, p. 809), and W. Simonson (*Proc. Amer. Pharm. Assoc.*, 1890, p. 188); hence the statement in Flückiger (*loc. cit.*), that emetine is a monad base, requires correction. Kunz also found *cholin* ($C_2H_4OH.N[CH_3]_3OH$), to be present in ipecac root.

Pure *emetine* forms a white, non-crystallizable powder which turns brown by exposure to light and air. It is very slightly soluble in water; the solution tastes bitter and is alkaline to litmus paper. It dissolves readily in diluted acids, as well as in chloroform, alcohol, warm benzin, and ether, and is also soluble in fixed oils and benzol, but insoluble in caustic alkalies and in essential oils. With acids, *emetine* forms neutral, soluble, bitter, acrid, and for the most part uncrystallizable salts. Flückiger obtained the hydrochlorate in crystalline form (*Pharmacognosie*, 1891). The nitrate dissolves in water with difficulty. The solutions of the salts are precipitated by gallic and tannic acids. Flückiger (*loc. cit.*), gives the following test for *emetine* in ipecac root: Shake the root with five times its weight of cold hydrochloric acid (sp. gr. 1.12), filter, and sprinkle some chlorinated lime upon the liquid. If emetine is present, a characteristic fire-red color is produced. By this reaction, the absence of emetine from the wood of the root is established.

In 1894 and 1895 Paul and Cownley (*Jahresb. der Pharm.*, 1894, p. 523, and 1895, p. 163), discovered another alkaloid in ipecac root which they called *cephaëline*.

This is distinguished from emetine principally by its being soluble in caustic alkalies, and by its melting point, which is 102° C. (215.6° F.), while for *emetine* they found 68° C. (154.4° F.). Pelletier also had observed that emetine was naturally combined with what he took to be gallic acid, but which was recognized later by Willigk as a new substance, and by him called *ipecacuanhic acid*. Reich subsequently found it to be a glucosid. *Starch* is present in ipecac root in large amounts, and a trace of a nauseating *ethereal oil* is also present. In some allied species *sugar* abounds.

Literature concerning the assay of ipecacuanha is abundant and often discordant, although a satisfactory solution of the ipecac problem seems to have been reached. The proportions of total alkaloids observed by different authors generally range from 1 to 3 per cent. C. C. Keller thinks that 2½ per cent may not be too excessive a standard of alkaloidal strength (*Proc. Amer. Pharm. Assoc.*, 1893, p. 400). Dr. A. R. L. Dohme (*Proc. Amer. Pharm. Assoc.*, 1895, p. 269), has found that the part of the root where it merges into the stem (*wiry root*) is at least as rich in alkaloid as the rest of the root (*fancy root*), and that the part of the stem adjacent to the root still contains considerable quantities of emetine. (Adapted in part from an article on ipecacuanha in the *Western Druggist*, 1897, p. 346. Tannic acid, all astringents containing tannic or gallic acids, iodine, salts of iron, and acetate of lead, are incompatible with ipecacuanha.

Action, Medical Uses, and Dosage.—Ipecac, in material amounts, is irritant to the cutaneous and mucous surfaces. Applied to the skin by inunction it excites irritation, and produces vesicular, pustular, and sometimes ulcerative effects. It is exceedingly irritating to the Schneiderian membrane, causing heat and violent sneezing. In some individuals, the inhalation of the powdered drug provokes decided paroxysms, closely resembling spasmodic asthmatic attacks—the chief symptoms being great dyspnœa, with marked anxiety and prostration, and wheezing respiration and cough. This is often accompanied with violent and prolonged sneezing and spitting of blood. Such attacks are usually followed by a free expectoration of mucus. Ipecac, in doses of less than 1 grain, acts as a gastric tonic and hepatic stimulant, but large doses prove emetic. When it fails to produce emesis, catharsis usually results, though both effects may take place from its employment. The stools produced by this agent are of the so-called bilious type, and have been denominated "ipecacuanha stools." A state of tolerance may be established from the prolonged use of ipecac. Ipecac produces a relaxation of the skin and consequent diaphoresis, and it increases the broncho-pulmonic secretions. Physiologically speaking, ipecacuanha is said to scarcely affect the circulation, but there is no doubt that in minute doses in disease, it stimulates the circulatory apparatus, acting thereby as a *special sedative*, as that term is employed in Eclectic therapy. Its therapeutic action upon the circulation is well shown in its effects upon *hemorrhage;* and in *acute* disorders of the stomach, bowels, and breathing organs. The alkaloid, emetine, the active principle of ipecac, is so severe and uncertain in its action that it is seldom used in medicine. Two grains of it have killed a large dog, and $\frac{1}{16}$ grain vomited an old man severely. Observations upon the lower animals prove that death takes place from cardiac paralysis. The post-mortem lesions are: Gastro-intestinal irritation, and sometimes swollen, red, blood-stained, and ecchymosed patches are seen, similar to those produced by some of the metals; the lungs are hyperemic, though occasionally anemic: and hepatized patches are observable. Emetine is eliminated by the way of the bowels.

Therapeutically, ipecac is a very important remedy. It has three chief fields of operation: (1) In large doses it provokes emesis, and for this purpose it may be employed as suggested below; (2) it checks active hemorrhages; (3) it relieves gastro-intestinal and broncho-pulmonic irritation and inflammations. Its specific use, in small doses, is to relieve *irritation*, no matter what the disease may be. The specific action of ipecac is best observed in acute affections, when there is hyperemia, capillary engorgements, and hypersecretion. Ipecac is often employed to assist the action of other agents, particularly agents to act upon the bowels, and with other agents which control irritation.

The dose of ipecac largely controls its uses. In doses of ¼ to ½ grain, it acts as a tonic, improving digestion, increasing the appetite, and is valuable in *irritative* *dyspepsia.* In doses of ½ to 2 grains, administered every 3 or 4 hours, it produces perspiration, and is beneficial in *febrile* and *inflammatory diseases;* combined with opium its diaphoretic influence is greatly augmented, as seen in the *powder of ipecacuanha and opium.*

Half-grain doses are expectorant. From 3 to 10 grains will produce nausea, which may be continued for any length of time, and which is attended with more or less depression of the pulse, languor, moisture of the skin, and an increased mucous discharge from all the mucous tissues of the system, which renders it very useful in *pulmonary* and *hepatic diseases.* It has been found very useful in *typhoid pneumonia* in combination with sulphate of quinine. In doses of from ¼ to 1 grain, rubbed up with sugar to render it pleasant, it has proved efficient in the *pneumonia* of children. Doses of from 5 to 15 grains have a tendency to move the bowels, while doses of 20 grains or more act as an emetic. It is stated that an infusion of 2 drachms of ipecacuanha in a gill of hot water and strained, will, if drank warm, prove emetic; then if the same quantity of hot water is again added to the residue, strained and drank cold, it will prove purgative; and the same process repeated the third time, and used cold, becomes a valuable tonic. This, however, requires confirmation.

Ipecac is a specific emetic, and the mildest of its class. As such, in 20-grain doses, it operates actively, causing much nausea and continued muscular straining, with a free secretion of mucus; vomiting, however, seldom takes place until 15 or 20 minutes after its administration. It is inferior to no other emetic, being safe even in large doses, seldom producing painful spasms of the stomach or bowels, and causing less prostration of the vital forces than tartar-emetic and similar drugs. It is best employed in combination with other emetics, as in the *compound powder of lobelia*, which is much used by practitioners, and is preferred to any other emetic in the early stage of *febrile diseases*, and in other instances where a severe succussion of the system is indicated. Ipecac is the best emetic for the purpose of unloading the stomach of undigested aliment, and "*acute indigestion*, *bilious attacks*, accompanied with *sick headache*, and other forms of headache, depending upon difficult digestion, may be cut short with an emetic dose of the powdered drug" (Locke, *Syllab. of Mat. Med.*, p. 24). "In *nausea*, with a broad, flabby, and slimy tongue, give ipecac in full emetic doses" (*ibid*). Repeated doses of the powder in sweetened warm water, until emesis takes place, are useful in the *convulsions* of children, *cramps*, *colic*, etc., arising from intestinal irritation, though it is less effectual than lobelia and gelsemium combined. Small doses of ipecac may follow to relieve irritation. In *intermittent fever*, and particularly in *chronic ague*, where quinine is ineffectual, the system may be gradually brought under the emetic action of ipecac, after which the quinine will give better results, and may even not be needed. Ipecac is less useful than zinc sulphate, or, preferably, apomorphine hydrochlorate, hypodermatically, in *narcotic poisoning*, for which it has been recommended. This is due to the fact that, being a specific emetic chiefly, it must be absorbed before it exerts its emetic effect. In *croup* and *membranous croup*, when the secretions are well loosened, ipecac is a useful emetic. In *spasmodic asthma* (less valuable than lobelia), *hysteria*, *pertussis*, *sore throat*, *common catarrh*, and *stricture of the chest* common in *phthisis*, ipecacuanha, as an emetic, will sometimes be found very beneficial. In *menorrhagia*, 20 grains of the powder at bedtime, followed by a saline cathartic in the morning, has, in the hands of several practitioners, promptly checked the discharge. As a rule, however, its emetic action is not required, as hemorrhage is best checked with smaller doses. *Bronchitis* in children, with dry, hoarse, croupal cough, is often cut short by the emetic action of ipecac.

While ipecac is an emetic, it has long been well-known as a remedy to check *nausea* and *vomiting.* This is best accomplished by it when the tongue is red and pointed, and shows evidence of irritation. If the condition depends upon foul accumulations within the stomach, the emetic action will be first required, after which the small doses may be continued to control irritation, if present.

The specific use of ipecac, as before stated, is to relieve *irritation*, no matter what organ is affected. With this may be vascular excitation. This is probably due to the irritated condition of the sympathetic. The patient may be irritable mentally, easily disturbed by noises, and the skin is heightened in color. Fits of weeping are not uncommon. Its beneficial effects are particularly noticeable in *acute* irritative and inflammatory disorders of the stomach and bowels. It should be said here that in these, as well as in other troubles of a similar nature, the special sedatives—aconite, veratrum, gelsemium, and rhus, and such other irritation-relieving remedies, as matricaria, amygdalus, epilobium, bismuth, magnesium sulphate (small doses), collinsonia, hydrastis, and bryonia, may be indicated with ipecac. In fact, where the indications below given for ipecac are present, it will materially aid the action of these remedies, one or more of which are usually necessary, as ipecac seldom covers the whole range of symptoms present in these cases. The chief indications pointing to the sole or associate use of ipecac, in stomach and bowel disorders, are the elongated and pointed tongue, with reddened tip and edges, with large papillæ, or effacement of the papillæ; tenderness on pressure; contraction of tissues; pinched countenance, white line around the mouth; tendency to nausea and vomiting, with or without eructations; and marked hyperæsthesia. There is evidence of hypersecretion, sympathetic irritation and capillary engorgement, and the cases are acute. With these indications well in hand, it will be found of great service in *gastric irritability, nausea*, and *vomiting* (if not from organic stomach lesions), and *acute mucous diarrhœa*. In the *diarrhœa of teething*, with tongue coated white, and stools green, bloody, and offensive, and associated with nausea, ipecac serves a useful purpose. For the offensive element chlorate of potassium may be associated with it, and for the peevishness and fretfullness usually present, matricaria. In *simple diarrhœa*, due to undigested and irritating food, an emetic or cathartic is preferable to small doses of ipecac, though the latter should be given to control after-irritation. It is a valuable remedy in *muco-enteritis*. It should be associated with aconite or epilobium. In *acute cholera infantum*, with small and frequent mucoid passages, it should be given early. It is of less value where the stools are profuse and watery, Though less valuable in chronic than in acute diseases, it is applicable in *chronic cholera infantum*, with pallid tongue, nausea, vomiting, abdominal pain, and pallid or yellowish face. But in this case nux vomica should be given with it (Scudder). In simple *irritative diarrhœa*, nux should be given with it when the preceding symptoms are present. No remedy, with the exception of magnesium sulphate, gives better results in *acute dysentery*. Combined with proper diet and absolute rest upon the back, the following may be given: R Specific aconite, gtt. v; specific ipecac, gtt. x to xv; magnesium sulphate, ʒi; aqua, fl℥iv. Mix. Dose, 1 teaspoonful every hour. Small doses of diaphoretic powder (containing ipecac) are also useful in dysentery. Ipecac is specially adapted to cases of *sporadic dysentery*, and is less effectual in zymotic cases, unless associated with antizymotic treatment. Dysentery has been treated with large doses of the powdered drug, sufficient to produce catharsis, but this method is less efficient than that indicated above. Formerly, 1 grain each of dried extract of leptandra and ipecacuanha, and ½ grain of resin of podophyllum, given every 3 hours until it operated freely, was considered an excellent remedy for *dysentery*.

Ipecac is a remedy of first importance in many respiratory disorders. These conditions are similar to those indicating its employment in gastro-intestinal diseases, viz., irritation, capillary engorgement, and hypersecretion. Thus, associated with the special sedatives and asclepias and bryonia, if necessary, it is a very valuable agent, in *hoarseness* or *congestion of the vocal cords, broncho-pulmonary congestion* from *colds, irritable and spasmodic coughs*, and in the early stage of *acute catarrhal affections, dyspnœa of pregnancy*, and *pertussis*. In *colds, capillary bronchitis, acute bronchitis*, and *pneumonia*, particularly of children, it has an important place. It acts chiefly on the bronchioles and the parenchyma of the lungs, allaying irritation, relieving cough, and diminishing expectoration when profuse (stimulant doses), and aiding expectoration when scanty (nauseant doses). It also answers well in subacute cases. The use of ipecac (emetic doses) in *croup* has already been referred to. It is also of value in small doses in *mucous croup;* it should be combined with aconite. In *membranous croup* it has been recommended with bryonia. In dry forms of *cough* it may be given in nauseant doses; in hypersecretion, in small or stimulant doses; in spasmodic cough, with bloody expectoration, frequently repeated doses short of nausea. It relieves *irritative conditions* arising from too frequent or violent use of the voice.

Owing to its evident action upon the capillaries, it is a valuable agent in *active hemorrhages—post-partum, hemoptysis, hematemesis, hematuria, epistaxis*, and *hemorrhages from the bowels.* The cases calling for it are usually those of nervous individuals, with marked irritability and vascular excitation. Under similar conditions it is of value in *menorrhagia* and *metrorrhagia.* It is sometimes of value in *hemorrhoids,* especially when of the bleeding variety. It may be associated with hamamelis, æsculus, or collinsonia as indicated.

In *fevers* and *inflammatory affections*, small diaphoretic doses of ipecac have been highly beneficial. Its action in these cases is also beneficial upon the nervous system and mucous membranes. Excitability and suppressed secretions being symptoms, it acts favorably in the *eruptive fevers.* Both *Dover's Powder* and the *Diaphoretic Powder* are often indicated in *inflammatory* and *febrile disorders.* Both are very efficient in the *night-sweats of consumption.* Doses of from $\frac{1}{10}$ to $\frac{1}{2}$ drop of specific ipecac give prompt relief in the majority of cases of *phlyctenular diseases of the eye* with photophobia, the latter symptom being quickly subdued by it (Webster's *Dynam. Therap.*, p. 588). It will likewise act as a sedative in many local inflammatory diseases, and will be found extremely valuable in *peritonitis.* even the worst form occurring in puerperal women. It is also of value in *acute rheumatism, gout, jaundice* from biliary catarrh, and to relax the parts in the passage of small *biliary calculi.*

A liniment of ipecac (℞ Powd. ipecacuanha, sweet oil, of each, ʒij; lard, ℥ss: mix well together), to be used with friction, 3 or 4 times a day, afterward covering the parts with flannel until an eruption was produced, was formerly used in the treatment of *incipient phthisis*, certain *rheumatic affections, chronic hydrocephalus, chronic inflammation of the synovial membrane of the knee*, and *infantile convulsions.* It has, however, but little to recommend it. In all cases where this drug as an emetic, can not be given by the mouth, it may be used in injection, adding 2 drachms of the powder to 1 pint of warm water, for an adult—it will operate kindly and thoroughly as an emetic.

The doses of ipecac, for its various uses, have been sufficiently indicated above. However, the range of dosage is from the fraction of a grain to 20 grains; specific ipecac, the fraction of a drop to 20 drops. The usual prescription for specific purposes is ℞ Specific ipecac, gtt. v to xx; aqua, fl℥iv. Dose, 1 teaspoonful every 1 or 2 hours. It must be remembered that sometimes powdered ipecac will do that which no fluid preparation of ipecacuanha can accomplish.

Specific Indications and Uses.—An emetic for overloaded or foul conditions of the stomach, and other conditions indicating emesis; *irritation*, whether of stomach, bowels, nervous system, or pulmonary tissues; active hemorrhages; irritative diarrhœa; acute bowel disorders with irritation; long, pointed tongue, with reddened tip and edges, accompanied with nausea and vomiting, and with or without fever; dyspnœa; irritative cough; hoarseness from cold; hypersecretion, with mucous rales (small doses); diminished expectoration (nauseant doses).

False Ipecacs and Related Species.—Several emetic roots of the natural orders *Rubiaceæ, Polygalæ*, and *Violaceæ*, have been at times thrown upon the market as varieties of Ipecacuanha. They are all known in Brazil as *poaya*, or in the remaining parts of South America as *Ipecacuanha.* These are:

LARGE STRIATED IPECACUANHA.—Derived from the *Psychotria emetica*, Mutis (*Nat. Ord* Rubiaceæ), New Granada. This is also known as *Violet striated ipecacuanha, Ipecacuanha of St. Martha*, etc. It is larger than ipecac-root, and is marked by longitudinal grooves. The thick, brown bark has constrictions, but is not, like ipecac, annulated. It is tough under the knife, exhibiting a violet-cut surface, and is *moist and soft*, even when many years old, this being its chief distinguishing feature. It has a sweet taste, due to sugar. It contains no starch (*Pharmacographia*).

SMALL STRIATED IPECACUANHA.—This is thought by Planchon to come from a species of *Richardsonia.* It is known also as *Black ipecacuanha, Striated brittle ipecacuanha, Black striated ipecacuanha*, etc. It resembles the foregoing, but is smaller, and usually tapering at the extremities. It differs in color (being black-brown), and in being *brittle.* Starch cells are prominent, and the taste is acrid, not sweet.

UNDULATED IPECACUANHA.—*Farinaceous, Amylaceous*, or *White ipecacuanha.* The root of *Richardia scabra*, Linné (*Richardsonia scabra*, St. Hilaire), *Nat. Ord.*—Rubiaceæ; Brazil. The fresh root is white; the dried, iron-gray. It is sinuous or undulated, appearing knotty, and is alternately fissured on the sides. Its bark is thick, brittle, white, and starchy, enclosing a strong, slender, flexible, ligneous portion. It contains no emetine.

Indian Ipecacuanha.—Another asclepiadaceous plant, the *Tylophora asthmatica*, Wight et Arnott (*Asclepias emetica*, Linné), furnishes an emetic root. Indian ipecac is a twining, shrubby species, a native of the Indian Peninsula, Ceylon, and the Moluccas. The root has long been used by the Hindus as a medicine; and, in small doses, is cathartic—in large doses, emetic. In consequence of its use as a substitute for ipecac, in India, the plant has acquired the name "*Indian ipecac.*" It has been successfully employed as a remedy for *epidemic dysentery*, and has also been recommended in *humoral asthma*. Kilpatrick reports the administration of the leaves, in a great number of cases, with entire satisfaction. The dose of the powdered leaves, as an emetic, is 25 or 30 grains; as a diaphoretic and expectorant, from 3 to 5 grains. *Tylophorine*, an alkaloid, was obtained from it, in 1891, by Mr. D. Hooper.

The other species yielding emetic roots are as follows: *Ionidium Ipecacuanha*, Ventenat. *Nat. Ord.*—Violaceæ. So-called *White ligneous ipecacuanha*. Brazil. *Solea verticillata*, Sprengel, and *Ionidium polygalæfolium*, Ventenat, have been employed by the Mexicans.

Asclepias curassavica, Linné, is known as *Bastard ipecacuanha*. A Senegambian plant furnishes a root known as *Batatior*, having properties like those of ipecac. A species of *Ionidium*, variously determined as *I. marcucci*, *I. parviflorum*, and *I. microphyllum*, yields an emeto-purgative root known in South America as *cuichunchulli*. It has been used in *elephantiasis*. *Gardenia campanulata*, Roxburgh (*Nat. Ord.*—Rubiaceæ), of India, yields a purgative and anthelmintic berry.

Naregamia alata, Wight and Arnott. *Nat. Ord.*—Meliaceæ. *Naregamia*, *Tinapani*, *Goanese ipecacuanha*. Western Indis. This root contains wax, oxidizable fixed oil, and *naregamine*, an alkaloid (D. Hooper). *Asparagine* is also thought to be present. It is reputed an expectorant, hepatic stimulant, and emetic. Small doses of it are given in India in bronchitis, fulfilling the indications for ipecac and senega. The natives of Malabar employ it in emetic doses in *dysentery*, *bronchitis*, *rheumatism*, and *bilious* and *dyspeptic states*. The ordinary dose of a strong tincture (1 in 4) is from 5 to 10 drops; as an emetic, 15 to 30 drops.

Cocillana.—Cocillana bark is derived from a Bolivian tree, the *Sycocarpus Rusbyi*. Its activity is due to a principle regarded by Rusby as an alkaloid; by Eckfeldt, a glucosid. Its action closely resembles that of ipecacuanha, vomiting, heavy headache, sneezing, coryza, depression, and purging having been produced by from 20 to 50 grains. As an expectorant it is reputed more stimulating than ipecac, and in doses of 10 to 20 drops of the fluid extract, it has been employed in *bronchial affections*, both acute and chronic, and in *pulmonary consumption*, with reputed success.

Cyperus articulatus, *Adrue*, *Guinea rush.*—Antiemetic. Tonic. Dose of fluid extract, 30 drops.

Petiveria hexaglochin, *Pipi root.*—Reputed diaphoretic and a stimulant expectorant.

IRIS (U. S. P.)—IRIS.

"The rhizome and roots of *Iris versicolor*, Linné"—(*U. S. P.*).

Nat. Ord.—Irideæ.

Common Names: *Blue flag*, etc. (see below).

Illustrations: Meehan, *Native Flowers and Ferns*, I, 141; Bigelow, *American Medical Botany*, I, 155; Millspaugh, *American Medicinal Plants*, 173.

Botanical Source.—Iris versicolor is an indigenous plant, with a fleshy, horizontal root or rhizome. Its stem is 2 or 3 feet in height, terete, flexuous, round on one side, acute on the other, and frequently branched. The leaves are about 1 foot long, ½ to 1 inch wide, ensiform, striated, erect, and sheathing at the base. Bracts scarious. The flowers are from 2 to 6 in number, generally blue or purple. The ovary is obtusely 3-cornered. The peduncles are of different lengths, and flattened on the inside. The sepals are spatulate, beardless, the border purple, the claw variegated with green, yellow, and white, and veined with purple. The petals are erect, varying in shape from spatulate to lanceolate, usually paler than the outer, entire, or emarginate. The stigmas are 3, petaloid, purple, or violet, bifid, crenate, and more or less reflexed at the point. Stamens 3, concealed under the stigmas, with oblong-linear anthers. Capsule 3-celled, 3-valved, when ripe oblong, turgid, 3-sided, with roundish angles. The seeds are numerous and flat (L.—B.—W.).

History and Description.—Iris versicolor has been designated by various names, as *Blue flag*, *Flag lily*, *Water flag*, *Liver lily*, *Snake lily*, *Flower de luce*, *Poison flag* in contradistinction to Sweet flag (*Acorus Calamus*), and *Larger blue flag* to distinguish it from the other species of this genus. The name *Iris*, from a Greek word meaning "the rainbow deified," was given it by the ancients on account of the brilliancy and diversity of color in its blossoms.

Blue flag is one of our most beautiful and interesting common wild flowers, growing throughout the United States in wet, marshy localities, blooming in May and June. The flowers, from 2 to 6 in number, are large and showy, of a purplish, or violet-blue color, variegated with white and greenish-yellow, interspersed with purple veins. The plant grows from 1 to 3 feet high, having a stout, sometimes branching stem, angled on one side. The leaves are sword-shaped, from 6 to 8 inches long, and ¾ of an inch wide. The root, which resembles that of *Acorus Calamus*, is the part officially used. It has a peculiar odor, augmented by rubbing and pulverizing. The *U. S. P.* thus describes iris: "Rhizome of horizontal growth, consisting of joints, 5 to 10 Cm. (2 to 4 inches) long, cylindrical in the lower half, flattish near the upper extremity, and terminated by a circular scar, annulated from the leaf-sheaths, grayish-brown; roots long, simple, crowded near the broad end; odor slight; taste acrid and nauseous"—(*U. S. P.*). The recently dried root varies from a light, pinkish-brown internally, studded over with minute white dots, somewhat resembling in color very light sandstone, to a dark red-brown—the latter being unfit for pharmaceutical uses. Care should be exercised as to the locality in which the plant grows. We recently rejected a large lot, more than 2000 pounds, extra fine in external appearance, that came from the South, and was of a dark, red-brown internally, but almost destitute of oleoresin, which principle had been replaced by a red, astringent tannate. Our experience is to the effect that the Ohio raised iris is superior to that of any other locality known to us, and in collecting the drug, for specific iris, many times the market price is paid for the rhizome from one locality in the state.

The active properties of iris are taken up by boiling water in infusion, and by alcohol or ether; and its acridity, as well as its medicinal virtues are diminished by age. The fresh root, sliced transversely, dried in an atmosphere not exceeding 39.4° C. (103° F.), pulverized, and then placed in darkened and well-closed vessels to protect it from the action of light and air, will have its medicinal virtues preserved for a great length of time.

Chemical Composition.—The fresh rhizome of iris, when distilled with water, yields an opalescent distillate, from which a white, camphoraceous substance separates, soluble in alcohol, and having a faint odor (C. H. Marquardt, 1876). The rhizome furthermore contains starch, gum, tannin, sugar, oil, and resin. The *resin* is of a light-brown color, of a faint odor, and of a taste resembling that of the root; when perfectly freed from oil it is whitish-yellow. Its therapeutic influences are not positively known. It is soluble in chloroform, ether, and boiling alkaline solution, from which acids precipitate it. The *oil* possesses in a high degree the taste and smell of the root, and is the principle to which it owes its medicinal activity. Cressler (*Amer. Jour. Pharm.*, 1881, p. 602) found indications of an alkaloid, obtainable by extracting the alcoholic extract of iris with acetic acid, removing fat by means of ether, and abstracting the alkaloidal substance by means of amylic alcohol after rendering the fluid alkaline.

As early as 1844, Prof. John King prepared and introduced to the profession the *oleoresin of iris*—about the same time that he discovered the resins of cimicifuga and podophyllum. The name, oleoresin of iris—a trade name being *iridin*—was applied to this substance 50 years ago. It is but little used at present, except in combination with other hepatics, in pill form, in the treatment of chronic diseases of the liver. The preparation upon the market known as *irisin*, though commonly spoken of by medical writers as iridin, or oleoresin, is a mixture of the oleoresin, with a sufficient amount of the root to stiffen it and render it pulverizable. It may be stated here that the watery fluid preparations of iris are very unreliable. Fluid preparations should be made only from recent rhizomes, presenting internally a very light pinkish-brown color, studded with minute white dots. Those having a brown-red color throughout, should be rejected. When dropped into water the preparation should give an opalescent, milky appearance, and when in large amount should precipitate oleoresin. The odor of iris should also be perceptibly increased when its preparations are added to water, being to most people a disagreeable, nauseous, fatty odor.

Medical History.—This plant was highly esteemed by our American Indians, who used it in gastric affections, and it was also a popular domestic remedy when it was thought necessary to produce salivation without resorting to mercurials—hence it is sometimes called "*vegetable mercury*." Bigelow, Smith, and Thacher wrote regarding its cathartic properties, but on account of its unpleasant effects, when given in purgative doses, it did not come into general use until taken up by our school, where it is not used as a cathartic.

The blue flag is one of our most valued of early Eclectic medicines, having been used almost exclusively by our practitioners, until of late years, when it found quite a prominent place in the therapeutics of both Allopathic and Homœopathic practice.

Action, Medical Uses, and Dosage.—Physiologically, iris acts upon the gastro-intestinal canal, and the glandular and nervous systems. It powerfully excites the biliary, salivary, and pancreatic secretions. Upon the gastro-intestinal tract it acts violently, causing acid vomiting, frequent, hydragogue catharsis, with intestinal burning and severe colic. A writer says: "The root of the blue flag extends its influence through every part of the system in small doses, and repeated at short intervals. It seems to act more particularly on the glandular system, exciting them to a discharge of their respective offices. In large doses it evacuates and exhausts the system, acting on the liver, and the alimentary canal throughout." Animals, after death from its ingestion, show marked congestion of the gastric and intestinal tissues. By its action upon the nervous system, it has produced neuralgia of the face, head, and extremities. Iris salivates, but without injury to the gums and teeth. In general practice salivation is not, as a common rule, desired for the cure of disease, yet we have many articles which produce it, and often without the practitioners being aware of the fact, and hence, when it does occur, the cry is at once raised that mercury is used. Salivation caused by vegetable agents may be known from that by mercury, by the absence of mercurial fetor, and no sponginess of the gums or loosening of the teeth.

Therapeutically, this agent is alterative and cholagogue. It is one of our best agents to influence the process of waste and repair. It exerts a powerful catalytic action upon the lymphatic glandular system, and the ductless glands, as well as upon the liver, pancreas, and kidneys. In *cachectic states* of the system, *bad blood*, *scrofula*, and "*mercurial diseases*," it does excellent service, and in *secondary syphilis*, with cerebral disturbances, and copper-colored dermal pigmentation, it is one of the best drugs we possess.

Upon the liver, its action is marked. In that unpleasant condition known as "*biliousness*," it is prompt and efficient, and as a remedy for *bilious headache*, accompanied by nausea and vomiting of bitter ingesta, or in *sick headache*, dependent upon *indigestion*, it is unsurpassed. In *chronic hepatitis*, and other hepatic disorders, with *constipation*, and sharp, cutting pains, increased by motion, iris may be given alone or may be advantageously combined with other hepatics. *Duodenal catarrh*, with jaundice, and clay-colored stools, indicating a lack of biliary secretion, is cured by iris, and it is likewise valuable in *constipation*, dependent upon biliary and intestinal torpor. Minute doses of iris allay *gastric irritation*, being valuable in *cholera infantum* and *cholera morbus*. ℞ Specific iris, gtt. v; aqua, fl℥iv. Mix. Dose, 1 teaspoonful every hour. In *diarrhœa* and *dysentery*, with large, slimy evacuations: ℞ Specific iris, gtt. xv; aqua, fl℥iv. Mix. Dose, 1 teaspoonful every hour. Iris, in small doses, is often valuable in *gastric irritation*, associated with sickness at the stomach and vomiting, and in *gastralgia*. It is not without good results in burning aphthous states of the oral cavity. From 1 to 5 drops should be used in the latter case. *Reflex muscular pains*, dependent upon gastro-intestinal and pancreatic disorders, are relieved by it, and especially when the muscular coats of the viscera are involved. *Pectoral pains* and distressing sensations beneath the scapula are also relieved by iris in doses of from 1 to 5 drops.

Iris is specifically indicated in *soft glandular enlargements*. It is one of the very few reliable drugs used for the cure of *goitre*, or *enlarged thyroid*. Indeed, for this condition it is our most direct and effectual remedy, whether the enlargement be constant, or whether it be simply a fullness due to menstrual irregularities. This use was early pointed out by Prof. King. Further, it has a marked influence for good on the *ovarian and uterine disturbances* giving rise to this fullness. In goitre, apply a cotton cloth saturated with specific iris, and give internally a teaspoonful, 3 times a day, of a mixture of specific iris, flℨss; aqua, fl℥iv. *Basedow's disease—exophthalmic goitre*—in the early stage, has been cured by iris; *Addison's disease* of the suprarenal capsules has been greatly improved, though not cured by it. In *chronic affections of the pancreas*, with a sodden, leaden-colored tongue, and in *chronic splenic disease*, when the skin is blanched—as in *leucocythæmia*—this drug is indicated. *Chronic renal diseases*, *ascites*, *anasarca*, *hydrothorax*, and *hydropericardium* have yielded to its curative powers. In *dropsy*, it is administered in cathartic doses. It is seldom used at present as a cathartic, but when so used its harsh effects may be somewhat overcome by combining it with ginger, piperin, or camphor.

As a remedy for *uterine hypertrophy*, *enlarged ovaries*, *ulcerated os and cervix uteri*, *uterine leucorrhœa*, and *dysmenorrhœa:* ℞ Specific iris, gtt. x to xx; aqua, fl℥iv. Mix. Dose, 1 teaspoonful every hour in acute troubles, and 4 times a day in chronic affections. It is all the more strongly indicated in these conditions, if there be impaired general health, with mental depression, and when the skin presents abnormal pigmentation.

This drug has been successfully used in *chronic rheumatism*, *syphilitic rheumatism*, *gonorrhœa*, *spermatorrhœa*, and *prostatorrhœa*. Specific iris, in doses of from 1 to 5 drops, every 4 or 5 hours, in a fluid ounce of water, will be found very useful in those *prostatic discharges* and *nocturnal emissions*, the result of masturbation, and which are accompanied with considerable debility, mental uneasiness, and more or less irritation of the nervous centers. Prof. Scudder, in his "Practice," states that he has for years placed great reliance on iris in treating *syphilitic iritis*. It is very efficient in *malarial jaundice*, and *intermittent* and *bilious remittent fevers*. It is rendered more efficient in malarial disorders, when combined with euonymus, or alstonia constricta. Iridin, in 3-grain pill, every night, followed by a saline cathartic in the morning, was quite popular among Edinburgh physicians some years ago as a remedy for the *vomiting of pregnancy*.

Iris is of great utility in dermal practice, given alone or associated with other indicated remedies. It seems to have a better action in chronic conditions. It is particularly adapted to diseases involving the sebaceous glands, and is especially useful in *comedones*, and other eruptions common to youth. It is indicated by rough, greasy, discolored conditions of the skin, and in those cases where pustular eruption seems to be associated with functional disturbances of the reproductive apparatus; also when associated with thyroid fullness in the female. It is valuable in *syphilitic skin diseases*. We have used it beneficially in *eczema rubrum* of children, and in cases of *eczema of the scalp* in adults. Some cases are benefited only, not cured by it. In one case of 13 years' standing, the unpleasant symptoms were subdued as long as the patient took the drug; as soon as the iris was withdrawn the unpleasantness returned, though the general health of the man was much improved by its administration. *Herpes zoster* and *herpes præputialis* usually call for iris and rhus. *Rupia* and *impetigo* have been cured by it when associated with sulphur, or Fowler's solution. *Persistent prurigo*, *psoriasis*, and *acne indurata* will usually present conditions calling for iris. For *lepra:* ℞ Specific iris, flʒi to flʒii; aqua, fl℥iv. Mix. Teaspoonful 4 times a day.

The system should first be prepared by sulphur, or the sulphites, compound tonic mixture, or acid solution of iron, if debilitated. Other remedies may be associated with iris in chronic skin diseases when indicated, as alnus, apis, phytolacca, or rhus tox. *Pustules* upon the scalp and face in children are benefited by the minute dose of iris.

The dose of iris depends largely upon the effect desired. If a pronounced action upon the gastro-intestinal and glandular secretions is desired, from 5 to 20 grains of the powder, or 10 to 60 minims of the strong tincture, or 5 to 20 drops of specific iris may be used. In some persons, and when exhibited in large doses, it is apt to occasion much distressing nausea, with considerable prostration; these effects may be obviated or mitigated by combining it with a few grains of capsicum, or ginger, a grain of camphor, or 4 or 5 grains of resin of blue cohosh (*caulophyllin*). For its specific uses, however, the specific iris, in doses of from $\frac{1}{20}$ to 5 drops, is preferred. Like all representative fluid preparations of iris, specific iris is liable to decompose and gelatinize, and is then useless as a medicine. The remedy is not appreciated as it should be, but it is safe to say that with a reliable preparation it will grow in favor the more it is employed.

Specific Indications and Uses.—The specific indications for iris may be stated as fullness of thyroid gland; enlarged spleen; chronic hepatic complaints, with sharp, cutting pain, aggravated by motion; nausea and vomiting of sour liquids, or regurgitation of food, especially after eating rich pastry or fats; watery, burning bowel discharges; enlarged lymphatics, soft and yielding; rough, greasy conditions of the skin; disorders of sebaceous follicles; abnormal dermal pigmentation; menstrual wrongs, with thyroid fullness; unilateral facial neuralgia; muscular atrophy and other wastings of the tissues; bad blood.

Related Species.—There are several species of iris, as *I. virginica*, Linné, *Boston iris* *I. lacustris*, Nuttall; *Iris verna*, Linné, or *Dwarf iris*, etc., which are often collected and mixed with the official article. *Iris florentina*, or *Florentine orris*, is said to be emetic, cathartic, and diuretic, but it is seldom employed except in the composition of tooth powders, and to conceal an *offensive breath* (see *Iris florentina*).

IRIS FLORENTINA.—FLORENTINE ORRIS.

The rhizome of *Iris germanica*, Linné; *Iris florentina*, Linné, and *Iris pallida*, Lamarck.

Nat. Ord.—Iridaceæ.

Common Names: *Florentine orris*, *Orris-root.*

Botanical Source and History.—Three species of iris furnish the orris-root of commerce, the *Iris germanica*, or *Blue flag;* the *Iris pallida*, or *Pale flag*, and the *Iris florentina*, or *White flag*. The first is indigenous to south Europe, and found likewise in Morocco and northern India, and is cultivated near Florence and Lucca, besides being a common flower in London gardens. All three species have the general characteristics of the order, but differ in the color of the flower. The *Iris germanica* has large, handsome, dark-blue flowers. *Iris pallida* has flowers of a delicate, pale-blue hue. Though not indigenous, it grows plentifully about Florence and Lucca, and wild in the stony regions of Istria. Its stem is much taller than that of the *I. germanica*. The two preceding varieties furnish the bulk of commercial orris-root, the *Iris florentina* furnishing but little. The latter is closely related to *Iris pallida*, but has large, beautiful white flowers, marked with yellow and brown. They are sweet-scented. The rhizomes of all these species are indiscriminately collected, and are termed by the Tuscan peasants *Giaggiolo*. They are gathered in August, peeled, and dried by solar heat. The larger sections are replanted. The peasants divide the drug into several grades, as *selected*, *sorts*, *raspings*, *powder*, and that made into *orris peas*. *Irisia*, of the Indian bazaars, which is brought into commerce unpeeled, is believed by the authors of *Pharmacographia* to be the product of *Iris germanica*. The same source is attributed to an inferior grade from Morocco. The fresh root-stock is jointed, branching, and fleshy. Externally it is yellowish-brown, internally juicy and white. Its taste is acrid, and its odor at first earthy, becoming, as it dries, of a pleasant, violet-like fragrance, which is said to be not fully developed until the root has been dried for two years. The rhizomes of the three species all resemble each other.

Fig. 148.

Iris florentina.

Description.—Dried orris-root comes in sections from 2 to 4 inches in length, and from 1 to 1½ inches in width, being broadest at the apex. The pieces are made up of an elongated portion which is irregularly subconical, and sends off at its broader extremity 1, 2, and occasionally 3, branches, and these, having been cut short in trimming, give them the appearance of small cones attached to the main portion by their apices. The rhizome is somewhat bent into an arch, flattened, shrunken, grooved, and contorted. Where the small rootlets have been attached to the under surface, little circular scars may be seen. The bark is usually absent, leaving a dull, white, heavy, compact texture, which fractures irregularly. Its taste is at first bitterish and aromatic, and finally acrid; its odor suggestive of the violet. Under the microscope the drug exhibits crystals of calcium oxalate. Orris-root is sometimes adulterated with other species of orris, but they lack its peculiar fragrance. The various starches used to adulterate the powder may be detected under the lens.

Chemical Composition.—Orris-root contains a large amount of starch, a small quantity of a crystalline, volatile substance (Dumas), a brownish, soft, acrid resin, and a small proportion of tannin, which strikes green with ferric salts. By distillation with water from 0.60 to 0.80 per cent of a crystalline *orris camphor* floats upon the surface of the distillate. Flückiger (*Pharmacographia*), has proved this to be chiefly *myristic acid* ($C_{14}H_{28}O_2$), intermingled with a small amount of volatile oil, which develops in the drying of the drug. This *orris camphor*, sometimes called *oil of orris-root*, has the persistent violet fragrance of the drug. The so-called *liquid oil of orris-root* is said to be prepared by digesting crushed orris-root in oil of cedar-wood, and finally distilling with steam.

Iridin ($C_{24}H_{26}O_{13}$) is a glucosid obtained from orris-root by G. De Laire and F. Tiemann (*Jahresb. der Pharm.*, 1893, p. 548; also see *Amer. Jour. Pharm.*, 1894. p. 32). It must not be confused with the Eclectic *Iridin* (see Iris versicolor), which for half a century has been an article of commerce. It forms white needles slightly soluble in water (1 to 500), and acetone (1 to 33), insoluble in ether, chloroform, benzol, etc., soluble in hot alcohol. Dilute alcoholic sulphuric acid decomposes it, near the temperature of boiling water, into dextrose and crystallizable *irigenin* ($C_8H_{16}O_8$), having the character of a phenol and producing with ferric chloride a deep violet color. *Irigenin*, when heated with concentrated alkali, is decomposed into *formic acid*, *iridic acid* ($C_{10}H_{12}O_5$), (which is an aromatic oxy-acid , and *iretol* ($C_7H_8O_4$), a phenol. Heated above its melting point, 180° C. (356° F.), *iridic acid* is decomposed into carbonic acid and a phenol, *iridol* ($C_7H_5[OCH_3]_2OH$). The synthesis of all these bodies was effected by the authors.

Action, Medical Uses, and Dosage.—Active irritant qualities are ascribed to orris-root, abdominal pain and emeto-catharsis being among its effects. These properties are dissipated upon drying the rhizome, when it becomes merely a gastric stimulant. The salivary flow and renal secretion are augmented by it while sneezing and increased pituitary secretion results from its use as a sternutatory. About the only use now made of orris-root is as an ingredient of breath perfumes and dentifrices, it not only giving a pleasant flavor, but acting beneficially on the gums. It was formerly used as a diuretic, expectorant, and remedy for *chronic diarrhœa*. From 5 to 15 grains constitutes a dose of the powdered root.

JACARANDA.—JACARANDA.

The leaves of *Jacaranda procera*, Sprengel (*Jacaranda Caroba*, De Candolle; *Bignonia Caroba*, Velloso; *Bignonia Copaia*, Aublet; *Karadelestris syphilitica*, Arruda da Camara).

Nat. Ord.—Bignoniaceæ.

COMMON NAMES: *Carob-tree*, *Caroba*, *Caaroba*.

Botanical Source.—The caroba tree grows in Guiana and Brazil, and attains a height of 30 or 40 feet. The tree is much branched, and luxuriantly crowned with a foliage of beautiful deep-green, compound leaves. These are abruptly bipinnatifid, dividing into 3 or 4 pairs of pinnæ, each having from 8 to 12 elliptical, nearly sessile leaflets, subacute at each extremity, and covered underneath with a woolly pubescence, due to the abundance of long, empty hairs. The flowers are borne in terminal cymes, are white and red and showy, and exhale a honey-like perfume. The fruit is a woody, many-seeded capsule. The root of the tree is deep-red externally, and yellow-white internally. The bark of the tree is of an ashen hue.

Fig. 149.

Leaves of Jacaranda procera.

Description and History.—The leaves are the medicinal parts. They are somewhat coriaceous, from 1 to 2 inches long, entire or nearly so, elliptic, lance-oblong, or oblong; either oblique at base, or subacute at both extremities, smooth, and dark-brown on upper surface, lighter beneath, strongly nerved, and velvety-woolly. The surfaces are beset with oil-glands. Odor slight; taste bitter-astringent.

The *Jacaranda procera* is one of the many trees known in Brazil as *Caroba* or *Carobinha*, others being *Jacaranda oxyphylla*, Chamisso; *Jacaranda brancha*, Sprengel; *Jacaranda subrhombea*, De Candolle; *Caroba de flor verde*, Sprengel; *Bignonia nodosa*, Manso; *Sparottosperma lithontripticum*, Martius; *Cybistax antisyphilitica*, Martius—all of them having uses similar to jacaranda in their native country.

Chemical Composition. A detailed analysis of the leaves and bark of *Jacaranda procera*, by Th. Peckolt (*Zeitschr. d. Oesterr. Apoth. Ver.*, 1881, Nos. 30 and 31), is abstracted in *Amer. Jour. Pharm.*, 1882, p. 135. The leaves contain *carobin* (0.16 per cent), a crystallizable, faintly bitterish, inodorous principle, soluble in boiling water and alcohol, insoluble in ether, precipitated from aqueous solution by tartar emetic; with acetic acid it yields a crystallizable compound. *Carobic acid* (0.05 per cent) crystallizes in needles of aromatic odor and acid taste; is soluble in water and diluted alcohol; *steocarobic acid* (0.10 per cent), pale-brown, of a tonka-like odor, soluble in cold absolute alcohol and ether; *carobone* (2.66 per cent), a balsamic, resinous acid, greenish, soluble in alcohol (sp. gr., 0.815) and caustic alkalies; *caroba resin* (3.33 per cent), inodorous and tasteless; *caroba balsam* (1.44 per cent), dark brown, syrupy, of tonka-like odor; *caroba tannin* (0.44 per cent), and a *bitter* principle (2.88 per cent); albumen, starch, etc. The bark contains *carobin* (0.3 per cent), *caroba resin* (0.5 per cent), the *bitter* principle (0.28 per cent), and in addition *carobaretic acid* (0.2 per cent), devoid of odor. According to Hesse (1880), no alkaloid is present.

Action, Medical Uses, and Dosage.—This agent has been used in its native country as an antisyphilitic, and was introduced into general medicine for the treatment of *venereal disorders*. If useful at all in *syphilis*, it appears to be endorsed as a remedy for secondary manifestations, and is used both locally and internally in *syphilitic ulcerations*. It has not been generally used by Eclectics for this purpose. It seems to have been successful in *cystic disorders* with pus-bearing and fetid urine, and in *gonorrhœa*. *Carobin*, which resembles the active constituent of sarsaparilla, has been used in doses of 1 grain in *syphilis* and *scrofula* (Peckolt). Dr. Lyman Watkins (*Ec. Med. Jour.*), treated successfully with jacaranda a case of *epilepsy* at the Eclectic Medical Institute Clinic. The disease was of fourteen years duration, and averaged from 7 to 10 convulsions in a day. From the very outset, through the 3 months during which the patient was treated, not a convulsive attack was experienced. Jacaranda undoubtedly has an influence upon the nervous structures. Epileptic disorders relieved by it are those superinduced by sexual indiscretions. It is recommended for those of feeble mentality though well-nourished in body, with voracious appetite and addicted to masturbation. The usual manner of exhibiting the remedy is as follows: ℞ Specific jacaranda, fl℥i or fl℥ii; aqua, fl℥iv. Mix. Sig. Teaspoonful every 4 hours. Fluid extract of jacaranda is given in doses of from 15 to 30 minims, 4 times a day; carobin, in 1-grain doses. For local use, ℞ Jacaranda leaves (powdered), ʒi to ʒii; petrolatum, ℥i.

Specific Indications and Uses.—Mental enfeeblement, voracious appetite, and epilepsy, particularly of masturbators; secondary syphilis and syphilitic ulcers.

JALAPA (U. S. P.)—JALAP.

"The tuberous root of *Ipomœa jalapa*, Nuttall"—(*U. S. P.*); (*Ipomœa purga*, Hayne; *Ipomœa Schiedeana*, Zuccarini; *Exogonium jalapa*, Baillon; *Exogonium purga*, Bentham; *Convolvulus jalapa*, Linné; *Convolvulus purga*, Wenderoth).

Nat. Ord.—Convolvulaceæ.

COMMON NAME: *Jalap*.

ILLUSTRATIONS: Bentley and Trimen, *Med. Plants*, 186; *Bot. Magazine*, Vol. 73, Plate 4280.

Botanical Source.—Jalap has a fleshy, tuberous, pyriform root, with numerous roundish tubercles. The stems are several, smooth, brownish, very slightly rough, with a tendency to twist, twining about surrounding bodies. The leaves are long petioled, the first hastate, the succeeding ones cordate, acuminate, mucronate, smooth, deeply incised at base, and conspicuously veined beneath. Peduncles axillary, 2-flowered, rarely 3, twisted, as long as the petioles. Calyx has no bracts; composed of 5 smooth, obtuse, mucronate sepals. The corolla is funnel-shaped, purple, with a long, somewhat clavate tube, and an undulated limb, with 5 plaits. Stamens 5; filaments smooth, unequal, and longer than the corolla tube; anthers white, oblong-linear, and projecting. Ovary slender, and 2-celled; stigma simple, capitate, and deeply furrowed. Capsule 2-celled; cells 2-seeded; seeds unknown (L.—N.).

Fig. 150.

Ipomœa jalapa.

History.—It is only within comparatively recent years that any certainty has existed in relation to the plant from which jalap root is obtained. It was first spoken of in 1609, as *Bryonia mechoacana nigricans*, then it was regarded by Ray as *Convolvulus Americanus jalapium dictus*, after which Tournefort, being deceived by persons who asserted that they had seen the plant growing, referred it to a species of *Mirabilis*. Balfour placed it as the *Exogonium purga*, and Linnæus named it *Convolvulus jalapa*, and thus much difference of opinion existed until, in 1827, when Dr. J. R. Coxe, of Philadelphia, succeeded in obtaining perfect flowers from roots of the true plant furnished to him from their native soils, and thus first made its true character known to the scientific world. The name of *Ipomœa purga* was bestowed upon the plant by Wenderoth and Hayne, but as the authorities of this country have, undoubtedly, the first claim, it may be viewed as fixed that *I. jalapa*, the name originally given to it by Nuttall, is the official plant.

The jalap plant is found in a deep, rich, vegetable soil, at an elevation of nearly 6000 feet above the level of the sea, growing in Mexico, near Chicanquiaco and Xalapa, from which last named place it is usually exported, and from which it has also obtained its name. It is generally imported in bags, containing 100 or 200 pounds. The root is the official part, and is gathered in all seasons, but principally in March and April, when the young shoots are appearing. The plant may be cultivated in the southern parts of the United States. In 1866, Dr. D. Hanbury planted a root or tuber of jalap in a garden, near London, and obtained promising results. It is now successfully grown in Jamaica and in India, especially in the Nilgherry hills of that country. According to Warden (1887), the jalap tubers of India are not of first quality. Jalap is a very variable drug, much of it being of an inferior quality. The best kind is that known as the Vera Cruz variety. Several related, and often inferior drugs, *e. g.*, Tampico jalap, have appeared on the market (see *Related Species*).

Description.—When fresh, the root is black externally, white and milky within, and varies in size according to its age, from that of a walnut to that of a moderate-sized turnip. It is dried in net bags over the fire, sometimes entire, and sometimes in sections. It is often preyed upon by insects which, however, leave its active part untouched, rendering it consequently more energetic. Jalap thus preyed upon is used for procuring the resin, but should not be given internally, except in much smaller doses than for the ordinary root. Jalap is rather difficult to pulverize, but if triturated with cream of tartar, sugar of milk, or other hard salt, the process of pulverization is facilitated, and the powder rendered much finer. When in powder, the color is a pale grayish-brown, and when in contact with the mucous membrane of the air-tube, causes coughing and sternutation, with an increased discharge of saliva. Its solvents are water, alcohol, or spirits. Water takes up a small portion of its cathartic principle, but considerable of an amylaceous and mucilaginous extractive matter. Alcohol dissolves the resin, on which its cathartic virtues depend. Ether only partially dissolves it. Diluted alcohol completely extracts its active properties.

The *U. S. P.* thus describes good jalap, and gives the method of valuation of same: "Napiform, pyriform, or oblong, varying in size, the large roots incised, more or less wrinkled, dark-brown, with lighter-colored spots, and short, transverse ridges; hard, compact, internally pale, grayish-brown, with numerous concentric circles composed of small resin cells; fracture resinous, not fibrous; odor slight, but peculiar, smoky, and sweetish; taste sweetish and acrid. On exhausting 100 parts of jalap with alcohol, concentrating the tincture to 40 parts, and pouring it into water, a precipitate of resin should be obtained, which, when washed with water, and dried, should weigh not less than 12 parts, and of which not over 10 per cent should be soluble in ether" (*U. S. P.*).

Jalap root is seldom adulterated; if light, whitish internally, spongy, friable, and of a dull fracture, it should be rejected. The resin of jalap, met with in commerce, however, is subject to falsification, being adulterated sometimes with guaiac, colophony, and various inert substances. In the case of colophony, freshly rectified oil of turpentine will dissolve out this adulteration, while jalap resin is insoluble in this medium (Tromsdorff).

Chemical Composition. Analysis of commercial jalap shows the presence of starch, uncrystallizable sugar (19 per cent, Guibourt), gum, coloring matter, a resin, soluble in alcohol, and a soft resin, soluble in ether. From 12 to 18 per cent is the average yield of resin (*Pharmacographia*), though as high as 22 per cent has been obtained. As stated above, the *U. S. P.* demands 12 per cent of total resin, including not more than 1.2 per cent of ether-soluble resin. The resin of jalap may be obtained by treating the coarsely-chopped roots with water, which removes such constituents as sugar, gum, and coloring matter, and extracting the resin from the roots by means of boiling alcohol, specific gravity 0.880. This resin consists of two distinct resins. One of these, having the odor and acrid taste of jalap, is soft, of acid reaction, and soluble in ether as well as in alkaline solutions; from the latter it is reprecipitated by acids. Prof. Maisch (*Amer. Jour. Pharm.*, 1887, p. 326) considers it a mixture of resins, not deserving a special name until better investigated. The other resin, insoluble in ether, is the purging principle (*jalapurgin*, Maisch, 1887; *convolvulin*, $C_{31}H_{50}O_{16}$, Wm. Mayer, 1856; or $C_{61}H_{108}O_{27}$, A. Kromer, 1894; *rhodeoretin*, of G. A. Kayser, 1844; and *jalapin*, of Buchner and Herberger, 1831). It is hard, white, odorless, and tasteless, while in alcoholic solution it is nauseously acrid. The latter solution is optically lævo-rotatory. *Convolvulin* (as it is mostly called) is insoluble, or nearly so, in water, ether, chloroform, carbon disulphide, petroleum benzin, oil of turpentine, etc., but dissolves readily in alcohol, acetic acid, acetic ether, in cold nitric acid, and in alkalies; in the case of ammonia being used, the heat of the water-bath effects solution. Upon again acidulating the alkaline solution, no precipitate is formed, owing to the conversion of *convolvulin* into *convolvulic* (*convolvulinic*) *acid* ($C_{62}H_{106}O_{35}$, Mayer), an amorphous, white, hygroscopic powder, soluble in water and alcohol, and insoluble in ether. Of this substance convolvulin is the anhydride. *Convolvulin*, as well as *convolvulic acid*, are glucosids (Kayser). When *convolvulic acid* ($C_{28}H_{52}O_{14}$, A. Kromer. *Amer. Jour. Pharm.*, 1894, p. 197) is treated with the ferment *emulsin*, or with warm diluted acids, it is decomposed into 2 molecules of sugar ($C_6H_{12}O_6$), and crystallizable *convolvulinolic acid* ($C_{16}H_{30}O_3$, Kromer). The latter is insoluble in water and melts at 46° C. (114.8° F.). *Convolvulin*, treated with the same agents, decomposes into glucose, volatile *methyl-ethyl-acetic acid*, and *convolvulinolic acid*; with alkalies, 1 molecule of *methyl-ethyl-acetic* and 2 molecules of *convolvulinic* acids are formed. Höhnel (1896), by the same agents, obtained 2 glucosid acids, *convolvulinic* and *purginic acids* (see *Jahresb. der Pharm.*, 1896, p. 511). Strong nitric acid oxidizes *convolvulin* to carbonic and oxalic acids, and a small quantity of *sebacic* (*ipomic*) *acid* ($C_8H_{16}[COOH]_2$), a substance which is also one of the products of the dry distillation of oleic fats.

Action, Medical Uses, and Dosage.—Jalap is an irritant and cathartic, operating energetically, occasioning profuse liquid stools with griping, and sometimes sickness at stomach, or even vomiting. Large doses produce violent hypercatharsis, sometimes terminating fatally. When applied to a wound, it is said to induce purgation. Notwithstanding its activity, it is a safe and convenient purgative, much in use among the profession, and is useful in all cases where it is desirable to produce an energetic influence on the bowels, or to obtain large evacuations. In intestinal inflammations it should not be used. United with the bitartrate of potassium, its hydragogue properties are much increased, and thus it proves beneficial in *dropsies*, as well as in some forms of *scrofula*. Jalap, however, is suitable for excitable, active conditions, and may be used where a cooling effect is desired, as when it is necessary to evacuate the bowels in *febrile disorders*. *Inflammatory conditions of the biliary apparatus* are exceptions to the rule that it should not be used in gastro-intestinal inflammations. When the rectum is impacted with a hard, fecal mass, the expulsion of the latter is facilitated by the purgative action of jalap, which greatly augments the intestinal secretions; all cases of *constipation*, due to dryness of the mucous membranes, through inactivity of the intestinal glands, are relieved by jalap. The dose for this latter purpose may be 5 grains in the morning, repeated for several days. When a stimulating laxative can not be used in *hemorrhoids*, jalap may be employed, and it is likewise efficient as a derivative in *cerebral disorders*. The *antibilious physic* (which see), or the following modifications (Locke) of it are very useful preparations: (1) R Powdered jalap, ℥viii; powdered senna, ℥xvi; powdered ginger, ℥i. Mix. Dose, a full teaspoonful in sweetened water; (2) R Jalap, ℥iij; potassium bitartrate, ℥vj; ginger, ʒii. Mix. Dose, 30 to 60 grains, in water, every 3 hours, as a hydragogue cathartic.

It is stated that the aqueous extract of jalap, the root having been previously exhausted of its resin by alcohol, will exert no cathartic influence, but will operate as a powerful diuretic, but I have not been able to procure this effect, though having made a trial in several cases (King). Three grains of jalap, taken an hour before each meal, act as a slight nauseant, destroying a desire for food among persons who are apt to eat too freely. If jalap is digested in ether, its nauseous taste and smell will be wholly removed without lessening its cathartic power. A biscuit is sometimes made for those to whom it is extremely nauseous and disagreeable; 5 drachms of jalap, 30 of sugar, and 4 ounces of flour, are made into 15 biscuits after the usual mode; 1 biscuit is a dose. The tendency of jalap to gripe and nauseate, may be obviated by adding to the dose 1 or 2 grains of camphor, or 3 grains of cloves. The dose of powdered jalap is from 10 to 30 grains (the aqueous extract ought not to be used, except as a diuretic); of the tincture, from 1 to 4 fluid drachms; the resin, or alcoholic extract, is given in from 2 to 8-grain doses, being usually rubbed up with sugar, or in emulsion, for the purpose of lessening its disposition to produce painful irritation of the intestinal mucous membrane. As a hydragogue, 2 drachms of the bitartrate of potassium are added to 10 or 30 grains of pulverized jalap. *Convolvulin* (*rhodeoretin*) purges violently in 3 or 4-grain doses, and appears to be the active principle of jalap. Specific jalap, 10 to 20 drops every 4 hours for its specific uses. Though not an anthelmintic, jalap is often given to hasten the expulsion of *worms*, after agents have been given for their stupefaction or destruction.

Specific Indications and Uses.—Constipation from deficient secretion of intestinal glands; pain and griping in lower bowel; colic, with stercoraceous vomiting; general gastro-intestinal torpor.

Related Species and Drugs.—Several related convolvulaceous tubers of Mexico and Brazil have been employed as purgatives. They are not, however, articles of general commerce.

TAMPICO JALAP.—This is the Mexican *Purga de Sierra Gorda*, and is derived from the *Ipomœa simulans*, Hanbury. It much resembles the jalap tuber in appearance, odor and taste. While it is difficult to distinguish some of the tubers from those of true jalap, most of the Tampico tubers are smaller and more elongated, more corky and shrivelled, and show an absence of little scars crosswise the roots so noticeable in true jalap (*Pharmacographia*). It yields a resin (10 to 15 per cent). Flückiger obtained 10 per cent of it. It is completely soluble in ether. Spirgatis (1870) named the resin *tampicin* ($C_{68}H_{10}O_{28}$). It is converted into *tampicic acid* ($C_{68}H_{120}O_{34}$) by means of concentrated alkalies. Acids resolve it into sugar and *tampicolic acid* ($C_{32}H_{64}O_{6}$), thus showing its glucosidal character, analogously to that of *convolvulin*. It has purgative properties.

Mirabilis jalapa, Linné; *Four o'clock.*—The tubers of this species, which somewhat resemble jalap, may be distinguished by the presence of needle-like raphides of calcium oxalate.

Ipomœa turpethum, R. Brown; *Turpeth root.*—This is the *Turbith végétal* of the *French Codex*. It is not very similar in appearance to jalap. It contains a resin (4 per cent), of which *turpethin*, the ether-soluble portion, a glucosid, behaves like resin of jalap in relation to acids and alkalies. Bases convert it into *turpethic acid*, *methyl-crotonic acid*, traces of formic, and *methyl-ethyl-acetic acids*, etc. (see articles by N. Kromer, *Oesterr. Zschr. f. Pharmacie*, 1895, Nos. 18 to 24).

Ipomœa nil, Roth (*Convolvulus nil*, Linné; *Pharbitis nil*, Choisy).—Tropical regions and southern United States. Seeds called *kaladana* in India, and are slightly purgative. They are black, triangular, with a rounded back, and have a sweetish taste, followed by an acrid sensation. They yield *pharbitisin* (identical with *convolvulin*) and a volatile oil. The seeds are roasted and given in powder.

Ipomœa triloba (*Pharbitis triloba*, *Ipomœa hederacea*). The seeds of the Japanese plant known as *kengashi*, yield *convolvulin*, and are employed like *kaladana*.

Mechoacan. This product, probably of a convolvulaceous plant, comes in gray or whitish circular sections or fragments, somewhat farinaceous, and destitute of the circles of resinous cells. It sometimes occurs as an adulterant of jalap, but its detection is not difficult. It is feebly cathartic.

Orizaba Root. This is variously known as *Woody*, *Light*, or *Fusiform jalap*, *Male jalap*, *Jalap tops* or *stalks*, and is the Mexican *Purgo macho*. It is derived from the *Ipomœa orizabensis*, Ledanois. This root is fusiform, and sometimes occurs in commerce in transverse slices, but more frequently in rectangular blocks. Its longitudinal wrinkles are deeper than those of jalap. Its color is also lighter. From the latter it may be known by the radiations on transverse section, and by leaving, when fractured, projecting bundles of fibrous vessels. Chemically, it closely resembles jalap. Its chief constituent is *jalapin* ($C_{34}H_{56}O_{16}$, or $C_{68}H_{112}O_{32}$, Poleck), so named by Mayer (*para-rhodeoretin* of Kayser), and should not be confounded with the *jalapin* of Buchner and Herberger, which is convolvulin. Mayer's jalapin differs from convolvulin in that ether and acetone freely dissolve it. Poleck (1892) proposes for it the name *orizabin*, as Prof. Maisch has done in 1887. Alkalies change it into water-soluble *jalapic acid* ($C_{68}H_{118}O_{35}$, or $H_2C_{17}H_{28}O_9$, Poleck). Diluted acids convert it into sugar and *jalapinol* ($C_{32}H_{62}O_7$), insoluble in water; probably identical with *jalapinolic acid* ($C_{32}H_{60}O_6$, or $C_{16}H_{30}O_3$, Poleck, 1892), obtainable from scammony resin. *Jalapin* (*orizabin*) is oxidized by nitric acid to carbonic, isobutyric, and *ipomic acid*, the latter an isomer of sebacic acid (compare *convolvulin*). *Jalapin* (Mayer's) has been shown by Spirgatis to be identical with *scammonin* both in chemical and purgative qualities, a fact more recently confirmed by Th. Poleck (see *Jahresb. der Pharm.*, 1892, p. 80).

Ipomœa pandurata, Meyer (*Convolvulus panduratus*, Linné); *Wild potato*.—This plant, likewise known as *Wild jalap*, *Man in the Ground*, *Mechameck*, *Man of the Earth*, etc., has a perennial, very large, tapering root, with several stems from the same root, from 4 to 8 feet long, round, slender, purplish, smooth or nearly so, trailing or twining. Leaves 2 or 3 inches long, about the same width, broadly cordate at base, acuminate, entire, or wavy, alternate, sometimes panduriform, smooth, deep-green above, paler beneath, on long petioles. Flowers white, dull-purple toward the base, large, opening in the forenoon; peduncles axillary, longer than the petioles, cymose, branching at the top, several-flowered. Corolla large, campanulate, 2 or 3 inches long. Calyx smooth, 5-parted, naked; sepals ovate-oblong, stamens white, the length of the tube; anthers oblong. Style white, thread-like; stigma capitate, bilobed. Capsule oblong, 2-celled, 4-seeded, without intermediate partitions (L.—W.—G.).

Wild potato is indigenous to the United States, growing in light and sandy soils, from Connecticut and west New York, southward and westward, and flowering from June to August; it rarely grows North, but is found in some parts of South America. The root is the medicinal part; it is very large, being from 2 to 8 feet in length, and from 2 to 4 or 5 inches in diameter, branched at the bottom, brownish-yellow externally, whitish and lactescent internally, furrowed lengthwise, and of a disagreeable odor and bitter, rather acrid taste; about 75 per cent in weight is lost in drying. It is generally met with in transverse, circular sections, which are somewhat tawny externally, whitish with diverging lines internally, and not readily powdered; the powder is somewhat grayish. Water or alcohol extracts its active properties, but diluted alcohol or spirits are its best solvents. It contains resin, bitter extractive, sugar, starch, gum, a body resembling tannic acid, etc. The resin is purgative. It consists of an acid, and a non-acid portion. It is a glucosid, and exists to the extent of 1.5 per cent.

The active principles of this plant are unknown. It possesses mild cathartic properties, acting gently in doses of from 40 to 60 grains of the powdered root. The infusion taken in wineglassful doses every hour, has been effective in *dropsy*, *strangury*, and *calculous affections*. It seems also to exert an influence over the lungs, liver, and kidneys, without excessive diuresis or catharsis. The saturated tincture is more energetic than the powdered root, decoction, or extract. It is asserted that the Indians can handle rattlesnakes with impunity after wetting their hands with the milky juice of this root.

JEFFERSONIA.—TWINLEAF.

The rhizome of *Jeffersonia diphylla*, Barton.

Nat. Ord.—Berberidaceæ.

Common Names: *Twinleaf*, *Rheumatism-root*, *Ground-squirrel pea*.

Botanical Source.—This is an indigenous, perennial plant, sometimes known as Ground-squirrel pea, and Rheumatism-root. Its rhizome is horizontal, with matted fibrous radicles; the scape or stem is simple, naked, 1-flowered, and from 8 to 14 inches in height. The leaves are in pairs, binate, placed base to base, oval, broader than long, ending in an obtuse point, smooth, glaucous beneath, and borne on petioles as long as the scape, which arise from the rhizome. The flowers are large, regular, and white. The calyx consists of 4 colored, deciduous sepals. The corolla is composed of 8 flat, oblong, spreading, incurved petals. Stamens 8, with oblong-linear anthers, on slender filaments. Ovary ovoid, soon gibbous, pointed;

stigma 2-lobed. The capsule is obovate, or somewhat pear-shaped, stipitate, and 1-celled, opening half-way round horizontally, making a persistent lid. The seeds are many on the lateral placenta, with a fleshy lacerate aril on one side and oblong (W.—G.).

History and Description.—This plant is found from New York to Maryland and Virginia, and in many parts of the western states, growing in limestone soil, in woods and near streams and rivers, and flowering in April and May. The part used is a thick, knotty rhizome, from which long, fibrous roots proceed, and is of a brownish-yellow color. It is used as an adulterant of hydrastis, and is often artfully mixed therewith. In cases that have come under our observation, this root has been chopped so as to bring it to about the size of hydrastis. In other instances it has been matted together inside of bunches of hydrastis, and in still others the rootlets have been removed, chopped, and mixed with hydrastis. The epidermis is somewhat corrugated, and in some specimens transversely cracked. The bark is resinous, and contains the active principle of the roots. The central portion is ligneous, of a light straw color, and is easily separated by bruising the root. The root has an odor similar to that of *podophyllum*, and a bitter, mucilaginous taste at first, followed by a pungent, nauseous, and acrid taste. Water or alcohol extracts its virtues.

Chemical Composition.—An analysis by Prof. E. S. Wayne, showed this plant to contain tannic acid, gum, starch, sugar, mineral matters, considerable pectin, fatty resin, a bitter substance, an acrid and nauseous matter somewhat similar to polygalic acid, which occasioned vomiting with persistent nausea (see *Amer. Jour. Pharm.*, Vol. XXVII, p. 1). Prof. F. F. Mayer states that the pectin of Prof. Wayne, in the above analysis, is *saponin;* also that the root contains a large proportion of a white alkaloid, and a small quantity of *berberine* (*Amer. Jour. Pharm.*, 1863, p. 99). A. W. Flexer (*Amer. Druggist*, 1884, p. 227), denies the existence of berberine in Jeffersonia.

Action, Medical Uses, and Dosage.—Diuretic, alterative, antispasmodic, and a stimulating diaphoretic. Successfully used in *chronic rheumatism*, as a tonic in *secondary* or *mercurio-syphilis;* also used with advantage in *dropsy*, in many *nervous affections*, *spasms*, *cramps*, *nervous excitability*, and even during *pregnancy*. In *syphilitic diseases* it has been combined with corydalis, but I have been unable to determine any other than a tonic influence, with evident improvement in nutrition, whether it be administered alone in this malady, or combined as just stated (King). As a gargle it has been beneficial in *diseases of the throat*, *ulcers* about the fauces, *scarlatina*, *ophthalmia*, and *indolent ulcers*. It is administered in decoction and saturated tincture. Dose of the decoction, from 2 to 4 fluid ounces, 3 times a day; of the tincture, from 1 to 3 fluid drachms, 3 times a day. Some practitioners substitute this plant for senega, as an expectorant and emetic.

Specific Indications and Uses.—Pain in the head with dizziness and sensation of tension (Watkins, *Compendium of Eclectic Practice*).

JUGLANS (U. S. P.)—JUGLANS.

"The bark of the root of *Juglans cinerea*, Linné, collected in autumn"—(*U. S. P.*). (*Juglans oblonga*, Miller; *Juglans cathartica*, Michaux). The leaves are also employed.

Nat. Ord.—Juglandaceæ.

COMMON NAMES: *Butternut*, *White walnut*, *Oil nut.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 247.

Botanical Source.—This tree is indigenous, and grows to a height of from 30 to 50 feet, with a trunk about 4 feet in diameter, at some 4 or 6 feet from the ground, and which, at 8 or 10 feet from its base, divides into numerous, nearly horizontal, wide-spreading branches, with a smooth gray bark, and forming a large tufted head, giving to the tree a peculiar appearance. The leaves are alternate, from 12 to 20 inches long, consisting of 7 or 8 pairs of leaflets, which are 2 or 3 inches in length, oblong-lanceolate, rounded at the base, acuminate, finely serrate, and downy, with the petioles and branchlets downy with clammy hairs

Male and female flowers distinct upon the same tree, the former in large aments, 4 or 5 inches long, hanging from the sides of the last year's shoots, near their extremities. The scales which compose them, oblong and deeply cleft on each side into about 3 teeth or segments. Anthers about 8 or 10 in number, oblong, and nearly sessile. The fertile flowers grow in a short spike at the end of the new shoot; are sessile, universally pubescent, and viscid; when fully grown they seem to consist of a large oblong ovary, and a forked feathery style. The top of the ovary, however, presents an obscurely 4-toothed calyx. Within this is a corolla of four narrow lanceolate petals growing to the sides of the style; the style divides into 2 large, diverging, feathery, rose-colored stigmas, nearly as long as the ovary. The fruit is sometimes single, suspended by a thin, pliable, peduncle; sometimes several are together on the sides and extremity of the same peduncle. It is of a green color, brown when ripe, oblong-oval, obtusely pointed, hairy, and extremely viscid. The nut or nucleus is dark-colored, hard, oblong, pointed, carinated on both sides, and its whole surface roughened by deep indentures and sharp prominences. The kernel is oily, pleasant-flavored, and edible (L.—W.—B.).

Fig. 151.

Juglans cinerea.

History and Description.—This tree and the *Juglans nigra* or Black walnut are common to North America. The *J. cinerea* is found throughout the New England, Middle, and Western states, and Canada, growing in rich woods, on elevated river banks, and on cold, uneven, rocky soils, flowering in April and May, and maturing its fruit during the middle of autumn. A saccharine juice, said to furnish a good sugar, is obtained by tapping the trees early in the spring. Butternut wood is light, of a reddish hue, not apt to become worm-eaten, and is frequently used in paneling and for ornamental work. The fruit collected sometime previous to its ripening is used in the form of pickles by many persons; the bark and shells of the nut furnish a dye of a chocolate color, for woolen goods, but as a dye, the bark of the black walnut is preferable. In the recent state, butternut bark is acrid, and when rubbed upon the surface of the body, occasions redness and sometimes blisters. The medicinal parts are its leaves and the inner bark of the root, the latter of which is best when gathered from April to July. The bark of the root is official, and this, the Pharmacopœia directs, should be gathered in the autumn. The official description of the bark is as follows: "In flat or curved pieces, about 5 Mm. (⅕ inch) thick; the outer surface dark-gray and nearly smooth, or deprived of the soft cork and deep-brown; the inner surface smooth and striate; transverse fracture short, delicately checkered, whitish, and brown; odor feeble; taste bitter and somewhat acrid"—(*U. S. P.*). Its original whiteness soon begins to alter upon exposure to the air, changing from a yellow to a dark-brown color. Water at 100° C. (212° F.), takes up all its active poperties.

Chemical Composition.—In the bark of *Juglans cinerea*, (Butternut tree), C. O. Thiebaud found (*Amer. Jour. Pharm.*, 1872, p. 253), bitter extractive, much oil, crystallizable, orange-yellow *juglandic acid*, soluble in benzol, alcohol, and ether, but hardly soluble in water, and probably related to chrysophanic acid; a crystallizable, colorless acid, and a volatile acid, but no tannin, although ferric chloride gave a dark-colored precipitate. Mr. E. S. Dawson (1874), however, established the presence of tannin in the bark, when rapidly and immediately dried after collection. The bark stains the skin persistently brown. A quantitative and comparative analysis of the bark of the root and trunk by E. D. Truman is recorded in *Amer. Jour. Pharm.*, 1893, p. 426. *Juglandic acid* was obtained by the author in orange-red crystals from the alcohol extract when this was treated with water and the solution abstracted with ether. The crystals turn deep-violet with alkalies, and decompose very readily, resinous products insoluble in water being formed. Perhaps *juglandic acid* is identical with *nucin* or *juglon*, obtainable from the green leaves and pericarps of the *Juglans regia*, Linné, or European walnut (see *Related Species*).

JUGLANDIN is a name once given to a dried extract from the *J. cinerea*. It was a member of the class of preparations introduced and used about 50 years ago by the Eclectics under the name *resinoids* or *concentrations* (see *Leptandrin* and *Podophyllin* for special remarks concerning this class).

Action, Medical Uses, and Dosage.—Butternut in small doses is a mild stimulant to the intestinal tract, proving laxative and in larger doses is a gentle and agreeable cathartic, causing no griping, nor subsequent weakness of the intestines. It resembles rhubarb in its effect, but without inducing constipation after its action. It is very valuable in cases of *habitual constipation*, *colorectitis*, and several other *intestinal diseases*. It is generally used in the form of an extract, in doses of 1 to 30 grains. An excellent combination for chronic constipation is the following: ℞ Ext. butternut, ʒj; ext. nux vomica, grs. v. Mix. Ft. Pil. No. 40. Sig. Two pills, 3 times a day (Locke). The same pill is very efficient in deficient gastric secretion, in *atonic dyspepsia*, and in *indigestion* accompanied with gastric irritation, sour eructations, and flatulent distension of the stomach. Administer 1 pill a day. Juglans is useful in tenesmic, burning, fetid *diarrhœa* and *dysentery*, and should be remembered in *intestinal dyspepsia* with irritation. The specific juglans may be given in from 1 to 10-drop doses. The same doses of the same preparation act as an efficient alterative in *chronic skin affections* and *scrofula*, being particularly indicated in those skin affections exhibiting vesicles or pustules. Webster believes it effectual in all skin diseases except those presenting parasitic, scrofulous, or syphilitic manifestations. Juglans is an efficient cathartic to use when a free action of the bowels is demanded in *rheumatism* and *chronic respiratory affections*. A strong decoction of it is much employed in some sections of the country, as a domestic remedy in rheumatism affecting the muscles of the back, and in *intermittent* and *remittent fevers*, as well as in other diseases attended with congestion of the abdominal viscera; it is also reputed efficient in murrain of cattle, and yellow water in horses. It was used with great advantage in the treatment of *dysentery* and *diarrhœa* occurring among our soldiers in the Civil War. Dose of the extract, from 1 to 30 grains, usually from 1 to 5 grains; specific juglans, 1 to 20 drops, the smaller doses being preferred for its specific action.

Specific Indications and Uses.—Chronic constipation; gastro-intestinal irritability, with sour eructations, flatulence, and either diarrhœa or constipation dependent thereon; diarrhœa and dysentery with tenesmus and burning and fetid discharges; torpid liver; chronic skin affections of a pustular or vesicular character, discharging freely; eczematous affections.

Related Species.—*Juglans nigra*, or *Black walnut* grows from 60 to 90 feet high, with a diameter of from 3 to 6 feet, with a brown bark. Leaflets numerous, 7 to 10 or 11 pairs, ovate-lanceolate, serrate, subcordate at base, taper-pointed at the apex, smooth above, the lower surface and the petioles minutely downy. Fruit globose, with scabrous punctures; nut corrugated, kernel sweet, more pleasant tasted and less oily than the butternut, but greatly inferior to the European walnut, *Juglans regia* (W.—G.). *Juglans nigra* is rarely found in the northern states, but is more common to the middle and western. It flowers and ripens its fruit at the same time with the butternut. The duramen of its wood is compact and heavy, of a deep-violet color, surrounded with a white alburnum. It is extensively used in building and for cabinet work (G.—W.). The leaves of *Juglans nigra* were analyzed by Lillie J. Martin (*Amer. Jour. Pharm.*, 1886, p. 468), and contained tannin as the dominant principle; volatile oil, a volatile acid, resin, wax, gum, and a crystallizable substance, probably a glucosid. The ash constituted 8.5 per cent, and the absence of aluminum in the ash was established. The juice of the rind of black walnut is said to cure *herpes*, *eczema*, *porrigo*, etc., and a decoction has been used to remove *worms*. The bark is very astringent and acrimonious, and is employed in dyeing.

Juglans regia, Linné; *English*, or *European walnut*.—The leaves and green pericarp of the fruit of this species have an astringent, bitter taste and a characteristic odor. They are known in European pharmacy respectively as the *Folia juglandis* and *Cortex fructus juglandis*. The kernels of the ripe fruit, as well as those of the black walnut, butternut, pecan-nut (*Carya olivæformis*, Nuttall), and the hickory nuts (species of Carya) yield a fixed oil known as *nut oil*. It is one of the drying oils, and is bland, of a greenish or light-yellow color, and becomes of the consistence of lard at near —18° C. (0° F.). It has a specific gravity of 0.928, and, according to Mulder (1865), contains linoleic, myristic, and lauric acids. A volatile oil was obtained from the leaves (0.029 per cent), by distillation with water. It has the flavor of tea, and solidifies at 15° C. (59° F.) (Schimmel's *Report*, 1890).

Juglon ($C_{10}H_6O_3$, *Oxy-alpha-naphtho-quinone*, Bernthsen and Lemper, 1885; *Nucin*, of Vogel and Reischauer, 1856 and 1858; *Regianin*, of Phipson, 1896), occurs in the green pericarps of the European walnut, and is obtainable by extraction with carbon disulphide, ether, etc. According to Bernthsen and Lemper, it is an oxidation product of *hydrojuglon*, which exists in the husks, and can be abstracted therefrom with ether. The ethereal solution shaken with diluted chromic acid, converts it by oxidation into yellow, crystallizable *juglon*, soluble in chloroform and concentrated sulphuric acid with blood-red color, hardly soluble in cold alcohol and ether. Crystals of *juglon* are sublimable, and are decomposed by hot water, a brown coloring matter resulting. *Juglon* stains the skin brown. Diluted alkalies dissolve *juglon* with an evanescent purple color. The pericarp of the immature fruit contains large quantities of tannic acid (*nucitannic acid*, of Phipson), but the ripe husk is entirely free from this principle (C. Hartwich, *Archiv der Pharm.*, 1887, p. 333).

A crystallizable alkaloid, *juglandin*, was isolated from the leaves in 1876, by Tanret; it turns black upon exposure to the air. *Nucit* ($C_6H_{12}O_6 + {}_2H_2O$), a non-fermentable sugar occurring in the leaves, was found by Tanret and Villiers (1878) to be identical with *inosit*. Sestini obtained from the root of juglans considerable quantities of *glycyrrhizin* in the form of potassium and calcium salts.

The European walnut has been found by Prof. Negrier, of Angers, to be very efficient in *scrofula*. To children laboring under this disease he administered a strong infusion of the leaves in teacupful doses, or the aqueous extract in doses of 6 grains, or a proportionate dose of a syrup prepared with 8 grains of the extract to 10 drachms of syrup, repeating the dose from 2 to 5 times a day. All the *ulcers* and *sore eyes* were washed with a strong decoction of the leaves, and the ulcers covered with linen compresses steeped in this decoction, or poultices made with flour and the decoction. No injury followed its long-continued administration. The above American species would probably answer as good a purpose.

JUJUBA.—JUJUBE-BERRIES.

The fruit of *Zizyphus vulgaris*, Lamarck, and *Zizyphus Lotus*, Lamarck.

Nat. Ord.—Rhamnaceæ.

COMMON NAME: *Jujube-berries.*

Botanical Source and History.—The shrubs bearing jujube-berries are cultivated in Spain, Italy, and France, and along the Mediterranean. The first species is indigenous to Syria and Asia Minor, the second grows in the northern part of Africa. Jujube plants are shrubs, sometimes arborescent, and have alternate, serrated, ovate leaves, which are 3-nerved and armed at the base with prickly and spinous stipules. By abortion the fruit is 1-celled and 1-seeded, but it usually has 2 cells and 2 seeds.

Description and Chemical Composition.—Jujube-berries are roundish-oval or oblong drupes, about the size of an olive. The skin is vivid-red when fresh, but when dried becomes brownish-red, and is leathery, thin, and wrinkled. The pulp is soft, yellowish, mucilaginous, sweet, and acidulous, and encloses the ovate, pointed stone. The drupe of the *Z. Lotus* is smaller (about $\frac{3}{5}$ inch) and subglobular. The fruit of an East Indian species, *Zizyphus jujuba*, Lamarck, possesses like properties, and the shrub gives a stick-lac from which a portion of the shellac of commerce is prepared (see *Amer. Jour. Pharm.*, 1886, p. 307). Chemically, jujube-berries contain sugar and mucilage, while tannin is a constituent of the bark. (2.8 per cent, D. Hooper, 1894). The fruits of the first two species constitute an article of food in their native countries, being employed like raisins, figs, etc.

Preparation.—JUJUBE PASTE. *Massa de jujubis.* With sufficient water extract jujube-berries, 5 parts, to obtain of the infusion, 35 parts; add sugar, 20 parts; acacia, 30 parts. Evaporate, add orange-flower water, 2 parts; boil slowly for 12 hours, and run into molds. This is in accordance with the *French Codex.* Jujube paste (in the United States), seldom contains jujube.

Action and Medical Uses.—Jujube decoction is employed in some countries as a demulcent pectoral, and like other acidulous and sweet fruits, jujube enters into the composition of tisanes for the relief of *throat* and *broncho-pulmonic irritations.* Jujube paste is demulcent, but seldom met with in this country.

JUNIPERUS.—JUNIPER.

The fruit (berries) of *Juniperus communis*, Linne.

Nat. Ord.—Coniferæ.

COMMON NAME: *Juniper berries.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 255.

Botanical Source.—This is a small evergreen shrub, never attaining the height of a tree, with many very close branches, the extremities of which are smooth and angular. The leaves are attached to the stem or branches in threes, in a verticillate manner, linear-acerose, sharply mucronate, entire, shining-green on their lower surface, and channeled and glaucous along the center of their upper surface; they are always resupinate, and turn their upper surface toward the ground. The flowers are diœcious, the males in small axillary aments, with roundish, acute, stipitate scales, inclosing several anthers. The female flowers are on a separate shrub, having a small, 3-parted involucre growing to the scales, which are 3 in number. The fruit is fleshy, roundish-oblong, berried, of a dark-purplish color, formed of the confluent, succulent scales, marked with 3 prominences, or vesicles at top, ripening the second year from the flower, and containing 3 bony, angular seeds (L.).

History and Description.—Juniper is common to Europe and this country, growing in dry woods and hills, and flowering in May. The fruit or berries are the medicinal parts; those which are imported from the southern parts of Europe are the best. The American berries possess less medicinal virtue, and are seldom employed. Juniper berries are about the size of currants, of a purplish-black color, shrunken, marked at the top with a triradiate groove, and at the base with the bracteal scales; they contain 3 seeds. Their odor is peculiar, terebinthine, and aromatic, and their taste terebinthine and sweetish, succeeded by some bitterness; these qualities are due to an essential oil, which may be obtained by distillation with water. They yield their properties to hot water or alcohol. An empyreumatic oil—*oil of cade* (see *Oleum Cadinum*), or *huile de cade*, is obtained in France by dry distillation of the wood of *Juniperus Oxycedrus*, Linné.

Chemical Composition.—According to Schimmel & Co., juniper berries contain 1.2 per cent of essential oil in Hungarian, and only 0.7 per cent in German fruit (Flückiger, *Pharmacognosie*, 1891). (Also see *Oleum Juniperi*.) Steer (1856) isolated from the berries a yellow coloring matter which he called *juniperin*. It is soluble in 60 parts of water, also soluble in ether, alcohol, sulphuric acid, and in ammonia with golden-yellow color. Two analyses by Ritthausen and Donath (*Jahresb. der Pharm.*, 1877, p. 62), gave the following percentage composition: Moisture 10.77 (recent), 29.44 (dry); ash 3.37 (R.), 2.33 (D.); dextrose 14.36 (R.), 29.65 (D.); water-soluble matter, consisting of formic, acetic, and malic acids and a bitter substance 11.7 (R.), 3.41 (D.); fat, resin, and volatile oil, 12.24 (R.), 11.33 (D.); protein bodies, 5.41 (R.), 4.45 (D.); cellulose, 31.6 (R.), 15.83 (D.); nitrogen-free matter soluble in sulphuric acid and caustic potash (pectin, Donath) 10.55 (R.), 0.73 (D.).

Action, Medical Uses, and Dosage.—Both the berries and oil are stimulating, carminative, and diuretic. The oil is said to act like copaiba in arresting mucous discharges, especially from the urethra. It is contained in the spiritous liquor called Hollands, one of its best forms as a diuretic. Five minims of the oil, with 1 fluid drachm of nitrous ether, given 3 times a day in any common vehicle, produces diuresis in *dropsy* when other means fail. Combined with an equal part of watermelon seeds, and made into an infusion, I have cured several cases of *ascites* occurring in children, having them to make free use of it (King). The berries are employed principally as an adjunct to other diuretics, and have been found efficient in *gonorrhœa, gleet, leucorrhœa, cystirrhœa, affections of the skin, scorbutic diseases*, etc. *Pyelitis, pyelo-nephritis*, and *cystitis* when chronic, and particularly when in old people, are relieved by juniper. Uncomplicated *renal hyperemia* is cured by it. The indications are a persistent weight or dragging in lumbar region. Dose of the berries, from 1 to 2 drachms; of the oil, from 4 to 20 minims. The infusion (berries, ℥i; aqua, Oj), may be given in wineglassful doses, a pint being taken in a day. It is very useful in the *dropsy* following *scarlatina*, and other infectious diseases, and may be combined with acetate or bitartrate of potassium if desired. OIL OF CADE has been successfully employed in *parasitic skin diseases, moist eczema*, and *psoriasis*.

Preparation of Juniper.—HOWE'S JUNIPER POMADE. This preparation is a compound of lard, oil of juniper and Fowler's solution, the proportions of which have been published in the *Eclectic Medical Journal*. Much pharmaceutical skill is required to blend the ingredients so as to prevent subsequent separation. Juniper pomade is useful in "all forms of *eczema* or *tetter*. It allays the itching and destroys the vesicles and scales. The unguent may be used upon all parts of the body, though sparingly upon mucous surfaces. It is employed in the nasal cavities with a camel's hair brush to mitigate the symptoms of *catarrh*, to arrest *hay-fever*, to heal *nasal ulcers*, to arrest *ringing in the ears*, and to improve states of *deafness* depending upon thickening of the linings of the Eustachian tubes. Juniper pomade softens the scaly patches on the face which are often *epitheliomatous*. It has proved an excellent dressing for *tetter of the edges of the eyelids*, which leads to '*wild hairs*,' and *induration of the tarsal borders*. The pomade is reliable in the treatment of *sore nipples* in nursing women; and it will cure *chapped hands*" (Prof. A. J. Howe, M. D.).

KALMIA.—MOUNTAIN LAUREL.

The leaves of *Kalmia latifolia*, Linne.

Nat. Ord. Ericaceæ.

Common Names: *Mountain laurel*, *Laurel*, *Sheep laurel*, etc. (see below).

Botanical Source and Description.—This plant is known by various names in different sections of the country, as *Laurel*, *Lambkill*, *Ivy*, *Big-leaved ivy*, *Spoonwood*, *Calico-bush*, *Mountain laurel*, etc. It is a beautiful shrub, from 4 to 8 feet high, sometimes attaining the height of a small tree, with crooked stems and a rough bark. The leaves are irregularly alternate and ternate, evergreen, coriaceous, very smooth, with under side somewhat paler, ovate-lanceolate, acute at each end, entire, on long petioles at the ends of the branches, from 2 to 3 inches long. The flowers are numerous, white or variously tinged with red, very showy, clammy, in splendid terminal, viscid-pubescent, simple or compound corymbs, with opposite branches. The pedicels are glutinous and pubescent, with ovate, acuminate bracts. Calyx small, 5-parted, and persistent, with oval acute segments. The corolla is large, monopetalous, with a conical tube, a cyathiform limb, and an erect, shallowy, 5-lobed margin; at the circumference of the limb, on the inside, are 10 niches or pits, accompanied with corresponding prominences on the outside; in these depressions the anthers are found lodged at the time when the flower expands. The stamens are 10, hypogynous, bent outwardly so as to lodge their anthers in the niches of the corolla, but liberating them during the period of flowering and striking against the sides of the stigma; anthers 2-celled with 2 terminal pores. The ovary is roundish, supporting a slender, declinate style longer than the corolla; stigma obtuse. The fruit is a dry capsule, which is roundish, depressed, 5-celled, 5-valved, the valves alternating with the divisions of the calyx. The seeds are numerous, and minute (L.—W.—B.—R.).

Fig. 152.

Kalmia latifolia.

Fig. 153.

Single flower of Kalmia latifolia.

History.—Sheep laurel, or more properly Mountain laurel, inhabits most parts of the United States, on rocky hills and elevated grounds, and in damp soil, sometimes forming a dense thicket, with a profusion of beautiful rose-colored flowers which appear in June and July, forming a contrast with its dark, glossy, green leaves. The leaves are reputed to be poisonous to sheep and several other animals, killing them; while others again, as deer, goats, and partridges, feed upon them without any unpleasant consequences. When partridges, which have eaten the laurel leaves, have themselves been cooked and eaten, they are said to have occasioned sickness at stomach, headache, impaired vision, difficult breathing, coldness of the surface and extremities, and other symptoms similar to those caused when putrid meats are eaten. An emetic of mustard with warm water has relieved some of the above symptoms by removing the poison from the stomach. It is very doubtful, however, whether these symptoms were caused by the poisoned flesh of the birds, as numerous persons eat partridges that have fed on these leaves, without the least inconvenience. The Indians are said to have used the expressed juice of the leaves, or a strong decoction, for the purpose of committing suicide. They also made spoons of the wood, hence the name spoonwood. The leaves, which are astringent and bitter (*described above*), are the medicinal parts, and yield their virtues to alcohol or water.

Chemical Composition.—The leaves contain, according to Mr. C. Bullock, fatty matter, resin, tannic acid, gum, a body somewhat like mannit, chlorophyll, wax, albumen, an acrid substance, extractive, yellow coloring matter, and various salts (*Amer. Jour. Pharm.*, Vol. XX, p. 264). Mr. G. W. Kennedy (1875) isolated *arbutin* in small quantity. The poisonous principle is *andromedotoxin* ($C_{31}H_{51}O_{10}$), a neutral body, found by Prof. Plugge in several poisonous, ericaceous plants (see also investigation by A. J. M. Lasché, *Pharm. Rundschau*, 1889, p. 208). It is soluble in water (1 in 35), chloroform (1 in 400), alcohol (1 in 9), and almost insoluble in ether (1 in 1400). The diluted mineral acids, when warm, impart to it a beautiful red color. Miss De Graffe (*Amer. Jour. Pharm.*, 1896, p. 321), found tannin resembling oak-tannin in the stems and leaves of mountain laurel. Mr. Harry Matusow (*Amer. Jour. Pharm.*, 1897, p. 341) analyzed the root of Kalmia latifolia, which contained 11.4 per cent of starch, 1.24 per cent of ash, tannin resembling oak-tannin, etc. The ether extract contained a substance which gave reactions for *andromedotoxin*.

Action, Medical Uses, and Dosage.—In immoderate doses, sheep laurel is a poisonous narcotic, producing the symptoms above named, with diminished circulation. In medicinal doses, it is antisyphilitic, sedative to the heart, and somewhat astringent. Internally, either in powder, decoction, or tincture, it is an efficient remedy in primary or secondary *syphilis*, and will likewise be found invaluable in *febrile and inflammatory diseases* and *hypertrophy of the heart*, allaying all febrile and inflammatory action, and lessening the action of the heart. In *active hemorrhages, diarrhœa*, and *flux*, it has been employed with excellent effect. and will be found useful in overcoming *obstinate chronic irritation of mucous surfaces*. I have extensively used this agent, and regard it as one of our most efficient agents in *syphilis;* and have likewise found it very valuable in *inflammatory fevers, jaundice*, and *ophthalmic neuralgia* and *inflammation*. The remedy must always be used with prudence; and should any of the above mentioned symptoms appear, the dose must be diminished, or its use suspended for a few days. In cases of poisoning by this article, stimulants, as brandy, whiskey, etc., must be given, with counter-irritation to the spine and extremities. Sheep poisoned by eating the leaves, have been saved by administering 1 or 2 gills of whiskey to them (King). Scudder (*Spec. Med.*), states that he has employed it with marked advantage in *secondary syphilis* and *atonic chronic inflammations*. For the treatment of aching pains in the muscles of the face, *muscular rheumatism* with shifting pains, and in the early stage of *rheumatism of the heart*, success has been claimed for this drug, the specific medicine being used in from 1 to 5-drop doses. *Bright's disease(?)* is asserted to have been benefited by its use. Pain in the back during the menstrual period, and pain upon moving the eyes are said to be relieved by kalmia. Externally, the fresh leaves stewed in lard, or the dried leaves in powder mixed with lard to form an ointment, are said to be beneficial in *tinea capitis, psora*, and other *cutaneous affections*. "Some time since I treated a case of syphilis of five weeks' standing, which had not received any kind of treatment during that period. The patient, at the time I first saw him, had several chancres, the surface of the body and head was covered with small red pimples, elevated above a jaundiced skin, and he was in a very debilitated condition. I administered a saturated tincture of the leaves of kalmia, and touched the chancres with a tincture of chloride of iron, and effected a cure in 4 weeks, removing the jaundice at the same time" (King). The saturated tincture of the leaves or specific kalmia, are the best forms of administration; they may be given in doses of from 10 to 20 drops every 2 or 3 hours; the decoction may be given in doses of from ½ to 1 fluid ounce; and of the powdered leaves, from 10 to 30 grains. For acute disorders, particularly affections of the heart, from 5 to 20 drops of specific kalmia may be added to 4 fluid ounces of water, and the dilution administered in teaspoonful doses every hour. A salve made of the juice of the plant, forms an efficient local application for *rheumatism*. This remedy was a great favorite with Prof. King, especially for troubles depending primarily upon syphilitic infection.

Specific Indications and Uses.—Syphilis with excitation of the heart and circulation; rheumatism with shifting pains; cardiac excitation; cardiac palpitation excited reflexly from gastro-intestinal irritation; pain upon movement of the eyes.

Related Species and Derivative.—There are other species of Kalmia, as *Kalmia glauca*, Aiton, or *Swamp* or *Pale laurel*, and *Kalmia angustifolia*, Linné, or *Narrow-leaved laurel*, which possess similar properties. The *K. angustifolia* is supposed by some to be the best of the species for medicinal use. Lasché, in 1889, found *andromedotoxin* in the leaves and twigs of the latter plant, as well as the berries of *Kalmia latifolia*. This plant is used by the Cree Indians as a tonic and remedy for *intestinal irregularities*.

Laurotetanine.—M. Greshoff has found in a number of Laurel species a crystalline, toxic alkaloid (*laurotetanine*), soluble in an excess of alkali. It closely resembles strychnine in its action upon the spinal cord (*Pharm. Jour. Trans.*, 1891, Vol. XXI, p. 662).

KAMALA (U. S. P.)—KAMALA.

"The glands and hairs from the capsules of *Mallotus philippiensis* (Lamarck), Müller Arg."—(*U. S. P.*); (*Echinus philippinensis*, Baillon; *Rottlera tinctoria*, Roxburgh; *Croton philippensis*, Lamarck).

Nat. Ord.—Euphorbiaceæ.

Common Names: *Rottlera* (*U. S. P.*, 1870), *Kamala*, *Kameela*, *Spoonwood*.

Illustration: Bentley and Trimen, *Med. Plants*, 236.

Botanical Source and History.—This is a small tree or arborescent shrub, found in the hilly parts of India, along the base of the Himalaya mountains from Assam to near Perhawur, in Mysore, and near Bombay, in Australia, China, Abyssinia, etc., and growing from 15 to 30 feet high. It was formerly known as *Rottlera tinctoria*. Its leaves are entire, petiolate, ovate, and acute. The fruit of this plant is about the size of a hazel-nut, tricoccous, with its external covering trifurrowed, and thickly covered with glands of a pulverulent appearance, and a reddish color. These glands are the parts used, and are obtained by simply brushing them off from the ripe capsule, which usually ripens between the last of January and the first of April. In Hindustan this powder, under the name of *wurrus* (see *Related Drugs*), has been extensively employed as a dyeing agent.

Description.—Kamala, when recent, has a peculiar, heavy odor (inodorous, *U. S. P.*), increased on being rubbed between the fingers, or upon being warmed, but which diminishes with age. In the mouth it is gritty and has a somewhat acrid taste. When exposed to a temperature of 93.3° to 100° C. (200° to 212° F.) it undergoes no apparent alteration; when a small portion is dropped into a flame it flashes up instantaneously. Its best solvents are alcohol, ether, and solutions of alkalies, from which it is precipitated by water or acid, in the form of a resinous substance.

The *U. S. P.* thus describes the official drug: "A granular, mobile, brick-red or brownish-red powder, inodorous, and nearly tasteless, imparting a deep-red color to alkaline liquids, alcohol, ether, or chloroform, and a pale-yellow tinge to boiling water. Under the microscope it is seen to consist of stellately arranged, colorless hairs, mixed with depressed-globular glands, containing numerous red, club-shaped vesicles. Upon ignition it should leave not more than 8 per cent of ash"—(*U. S. P.*). Dr. F. A. Flückiger states that if the glands are caused to roll under water or glycerin, they all ultimately show, to the observer, under the microscope their flat side. In its center we find a very short stalk-cell, from which a certain number of small clavate cells radiate in different directions, thus constituting the somewhat globular form of the gland, which is covered by a weak integument. The thicker ends of the small clavate cells within appear at the outside as soft protuberances, upon which partly depends the irregularity of the nearly globular form of the glands. The radiate cells in question are arranged around the center of the flat side to the number of from 9 to 30. If only the basal side is examined, they will be seen to be filled with a dark-brown or brownish-red resin, the intermediate spaces and the outer membrane being of a light-yellow color. The outline of that side, which is always turned to the observer, forms thus an undulated circle or ellipsis, the diameter of which varies from 70 to 120 micromillimeters (thousandth parts of a millimeter), the height of the whole gland being always considerably less. The kamala glands are always accompanied by a tolerable amount of characteristic, stellate, colorless, or brownish hairs, belonging equally to the fruits of *Mallotus*, and some fragments of the latter, and inorganic impurities (*Pharm. Jour.*, Dec., 1867, p. 279).

Chemical Composition.—Kamala contains a small amount of moisture (0.5 to 3.5 per cent), starch, tannin, gummy extractive, citric and oxalic acids, volatile oil, and ash, but consists chiefly (to 80 per cent) of a red-colored resin, which is soluble in ether, alcohol, carbon disulphide, amyl alcohol, glacial acetic acid; also in alkalies, imparting to the latter a beautiful red color. Leube (1860) differentiated the ether-soluble part of kamala into a resin freely soluble in alcohol, fusing at 80° C. (176° F.), and another, less soluble, fusing at 191° C. (375.8° F.). Anderson (1855) observed a yellowish-brown crystalline sediment in an ethereal solution of the resin, and named it *rottlerin* ($C_{22}H_{20}O_6$). By fusion with caustic potash, Flückiger obtained from this substance *para-oxy-benzoic acid*. *Rottlerin* (or *kamalin* of Merck; see Flückiger, *Pharmacognosie*, 1891, p. 261), is probably the same substance as *malloloxin* ($C_{18}H_{16}O_5$, or $C_{11}H_{10}O_3$), obtained in flesh-colored needles from kamala by A. G. and W. H. Perkin (1886), and by Jawein (1887), the latter observing its melting point at 200° C. (392° F.). Acids reprecipitate this substance from its solution in alkalies. The ash of kamala was found by Flückiger and Hanbury not to exceed 3 per cent in a good grade; the *U. S. P.* allows 8 per cent. A red color of the ash points to the presence of ferric oxide. H. G. Greenish (*Amer. Jour. Pharm.*, 1893, p. 193) calls attention to a *false kamala* observed by him in trade, and which consisted mainly of powdered safflower, carelessly collected and badly preserved.

Action, Medical Uses, and Dosage.—This article has been known as a remedy for *tapeworm* among European and American physicians, for only a few years, though long known and employed for this purpose in India. Dr. C. Mackinnon, a surgeon in the English army in India, first made its properties known to the profession, he having been almost invariably successful with it. Since then other practitioners have employed it with equal success. In doses of from 2 to 4 drachms it purges, often with griping, or nausea and vomiting, and producing from 4 to 10 or 15 stools. The worm is usually expelled entire, but often without the head, in the third or fourth stool, after 3 drachms of the powder have been administered. A strong alcoholic tincture acts more mildly and with more uniform effects. *Round* and *seat worms* are also said to be expelled by it. The dose of the powder for an adult is from 2½ to 3 drachms, given in mucilage, syrup, or other vehicle; of the tincture, made in the proportion of 3 ounces to ½ pint of alcohol, ½ fluid ounce. The dose to be repeated, if necessary. Dose of specific kameela, as a tænifuge, 30 to 60 drops, every 3 hours, until 5 or 6 doses have been taken. Externally, its employment is stated to be efficient in certain cutaneous affections, particularly *scabies* and *herpetic ringworm*.

Related Drug.—WARS, WURRAS, or WARRAS. This term properly signifies saffron, but has been applied not only to kamala, but more especially to a certain powder, the botanical source of which is not definitely known, though thought to come from *Flemingia Grahamiana*. This is the substance referred to and beautifully illustrated in the paper from which the above quotation (see *Kamala, description*) is extracted. Dr. Flückiger therein refers to a new kind of kamala, which he thinks must belong to another plant. It is darker colored, more free from earthy impurities, and its grains are all larger than those of the old or true kamala, and instead of being globular they are cylindrical or nearly conical; its cells are not clavate, but simply subcylindrical, and not radiate, and the hairs with which it is mixed are nearly colorless, and not stellate or tufted, as in the true kamala, but quite simple. When exposed to a temperature of 93.3° to 100° C. (200° to 212° F.), the new kamala becomes intensely black. Its alcoholic tincture, slowly evaporated, leaves microscopic crystals, probably the *rottlerin* of Dr. Anderson. It is imported from Aden. (For interesting details regarding wars, see Flückiger, *Pharmacognosie*, 2d ed., 1883, p. 236).

Other Tæniafuges.—*Embelia ribes*, Burmann. *Nat. Ord.*—Myrsineæ. India. The berries of this tree are aromatic, and have been used to adulterate pepper. The color is dull-red. The stalk and 5-parted calyx are often attached; the apex is beaked; and the surface striated. The taste is pleasantly astringent and feebly aromatic. It is tæniacide. The natives of India attribute tonic, alterative, and especially anthelmintic properties to it. It is said to cause the death of the worm. It enters into the local applications for skin diseases, especially [illegible], and has some reputation as a carminative stomachic in *dyspepsia*. The natives further believe that its use, with licorice, tends to strengthen the body, and prevent the ill-effects of old age (Dymock, *Mat. Med. Western India*). Warden (1888) isolated from it golden-yellow crystals of *embelic acid* ($C_9H_{14}O_2$). It is soluble in alcohol and chloroform, but not in water. For *tapeworm*, *Embelia ribes* is given in powder (ʒi to ʒiii) with milk, upon an empty stomach, and followed with a purgative.

MUSENNA, MESENNA, BISINNA, or BUSSENA. The bark of *Acacia anthelmintica*, Baillon. *Nat. Ord.*—Leguminosæ. An acrid drug containing, according to Thiel (1862), bitter and sweet principles, besides *musenin*, an amorphous, saponin-like principle. An Abyssinian remedy for *tapeworm*, taken in doses of 2 or 3 ounces of the powder, followed after some time with a purgative. It is said to cause nausea, and the worm is expelled in a pulpy condition.

Kossala is a remedy employed by the Abyssinians for the removal of *tapeworm*.

Ophioxylon serpentinum.—East India. The root contains an essential oil and *ophioxylin* $C_{16}H_{12}O_6$, a yellow, crystalline body. The root is used by the natives as an anthelmintic and cathartic.

Saoria.—Fruit of *Mæsa lanceolata*, Forskal. *Nat. Ord.*—Myrsineæ. Abyssinia. A brown-green, resinous drupe, having a bitter, acrid, pungent taste, and sometimes causing nausea, emesis, and catharsis. It contains, according to Apoiger (1857), pectin, an iron-greening tannin, fatty and volatile oil, and an acrid body. Wittstein and Apoiger (*Amer. Jour. Pharm.*, 1858, p. 159) established the remarkable occurrence of *boric acid* among the mineral constituents of this plant. Reputed an effective tæniacide. Administered in powder. It is said to impart a violet hue to the urine.

Tatzé, or Satzé.—A disagreeable fruit, of a red-brown color, derived from the *Myrsine africana*, Schimper. Tæniacide. Dose, 4 to 6 drachms.

KINO (U. S. P.)—KINO.

"The inspissated juice of *Pterocarpus Marsupium*, Roxburgh"—(*U. S. P.*).

Nat. Ord.—Leguminosæ.

Common Name: *Gummi kino*, *Resina kino*, *Buja* (Bengalese).

Illustration (of tree): Bentley and Trimen, *Med. Plants*, 81.

Botanical Source.—For a long time the origin of kino was unknown. It has been ascertained to be the product of a lofty tree, growing upon the mountains of the Malabar coast of Hindustan, named *Pterocarpus Marsupium*, belonging to the *Nat. Ord.* Leguminosæ. It has an erect, very high trunk, rarely straight. The outer layer of the bark is brown and spongy, falling off in flakes; the inner red, fibrous, and astringent; branches spreading, horizontal, numerous, and far-extending. The leaves are sub-farious, alternate, pinnate with an odd one, 8 or 9 inches long; leaflets 5, 6, or 7, alternate, elliptic, emarginate, firm, deep-green, and shining above, less so below, from 3 to 5 inches long, and 2 or 3 broad. The petioles are round, smooth, waved from leaflet to leaflet, 5 or 6 inches long, stipules none. Panicles terminal, very large; ramifications bifarious, like the leaves. Peduncles and pedicels round, a little downy. Bracts small, caducous, solitary below each division and subdivision of the panicle. The flowers are very numerous, white, with a small tinge of yellow. Vexillum with a long, slender claw, very broad; sides reflexed, waved, curled, and veined; keel 2-petaled, adhering slightly for a little way near the middle, waved, etc., same as the vexillum. Stamens 10, united near the base, but soon dividing into 2 parcels of 5 each; anthers globose, 2-lobed. Ovary oblong, pedicelled, hairy, generally 2-celled; cells transverse, 1-seeded. Style ascending. The legume, which is borne on a long petiole, is three-fourths orbicular, the upper remainder, which extends from the pedicel to the remainder of the style, is straight, the whole surrounded with a waved, veiny, downy, membranous wing, swelled, rugose, woody in the center, where the seed is lodged, not opening; generally 1, but sometimes 2-celled. Seeds single and reniform (L.).

History and Description.—Kino is the juice of the tree obtained by making longitudinal incisions in the bark; it flows abundantly, has a red color, and by drying in the sun, cracks into irregular, angular masses, which are then placed into wooden boxes for exportation. It usually reaches this country by way of England, being originally imported from Bombay or Tellicherry. East India (or Malabar) kino is that recognized by the *U. S. P.*, which describes it as follows:

"Small, angular, dark, brownish-red, shining pieces, brittle, in thin layers ruby-red and transparent, inodorous, very astringent and sweetish, tinging the saliva deep-red. Soluble in alcohol, nearly insoluble in ether, and only slightly soluble in cold water"—(*U. S. P.*). Kino burns without fusion or softening, with but little flame and frothing, leaving a scanty gray ash. Boiling water dissolves a large proportion of it, forming, when cold, a permanent, intense, blood-red solution, which yields with ferric chloride a dark-green, coarsely flocculent precipitate, which is so abundant as to render the whole liquid gelatinous. Acetate of lead produces a gray precipitate, and tartar emetic gradually a lake-red, muddy jelly. Cold water, which partly dissolves it, forms with it a clear, cherry red solution, leaving a crumbly, grayish residuum. Alcohol dissolves about two-thirds of it, and forms a deep, brownish-red tincture, which is not disturbed by water. By long standing the tincture gelatinizes, and becomes less astringent. Proof-spirit is a less complete solvent, but the tincture is less apt to gelatinize. Its solubility in water is facilitated by alkalies, but its astringency is thereby lost, and its general characters changed.

Chemical Composition.—The chief constituent of kino is *kino-tannic* (*coccotannic*) *acid*, which is present in the amount of from 45 to 55 per cent (F. E. Mafat, *Pharm. Jour. Trans.*, 1892, Vol. XXIII, p. 146). It is closely related to the tannin from catechu; its non-glucosidal nature was established by Bergholz (*Dissert. Dorpat*, 1884). Unlike catechu, however, kino yields to ether no *catechin* (*catechuic acid*). This solvent, according to Eissfeldt (1854), abstracts from kino only traces of *pyrocatechin* ($C_6H_4[OH]_2$). On continued boiling of an aqueous solution of kino or *kino-tannic acid*, an insoluble, red phlobaphene, *kino-red*, is precipitated. This substance is also formed gradually by prolonged exposure of solutions of kino at ordinary temperature (Gerding, 1851). By fusion with caustic potash, Hlasiwetz (1865) obtained from kino 9 per cent of *phloroglucin* ($C_6H_3[OH]_3$); *protocatechuic acid* ($C_6H_3[OH]_2.COOH$) has also been observed in this reaction (Stenhouse). *Kinoïn* ($C_{14}H_{12}O_6$) is a crystallizable substance obtained by Etti (1878 from Malabar kino, by boiling this with diluted hydrochloric acid, decanting from the *kino-red* formed, and abstracting the aqueous solution with ether (see *Jahresb. der Pharm.*, 1878, p. 190).

The yield of *kinoïn* is 1.5 per cent. Etti found this substance to be decomposable by hydrochloric acid into *gallic acid* ($C_6H_2[OH]_3.COOH$), *pyrocatechin*, and *methyl chloride*. Heated to 130° C. (266° F.), it loses water and is converted into *kino-red* ($C_{28}H_{22}O_{11}$). *Kinoïn* is soluble in alcohol and boiling water, little soluble in ether; its solutions produce with ferric chloride a red coloration, and are not precipitated by gelatin. *Kino-red* is hardly soluble in water, soluble in alcohol and alkalies; its solutions are precipitated by gelatin, and colored green by ferric chloride. A. Kremel was unable to obtain *kinoïn* by Etti's method; in its place he invariably found *protocatechuic acid* (see *Jahresb. der Pharm.*, 1884, p. 281). Good kino leaves about 1.5 per cent of ash.

Action, Medical Uses, and Dosage.—Kino is a pure and energetic astringent, and may be used to fulfil all the indications for which catechu is employed. It is not considered so efficient in *chronic dysentery* as catechu, but is preferred internally in *menorrhagia*, and as a topical application in *leucorrhœa*, *relaxed sore throat*, and *aphthæ* of the mouth or fauces. An infusion thrown into the nostril has suppressed *hemorrhage* from the Schneiderian membrane; and the powder on lint has suppressed a hemorrhage from a wound in the palate. Dose of the powder, from 10 to 30 grains; of the tincture, from ½ to 2 fluid drachms.

Related Drugs.—There are many other exudations known in commerce as *Kino*, partly derived from plants belonging to entirely different natural orders, *e. g.*, many species of *Eucalyptus*, *Myristica*, etc. Among the most important are the *African kino*, *Dhak-tree kino*, *Botany Bay kino*, *Jamaica kino*, and *South American kino*.

African Kino, *Gambia kino*, until within recent years was very rarely seen in commerce; from specimens received from Mungo Park, when on his last journey, it was decided to be an exudation from the *Pterocarpus erinaceus*, Poiret, a tree growing in many districts of the Senegal, Nunez, and along the banks of the Gambia and other streams of West Africa. Its behavior is similar to that of ordinary kino. According to Th. Christy, of London, this tree yields the genuine kino that was first introduced into medicine by Dr. Fothergill. An authentic commercial specimen left 1.75 per cent of ash, and contained 52 per cent of tannin, while other commercial species yielded from 2.6 to 7 per cent ash, and from 14 to 39 per cent tannin.

Dhak-tree Kino, *Butea kino*, *Bengal kino*, *Butea gum*, *Palas kino*, *Pilas kino*, *Gum of the Palas* (*Dhak-tree*), is the product of the *Butea frondosa*, Roxburgh, a magnificent leguminous tree of the East Indies. *Butea superba*, Roxburgh, and *Butea parviflora*, Roxburgh, exude a similar product. The juice naturally exudes from fissures in the branches of the tree, and concretes into red tears which become black under the action of the sun. They are irregularly angular, seldom so large as a grain of barley, apparently black and opaque, but really of an intense garnet-red color, transparent in thin pieces, and frequently have fibers of bark adhering to one of their faces. Their taste is very astringent, brittle when chewed, without adhering to the teeth, and they tinge the saliva lake-red. Their chemical reactions and solubilities are similar to those of the East India variety. They contain from 73 to 90 per cent of tannic acid, and might be safely substituted for ordinary kino. It rarely reaches England, and has not been imported to America. It is termed *Gum butea*.

BOTANY BAY KINO, *Australian kino*, or *Eucalyptus kino*, first described by White and Smith, in 1790, was believed to be the astringent inspissated juice of the brown gum tree of New Holland (the *Eucalyptus resinifera*), a fine tall tree belonging to the *Nat. Ord.*—Myrtaceæ, and was stated to yield a red juice so profusely from incisions that 60 gallons might be collected from one tree. According to J. H. Maiden (*Pharm. Jour. Trans.*, Vol. XX, 1889, pp. 221 and 321), these statements are considerably overdrawn, and the peculiar *Eucalyptus resinifera* botanically described by Smith, can not now be identified, as the majority of Australian eucalyptus species are resin-bearing plants. Only one species, however, is of commercial value (although Maiden recommends several others), viz., *Eucalyptus rostrata*, Schlecht., growing in enormous quantities along the Murray River, in Australia; it yields the *Murray red-gum*, or *Red-gum kino*. The product obtained from all other species is sparingly soluble in water and alcohol and therefore commercially unsuitable, but this is probaly due to prolonged exposure of the resin to the air before it is gathered. This inferior grade has been used as an adulterant of the better grades of kino. Mr. Joseph Bosisto (*Amer. Jour. Pharm.*, 1897, p. 533), states that the *red-gum* of *E. rostrata* lodges itself in the ducts between the bark and the wood, and when tapped it can be obtained in rather large quantities. J. H. Maiden (*Amer. Jour. Pharm.*, 1897, p. 1) gives the highest yield at 4 gallons, the average being 1 quart from one tree. On evaporating the juice in a vacuum pan a ruby-red gum is obtained, entirely soluble in water and alcohol. Commercial specimens yielded about 47 per cent of tannic acid. The turbidity observed with some of the kinos from Australian eucalyptus (including *E. rostrata*), when dissolved in alcohol or water, is due to the presence of two crystallizable substances, *eudesmin* and *aromadendrin*. (For details regarding the chemistry of these substances, see Henry G. Smith, *Amer. Jour. Pharm.*, 1896, p. 679).

JAMAICA, or WEST INDIAN KINO, is obtained from the *Sea-side grape* (*Coccoloba uvifera*, Linné), a tree belonging to the *Nat. Ord.*—Polygonaceæ. The tree inhabits the seacoast of the West India Islands and the adjoining coast of America. A decoction is prepared from the leaves, wood, and bark, which are excessively astringent, then evaporated, and the thick fluid poured into vessels, in which it solidifies upon cooling. Upon extracting it from the vessels containing it, it is readily reduced to pieces varying in size, generally about as large as a small cherry, and with a disposition to the orthogonal form. They are ligliter colored, and less shining than the ordinary kino, are impervious to light in bulk, but garnet-red and semi-transparent in thin fragments; are brittle and pulverable, forming a paler-colored powder than the commercial drug. They are inodorous, amarous, and excessively astringent, impart a red hue to the saliva when masticated, and contain about 41 per cent of tannic acid. Cold water, and alcohol, dissolve nearly the whole of West Indian kino, about 6 to 11 per cent remaining undissolved.

SOUTH AMERICAN, COLUMBIA, or CARACAS KINO, is probably furnished by the same tree as the West Indian, and is likewise probably derived from the *Coccoloba uvifera*, Linne. It is imported in heavy masses, and closely resembles the Jamaica kino in its several properties, excepting that it is equally soluble in cold water and alcohol, is more free from any tenacious substance interfering with the filtration of its watery solution, and contains no resinous body. It is rarely seen in America.

MYRISTICA KINO (*Kat jadikai*) is an extract resembling official kino, obtained as an exudation upon making incisions into the bark of *Myristica malabarica*, Lamarck, a tree growing in southern India. The product was studied in recent years by Prof. Ed. Schaer (*Amer. Jour. Pharm.*, 1896, p. 546), who found that the myristica kino agrees in all characteristics with true kino, except that no *pyrocatechin* could be abstracted with ether. A characteristic constituent of *Myristica kino*, however, was found both in a dry specimen obtained from the Kew Gardens, and a semi-liquid extract prepared for the author in the Buitenzorg (Java) Botanical Garden, namely, crystals of *calcium tartrate*, the presence of which, therefore, seems to indicate *Myristica kino*, and to distinguish it from the official kino. *Myristica succedanea* seems to yield most of these crystals.

Pterocarpus indicus, Willdenow.—Philippine Islands and South India. This species yields a red kino of a fetid character, known as *Sang dragon*.

CERATOPETALUM.—A kino-like gum. Is said to be obtained from a plant of this genus growing in New South Wales.

KOLA.—KOLA.

The seeds of *Sterculia acuminata*, Palisot de Beauvais (*Cola acuminata*, Robert Brown). It has many other synonyms. (See *Kola*, Monograph No. 5, of Frederick Stearns & Co.)

Nat. Ord.—Sterculiaceæ.

COMMON NAMES: *Kola, Kola nut, Female kola, Cola* (*Bissy-bissy, Guru*, Vernacular).

ILLUSTRATIONS: *Kola*, Monograph No. 5, of Frederick Stearns & Co., Figs. 3, 5, 6 and 11; *Kola Illustrated*, by Johnson & Johnson.

Botanical Source.—This is a tree from 40 to 60 feet high, somewhat resembling the common chestnut tree. The trunk is erect, smooth, and cylindrical. The bark is green and thick. The leaves are alternate, entire, slightly revolute, smooth, green, and oblong-acuminate, from 8 to 6 inches long by 1 to 2 inches broad. They are borne on petioles from 1 to 3 inches long. The younger leaves are pubescent. The flowers are polygamous, and borne in both terminal and axillary cymose panicles, beset with stellate hairs. The flowers are greenish-yellow or white and purple at the margins of the petals. The fruit is composed of follicles, containing from 1 to 10 oblong, obtuse seeds, with a cartilaginous, purplish testa. The cotyledons are generally 2 in number (may be 3 to 5), red or greenish-yellow, flatly ovate, or auriculate, compressed, and thick.

Fig. 154.

Sterculia acuminata.

History.—The kola tree grows in a somewhat limited locality, comprising that portion of western Africa between Sierra Leone and the Congo and Lower Guinea. It thrives at about or a little higher than the sea level, in hot and moist situations. When conditions of soil and climate are favorable, it grows inland from the points mentioned 500 or 600 miles. It has been found elsewhere, though undoubtedly introduced, as in Jamaica, where it was distributed by slave traders. The English and French have introduced it into many of their possessions, and the gulf and Pacific coast districts of the United States are said to possess the required climate and soil for its growth in this country. The travels of Leo Africanus (in the 16th century) referred to this tree as the Gora or Guru, and he wrote concerning its bitter nut. Clusius (1591) described and illustrated the seeds. J. Bauhin first referred to its medicinal use, noting its employment by the natives in fevers. Kola seeds have been used by the African natives from time immemorial as a necessity and a luxury. It figured as an indispensable necessity in many ceremonials—social, political, and religious. It was used as a declaration of war (red nut), and as a symbol of peace (white nut). It figured in courtship and marriage, compacts of friendship, as a mark of hospitality, and was put into the graves of the dead to nourish them on their long journey. The natives masticated kola to allay hunger, prevent thirst, promote digestion, and sustain strength. Like the so-called Indian clearing nut, it was accredited with the property of purifying and sweetening water. The natives prefer it over tea and coffee, and innumerable are the fabulous virtues ascribed to it. In civilized countries kola was known chiefly as a curiosity until quite recently. In 1883, Heckel and Schlagdenhauffen published a detailed monograph concerning it, entitled "*Sur les Kolas Africains.*" It now has an extensive commerce in this country. (For exhaustive and instructive matter concerning kola consult "*Kola,*" by Frederick Stearns & Co., and *Kola Illustrated*, by Johnson & Johnson; see also an interesting illustrated paper by F. B. Kilmer, on *Bissy nuts*, the *Kola* of the West Indies, in *Amer. Drug.*, 1894, p. 356.)

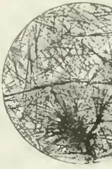
Description.—Kola nuts, so-called, are the cotyledons of the seeds, deprived of their purplish, cartilaginous testa. The irregular seeds, owing to close nesting in the follicle, have a compressed, somewhat triangular and subtetragonal shape, and bear considerable resemblance to the horse-chestnut. The cotyledons, which may number from 2 to 5, are fleshy and thick, and about 1 inch in length. They have, when fresh, a bitterish, somewhat astringent taste. When dried, however, they possess a mild and faintly aromatic taste, and an odor that has been compared to that of nutmegs. There are two varieties of kola nut—the *white kola*, which is more nearly "a pale greenish-yellow," and the *red kola*—both being yielded by the same species, and often occurring in the same pod.

Chemical History and Composition.—O. Dapper, in his description of Africa (Amsterdam, 1670), states that the kola nut, "as experience teacheth, eaten in the evening, hindereth sleep" (J. O. Schlotterbeck, in "*Kola,*" published by F. Stearns

& Co.). That this effect was due to the presence of *theine* (*caffeine*), was ascertained, in 1864, by Dr. Daniell, a noted traveller in West Africa, who also supplied Dr. Attfield with the drug for the purpose of analysis. Beside *theine* (*caffeine*) (2.13 per cent), starch (42.5 per cent), ash (3.20 per cent), volatile oil, fat, albuminoids, gum, and sugar were found by the latter chemist (*Pharm. Jour. Trans.*, 1864, Vol. VI, p. 450).

More recently, Heckel and Schlagdenhauffen (*Sur les Kolas Africains*, 1883), discovered, in addition, small quantities of *theobromine* ($C_7H_8N_4O_2$, the chief alkaloidal principle of cacao (*Theobroma Cacao*); *tannin*, a substance not recorded by Attfield; and a residual, peculiar and physiologically active substance, called *kola-red*. E. Knebel, in 1892, concluded that the kola-red of these French chemists was an impure glucosid, to which, in its pure form, he gave the name *kolanin*. According to Knebel, *kolanin* is a combination of equal molecules of *caffeine*, glucose, and *kola-red* proper, a body closely allied to the tannins. It is decomposed into its constituents by drying the drug, or by the action of diluted acids, or a certain diastatic ferment, which he succeeded in isolating. The gradual decomposition and consequent liberation of caffeine would account for discrepancies observed in the analyses on record. In this connection, see an interesting paper on *kola* and *kolanin*, by F. B. Kilmer, in *Amer. Jour. Pharm.*, 1896, p. 96. The recent exhaustive researches of James W. T. Knox and A. B. Prescott (*Proc. Amer. Pharm. Assoc.*, 1896, p. 136; and 1897, p. 131) have shown, however, that the caffeine compound, called by Knebel *kolanin*, is simply a *kolatannate of caffeine*, the *kolatannic acid* itself being free from sugar, thus differing from *caffeotannic acid*.

Fig. 155.



Crystals of Caffeine.

Kolatannic acid (*kolatannin*) exists in kola both free and in combination with caffeine, and was obtained in pure form by abstracting it by repeated shakings with acetic ether, after removing the alkaloids with chloroform. (For the details of this painstaking process, as well as the description of its acetyl and bromine derivatives, prepared in order to clear up the constitution of this compound, consult the original paper.) The formula for *kolatannin* is $C_{20}H_{10}O_8$. It is completely soluble in water, alcohol, acetone ethyl ether; sparingly so in ether; and insoluble in chloroform and benzin. Fusion with caustic potash yields *protocatechuic acid* ($C_6H_3[OH]_2.COOH$) and *phloroglucin* ($C_6H_3[OH]_3$). Boiling with diluted acids converts it into an insoluble *red body* of variable composition; the filtrate yields to ether *protocatechuic acid*. *Kolatannin* is to be classed with the oak tannin group, as contradistinguished from the gall tannin group (Trimble), the former group yielding with ferric salts a green (the latter a blue) solution and precipitate, with calcium hydroxide a light-pink precipitate, turning red, then brown (the gallotannic group forming a white precipitate, turning blue), and with bromine water a yellow precipitate, turning brown, while the latter group yields no precipitate.

The question of assay methods seems to be still a matter of some controversy. For a resume of the methods of J. Jean (1896), F. Carles (1896), and the method of Knox and Prescott (1897), see the paper of these chemists herein referred to; also see K. Dieterich, *Pharm. Centralhalle*, 1897, p. 675.

A. R. L. Dohme and H. Engelhardt (1896) found specimens of African kola to yield more caffeine (2.24 per cent) than Jamaica kola (1.93 per cent).

Action, Medical Uses, and Dosage.—The action of kola has been compared to that of coffee and cocoa, but it differs even from these, and from that of the two principles—caffeine and theobromine—contained in it. Upon the stomach it appears to exert a tonic influence, improving digestion. This it does either by increasing secretion or by acting upon the circular fibers of the stomach (Monnet). It increases the functions of the cerebro-spinal system and sympathetic system. This is the effect of small and medium doses, rendering one capable of severe mental exertion, overcoming mental depression, and the tendency to somnolency. Large doses produce overstimulation, and thus tend to destroy the usefulness of the drug when given in proper doses. Physical strength is augmented and sustained by kola, its action upon the muscular system, increasing contractility, being pronounced. It must not be forgotten, however, that while kola has considerable power in warding off physical and mental depression and exhaustion, that statements regarding its action in this respect are largely overdrawn. Kola is a tonic to the heart, regulating its contractions and increasing its power. Under a weakened state of the heart, kola causes the pulsations to become fuller and less frequent. Arterial tension is increased by the drug, diuresis augmented, an especial increase of the watery portion of the urine having been observed. Tissue waste is retarded under its administration, the excretion of urea being diminished.

Kola is undoubtedly of value in certain conditions, hinging chiefly on *nervous depression*. *Hysteria* and *neurasthenia*, with mental gloominess and forebodings, have been relieved by it. In *melancholia* it appears sometimes useful, particularly if that condition be associated with *phthisis*. The neurasthenic conditions following exhaustive discharges, or following typhoid and other fevers, is a field for its exhibition. It is very useful in *cerebral anemia*. The guiding symptoms, after protracted illness, are mental depression, tendency to faintness, marked nervous irritability, poor appetite and digestion, and great muscular debility. To these may be added the *diarrhœa of debility*. It has been administered in *pneumonia* and *typhoid fever*, when great nervous irritability was present. Its reputation as a remedy for the *alcohol habit* has not been sustained, though there is good reason to credit the statement that it quickly overcomes *acute alcoholism*. Evidence is not wanting that it sustains the nervous system in one attempting to break from the *tobacco habit*. C. W. Hamilton, M. D. (*Brit. Med. Jour.*, 1890. Vol. I, p. 1067), claims it an effective remedy in *sea sickness*. Certain forms of *atonic dyspepsia* are benefited by it, while for the cure of obstinate *chronic diarrhœas*, it has long had a reputation. It has been asserted that its action in this respect can not be well understood, as the amount of tannin in the drug is so small. May it not be due to relieving irritation, and not to its astringent action? That form of dyspepsia, attended with pyrosis, eructations, and sick headache, is amenable to kola. The *vomiting of pregnancy* is said to be arrested by it. It has also appeared useful to check Asiatic *cholera*, and has been used in the various forms of diarrhœa prevalent in the tropics.

Kola may be used in feeble conditions of the heart, especially *cardiac irritability*, the cases being those in which caffeine is useful. Difficult breathing, irregular action, and valvular deficiency are the indications for its use. It forms a good vehicle for the exhibition of other cardiac stimulants. It is said to be of marked value in *smoker's heart*. Kola has given good results in *migraine*, and in those forms of *neuralgia of debility* in which caffeine and like agents have proven useful. Dose of powdered nut, 5 to 30 grains; fluid extract, 5 to 30 drops; solid extract, 1 to 6 grains. Various proprietary fluid preparations are upon the market. The best form for administration is kola in bulk, the drug to be slowly masticated and the salivary solution swallowed.

Substitutes and Adulterations.—The seeds of several plants have been used either wholly as a substitute for, or as adulterants of, true kola. All of these, however, are wholly destitute of the characteristic principles of that drug. Among these plants may be mentioned the following:

Garcinia Kola, Heckel. *Nat. Ord.*—Guttiferæ. The fruit of this plant is rarely found as an adulterant of kola, as their external features are entirely different. However, it bears the names of *False kola*, *Male kola*, and *Bitter kola*. False kola does not enter commerce, but it is highly esteemed by the natives of Africa, though devoid of marked stimulant properties. Aphrodisiac effects are accredited the seeds by the Negroes, and, as a masticatory, they employ them in *common colds*. They contain tannin, coloring matter, and a brown and a yellowish-white resin, but no alkaloids (see also *Garcinia Mangostana*).

Heritiera littoralis, Aiton. *Nat. Ord.*—Sterculiaceæ. An orbicular-shaped seed of a chocolate color, which ought not to be mistaken for kola, its characteristics being sufficiently different. Admixture with the smaller seeds of kola is possible. This plant grows in India, Africa, Australia, and the Philippines. It contains none of the characteristic principles of kola, excepting a tannin similar to kolatannic acid. It contains, however, 10 times as much fat.

Pentadesma butyraceæ, Don. *Nat. Ord.*—Clusinceæ. *Kanya.* Tree growing along west coast of Africa. Found by Heckel and Schlagdenhauffen as a frequent adulterant of kola, which it closely resembles in appearance and color, and from which its differentiation is difficult. No starch or alkaloids are present, but the seeds contain an abundance of fat—*kanya butter*—and a peculiar, odorless, and tasteless resin, of a yellowish color, and possessing toxic properties.

Sapolema imperialis, Beauvais.—The reniform, reddish seeds of this species constitute a false kola, which has a taste closely resembling that of true kola. The external appearances, however, are entirely different. *Saponin* is present in large amounts, according to Heckel and Schlagdenhauffen.

Lucuma mammosa, Griesebach. *Sapote*. *Nat. Ord.*—Sapotaceæ. According to Helbing the seeds of this plant have been offered as kola. The dried seeds are said to evolve a strong odor of prussic acid. On account of their aroma, the seeds, which contain a large quantity of fatty oil, are said to be used as a condiment by the natives of the West Indies.

Dimorphandra Mora (*Mora excelsa*) a leguminous tree, is the probable source of a false kola, from St. Domingo (West Indies), which was offered in 1896 in the English market. It appears to contain no caffeine (*Pharm. Jour. Trans.*, 1898, p. 287).

Related Species.—*Abroma augusta*, Linné. *Nat. Ord.* Sterculiaceæ. A common shrub in Bengal, where it is known as *Ulat kambal*, and cultivated as *Olak-tambol* in Bombay gardens. The shrub has velvety branches, and the flowers are of a handsome red color. The leaves are ovate-oblong, and the seeds are contained in a cottony envelope. Sircar (*Ind. Med. Gaz.*, 1872) announced the bark of the root as an efficient emmenagogue. It is also reputed serviceable in *dysmenorrhœa*, particularly when accompanied with congestion or with neuralgic pain. One-half drachm of the white, viscid juice found in the bark of the root is administered in combination with black pepper (see Dymock. *Mat. Med. Western India*).

KRAMERIA (U. S. P.)—KRAMERIA.

"The root of *Krameria triandra*, Ruiz et Pavon, and of *Krameria Ixina*, Linne"—(*U. S. P.*).

Nat. Ord.—Polygaleæ.

COMMON NAMES: *Rhatany*, *Ratanhia*.

ILLUSTRATIONS: Bentley and Trimen, *Med. Plants*, 30 and 31.

Botanical Source.—KRAMERIA TRIANDRA. This is a suffruticose plant, with a horizontal, very long, and branched root, with a thick bark, reddish-brown externally, and red internally. The stem is round, procumbent, much branched, and tapering; the branches are 2 or 3 feet long, and when young white and silky; when old, dark and naked. The leaves are alternate, sessile, oblong, and obovate, acuminate, entire, and hoary on each side. Flowers red, solitary, and axillary, on short stalks. Calyx of 4 sepals, the inferior largest, silky externally, smooth and shining inside, of the color of lac. The corolla consists of 4 petals, the 2 upper separate, spatulate, the two lateral roundish and concave. Stamens 3, hypogenous; anthers small, urceolate, with 2 openings at top; ovary ovate; style red, and terminal; stigma simple. The fruit is a dry, hairy drupe, burred with dull red hooks; seeds 1 or 2 (L.).

KRAMERIA IXINA, Linné, differs in having 5 unlike petals in its flowers which are red, and borne in terminal, loose racemes. Its leaves are petiolate and longer than those of the preceding species.

History and Description.—The root of *Krameria triandra* is known as Payta or Peruvian rhatany; that of *K. Ixina* as New Granada or Savanilla rhatany. The latter is found growing from North Brazil to Mexico, and in the West Indies. The former plant grows upon the dry, gravelly, and sandy hills in Peru and Bolivia flowering all the year round. The natives had used it as a strong astringent long before its discovery by Ruiz, in 1780. The root is the official part; it is dug up in large quantities after the rains, and after being well dried is exported. In Portugal it has been employed to adulterate red wines. Sometimes an extract is prepared from it, which is exported and used in a similar manner. The *U. S. P.* thus describes rhatany: "From 1 to 3 Cm. ($\frac{2}{5}$ to 1$\frac{1}{5}$ inch) thick, knotty, and several-headed above, branched below, the branches long; bark smooth, or in the thinner pieces, scaly, deep, rust-brown, 1 to 2 Mm. ($\frac{1}{25}$ to $\frac{1}{12}$ inch) thick, very astringent, inodorous; wood pale brownish-red, tough, with fine medullary rays, nearly tasteless. The root of *Krameria Ixina* (Savanilla rhatany) is less knotty and more slender, and has a dark purplish-brown bark, about 3 Mm. ($\frac{1}{8}$ inch) thick"—(*U. S. P.*). Cold water or diluted alcohol readily extracts its active constituents. In powder it is of a reddish color. The bark contains more of the medicinal virtues than the ligneous or woody part. If the root be macerated in water at 100° C. (212° F.), its medicinal properties will be extracted, but as a little starch and some colored extractive will also be dissolved, the infusion, when cool, will become muddy, and after a time the above inert substance will be deposited.

Boiling will extract still more of this matter, and the tannic acid of the root being oxidized by the action of the air, loses all its therapeutical influences. A cold infusion, or an extract from the cold infusion, are the best forms for use. By placing the powdered root in a percolator, and passing water through it, a brick-red, aqueous solution is obtained, possessing all the medicinal qualities of the root. and from which an excellent extract may be procured by a quick, but cautiously conducted evaporation.

Chemical Composition.—Wittstein (*Vierteljahrsschrift*, 1854, Vol. III, pp. 348 and 485), found the freshly peeled root-bark of rhatany to contain an iron-greening tannic acid, and a red decomposition product of the latter, analogous to *chinova-red;* gummy matter, wax, sugar, starch, calcium oxalate, etc. No gallic acid is present. The tannin of rhatany, called *ratanhia-tannic* (*krameria-tannic acid*, is the most important constituent. It is a red amorphous powder. Nearly 18 per cent was obtained from the Payta variety by Wittstein (1854), while R. G. Dunwody (*Amer. Jour. Pharm.*, 1890, p. 166) found in the commercial drug considerably less tannin, viz., 8.4 per cent. Tartar emetic causes no precipitate with it; with gelatin a flesh-colored precipitate is obtained. *Pyrocatechin* is produced as a decomposition product in dry distillation; fused with potassium hydroxide it yields *phloroglucin* and *protocatechuic acid;* and diluted acids acting upon it produce sugar and *ratanhia-red* ($C_{26}H_{22}O_{11}$), a product similar in composition to one yielded by hippocastanum and tormentil. The dry extract of rhatany formerly imported from South America yielded to Wittstein a crystalline principle which he believed to be identical with *tyrosin* ($C_9H_{11}NO_3$), an amido acid; this principle is not contained in ratanhia root. Ruge and Städeler (1862) found it to have the formula $C_{10}H_{13}NO_3$, and pronounced it to be *methyl-tyrosin*, and also named it *ratanhin*. Ruge obtained 1.26 per cent of this substance. Gintl (see *Jahresb. der Pharm.*, 1869, p. 165), showed it to be identical with *angelin*, first obtained by Peckolt in the quantity of more than 86 per cent from the *Resina d' angelim pedra*, a natural exudate from the Brazilian tree *Ferreira spectabilis*, Allemao. It is probable that the South American ratanhia extract in question was derived from this tree and not from krameria. O. Hiller-Bombien (*Archiv der Pharm.*, 1892, pp. 513–548). confirmed the identity of *ratanhin* with *methyl-tyrosin* and *angelin*, and also with the alkaloid *surinamine*, obtained in 1824 by Hüttenschmid from *Geoffroya surinamensis*, and proposed for it the name *andirin*, on account of its probable occurrence in all species of *Andira*.

Action, Medical Uses, and Dosage.—Rhatany is a powerful astringent, with some slight tonic virtues. Constipation with slight dyspeptic symptoms may be induced by immoderate doses. It may be employed internally with advantage in *menorrhagia, hematemesis, passive hemorrhages, chronic diarrhœa, leucorrhœa, chronic mucous discharges, colliquative perspiration*, and *incontinence of urine.* Internally in small doses, Prof. J. M. Scudder (*Spec. Med.*) recommends it in "*gastric catarrh, dyspepsia*, with full, relaxed skin, *incontinence of urine, gleet, prostatorrhœa, leucorrhœa*, and in some cases of *catarrh*" (p. 164). It is also used as an energetic styptic in *epistaxis, hemorrhage* from the cavity of an extracted tooth, or the surface of a wound, and as a local application to *prolapsus ani, fissure of the anus, fissured nipples*, and *leucorrhœa.* As an application to *spongy and bleeding gums*, to redden and consolidate them, as well as to preserve the teeth, the following paste will be found unsurpassed: Take of prepared chalk and powdered cinchona, of each, equal parts; combine them with a sufficient quantity of equal parts of the tinctures of rhatany and myrrh, to form a paste. Use daily with a brush. Dose of the powdered rhatany, from 10 to 30 grains; of the tincture, from 1 to 4 fluid drachms; of the infusion, from 1 to 4 fluid ounces; of the extract, from 10 to 20 grains.

Related Drugs.—BRAZILIAN (PARA or CEARA) RHATANY is referred by Fluckiger and Hanbury to *Krameria argentea*, Martius, of Brazil. *Krameria cistoidea*, Hooker, of Chili, furnishes a rhatany closely resembling the Payta product, while *Texas rhatany* is yielded by the *Krameria secundiflora* of De Candolle. *Krameria lanceolata*, Torrey, of North America, is richer in tannin and extract than the official product. A false rhatany has been met with, the source of which is unknown; compared with true rhatany, its twigs are smoother and slightly sl[illegible]ing, having also deeper furrows and transverse depressions of an annular form. It is not so tough, breaks more easily and with a short fracture; its bark is thicker and adheres firmly to the wood, is lighter-colored on its inner surface, and has a glistening aspect when cut with a sharp knife. The center, when cut through, is of a dull, pale-red color, and without the dark points met with in the true root. It is inodorous, more strongly astringent in taste than the genuine rhatany, and gives more abundant precipitate with chemical reagents (*Pharm. Jour. and Trans.*).

LABURNUM.—LABURNUM.

The seeds of *Cytisus Laburnum*, Linne.

Nat. Ord.—Leguminosæ.

COMMON NAMES: *Bean-trefoil*, *Golden chain*.

ILLUSTRATION: *Botanical Magazine*, Plate 176.

Botanical Source and History.—Laburnum is an unarmed shrub or small tree, native of the mountainous portions of southern Europe, and frequently found in cultivation, especially in Great Britian. The leaves are petiolate and trifoliate, with ovate lanceolate leaflets, pubescent underneath. The golden-yellow flowers, which appear from May to June, are very showy, and are disposed in loose, pendulous racemes. The calyx is campanulate and two-lipped; the upper lip is entire, the lower one three-toothed. The corolla is papilionaceous, with a large vexillum. The fruit is a brown legume, containing many seeds, and is attenuate at the base. The genus Cytisus is almost exclusively European, and there is no indigenous species in the United States. *Cytisus Scoparius*, Link, or "common broom," a very abundant shrub in Great Britain, is extensively used as a diuretic.

Chemical Composition.—The ripe seeds of *Cytisus Laburnum*, as well as other species of Cytisus, contain an alkaloid *cytisine*, discovered and obtained pure in 1864, by Husemann and Marmé. It also occurs in other genera of plants, and was established by A. Partheil (*Archiv der Pharm.*, 1892, p. 470), to be identical with *ulexin*, discovered by A. W. Gerrard (*Pharm. Jour. Trans.*, 1886, Vol. XVIII, p. 101), in the seeds of *Ulex europæus*. More recently, K. Gorter (*Archiv der Pharm.*, 1897, p. 321), proved its identity with *baptitoxine*, the alkaloid of the root of *Baptisia tinctoria* (which see). Prof. Plugge (1891) also believes it to be the same substance as *sophorin*, from *Sophora tomentosa*. *Cytisine* (*Ulexine*, *Baptitoxine*) has the formula $C_{11}H_{14}N_2O$ (Partheil, 1892; Gorter, 1897), and when pure crystallizes in large colorless prisms, soluble in water, alcohol, chloroform, and acetic ether; less soluble in benzol, amyl alcohol, and acetone; insoluble in petroleum ether, carbon disulphide, and absolute ether. It melts at 152° to 153° C. (305.6° to 307.4° F.), and can be sublimed by heating *in vacuo*. It is a dyad base, forming two series of salts with acids. The nitrate ($C_{11}H_{14}N_2O.HNO_3+H_2O$) forms large crystals. Partheil obtained 1.5 per cent of cytisine from laburnum. In the mother liquors he observed the presence of *cholin*.

Action, Medical Uses, and Dosage.—Administered to certain animals, as the dog, cat, etc., even in small doses, M. Chevallier found laburnum to occasion emesis, muscular debility, increased pulse, accelerated respiration, somnolence, spasms, and finally death. With man, according to Dr. T. S. Gray, Popham, Clout, and others, the bark, the flowers, or the seeds, in large doses, produce a sense of indisposition, drowsiness, followed by vomiting, vertigo, cold sweats, dryness and constriction of the throat, gastric pain, pallor, purging, accelerated respiration, strong contraction of the features, dilatation of the pupils, muscular contractions, quick and agitated pulse, and other symptoms of narcotism. Recovery from these symptoms occurs more or less speedily, and no case is recorded in which death was the result. In cases of poisoning by laburnum, Dr. Gray has advised the use of charcoal, though in many severe cases, persons who have suffered severely from the symptoms named, have promptly recovered without the aid of any antidote. Chevallier, who, having taken 6 or 8 grains of cytisine, found himself threatened with severe symptoms, drank quite freely of lemonade, and thereby checked their further progress. In medicinal doses, Dr. Gray recommends the use of the active principles of laburnum in the treatment of *dyspepsia* attended with vomitings of bile-matters and alternate attacks of diarrhœa and constipation; likewise to check the *vomiting of children* who eject their food soon after its ingestion; to relieve *bronchial cough*, and mitigate the severity of the paroxysms of *pertussis* and *asthma*, and to prevent the sympathetic *vomiting of pregnancy;* however, these recommendations have not been supported by subsequent trials. Prof.

J. M. Scudder (*Spec. Med.*), suggests the small dose (teaspoonful of the solution of 10 drops of a tincture of the recent bark, made with 98 per cent alcohol, in 4 ounces of water), every 1 to 3 hours in *irritation of mucous tissues* occurring in *nervous dyspepsia*, in the *restlessness* and uneasiness which follows mental overwork, and in the excitation of the gastric and hepatic nerves giving rise to frequent and easily excited *vomiting*. The dose of a decoction, of sp. gr. 1.034, is from 2 to 30 minims; of cytisine, from $\frac{1}{8}$ grain to 2 grains (hypodermatically $\frac{1}{10}$ to $\frac{1}{4}$ grain); of laburnine, from 2 to 10 grains. In a case where poisoning occurs, the best course to pursue is to remove the contents of the stomach as speedily as possible by means of an emetic well diluted with warm water, and then to administer ammonia, whiskey, or other diffusible stimulants.

LAC.—MILK.

"The fresh milk of the cow, *Bos Taurus*, Linné"—(*Br. Pharm.*, 1885).

Class: Mammalia. *Order:* Ruminantia.

Description.—Cow's milk was official in the former *British Pharmacopœias*, being used in the preparation of *Mistura Scammonii*. It is a white, opaque fluid, having a density of near 1.030. Its taste is sweet, bland, and to most individuals agreeable; its odor slight and peculiar and its reaction feebly alkaline or neutral. Under the microscope it appears as a transparent fluid in which are imbedded minute globules or corpuscles of a fatty nature, which give to the liquid its opacity and whiteness. According to some observers, these globules are surrounded by an albuminous envelope. The globules being somewhat lighter than the medium in which they are suspended, rise to the surface and constitute what is familiarly known as *cream*. This yellowish-white stratum, which contains also some of the serum and casein, constitutes about 5 per cent of the fluid. When the cream is removed or skimmed off, skim-milk remains, containing enough of the globules to give it opacity and a bluish whiteness. If the cream be agitated for a time, as in churning, the fat globules aggregate, or as some contend, the envelope is ruptured, and *butter* is produced. The serum which remains upon removing the butter, contains some butter and casein, saline matter, and *milk sugar* in solution, and is the well-known *buttermilk*. The pleasantly acid taste of buttermilk is due to *lactic acid* formed by the fermentation of some of the milk sugar. If milk be allowed to stand it will become soured on account of the formation of *lactic acid*, and forms *curds* or *clabber*, due to the precipitation of the *casein*. The latter substance is the material which forms cheese. Acids and rennet produce the same effects. The curds are suspended in a thin fluid and can be readily separated by straining. The separated fluid is then known as *whey*, and is chiefly a solution of salts and *sugar of milk* (*saccharum lactis*) and some albumen, coagulable by heat. When the casein is precipitated by rennet, *sweet whey* is obtained, while when precipitated by spontaneous souring, *sour whey* results. According to C. Arnold (*Archiv der Pharm.*, 1881, p. 41), fresh milk that has not been boiled may be recognized by the guaiacum test, producing with tincture of guaiacum a blue color; if, however, an alkali or an acid has been added, or the milk heated to 80° C. (176° F.), no such coloration takes place (also see *Guaiaci Resina*). Benzin, ether, alcohol, chloroform, and carbon disulphide yield with milk permanent emulsions. This behavior prevents the elaboration of a method to determine the total solids in milk by taking its specific gravity after removing the fat by means of immiscible solvents (Gustavus Pile, *Amer. Jour. Pharm.*, 1883, p. 244).

Chemical Composition.—The milk of all mammals has the same composition qualitatively; the ingredients differ only in their relative quantities. Even in one and the same species of animals, there is a marked diversity in the composition of the milk, according to the breed of the animal, the quality and quantity of its food, according to whether the animal is at rest or active, or on the proximity to a birth. For cow's milk, Wagner (*Handbuch der Chem. Technologie*, 1889, p. 953) gives the following limits in the percentage of its constituents: Total solids, 6.8 to 17.1 (water, 92.2 to 82.9); fat, 1.4 to 7.2; nitrogenous matter, 2.2 to 6.2; milk sugar, 1 to 5.2; salts, 0.1 to 1.7. The following table compiled from data given by J. König (*Die Menschl. Nahrungs und Genussmittel*, 3d ed., 1893), illustrates the comparative average composition of a great number of samples of milk from various sources:

	Woman.	Cow.	Goat.	Sheep.	Ass.	Mare
Water	87.41	87.17	85.71	80.82	89.64	90.78
Casein	1.03	3.02	3.20	4.97	0.67	1.24
Albumin	1.26	0.53	1.09	1.55	1.55	0.75
Total nitrogenous matter	2.29	3.55	4.29	6.52	2.22	1.99
Fat	3.78	3.69	4.78	6.86	1.64	1.21
Sugar of milk	6.21	4.88	4.46	4.91	5.99	5.67
Salts	0.31	0.71	0.76	0.89	0.51	0.35

It is evident from this table that cow's milk and woman's milk differs in some respects. Woman's milk is richer in milk sugar, but poorer in salts. Woman's milk also contains more albumin and less casein than cow's milk. The deficiency in the salt contents in woman's milk is probably the cause why its casein is precipitated by the acid of the gastric juice in the unusual form of fine flakes which are more readily digestible than the more lumpy casein precipitate of cow's milk (A. Dogiel, in J. König, *loc. cit.*). Even richer in salts than cow's milk is the milk of goats and sheep. Much fat (butter) and nitrogenous matter characterize that of the goat and sheep. The milk of the mare and ass, on the other hand, show a marked deficiency in butter and albuminoids, and a relatively larger amount of sugar of milk. They approach woman's milk in composition.

The nitrogenous portion of milk is chiefly composed of *casein* and *albumin*. The latter is coagulable by heat in the presence of acids. Besides, there are small quantities of pepton-like bodies present, probably originating in the decomposition of casein or albumin. One of these substances is called *lacto-protein*, which is not precipitated by acids, or heat or rennet, but is thrown from solution by alcohol or tannic acid. *Casein*, which is held in solution probably as a calcium compound (W. Eugling, 1885), differs from albumin in not being coagulable by heat, but being coagulated by the action of inorganic and organic acids, and by certain ferments, especially a peculiar *enzyme* (unorganized ferment) contained in rennet, a membrane obtained from the fourth stomach of the calf. The separation of casein also takes place spontaneously at ordinary temperatures upon standing, the process being greatly favored by warmth, and being due to the formation of lactic acid. (For Duclaux's views regarding the properties of the protein matters of milk, see *Amer. Jour. Pharm.*, 1884, p. 591.)

The fatty matter in milk is the butter, which is a rather complex body. The fats are glycerides of butyric, capronic, caprinic, stearic, oleic, palmitic, and myristic acids. *Rancid butter* is due to the decomposition of the glycerides containing the lower fatty acids, and the liberation of the free fatty acids, especially butyric acid, in fluid form. Besides the fats, an odorous substance in small quantity and *lactin* (sugar of milk), salts, casein, and water are present in butter. The salts contained in milk are chiefly phosphates and chlorides of calcium, magnesium, potassium, and sodium, all being inorganic bodies necessary to the sustenance of life. Th. Henkel (1888) has found citric acid to be a normal constituent (0.1 per cent) of cow's milk; woman's milk does not contain it.

Preservation.—Boiled milk may be preserved in open air longer than raw milk. To preserve milk for journeys the simplest method is to sterilize it by placing the fresh milk in a proper container, well filled, immersing in a boiling water-bath for a time, closing the container tightly, and taking proper measures to prevent the access of air. It is also recommended to place the milk in a well-annealed glass container, to add sodium bicarbonate (about 5½ grains to the quart), cork the bottle tightly, place in water-bath at 90° C. (194° F.), for 4 hours, remove the container, and varnish the cork. Boric acid (1 to 1000) and salicylic acid (1 to 5000) will prevent for a time the formation of lactic acid in milk. However, preserved milk, even if kept in well-sealed bottles, is liable to decomposition and to become intensely bitter, if it is not heated to a sufficiently high temperature or for a sufficient length of time (C. Naegeli). This observation is confirmed by Meissl (1882), who found the milk, after a lapse of one year, to have a somewhat bitterish taste; the fat being somewhat rancid and bleached, the milk sugar (4 to 5 per cent) unaltered, the nitrogenous matter peptonized, and small quantities of leucin, tyrosin, and ammonia were present, but no organized ferment. O. Loew (*Berichte*, 1882; also see *Amer. Jour. Pharm.*, 1883, p. 102), found that milk heated to 120° C. (248° F.) will keep for a number of years, while another specimen that was kept for 8 years after having been heated to 101° C. (213.8° F.) for 40 minutes, was intensely bitter, the milk sugar being decomposed into lactose and dextrose, and casein and albumin into peptones, etc.

Condensed, or Concentrated Milk is now largely used in place of preserved milk. This, as usually found upon the market, appears as a pasty mass, of yellowish-white color and somewhat translucent. When diluted with about 5 parts of water (by weight), it will appear like ordinary milk. There are various brands, and all are prepared by varying methods and require different amounts of diluent. The above-mentioned dilution applies to a condensed milk prepared essentially as follows: Milk is poured to a depth of about 2 inches into a flat-bottomed, shallow boiler, and heated by means of a water-bath. Cane sugar is added in the proportion of 1 ounce to the pint of milk. Heat is continued and evaporation favored by constantly stirring the mixture, which is reduced in volume four-fifths, when it is poured into cans and these are hermetically sealed. The cans are then arranged in a boiler and subjected to a steam heat a little above the boiling point of water. The process is then completed (Lignac). On a manufacturing scale, milk is condensed by evaporation in vacuum apparatus. Sugar is added to the original milk as a preservative. Evaporation can also be carried to dryness, producing "*milk powder*." (See tabulated results of 21 analyses of condensed milk in *Jour. Amer. Chem. Soc.*, 1899, p. 444.)

Adulteration and Detection.—Watered milk may be known by its relatively low specific gravity, that of milk being 1.030. Skim-milk has a higher specific gravity. To detect adulterations it is first necessary to carefully evaporate the fluid to dryness; the loss will represent the water, the residue the solids. To ascertain the amount of fats, extract the residue with benzin or ether; incineration of the residue now remaining will indicate the amount of salts in ash, while the nitrogenous matter and sugar are represented by what is lost in incineration. Another method is to treat with alcohol and water the ether-insoluble residue, whereby the salts and sugar are dissolved and the casein remains as residue. Special instruments have been devised for the rapid determination of the amount of cream, butter, and the density and degree of opacity of milk. These are known as *lactometers* (*creamometers*), and *lactoscopes*. The following process for the determination of fat in milk is recommended in *Pharm. Centralhalle* (1899, p. 274) as giving exact results: In a glass cylinder 40 Cm. long, provided with a graduation between 15 and 20 Cc. and at 70 Cc., place 10 Cc. of milk, 1 Cc. of 20 per cent ammonia water, and 10 Cc. of 95 per cent alcohol. Add 25 Cc. of ether, shake and add 25 Cc. of petroleum ether, shake again. Allow the ether—petroleum ether solution to separate, measure its volume, evaporate an aliquot part of it to dryness. Dry the residual fat at 100° Cc. (212° F.) for 2 hours, and weigh.

The presence of *salicylic acid* in milk can easily be recognized by abstracting milk diluted with its own volume of water, treating with a few drops of acetic acid, and filtering with ether, evaporating this solvent, and observing the violet coloration with a 1 per cent solution of ferric chloride (see *Amer. Jour. Pharm.*, 1882, p. 358). (For details regarding milk analysis see J. König [*loc. cit.*]; also Prof. Sadtler's *Handbook of Industrial Organic Chemistry*, 1885, p. 264, and special literature there indicated.)

Action, Medical Uses, and Dosage.—The use of milk as a beverage and food are too well-known to require comment. Suffice to say that in *acute diseases*, with high temperature and rapid burning of the tissues, hot milk, salted or unsalted, is the best food for administration, being easily digested and sustaining the nutrition of the body. It is specially of value in most *wasting conditions*, and, when modified, forms the best *substitute for mother's milk*. Occasionally, some individuals can not partake of milk, claiming that it renders them bilious. This effect is undoubtedly more largely due to a faulty condition of the digestive tract, rendering the digestion of cream difficult. In such cases skimmed milk has the advantage over whole milk. Milk is frequently of great advantage in *digestive derangements*, particularly in chronic affections, relieving *gastro-intestinal irritation*, *uneasiness*, *unrest*, and *insomnia*. Sour or coagulated milk is an excellent agent to meet the indications alluded to under *Acidum Lacticum*.

The so-called "milk cure" has given excellent results in many disorders, chiefly of a chronic character. In certain European centers milk cures have been established, and, while to the fresh milk must be attributed great good, there is no doubt but that hygienic attention, climate, and sanitary surroundings contribute much toward a cure. The plan is usually to place the patient upon an exclusive milk diet for at least 3 weeks, from 1 to 2 quarts of milk being consumed in a day. This treatment requires great fortitude on part of the patient. Upon taking this treatment, but a short time elapses before a repugnance for milk comes upon the patient, the appetite fails, there is a distressing sense of goneness and emptiness in the stomach, the tongue becomes pasty and furred and tastes badly, and constipation and great weakness ensue. The body steadily loses weight until a certain point is reached, and there it is maintained. Constipation, with dry, scybalous, practically inodorous, and yellowish stools is the rule.

The urinary flow is increased, and the quantity of urea greatly lessened. After the third week it is customary to allow a little bread, and then meat, and so on, for a continued period, the chief part of the diet, however, still consisting of milk. Sometimes it is necessary to skim the milk or to boil it, or to add to it lime-water or some of the carbonated alkalies, but where possible the pure milk alone is to be preferred. Coffee, mineral waters, and laxatives are sometimes required to overcome the constipation. The "milk cure" has been signally effective in certain *obstinate stomach and bowel affections*, as *chronic dyspepsia*, *gastric ulcers*, *gastric catarrh*, *gastralgia*, *chronic diarrhœa*, *chronic dysentery*, *persistent enteralgia*, *intestinal indigestion*, *ascites*, *diabetes*, and *desquamative nephritis*, with *albuminuria*. *Gout* and *eczema* are also said to have been cured by an exclusively milk diet. Milk is one of the most soothing of substances for *gastric cancer*, and sustains the strength of the patient.

CONDENSED MILK is stated by Dr. Richard Neale to be of great medicinal value to infants at times, but it should not be given to them as food, as it does not sufficiently support vitality (see *Amer. Jour. Pharm.*, 1883, p. 472). Similar experience is recorded by Dr. Edmund Owen (*Amer. Jour. Pharm.*, 1884, p. 278). It is evident that if too much sugar has been added considerable dilution with water is necessary, which renders the milk too weak in nutritive constituents.

BUTTERMILK is signally effective in many cases of *stomach and bowel disorders;* and in *diabetes* and *albuminuria*. (For indications, see *Acidum Lacticum*.)

SWEET WHEY forms an excellent diet drink in *acute diseases*, *fevers*, and *inflammations*. The pale tongue indicates it.

SOUR WHEY should be given when the tongue is red.

KOUMYS is useful in many constitutional and exhausting diseases, as *chronic bronchitis*, *phthisis pulmonalis*, *scrofula*, *low fevers*, *chronic diarrhœa* and *dysentery*, *dyspepsia*, *neurasthenia*, *gastric cancer* and *gastric ulcer*, *summer bowel disorders of children*, and in many *adynamic states* requiring food and an alcoholic stimulant. It should be borne in mind, however, that on account of the amount of alcohol present, an intemperate habit may be formed or fostered by the continued use of koumys. Under favorable conditions, as under the koumys treatment in the steppes of Russia and in Asia, consumptives are reported to have been cured by this beverage.

KEFIR is very similar in its effects to koumys, though less stimulating, and may be used in the affections for which the latter is useful. The amount of these two beverages to be consumed will be regulated according to the effect desired or produced.

Milk is one of the substances usually administered in *poisoning by the corrosive poisons*, particularly those with which it may combine chemically, as with mercuric chloride; even when not antidotal it forms a soothing agent in the after treatment. A bread and sweet milk poultice is in frequent use to hasten suppuration in *boils*, *abscesses*, etc., and milk has been employed as a lenitive in several skin diseases, particularly in cases of *sunburn*, and as an application in *ophthalmia* and *otorrhœa*. The practice of milking mother's milk into the eyes of the newborn is to be condemned.

Milk Preparations.—Koumys (*kumiss*), a fermented beverage and medicine, prepared and used by certain nomadic tribes of Russia and the inhabitants of Tartary, is produced by fermenting fresh mare's milk with yeast. When about 12 hours old it is known as *staumgal* or *ssaumal*. Upon standing a few days it becomes much more energetic, acquires a stronger acid taste, and becomes well charged with carbonic acid gas, which renders it sparkling. Even when well secured in bottles, and at a low temperature, fermentation having once begun will continue, with an increase of lactic acid, carbon dioxide, and alcohol. The Tartars are said to prepare koumys also by adding $\frac{1}{10}$ part of koumys to fresh milk, stirring frequently, and, at the end of 3 or 4 hours, removing the mixture from the tall vessels employed and putting it into champagne bottles, placing them into a cool place for a period of about a week. The product acquires thereby a peculiar, sweet, acidulous taste. Cow's milk is free from the unpleasant odor and taste of mare's milk, and is, therefore, to be preferred in preparing koumys. Dr. L. Wolff recommends as follows: Take $\frac{1}{2}$ ounce of grape sugar, dissolve it in 4 ounces of water in a quart champagne bottle, and add to the mixture a solution of 20 grains of compressed yeast (Fleischmann's), or well-washed and pressed brewer's yeast; finally, to the whole add good cow's milk sufficient to almost fill the bottle. Place the cork and wire it. Put the bottle in a cool place at 10° C. (50° F.), or lower, shake 3 times a day, and allow fermentation to proceed about 3 or 4 days. It is then ready for use, and will keep 4 or 5 days. The kumyss of the *National Formulary* is prepared as follows:

Lac Fermentatum (N. F.), *Fermented milk, Kumyss.*—"Cow's milk, fresh, 32 fluid ounces; yeast, semiliquid, 60 minims; sugar, 1 troy ounce. Dissolve the sugar in the milk contained in a strong bottle, add the yeast, cork the bottle securely, and keep it at a temperature between 25° and 32° C. (75° to 90° F.) for 6 hours, then transfer to a cold place"—(*Nat. Form.*, 1st ed.).

Kefir, or Kephir.—A milk-wine, prepared by certain tribes of the Caucasus from goat's and sheep's milk by fermentation, in a leather bag, with yeast and a peculiar bacterium or fungus. A goat-skin bag is filled with milk, and to it is added "*kefir seed*," a tenacious, dark-brown, dry, earthy mass, the origin of which is kept secret, and which contains, according to Kern, the bacterium *Dispora caucasica*, Kern, with some *Saccharomyces cerevisiæ*, or yeast fungus. The properties of this "seed" are retained for a long period after drying. It is an article of commerce, and is used in the preparation of kefir from cow's milk, which is preferably sterilized by heat before the adding of the kefir seeds (B. Niederstadt, 1890). Fermentation ensues in a few hours after adding the ferment. The changes which take place are chiefly in the casein. Prepared from cow's milk, it is less acid and not so alcoholic as koumys, but contains more albumin, and, by some, is preferred to the koumys preparation. For directions to prepare kefir without the "kefir seeds," see Dr. Kogelmann, *Amer. Jour. Pharm.*, 1886, pp. 295 and 388.) The comparative percentage composition of cow's milk, koumiss and kefir, is stated as follows *Amer. Jour. Pharm.*, 1887, p. 515):

	Cow's Milk.	Koumiss.	Kefir.
Albumin	4.8	1.12	3.8
Butter	3.8	2.05	2.0
Sugar of milk	4.1	2.20	2.0
Lactic acid	....	1.15	0.9
Alcohol	....	1.65	0.8
Water and salts	87.3	91.83	90.5

Serum Lactis Dulce, *Whey.*—With 200 parts of fresh cow's milk mix 1 part of rennet-wine; warm to 35° to 40° C. (95° to 104° F.), when coagulation takes place, and the whey may be strained from the curd.

Serum Lactis, or *Serum lactis acidum, Acid whey.*—Heat 100 parts of fresh, or skim milk, to boiling, and add 1 part of vinegar, or 0.1 part of citric acid, in 1 part of water. When coagulation is complete strain, mix the strained fluid with the white of 1 egg, heat to the boiling point, and filter.

Serum Lactis Tamarindinatum, *Tamarind whey.*—A brownish whey, obtained by heating together 4 parts of tamarinds and 100 parts of milk, and straining.

Serum Aluminatum, *Alum whey.*—Obtained by heating to boiling 1 part of powdered alum and 100 parts of milk. Strain.

LACCA.—LAC.

A resinous exudate produced through the puncture of several trees by the hemipterous insect, *Coccus lacca*, Kerr.

Source.—Lacca is collected from the branches of several trees, most of them lac-bearing, found chiefly in the East Indies. Several American plants are also said to yield the product, these being the *Larrea mexicana*, Moricand (*Larrea glutinosa*, Engelmann), the *Stinkweed* or *Creasote-bush*, and the *Acacia Greggii*, Gray, both growing in Arizona, west Texas, Mexico, and southern California. The East India trees yielding it are said to be the following: *Aleurites laccifera*, Willdenow (*Croton* *lacciferum*, Linné [Euphorbiaceæ]; *Ficus indica*, Roxburgh; *Ficus religiosa*, Linne, *Ficus bengalensis*, Linne; *Ficus Tsjela*, Hamilton [Urticaceæ]; *Butea frondosa*, Roxburgh [Leguminosæ]; *Schleichera trijuga*, Willdenow [Sapindaceæ]; and *Zizyphus jujuba* [Rhamnaceæ]).

Large numbers of the insects (*Coccus lacca*) congregate upon the smaller and tender branches of these trees. The female insect punctures the limb and becomes surrounded by the exuding resinous matter. The imbedded insects swell up and form a cell containing a red-coloring matter (yielding *lac-dye*), which gives to the lac containing it a superior value. The young larvæ are developed in the exudation, which gradually becomes hard, and, boring their way out, make their escape.

History and Description.—The principal grades of lacca are *stick-lac*, *grain-lac* (*seed-lac*), *shell-lac* (*shellac*), and *lump-lac* (*grape-lac*). The thickly beset resin-nodules enclosing the twigs constitute *stick-lac*. This contains about 10 per cent of red coloring matter. When these nodules are detached from the branchlets, and for the most part deprived of their coloring matter by a washing process, they form the *seed* or *grain-lac*. The individual tears of the first variety are reddish-brown and contain in their central portion a deep, blackish-red substance. The taste is subastringent and slightly bitterish. When the young insect has made its escape the exudation is brown. The second variety consists of more or less shiny, small fragments, of a yellowish or reddish color, and are almost tasteless. *Shell-lac* is the product of the preceding varieties after they have been boiled in water and partially deprived of coloring matter, fused, and congealed upon a polished surface. Or, the crude seed-lac is put into a narrow, sausage-like cloth bag, heated over a charcoal fire, and the cloth slightly twisted until the melted lac appears on the outside; the bag is then removed from the fire, and the lac scraped off by means of an aloe leaf. The scrapings at once harden, and constitute what is known as shellac (see interesting article on shellac, by Jos. Bosisto, in *Amer. Jour. Pharm.*, 1886, p. 307). *Lump-lac* is the same as stick-lac, yet deprived of the woody portion and melted together. Seed-lac, in agglutinated masses, is sometimes known as *grape-lac*. If stick-lac be chewed, it becomes soft, and a beautiful, purple-red hue is imparted to the saliva. Red stick-lac boiled in water, imparts to it its coloring matter. This, when precipitated by alum, and pressed into cakes, constitutes what is known as *lac-dye*—a purple coloring body. Lime-water likewise precipitates the coloring matter. Caustic soda and potash, sodium biborate, acetic and hydrochloric acids dissolve shellac, also hot alcohol, while cold alcohol dissolves about 90 per cent, leaving a wax-like body undissolved. With aqua ammoniæ, if digested in a closed container, it forms a gelatinous magma. Acids reprecipitate shellac from its solution in alkali. *Bleached shellac* is obtained by acting with chlorine gas upon shellac in alkaline solution. This yields a product insoluble in alcohol. Alcohol-soluble bleached shellac is obtained by digesting an alcoholic solution of it with animal charcoal.

Chemical Composition.—Unverdorben found lac to be a complex material consisting of at least five resins (separable by their behavior toward ether, alcohol, or alkalies), fat, wax, and coloring matter. According to Hatchet, shellac contains about 90 per cent resin and 4 per cent wax, while scarcely seven-tenths of resin and 10 per cent of coloring matter, also wax, etc., is contained in stick-lac (see Hager, *Handbuch der Pharm. Praxis*, 1886, Vol. II, p. 330). Shellac contains but little if any coloring matter. The coloring body has been more recently examined by R. E. Schmidt (1887), who gives it the formula $C_{16}H_{12}O_8$, and names it *laccaic acid*. It closely resembles the coloring matter of cochineal, *carminic acid*, although they are not identical. It forms brown-red, crystalline crusts, is slowly soluble in alcohol, easily soluble in amyl alcohol, acetone, and glacial acetic acid; also somewhat soluble in water, and insoluble in ether. It forms colored solutions with alkalies.

Action and Medical Uses.—Lacca is slightly astringent, besides possessing some of the properties common to the resins, on which account it was formerly used as a dressing for *wounds* and *ulcers*. It is not now used medicinally. Surgical splints are sometimes prepared from it (see below).

Shell-lac Splints.—Take of finely pulverized shell-lac, 1 pound; alcohol (90 per cent), 1 quart; mix, and expose it to a moderate heat in a loosely-stopped bottle, for 48 hours, when the shell-lac will be dissolved. With this solution saturate woolen cloth, and allow it to dry. To apply and fit the cloth to any part, cut it into the proper shape, and then hold it near a fire or hot stove, or dip it into boiling water, when it will become soft and pliable. As soon as it has cooled so as not to burn the patient, apply it to the part, and by holding it for a few minutes, or by the application of the bandage while it is yet pliable, it will assume any form desired, and on cooling, it becomes hard and retains its form exactly. If it is desirable to strengthen the splint, take two pieces of the saturated cloth, spread one side of each with a thick coat of the solution, by means of a common paint brush, allow the alcohol to evaporate, and then, placing these two coated sides together, press them with a hot flat-iron until they have become perfectly cemented. This operation may be repeated several times. if it is necessary to increase the strength of the cloth or splint.

Related Products.—Xanthorrhœa Resins, *Gum acaroides, Gum acroides, Grass-tree gum.* Different species of Xanthorrhœa in Australia have yielded resinous balsams, the chief of which are the yellow balsam from *Xanthorrhœa hastilis*, and the red, from *X. australis*. They contain *cinnamic* and *benzoic acids*, and when heated evolve a tolu-like odor. Heated with nitric acid they are converted into picric acid. Medicinally they resemble tolu and storax, and have been used in the treatment of *diarrhœa*. The supply is inexhaustible, and the resin has been used like shellac for varnishing cabinet work, but is much inferior to that product.

Sonora Gum.—An acidulous gum-resin, said to be the exudate of the branches of *Larrea mexicana*, Moricand. It is employed by brewers, and is said to be identical with Arizona shellac.

LACHNANTHES.—LACHNANTHES.

The whole plant *Lachnanthes tinctoria*, Elliott.

Nat. Ord.—Hæmodoraceæ.

Common Names: *Red root, Spirit weed.*

Botanical Source.—This is a perennial plant, introduced into practice by the Homœopaths. It has a red fibrous root, and an erect stem, strict. 18 to 24 inches high, clothed with white wool above. The leaves are mostly radical, fleshy, equitant, sword-shaped, 3 to 4 inches wide, and nearly as high as the stem; the cauline leaves remote and bract-like. The corymb is terminal, close, 15 to 30-flowered; the flowers densely clothed with white wool outside, glabrous and yellow within. Perianth woolly outside, 6-parted down to the adherent ovary. Calyx lobes exterior, of 3 linear sepals, as long as the 3 lance-oblong petals. Stamens 3, opposite the sepals; filaments long, exserted; anthers linear, bright-yellow. Style thread-like, exserted, declined; stigma minutely 2-lobed. Capsule globular, truncated, 3-celled, many-seeded; seeds few on each fleshy placenta, flat and rounded, fixed by the middle (W.—G.).

History.—This plant is a native of the United States, growing in sandy swamps and along borders of ponds, near the Atlantic coast, from Rhode Island to Florida, flowering in July. The root has been used for dyeing purposes, and, according to Dr. Byron, has been used among the Florida Indians to produce a brilliancy of the eye, a flushed and swollen face, a bold appearance, and eloquent speaking; after these peculiar stimulating effects pass off, the person becomes stupid and very irritable. The method of employing it is to make the whole plant into a saturated tincture.

Action, Medical Uses, and Dosage.—Large doses of lachnanthes produce dilatation of the pupils, impaired vision, dizziness, and other unpleasant symptoms, somewhat similar to those produced by belladonna. Lachnanthes has been more particularly recommended in *pneumonia, nervous* and *typhus fevers*, some *diseases of the brain*, in the *delirium of fever*, in *morbid conditions of the brain and nervous system*, especially when in these several maladies redness of the cheeks and brilliancy of the eyes are accompanying symptoms. It has also been efficient in *rheumatic wry neck, hoarseness, laryngeal cough, tinnitus aurium*, and in *nervous headache*. A fluid drachm of the tincture added to 4 fluid ounces of water, and administered in fluid drachm doses, every 3 or 4 hours, is the proper method of administering it.

LACMUS.—LITMUS.

A peculiar blue coloring matter obtained from *Roccella tinctoria*, Acharius, and other lichens.

Nat. Ord.—Lichenes.

Common Names and Synonyms: *Litmus, Turnesole, Tournesol, Lacca cærulea, Lacca musica.*

Botanical Source.—*Roccella tinctoria*, or *Orchilla weed*, is a small, dry lichen, with a rounded, glaucous, nearly erect thallus, forked and subdivided into numerous branchy, roundish, gray, yellowish, or brownish threads; the apothecia are scattered, red and elevated; the disks are flat, cæsius, pruinose, and as broad as the border.

History, Preparation, and Description.—Roccella tinctoria is found on the maritime rocks of the eastern Atlantic Islands, as the Azores, Canaries, etc., the western coast of South America, south of England, Portland Islands, Scilly Islands, and various other countries. Litmus was formerly obtained from this plant alone, but other lichens have now in a great measure supplanted it, as the *Roccella fuciformis*, or *Angola weed*, from Angola and Madagascar; the *Lecanora tartarea*, or *Tartarean moss*, from Norway and Sweden; the *Variolaria dealbata*, from Auvergne and the Pyrenees, and some others.

LACMUS, or *Litmus*, was formerly prepared only in Holland, but at present is manufactured from various lichens in Italy, France and Britain. It is made "by macerating powdered lichen for several weeks, with occasional agitation, in a mixture of urine, lime, and potashes, in a wooden trough under shelter. A kind of fermentation takes place, and the lichen becomes first reddish, and subsequently blue. When the pulp has acquired a proper blue color, it is placed in brass or steel molds, and the cakes thus obtained are subsequently dried. An addition of aqueous ammonia answers the same purpose as that of urine in the above mixture. "Litmus is imported in the form of small, rectangular, light and friable cakes of an indigo-blue color. Examined by the microscope, we find sporules and portions of the epidermis, and mesothallus of some species of lichen, moss, leaves, sand, etc. Its odor is that of indigo and violets" (P.). Litmus is usually mixed with chalk or gypsum in order to form it into cakes.

Chemical Composition.—The chromogenic bodies in the lichens mentioned are crystallizable phenols and phenol acids. To the latter class belong *lecanoric acid*, discovered in 1842 by Schunck, with which *beta-orsellinic acid* of Stenhouse (1848) is identical; *erythrinic* and *roccellic acids* (Heeren, 1830), *usnic acid*, *evernic acid*, etc. (For details regarding these acids, see Husemann and Hilger, *Pflanzenstoffe*, Vol. I, p. 303.) They are in themselves colorless, but become converted into coloring matters by the joint action of water, air, and ammonia.

Lecanoric acid ($C_{16}H_{14}O_7$, Gerhardt and Hesse), crystallizes in white stellate needles soluble in 2500 parts of boiling water with acid reaction, more soluble in hot acetic acid, also soluble in alcohol and ether. Its melting point is 153° C. (307.7° F.), and it forms crystallizable salts with acids. Heated with water, alcohol or aqueous alkalies, *lecanoric acid* adds one molecule of water and is converted into crystallizable *orsellinic acid* ($C_8H_8O_4$). This when continuously boiled with water, loses carbonic acid and forms *orcin* or *dihydroxy-toluene* ($C_7H_8O_2$ or $C_6H_3.CH_3.[OH]_2$), which is also obtained by dry distillation of lecanoric acid. *Orcin* is the chromogene body proper of this group. It forms colorless needles of sweetish, nauseating taste, is easily soluble in water, alcohol, and ether; ferric chloride produces with it a violet coloration. Exposed to light and air it turns reddish. In alkaline solution it changes to red or brown upon exposure to the air. In contact with moist air containing ammonia, it is converted into *orceïn* ($C_7H_7NO_3$), a brown substance soluble in aqueous alkalies with purple-red color, being precipitated from this solution by acids. *Orceïn* is the coloring principle of *orseille* or *archil* (see below).

Orcin, when exposed to moist and ammoniated air in the presence of alkali carbonates, is converted into *azolitmin*, the blue coloring matter of *litmus*. The coloring bodies in litmus, according to Dr. Kane (*Chem. Centralblatt*, 1841, p. 567; also see Pereira, *Mat. Med.*, edition by J. Carson, 1846), are: (1) A purplish-red semifluid material, *erythrolein*. It is soluble in ether and alcohol, and yields with ammonia a rich purple solution; (2) a crystalline body of a light red color, *erythrolitmin*, nitrogen free, soluble in alcohol, but sparingly so in ether and water, and striking blue with ammonia; (3) a brownish-red, noncrystalline body, the chief coloring principle of litmus, named *azolitmin* ($C_7H_7NO_4$); it turns blue with alkalies, is insoluble in alcohol and ether, and sparingly soluble in cold water; (4) a small amount of a bright-red body, *spaniolitmin*, which is colored blue by alkalies; water dissolves it sparingly; insoluble in alcohol and ether.

Action and Uses.—*Orcin* resembles resorcin in its effects upon skin diseases. It is said to be a decided antiseptic, and to cause death in toxic doses by paralyzing the heart-muscle.

Litmus is employed in urinary, chemical, and pharmaceutical analysis, and is a familiar test for free acids and alkalies. The acids impart a red color to blue litmus; the alkalies restore the original blue color to the reddened litmus. Carbonate of calcium dissolved in water by a considerable excess of carbonic acid, will also restore the blue color of reddened litmus. It is used either in infusion, or in the form of *litmus paper.* The infusion, sometimes erroneously called *tincture of litmus,* is made by adding 1 part of litmus to 25 parts of distilled water, to which, for the purpose of preserving it about $\frac{1}{10}$ part of spirit or alcohol may be added.

Litmus Paper.—Blue Litmus Paper (*Charta Exploratoria Cœrulea*) is prepared by dipping strips of paper in a clear and strong infusion of litmus, or by brushing the infusion over the paper. White unsized paper is the best for this purpose; and the infusion may be made by adding 1 part of litmus to 6 parts of boiling water. Good litmus paper should be of uniform color, neither too light nor too dark, and when carefully dried, should be kept in well-stopped vessels in a dark place; when it has a purplish tint, it is a more delicate test for acids than when pure blue. An extremely delicate test-paper may be made by almost neutralizing the alkali contained in the litmus; thus: Divide the filtered infusion of litmus into two parts; stir one portion with a glass rod which has been previously dipped into very dilute sulphuric acid, and repeat this until the liquid begins to look reddish; then add the other portion of liquid, and immerse the paper in it (P.).

Red Litmus Paper (*Charta Exploratoria Rubefacta*) is best prepared by dipping the blue paper in a very dilute acetic or hydrochloric acid, merely acid enough to redden it.

Related Products.—The following pigments are produced from the same plant which yields lacmus. They are similarly prepared, excepting that alkalies, caustic soda, or potash, are not added to the ammoniacal mixture (see *Chemical Composition* above).

Orchil, or Archil, is used for dyeing, coloring, and staining. There are two kinds, called *blue orchil* and *red orchil,* which differ merely in the degree of their red tint. They are deep-reddish purple liquids, or pasty masses, with an ammoniacal odor. Orchil is prepared by steeping the lichens in an ammoniacal liquor, in a covered wooden vessel.

Cudbear, or *Persio,* is obtained by the same process as orchil, and when the proper purplish-red color has been developed, the mixture is dried in the air and reduced to fine powder. It is used as a dye, and sometimes as a test for acids and alkalies. (An interesting article on the manufacture and chemistry of orchil, cudbear, and litmus, by Dr. Crace-Calvert is to be found in *Pharm. Jour. Trans.,* Vol. II, 1871, pp. 514 and 535.)

LACTUCA.—LETTUCE.

The flowering herb of *Lactuca virosa,* Linné, and other species of *Lactuca.*

Nat. Ord.—Compositæ.

Common Name: *Strong-scented lettuce.*

Illustration: Bentley and Trimen, *Med. Plants,* 160 and 161.

Botanical Source.—*Lactuca virosa* has a tap-shaped root, with a solitary stem, 2 or 3 feet high, erect, round, smooth, sparingly leafy, scarcely branched, panicled at the top, and a little prickly below. The leaves are horizontal, nearly smooth, and finely toothed; the radical ones numerous, obovate, undivided, depressed; those of the stem smaller, often lobed; arrow-shaped, clasping at their base; the midrib of all more or less beset underneath with prominent prickles, such as often occur on the margin also. The flower-heads are numerous and panicled, with an abundance of small, heart-shaped, pointed bracteas. Involucral scales downy at the tip, destitute of any keels or ribs. Corolla small and light-yellow. Pappus rough (L.). There are many varieties of lettuce; they all have large leaves, often corrugated, and containing more or less of a whitish juice, the lactucarium. Their stems are round and corymbose at the summit; the leaves suborbicular and runcinate; cauline ones cordate or obovate; flowers yellow.

Lactuca sativa has an annual, tap-shaped root, with a corymbose stem, 2 or 3 feet in height, and suborbicular leaves; cauline ones cordate. Heads numerous and small, with yellowish corolla (W.). It is not so rank in odor as the *L. virosa*, has not blood-red spots on its stems, and no prickles on the keel of its leaves. Previous to the appearance of the flowering stems, the garden lettuce contains a pleasant, sweet, watery juice, and in this condition the plant is employed as a salad; but in both species, no sooner does the flowering stem rise above the early leaves than the juice grows milky, very bitter, and of a strong, peculiar, rank odor, not unlike that of opium (see *Chemical Composition*).

Lactuca Scariola, Linne, differs from *L. virosa* in having vertical, spinescent, toothed, deeply-cut, or pinnatifid leaves.

History.—The *Lactuca virosa*, Linné, is the only species recognized by the *Br. Pharm.*, 1885, and is directed by the *U. S. P.* as the source of *Lactucarium* (see *Lactucarium*). Several other species, however, yield this product. *Lactuca sativa*, or common lettuce of the gardens, is supposed to be a native of the East Indies; it is extensively cultivated in Europe and this country. According to Prof. J. M. Maisch, the *L. canadensis*, var. *elongata* (wild lettuce), of our country possesses narcotic principles similar to the others. Mr. H. Flowers (*Amer. Jour. Pharm.*, 1879, p. 343) observed in a growing specimen of this plant a strong, narcotic odor of the milky juice, but a remarkable change in the taste, from sweetish to bitter, took place later in the season. *Lactucarium*, or *lettuce-opium*, so-called, is obtained from the plants "by cutting the stem of the lettuce at the time of flowering, imbibing the milky juice that flows out by a sponge or by cotton, and squeezing it out into a vessel containing a little water. It is then left in a dry place until it concretes into a solid mass" (Thompson's *Org. Chem.*). The juice, in drying, loses about half its weight of water. By making another cut a short distance below the first, and so proceeding several times daily, the whole of the juice contained in the plant may be collected. There are several other modes recommended for procuring the lactucarium, but no one of them obtains an article equal to that collected by the above plan. After the middle period of inflorescence, the juice becomes thicker, but deteriorates in its medicinal principles. A single plant of *L. sativa* is said to yield 17 grains of lactucarium, while a plant of *L. virosa* gives 56 grains. *L. Scariola*, or prickly lettuce, yields 25 grains. As found in commerce, lactucarium is in roundish, compact, rather hard masses, weighing several ounces, of a reddish-brown color externally, of a bitter, narcotic, and somewhat acid taste, and an odor approximating that of opium. It is asserted that two species—*L. Scariola*, Linné, and *L. altissima*, Bieberstein—furnish a superior article of lettuce-opium. Fairgrieve, of Scotland, cultivated the *L. virosa*, var. *montana*, and Aubergier, of France, the *L. altissima*.

Chemical Composition.—The chief constituent of lactuca is *lactucarium* (see *Lactucarium*). Potassium nitrate is an additional constituent. Mr. T. S. Dymond (*Pharm. Jour. Trans.*, 1891, Vol. XXII, p. 449), having observed mydriatic action with extracts of *Lactuca sativa* (common garden lettuce) and *L. virosa*, the former being collected while flowering, succeeded in isolating therefrom an alkaloid (not exceeding 0.02 per cent), which he identified as *hyoscyamine*. Specimens of English and German *lactucarium*, on the other hand, did not contain a trace of the alkaloid. The occurrence of an alkaloid in so widely-used a vegetable need not, however, cause alarm. It is probably in insignificant quantity in the early stages of growth of the vegetable.

Medical Uses.—(See *Lactucarium.*)

LACTUCARIUM (U. S. P.)—LACTUCARIUM.

"The concrete milk-juice of *Lactuca virosa*, Linné"—(*U. S. P.*).

Nat. Ord.—Compositæ.

Common Name: *Lettuce-opium*.

Description.—(For source, history, and collection of Lactucarium [in part], see *Lactuca*. Lactucarium comes to us chiefly from Germany and Scotland, and is also produced in France, although little of the latter product reaches American markets. The *Scotch*, or *English*, variety is said to be of better quality than the *German*. It occurs in angular pieces of various sizes, is brown in color, and earthy in appearance. The *German* product occurs in brown quarter-sections of plano-convex, circular, or saucer-shaped cakes. French lactucarium comes in small, circular cakes, otherwise resembling the German drug.

The official product is thus described: "In sections of plano-convex, circular cakes, or in irregular, angular pieces, externally grayish-brown, or dull reddish-brown, internally whitish or yellowish, of a waxy luster; odor heavy, somewhat narcotic; taste bitter. It is partly soluble in alcohol and in ether. When triturated with water, it yields a turbid mixture, and, when boiled with water, it softens and yields a brownish-colored liquid which, after cooling, is not colored blue by iodine T.S."—(*U. S. P.*). Lactucarium does not absorb moisture from the atmosphere; is softened by heat, and at a high temperature burns with a large, white flame. Cold water takes up about a sixth of it, forming a deep-brown infusion; boiling water, proof-spirit, alcohol, and ether a much larger proportion. The addition of acetic acid to water or alcohol improves their solvent powers upon this article. It pulverizes with difficulty. It does not readily emulsionize with water, unless gum Arabic be present. By previous trituration with a small quantity of nitrous ether, it may be readily incorporated with water (Vogeler).

Chemical Composition.—Lactucarium contains neither morphine nor hyoscyamine, nor any other alkaloid (see *Lactuca*), but is found to consist of the bitter substances *lactucin*, *lactuco-picrin*, and *lactucic acid*, large amounts of *caoutchouc* and *lactucerin* (*lactucon*), a camphoraceous volatile oil (Thieme), sugar, gum, pectic acid, albumen, oxalic acid, mannit, potassium nitrate, etc.

Lactucin ($C_{11}H_{14}O_4$, Kromayer, 1861), one of the bitter principles of lactucarium, may be obtained by extracting lactucarium with cold alcohol of specific gravity 0.85. It is a colorless, odorless, fusible, neutral substance, crystallizing in rhombic plates, or in pearly-white scales. It dissolves in from 60 to 80 parts of water, is slightly soluble in ether, readily so in alcohol, and in acids. It reduces Fehling's solution, but yields no sugar upon hydrolysis. *Lactucic acid* (Ludwig, *Archiv der Pharm.*, 1847) is light yellow, very bitter, soluble in water and alcohol, and does not readily crystallize. Alkalies turn its aqueous solution red. By some this acid is considered a prominent active constituent. The mother liquor of lactucin yielded (Kromayer, 1861) *lactuco picrin* ($C_{44}H_{32}O_{21}$). It is a brown, amorphous, bitter body, faintly acid in reaction, soluble in water and alcohol. It is probably an oxidation product of lactucin. Kromayer regards lactucic acid as the product of the oxidation of lactuco-picrin.

By far the most abundant substance in lactucarium is *lactucerin* (*lactucon* of Lenoir, 1846) ($C_{19}H_{30}O$, Flückiger and O. Schmidt, 1875), constituting half or more of its weight. It is obtained by extracting lactucarium with cold, then with boiling alcohol, which leaves caoutchouc undissolved; or by extracting lactucarium with a mixture of 1 part of chloroform and 3 parts of alcohol. It forms odorless, tasteless, colorless needles, soluble in alcohol, ether, benzin, benzol, chloroform, and volatile and fixed oils, but not soluble in water. Its exact chemical nature remains yet to be established (see O. Hesse and G. Kassner. *Jahresb. der Pharm.*, 1886, p. 37; and 1887, p. 65; also *Lieb. Annal.*, 1886 and 1888). Flückiger (*Pharmacographia*) calls attention to the fact that it is remarkably analogous to *euphorbon* (from euphorbium), *cynanchol* ($C_{15}H_{24}O$) (from *Cynanchum acutum*, Linne), *echicerin* (from Alstonia), and *taraxacerin* (from *Taraxacum*). Lactucarium is liable to be adulterated with bread crumbs, hence the pharmacopœial test for starch above given.

THRIDACE is the inspissated, expressed juice obtained, in France, from *Lactucarium gallicum s. parisiense*, by collecting the stalks near the flowering period, depriving them of their leaves, and then subjecting them to pressure. It is not identical with lactucarium as was at one time supposed.

Action, Medical Uses, and Dosage.—Lactucarium has never been thoroughly and satisfactorily investigated in relation to its therapeutical influences; indeed, various experimenters differ in their views on this point, some asserting it to be a stimulant and others a sedative. It is, when employed at all, usually given as a calmative and hypnotic, and as a substitute for opium, to which it is to be preferred in many instances, on account of its freedom from unpleasant after-effects, as constipation, excitement of the brain, etc. However, it is not considered equal in power to opium. The most energetic lactucarium is said to be obtained from *L. virosa* and *L. altissima*. Moderate doses of it act as a narcotic poison on the lower animals, and 10 or 20 grains swallowed by a dog will cause sleep, or the watery solution injected into a vein occasions sleep, coma, and death. It appears to be of use in *insomnia*, due to mental overwork. A syrup of lactucarium is of value in the *cough of phthisis*, and even garden lettuce appears to exert a good influence in this disease, tending to allay the broncho-pulmonary irritation. Dose of lactucarium in pill or powder, which is the most efficient mode of administration, from 5 to 20 grains; of the tincture, 30 to 60 drops; of the alcoholic extract, 1 to 5 grains.

LAMELLÆ.—DISCS.

Synonyms: *Gelatin discs, Medicated gelatin.*

Preparation and History.—Under this head the *British Pharmacopœia* (1885), without giving processes for making them, introduces discs of gelatin, medicated with powerful alkaloids, for insertion under the eyelids for ocular effects. They weigh about $\frac{1}{50}$ grain and are about $\frac{1}{25}$ of an inch thick. They are prepared by pouring upon glass or porcelain, slightly greased to prevent their adhering, hot solutions of the desired alkaloids in gelatin, allowing them to cool, and finally cutting them into the form of discs. To keep them pliable glycerin is added. The following are official in the *British Pharmacopœia*, 1885:

Lamellæ Atropinæ, *Discs of atropine.*—"Discs of gelatine, with some glycerine, each weighing about $\frac{1}{50}$ grain, and containing $\frac{1}{5000}$ grain of sulphate of atropine"—(*Br. Pharm.*, 1885).

Lamellæ Cocainæ, *Discs of cocaine.*—"Discs of gelatine, with some glycerine, each weighing about $\frac{1}{50}$ grain, and containing $\frac{1}{200}$ grain of hydrochlorate of cocaine"—(*Br. Pharm.*, 1885).

Lamellæ Physostigminæ, *Discs of physostigmine.*—"Discs of gelatine, with some glycerine, each weighing about $\frac{1}{50}$ grain, and containing $\frac{1}{1000}$ grain of physostigmine"—(*Br. Pharm.*, 1885).

The *British Pharmacopœia*, of 1898, has added the following.

Lamellæ Homatropinæ, *Discs of homatropine.*—"Discs of gelatine, with some glycerine, each weighing about $\frac{1}{50}$ grain (1.3 milligrammes), and containing $\frac{1}{100}$ grain (0.65 milligramme) of homatropine hydrobromide"—(*Br. Pharm.*, 1898).

LAMINARIA.—LAMINARIA.

The sea weed *Laminaria Cloustoni*, Edmonston (*L. digitata*, Lamouroux).

Nat. Ord.—Algæ.

Common Names: *Sea tangles, Sea girdles.*

Botanical Source and History.—This marine plant, together with another, the *Laminaria flexicaulis*, Le Jolis (*Laminaria stenophylla*, Harvey), were included by Linnæus under the name *Fucus digitatus*. The last has a deep-brown, flexible, shining stem, and, when dry, becomes thin and fibre-like. The *Laminaria Cloustoni* is not flexible, but rigid and erect, its stem being cylindrical and from 3 to 6 feet long and 2 inches thick at the base. In color it is light-brown. Below the stem it divides into root-like branches, which spread and attach the plant to the submarine rocks. The frond is flat, coriaceous, of an olive-green color, and divided into finger-like divisions. The cylindrical part of the stem only is used. The plants grow upon the rocks in the Atlantic, Pacific, and Arctic Oceans.

Description and Chemical Composition.—Laminaria, in commerce, consists of dried, cylindrical portions of the stem, somewhat irregular, deeply corrugated, a half inch or less in thickness, horny in consistence, of great strength and elasticity, and breaking with a smooth, corneous fracture. The color is brown, the internal portion being paler than the outer. Its value depends upon its property of softening and swelling to several times its diameter when immersed in water, and when in contact with the secretions of the body. A whiter, inner layer is composed of large cells, while smaller cells occupy the outer, brownish portion. Large, elongated, mucilage cells are also present. When formed into conical and cylindrical sticks they are ready for use. Mannit was found in the plant by Stenhouse. Dextrose is likewise present. It contains an abundance of mucilage, from which Schmiedeberg (1885) isolated *laminaric acid*, a substance having the property of swelling up with water to an unusual degree, and *laminarin*, an indifferent mucilage; and the mineral constituents common to marine plants (see *Chondrus*). The ash of this class of algæ (*Laminaria*) amounts to about 14 per cent. and the species, *L. digitata*, is the chief source of the production of iodine on the Norwegian coast, containing about 1 per cent of this element (Jensen, *Jahresb. der Pharm.*, 1888, p. 155). Laminaria, when distilled with sulphuric acid and water, yields a liquid (*fucusol*) containing *furfurol* (*furfuraldehyde*, $C_4H_3.CHO$) and derivatives (Flückiger, *Pharmacognosie*, 1891, p. 279).

Action and Uses.—Laminaria was brought forward as a substitute for sponge tents for the dilatation of such parts as the uterine os, urethra, etc. Being of smaller size, and of greater rigidity, they are more easily introduced into small apertures and tortuous canals than sponge tents, while, on the other hand, their very rigidity renders them more liable to produce hemorrhage when organic changes occur in the uterus, or when such growths as polypi occlude the os. They readily swell to four times their diameter by the ease with which they absorb fluids, and do not so retain the discharges as to induce putrefactive changes. If greater dilatation is desired than is produced by a single tent, several may be fastened together. Sea tangle tents are considered less eligible than the rubber bag, or the sponge tents, for inducing premature births.

Related Plants and Preparations.—*Laminaria esculenta*, Lamouroux, as well as the *Laminaria saccharina*, Lamouroux, which has entire fronds and a flattish stem, and when washed with water becomes sweet, are edible. They likewise yield iodine.

Several pharmaceutical preparations from various species of *laminaria* and related algæ, were suggested by Mr. James Wheeler (see *Amer. Jour. Pharm.*, 1882, p. 124).

Tupelo.—On account of the greater ease with which absorption of fluids and consequent swelling of tissues take place, the root-wood of two species of *Nyssa* has been used for tents and bougies instead of laminaria. The tissue is light, spongy, and white, and, when in contact with fluid, doubles in thickness. This root-wood is known as *Tupelo*, from the trees (of *Nat. Ord.*—Cornaceæ) which yield it, the species being the *Nyssa grandidentata*, Michaux filius. the *Cotton-gum*, or *Large tupelo;* and the *Nyssa capitata*, Walter, the *Sour-gum*, *Tupelo-gum*, or *Ogechee lime*. They grow near the coast in the southern states.

LAPPA (U. S. P.)—BURDOCK.

The root and seeds of the *Arctium Lappa*, Linné (*Lappa officinalis*, Allioni). The *U. S. P.* directs: "The root of *Arctium Lappa*, Linné, and of some other species of *Arctium*."

Nat. Ord.—Compositæ.

Common Name: *Burdock*.

Botanical Source.—Burdock is a well-known biennial weed, with a tapering, fleshy, brown-colored root, from 8 to 15 inches in length, throwing off slender fibers. It has a round, solid, fleshy, juicy stem, 3 feet or more in height, furrowed, hairy, and having many wide-spreading branches. The leaves are large, alternate, on very long petioles, and are nearly entire, or slightly dentated, heart-shaped, undulated, veiny, 3-ribbed at the base, and somewhat hoary and downy beneath. The flower-heads are axillary and globose; the florets, anthers, and stigmas of which are purple, and occasionally white. The involucre is composed of imbricated scales, terminating in recurved or hooked extremities, and, when in fruit easily breaks from the stalk, and is well-known as the "burdock bur," sticking to the hair or clothing of persons who come in contact with it. The fruit is a smooth, oblong, laterally compressed achenia, transversely wrinkled, with a short, rough, prickly pappus. The seeds are quadrangular.

Fig. 156.

Arctium Lappa.

History.—By De Candolle this plant is named *Lappa minor;* by Gaertner, *Lappa major;* and by Lamarck, *Lappa tomentosa*. The plants named by these botanists are now considered as varieties only, and are all, at the present time, included under the one term *Arctium Lappa*, Linné. Burdock is indigenous to Asia and Europe, and grows freely in uncultivated soils, in waste places, and around dwellings in this country, flowering in July and August. The root and seeds are the medicinal parts; the root is to be collected in the spring, or the autumn of its first year, and loses four-fifths of its weight by drying. The root only is official in the *U. S. P.* A tincture of the seeds (*Tinctura Lappæ Fructus*) is prepared by percolating with diluted alcohol (3 of alcohol to 1 of water) 4 ounces of the ground fruit, to obtain 1 pint.

Description.—Radix Lappæ. The root is long, tapering, subcylindrical, or fusiform, externally black-brown or grayish-brown, internally of a light color. It is fleshy when recent; scaly, and longitudinally corrugated when dried, and breaks with a horn-like fracture. At the top of the root the white, silky bases of the leaf-stalks may remain as a small, tuft-like crown. It has a weak, unpleasant smell. The bark has a subsaline, and the internal, spongy parenchyma a sweetish, afterward bitter, mucilaginous taste.

Fructus Lappæ, *Burdock seeds.*—Small, curved, compressed, angular seeds, of a dark-brown color, or spotted with black, having an oily, spicy, bitter, subacrid taste, but no odor.

Chemical Composition.—The *root* was quantitatively analyzed by G. A. Weckler (*Amer. Jour. Pharm.*, 1887, p. 393), who found fixed oil (0.4 per cent), mucilage, sugar, altered tannin (*phlobaphene*, 0.075 per cent), *inulin*, resin, ash (3.67 per cent), etc. The aqueous solution of the alcoholic extract gave indications of a *glucosid.* The *seeds* were analyzed by Prof. Trimble and Mr. F. D. McFarland (*Amer. Jour. Pharm.*, 1885, p. 127, and 1888, p. 79). Moisture was 7.3 per cent, and ash 5.34 per cent. Petroleum spirit abstracted 15.4 per cent of a bland, fixed oil, drying upon exposure in thin layers to the air. It has a specific gravity of 0.930, and is soluble in ether, chloroform, benzol, and hot, absolute alcohol. A crystalline, bitter substance was also obtained by extracting the drug first with petroleum spirit, then with alcohol, pouring the concentrated alcoholic solution into water, whereby resin is separated. The aqueous solution contains the bitter principle, which proved to be a glucosid devoid of alkaloidal reaction. The name *lappin* is applied to it. Upon hydrolysis with very dilute acid, it is decomposed into sugar and alcohol-soluble resin.

Action, Medical Uses, and Dosage.—The root is alterative, aperient, diuretic, and sudorific. A decoction of it has been used in *rheumatic, gouty, venereal, leprous*, and *other disorders*, and is preferred by some to that of sarsaparilla. It is also useful in *scurvy, scrofula*, etc. The seeds are recommended as very efficient diuretics, given either in the form of emulsion, or in powder to the quantity of a drachm, or, preferably, in alcoholic form, as in specific lappa officinalis. They form a good diuretic alterative, and are used in *diseases of the kidneys*, and to remove *boils* and *styes* on the eyelids. The action of the seeds upon the urinary tract is direct, relieving irritation and increasing renal activity, assisting at the same time in eliminating morbid products. In chronic disorders lappa may be used to remove worn-out tissues, where the saline diuretics are inadmissible. *Dropsy* and *painful urination*, due to *renal obstruction*, have been relieved by it. A tincture of the fresh fruit or specific lappa should be employed. It is of marked value in *catarrhal* and *aphthous ulcerations of the digestive tract.* A favorable action is obtained from it in *dyspepsia.* When a cachectic condition of the blood is manifest, and where an alterative is demanded, it relieves *broncho-pulmonic irritation and cough. Rheumatism*, both muscular and articular, when previous inflammations have left no structural alteration, are said to be benefited by the seeds. *Skin diseases*, depending upon a depraved state of the cutaneous tissues and less upon the state of the blood itself, are conditions in which lappa has gained a reputation. It has been particularly praised in *psoriasis*, its use being long-continued to produce good results. *Chronic erysipelas, milk crust*, and various forms of *eczema* have been cured with it. The cutaneous circulation is feeble in cases requiring burdock seeds. A tincture of the recent seeds may be given in doses of from 1 to 60 drops; of specific lappa officinalis, 1 to 25 drops. An ointment of the leaves, or their juice, has been used advantageously in certain *diseases of the skin* and *obstinate ulcers.* The dose of a decoction, or syrup, of the root is from 4 to 6 fluid ounces, 3 or 4 times a day.

Specific Indications and Uses.—Feeble cutaneous circulation; scaly, dry eruptions; impaired nutrition of skin; urinary irritation; psoriasis.

LARICIS CORTEX.—LARCH-BARK.

The bark, denuded of its outer corky layer, of *Larix europœa*, De Candolle (*Pinus Larix*, Linné; *Abies Larix*, Lamarck; *Larix decidua*, Miller).

Nat. Ord.—Coniferæ.

Common Names: *European larch-bark, Larch-bark.*

Illustration: Bentley and Trimen, *Med. Plants*, 260.

Botanical Source.—The larch is a tree of straight and lofty growth, with wide-spreading branches, whose extremities droop in the most graceful manner. The buds are alternate, perennial, cup-shaped, scaly, producing annually a pencil-like tuft of very numerous, spreading, linear, bluntish, entire, smooth, tender, bright-green, deciduous leaves, about an inch long. The male flowers are drooping, about ½ inch long, and yellow; the female catkins, erect, larger than the male flowers, variegated with green and pink; the cones are erect, ovate, about an inch long, purple when young, reddish-brown when ripe, their scales spreading, orbicular, slightly reflexed, and cracked at the margin (L.).

History.—The larch inhabits the mountainous regions of central and south Europe, and is cultivated in Europe and America for ornamentation. *Venice Turpentine* (see *Terebinthina Canadensis*), is obtained from the trunk. The bark contains a large amount of tannic acid. "A saccharine matter called *Manna of Briançon* exudes from the branches, and when the larch forests in Russia take fire, a gum issues from the trees during their combustion, which is termed *Gummi Orenbergense*, and which is wholly soluble in water like gum arabic" (Lindley, *Flor. Med.*, p. 555). The manna referred to contains a peculiar sugar called by Berthelot *melezitose.*

Description and Chemical Composition.—The bark is the part employed and was official in the *British Pharmacopœia* of 1885, as *Laricis Cortex*, or larch-bark. It is collected from the branches and trunk in the spring of the year. It is of a rose or deep-red color externally (after the corky layer is removed), the internal surface being yellowish or pinkish. The pieces are flat or quilled, and break with a fibrous fracture. It is astringent to the taste, and its odor is somewhat balsamic and terebinthinate. The bark contains gum, sugar, resinous matter, and a peculiar tannin, which strikes olive-green with iron salts. A syrupy preparation, obtained by evaporating an aqueous infusion of larch-bark, yielded to Stenhouse, by cautious distillation, a peculiar volatile body, *larixinic acid* or *larixine* ($C_{10}H_{10}O_5$), which exists ready-formed in the bark of larix. It sublimes at 93° C. (199.4° F.), and forms beautiful long, colorless, lustrous crystals, freely soluble in hot water, alcohol, diluted alkalies, or acids, and sparingly so in ether. It has a faintly bitter, aromatic taste, and a feebly empyreumatic or somewhat camphoraceous odor. It is inflammable and is allied to pyrocatechin and pyrogallol, yielding in solution a purple color with ferric chloride. With an excess of concentrated solution of baryta it forms a thick, gelatinous, and transparent precipitate. It occurs most abundantly in the bark of young trees (*Amer. Jour. Pharm.*, 1862, p. 555).

Action, Medical Uses, and Dosage.—(For uses of *Venice Turpentine*, see *Terebinthina Canadensis.*) Larch-bark resembles the other terebinthinous barks, and in strong tincture has been used in *chronic genito-urinary inflammations, chronic bronchitis* to check secretions, and to control the bleeding of *purpura hemorrhagica*, and in *passive hemorrhage.* Dose of tincture, 5 to 30 drops.

LARIX AMERICANA.—TAMARAC.

The bark of *Larix americana*, Michaux.

Nat. Ord.—Coniferæ.

Common Names: *American larch, Tamarac, Hackmetack, Black larch.*

Botanical Source.—This is the *Pinus pendula, Pinus microcarpa*, and *Abies americana* of various botanists, and is known by the several names of Black larch, American larch, Hackmetack, etc. The tree has a straight and slender trunk, with slender horizontal branches, and attains the height of 80 or 100 feet. The leaves are short, 1 or 2 inches long, very slender, almost thread-form, soft, deciduous, without sheaths, in fascicles of from 20 to 40, being developed early in the spring from lateral, scaly, and globular buds, which produce (the same or the second year) growing shoots on which the leaves are scattered. The cones are oblong, of few rounded scales, inclining upward, from ½ to 1 inch in length, and of a deep-purple color. The scales are thin and inflexed on the margin. The bracts are elliptical, often hollowed at the sides, abruptly acuminate, with a slender point, and, together with the scales, persistent (W.—G.).

History.—This is a beautiful tree, more common throughout New England; it is found in swamps and moist places, and flowers in April and May. It may be distinguished from the pines, by the branches being without leaves for nearly half the year. Its wood is very heavy, strong, and durable, and is the most valuable of all the pines or spruces. The bark is the part used as medicine.

Action, Medical Uses, and Dosage.—A decoction of the bark of this tree is said to be laxative, tonic, diuretic, and alterative, and is recommended in *obstructions of the liver*, *rheumatism*, *jaundice*, and some *cutaneous diseases;* a decoction of the leaves has been employed in *piles*, *hemoptysis*, *menorrhagia*, *diarrhœa*, and *dysentery*, and externally in *cutaneous diseases*, *ulcers*, *burns*, etc. In *dropsy*, combined with spearmint, juniper berries, and horseradish, it has proved valuable. Dose of the decoction, from 2 to 4 fluid ounces, 2 to 4 times a day.

LAUROCERASI FOLIA.—CHERRY-LAUREL LEAVES.

The leaves of *Prunus Laurocerasus*, Linné (*Cerasus Laurocerasus*, Lois).

Nat. Ord.—Rosaceæ.

COMMON NAME: *Cherry-laurel.*

ILLUSTRATIONS: Bentley and Trimen, *Med. Plants*, Plate 98; Woodville's *Med. Bot.*, Plate 185; Artus' *Hand Atlas*, Vol. I, p. 205.

Botanical Source and Description.—Cherry-laurel is a small evergreen tree, native of Asia Minor, and often cultivated as an ornamental shrub in the southern part of Europe. The flowers are small, white, and disposed in axillary racemes, which are shorter than the leaves. The fruit is an ovate, acute, purple drupe, with a globular stone. The leaves are very thick and leathery, about 6 inches in length, and one-third as broad, tapering at the apex to a sharp point, and at the base to a short leaf-stalk. The margin is denticulated with sharp, appressed, rather distant, serrate teeth. The upper surface of the leaf is of a bright-shining green color; the lower pale and dull. The tree belongs to the section *Cerasus* (Jussieu), which, by many botanists, is considered distinct from Prunus, chiefly on account of the globular fruit-stone.

History.—The leaves are employed in medicine. When fresh and bruised, they evolve hydrocyanic acid, but the unbroken fresh leaf is odorless. If the perfect leaves are dried and then powdered, they do not give rise to hydrocyanic acid, but the addition of a little water at once develops the acid (Hanbury). At a meeting of the *Pharmaceutical Society of Paris*, December 6, 1871, Mr. Marais stated that a temperature of —22° C. (—7.6° F.), applied to the leaves and twigs prevented subsequent formation of hydrocyanic acid, although other volatile products were formed.

Chemical Composition.—The leaves of the cherry-laurel, as well as the bark and the seeds of the tree, when distilled with water, yield a distillate of *hydrocyanic acid*, and *benzoic aldehyde* (*benzaldehyde*, *bitter almond oil*, $C_6H_5.CHO$). W. A. Tilden (*Pharm. Jour. Trans.*, Vol. V, 1875, p. 761), finds that the essential oil of cherry-laurel is not absolutely identical with that of the bitter almond; it consists mainly of benzoic aldehyde, and is accompanied by hydrocyanic acid, possibly some *benzoic alcohol* ($C_6H_5.CH_2OH$), and minute quantities of a resin having the peculiar odor of the cherry-laurel leaf. Both substances constitute the medicinal principles of *Aqua Laurocerasi* (*Br.*) or cherry laurel water (see *Aqua Laurocerasi*).

The formation of these substances suggests the presence of *amygdalin* in these parts of the plant (see *Amygdalus*). Lehmann (1874), testing the leaves for amygdalin, obtained 1.3 per cent of crystallizable but deliquescent bitter *laurocerasin*, which behaved toward the ferment *emulsin* exactly like amygdalin, yielding hydrocyanic acid, benzaldehyde, and dextrose. The similarity also holds good in the products obtained from both when boiled with baryta water; ammonia is split off in both cases, and the barium salt of *amygdalic acid* ($C_{20}H_{28}O_{13}$) is formed, which must not be confused with *mandelic acid* ($C_8H_8O_2$). With *laurocerasin*, however, 2 molecules of amygdalic acid were formed for each molecule of ammonia, while *amygdalin* yielded but one. Hence, Lehmann accepts that 1 molecule of *laurocerasin* ($C_{40}H_{67}NO_{30}$) is composed of equal molecules of *amygdalin* (anhydrous, $C_{20}H_{27}NO_{11}$), *amygdalic acid* ($C_{20}H_{28}O_{13}$), and 6 molecules of water. Laurocerasin is believed also to exist in the unripe bitter almonds, and to evolve amygdalin during the process of maturing. It is also contained in the bark of *Prunus padus*, the bird-cherry tree, while in its seeds, as well as those of cherry-laurel, amygdalin is present. The theoretical yield of *hydrocyanic acid* from laurocerasin ($C_{40}H_{67}NO_{30}$) is only about one-half of that from crystallized amygdalin ($C_{20}H_{27}NO_{11}+3H_2O$). Flückiger (*Pharmacognosie*, 3d ed., 1891, p. 766), obtained on an average 0.12 per cent of hydrocyanic acid in the distillate of bruised fresh leaves. The yield also varies with the season, being highest in the spring and lowest late in the fall, being then reduced to about one-half. The leaves also contain reducing sugar, an iron-greening tannin, and a fatty or waxy matter. Bougarel (1877) isolated from the leaves crystallizable *phyllic acid*, soluble in alcohol and ether, insoluble in water, and melting at 170° C. (338° F.). It also occurs in the leaves of the apple tree, maple, peach, almond, etc. Young leaves incinerated, yielded to Flückiger about 7 per cent of ash.

Action, Medical Uses, and Dosage.—(See *Aqua Laurocerasi.*) The bruised leaves are anodyne.

LAURUS.—LAUREL.

The leaves, fruit, and oil of *Laurus nobilis*, Linné.

Nat. Ord.—Laurineæ.

Common Names: *Laurel*, *Bay*, *Sweet bay*, *Sweet bay tree.*

Illustration: Bentley and Trimen, *Med. Plants*, 221.

Botanical Source.—The bay tree is either a shrub or small tree, usually growing to a height of from 20 to 30 feet. The leaves are short-petioled, oblong-lanceolate or oblong, veined, entire, or occasionally repand, somewhat acute at each end, and alternately affixed. They are smooth, leathery, glossy-green above, and paler beneath. The veins meet the midrib at an acute angle, and by means of small lateral veinlets, form a network which does not anastomose prominently near the leaf-margin. The flowers are diœcious, yellow, or yellowish-white, axillary, and borne in umbellate clusters. The fruit is an oval, deep-purple, almost black drupe.

History, Decription, and Chemical Composition.—This plant, the well-known bay tree, is cultivated in Mexico, but is indigenous to the countries round about the Mediterranean. The leaves, expressed oil, and berries are employed.

I. Folia Lauri, *Laurel leaves.*—These, as well as the fruit, have been described above. When dried they are of a yellow-green or brown-green color, and possess an aromatic, bitter taste, and an aromatic agreeable odor. Their virtues are due to the presence of a volatile oil ($\frac{1}{3}$ per cent, Flückiger, *Pharmacognosie*, 1891; from 0.8 to 2.5 per cent, referred to dried leaves, Schimmel & Co.'s *Report*, October, 1893). It is probably identical with that from the fruit (which yields 0.8 per cent), but has a finer aroma. Its specific gravity is 0.924. According to Prof. Wallach (1889), the oil both from the leaves and the berries, contains for the most part *cineol* (*eucalyptol*), a terpene derivative, and small quantities of the terpene *pinene.* (For list of 22 essential oils in which *cineol* has been found to occur, see Schimmel & Co.'s *Report*, 1891, p. 68.)

II. Fructus (or Baccæ) Lauri, *Laurel* or *Bay-berries.*—The dry berries are fragile, wrinkled, green-black, or black-brown, having a thin, friable integument enclosing an aromatic, oily, bitter, dicotyledonous kernel. Bonastre (1824) found the fruits to contain 0.8 per cent of volatile oil, 12.8 per cent of a green fatty oil. and 5.1 per cent of solid fat. According to analysis by Staub (1879) a variety of fatty matters are present, viz., the glycerides of acetic, oleic, linoleic, stearic, palmitic, myristic, and lauric acids, with small amounts of free acetic acid.

III. Oleum Lauri, *Oil of Laurel.*—This is the expressed oil of the fruit, and is known also as *Oleum Lauri Expressum*, *Oleum Laurinum*, and *Oleum Lauri Unguinosum*. This oil is a green, granular, lard-like mixture, melting at 40° C. (104° F.), to a dark-green aromatic fluid, and consisting of a semi-solid fat (chiefly *laurostearine*, the glyceryl-ester of *lauric acid* $C_{12}H_{24}O_2$), fragrant ethereal oil of bitter, balsamic taste, and green chlorophyll, which is permanent toward ammonia. An adulteration with indigo and curcuma can therefore be recognized by the formation of a red color upon the addition of ammonia water to an alcoholic extract of the oil. These coloring matters are also insoluble in ether, while oil of laurel is completely soluble with green color. Cold alcohol dissolves out essential oil and chlorophyll, leaving the fatty matter undissolved.

Action, Medical Uses, and Dosage.—The ancients valued bay leaves and laurel berries, using them as astringents, stimulants, and stomachics. In Europe pastry is at the present day flavored with the leaves, the belief prevailing that they render the food more easily digested. Active emmenagogue properties were formerly ascribed to laurel, and a decoction of the root-bark was in vogue as a remedy in *dropsies* and *disorders of the urinary tract.* Locally, in powder or decoction, the leaves and fruit were applied to *insect bites* and *stings*, *scalp eruptions*, and in *leucorrhœa* when accompanied by lax vaginal walls. All that now remains of this ancient medication is the use of the oil (both volatile and fixed) as a stimulant topical agent for *rheumatic* and other *painful parts.*

Related Species.—*Persea gratissima*, Gærtner (*Laurus Persea*, Linné), *Alligator pear.* The fruit, from its long, pear shape, is also known as the *Avacado pear*, and from its butyraceous, rich pulp, *Midshipman's butter*, or *Vegetable marrow.* The tree closely resembles our sassafras tree, and the fruit is either green, purple, or red, the first variety being preferred by the natives who consume the fruit. If eaten before maturity the fruit is liable to induce dysenteric and febrile disorders. The seeds, which are the medicinal parts, are hard and globose, contain a milky juice which leaves a red ineffaceable mark upon a white surface when exposed to the atmosphere. The seeds contain *amygdalin*, and a ferment capable of producing therefrom *hydrocyanic acid;* fat, starch, mannit, and sugar; the fruit, gum, sugar, fixed oils, and salts of malic acid (Betancourt). The seeds are reputed anthelmintic, and are applied locally and given internally, in fluid extract, for *rheumatism* and *intercostal neuralgia.*

LAVANDULA.—LAVANDULA.

The flowers of *Lavandula vera*, De Candolle (*Lavandula spica*, var. *a.* Linne; *Lavandula officinalis*, Chaix; *Lavandula angustifolia*, Ehrhart).

Nat. Ord.—Labiatæ.

Common Names: *Lavender*, *Lavender flowers.*

Illustration: Bentley and Trimen, *Med. Plants*, 199.

Botanical Source.—*Lavandula vera*, of De Candolle, is a small shrub, generally 1 or 2 feet high, but sometimes growing to even 6 feet. The leaves are oblong-linear or lanceolate, entire, opposite, sessile, and, when young, hoary and revolute at the edges. The flowers are of a lilac color, small, in terminal, cylindrical spikes, formed of interrupted whorls of 6 to 10 flowers, each whorl with 2 minute bracts. The corolla is tubular, 2-lipped, upper lip large and 2-lobed, lower lip 3-lobed. The floral ~~leaves are~~ rhomboid-ovate, acuminate, membraneous, all fertile, the uppermost shorter than the calyx. Stamens 4, declinate; anthers reniform, 1-celled; style slender; stigma bilobate (L.).

History and Chemical Composition.—*Lavandula vera* inhabits southern Europe and north Africa, growing in dry, sterile soils in mountainous and other sunny elevations. It is largely cultivated in the United States, flowering in July and August. It is subject to a disease, which can only be avoided by not allowing the plants to grow too closely together. The whole plant is aromatic. The flowers are the parts used; they are gathered shortly after their appearance, or before fully expanded, usually in June and July, and carefully dried. They have a rich, peculiar fragrance, which is retained long after drying, and a strong, bitter, aromatic, somewhat camphoraceous taste. Their properties are yielded to alcohol or ether. They contain volatile oil (see *Oleum Lavandulæ*), resinous matter, tannic acid, a bitter principle, and woody fiber. The recent flowers yield from about 1.2 to 1.6 per cent of the volatile oil.

Action and Medical Uses.—Lavender is a tonic, stimulant, and carminative. It is seldom given in the crude state, but in its official preparations, which see. Colic is said to be occasioned by the infusion if immoderately used. Lavender fomentations are occasionally employed in *painful local affections*. The infusion is prepared with 1 drachm of the flowers and 1 pint of water. Prof. Scudder considered lavender the child's stimulant, preferring the tincture of the oil (℥ii) to alcohol (Oj).

Fig. 157.

Lavandula vera.

Related Species.—*Lavandula spica*, of De Candolle, is more dwarfish and more hoary than the *Lavandula vera*. Leaves oblong-lanceolate, somewhat spatulate, entire, much narrowed at the base, hoary on both sides. Spikes somewhat interrupted. Bracts linear-subulate, shorter than the calyx. This plant is not used in medicine, but yields what is called *oil of spike*, much used in the preparation of artistical varnishes and by porcelain painters. The chief constituent of this oil is *cineol*.

Lavandula stœchas, Linné.—This small shrub, the flowering spikes of which are known as *French* or *Arabian lavender*, is found in the countries bordering on the Mediterranean. They bear small-stalked, deep-purple, small flowers, having a camphoraceous, pronounced aroma.

Ocimum basilicum, Linné, *Basil*, *Sweet basil*.—This herb is an annual, belonging to the Labiatæ, and indigenous to Africa and Asia, in the tropical portions, and often cultivated in gardens. It has a cooling, balsamic taste, and a strongly aromatic, agreeable odor. It contains a small amount of tannin and a volatile oil. This plant is employed in some sections as a flavoring herb in cooking, and in southern South America, the fresh juice is employed to expel *worms*. It has been used in *mild nervous disorders*. The oil is nervine and carminative.

LEDUM.—LABRADOR TEA.

The leaves of *Ledum latifolium*, Aiton.

Nat. Ord.—Ericaceæ.

COMMON NAMES: *Labrador tea*, *James' tea*.

Botanical Source.—*Ledum latifolium* is an evergreen shrub, with an irregularly branched stem, from 2 to 5 feet in height. The branches are woolly. The leaves are alternate, subsessile, entire, 1 or 2 inches in length, nearly one-third as wide, obtuse, elliptical or oblong, smooth above, clothed with a dense, rusty wool beneath, and have revolute or replicate margins. The flowers are large, white, in dense, terminal corymbs of about a dozen flowers; the pedicels nearly as long as the leaves, filiform and pubescent. The calyx is very minute. Corolla white, consists of 5 spreading, obovate, obtuse petals. Stamens 5 or 10, as long as the petals; filaments slender and smooth; anthers small, opening by 2 simple, terminal pores. Ovary roundish; style straight, about as long as the stamens; stigma small and obtuse. Capsule ovate-oblong, subpubescent, 5-celled and 5-valved; valves splitting from the base upward, with the margins inflexed and connivent; and receptacles linear, extending into the cells of the capsule. The seeds are minute, terminating in a membrane at each extremity (L.—Torrey).

History and Chemical Composition.—This plant is a native of North America, and is found in the northern part of the United States and in Canada, growing in cold bogs and damp mountain woods, flowering in June and July. It is also found further south, growing on the mountains. The leaves are the parts used. They have a pleasant flavor, and yield their virtues to hot water in infusion, or to alcohol. It contains the glucosid *ericolin* (R. Thal, 1883). They were much employed instead of tea leaves during the Revolutionary War. Their medicinal virtues were well-known to the Cree Indians in the territory of the Hudson Bay, and to other Indian tribes.

Action, Medical Uses, and Dosage.—Ledum latifolium is pectoral and tonic, and, in small doses, is useful in *coughs, irritations of the pulmonary membranes*, and in *dyspepsia*. It increases the urinary flow. Reputed also to possess similar, but less energetic, properties than the *Ledum palustre* (see below), which is supposed to possess narcotic powers. An infusion of the leaves has been successfully employed in decoction in *pertussis*, *dysentery*, and to allay *pruritic irritation in exanthematous diseases*. In *leprosy*, *itch*, and *several diseases of the skin*, the decoction internally and externally has been beneficially used. Clothes, among which it is strewed, are said to be preserved from the ravages of moths. A strong decoction, used externally, will kill *lice* and other insects. Dose of the infusion of either of the above plants, from 2 to 4 fluid ounces, 3 or 4 times a day. A tincture may be prepared from the fresh leaves (℥viii to alcohol, 98 per cent, Oj). Dose, 1 to 10 minims.

Related Species.—*Ledum palustre*, Linné, or *Marsh tea*, also known as *Marsh cistus*, *Wild rosemary*, and *Rosmarinus sylvestris*, inhabits sphagnous swamps in the cold regions of the two continents, and may be distinguished by its linear leaves, having uniformly 10 stamens, and especially by its oval pods. The leaves have a pleasant, resinous odor, and a not unpleasant, amarous, and somewhat spicy taste, with slight astringency. They were formerly used in place of hops in the making of beer in some parts of Germany and Sweden. Water, by infusion, or alcohol, extracts the properties of ledum. Its chief proximate principles are: (1) *Ericolin* ($C_{26}H_{30}O_3$, R. Thal, 1883), a resinous, bitter glucosid without odor, decomposing with water, or more rapidly with diluted mineral acids, into sugar and *ericinol* ($C_{20}H_{26}O$), which readily absorbs water and forms *hydroericinol* ($C_{10}H_{20}O_4$), a thick fluid of a peculiar odor; (2) *leditannic acid* ($C_{25}H_{20}O_4$); (3) volatile oil containing crystallizable *ledum camphor* ($C_{15}H_{26}O$, Rizza, *Jahresb. der Pharm.*, 1887, p. 363, and Hjelt, *Chemiker Ztg.*, 1895, p. 2126), melting at 105° C. (221° F.). 0.7 per cent of the oil was obtained by Hjelt and Collan (1882) from the herb grown in wet localities. The flowering tops yielded (Schimmel & Co., Oct., 1894) 1.2 per cent of the oil, while the non-flowering shrub yields only about 0.35 per cent. The poisonous *andromedotoxin* was established, by Prof. Plugge and De Zaayer, to be absent from Ledum palustre (*Amer. Jour. Pharm.*, 1889, p. 360).

LEONURUS.—MOTHERWORT.

The tops and leaves of *Leonurus Cardiaca*, Linné.
Nat. Ord.—Labiatæ.
Common Name: *Motherwort.*

Botanical Source.—*Leonurus Cardiaca* is a perennial plant, with stems from 2 to 5 feet in height, wand-like, minutely downy, acutely quadrangular, with intermediate channels, purplish, beset with numerous pairs of opposite, long-stalked, rough, dark-green, somewhat downy leaves in 4 vertical rows. The lower stem-leaves are palmate-lobed and broadest; the upper ones acutely 3-lobed; those about the summit lanceolate and undivided; and all toothed and cuneiform at the base. The flowers are purplish or whitish-red, in numerous axillary whorls. The calyx is rigid and bristly. Corolla purplish, upper lip clothed with dense, white, shaggy, upright hairs; lower deeply colored, variegated, smooth, in 3 nearly equal entire lobes; middle lobe obcordate. Stamens didynamous; anthers approximated in pairs, with parallel transverse cells and naked valves, sprinkled with shining dots. Achenia oblong, or linear-obovate, blunt and squamosely muricated at the summit, and longitudinally striated, with a long beak; pappus white, hair-like, very soft, simple, and radiated in many rows (L.—W.—G.).

Fig. 158.

Leonurus Cardiaca.

History and Chemical Composition. Motherwort is an exotic plant, but extensively introduced into this country, growing in fields and pastures, and flowering from May to September. It is supposed to be a native of Tartary, and may probably be indigenous to the northern sections of this country. In some sections of continental Europe, and particulary in Russia *Leonurus Cardiaca* has been highly endorsed as a remedy for hydrophobia. It has not, however, been as extensively used as a medicinal agent in this country, as its virtues warrant. The root sends forth a number of small, long fibers of a dark-yellowish color. The whole plant is medicinal. It has a peculiar, aromatic, not disagreeable odor, and a slightly aromatic, very bitter taste, and yields its properties to water or alcohol. Mr. W. A. H. Naylor (*Pharm. Jour. Trans.*, Vol. XXV, 1894, p. 181) found the following constituents of *Leonurus Cardiaca:* A bitter principle soluble in alcohol, chloroform, and ether, insoluble in water, benzol, and petroleum ether; an *alkaloidal* substance, not reacting, however, with Mayer's Solution;

a hard resin, a soft resin, fixed oil, wax, and potassium chloride, calcium phosphate, and citric, malic, and tartaric acids. Some interesting notes on the early literature of Leonurus, by E. M. Holmes, precede Mr. Naylor's article.

Action, Medical Uses, and Dosage.—Motherwort is emmenagogue, nervine, antispasmodic, and laxative. It is usually given in warm infusion in *amenorrhœa from colds;* and in *suppressed lochia* we have found it superior to any other remedy. Also useful in *hysteria* and *chorea* (King). The extract is recommended in *nervous complaints, pains peculiar to females,* in *irritable habits, delirium tremens, typhoid stages,* with morbid nervous excitability, all chronic diseases attended with restlessness, wakefulness, disturbed sleep, *spinal irritation,* and *neuralgic pains* in the stomach and head, and in *liver affections.* It is adapted to cases of *nervous debility* with irritation, nervous unrest, tendency to choreic or spasmodic movements, pelvic and lumbar uneasiness or pain, bearing down pains, and the irritability due to *female disorders.* Combined with ictodes and resin of black cohosh, it forms a superior antispasmodic, nervine, and emmenagogue. Externally, it may be used as a fomentation to the bowels in *suppressed and painful menstruation,* etc. Dose of decoction, from 2 to 4 fluid ounces, every 1, 2, or 3 hours; of the extract, from 3 to 6 grains, every 2 to 4 hours. The root in infusion is diuretic, and is stated to be efficient in *obstinate intermittents.* The seeds have been given in half-teaspoonful doses in water, in *bilious colic,* and, it is said, will pass through the bowels when quicksilver will not; they must not be pulverized. This, however, requires more satisfactory evidence (King).

Related Species.—*Stachys palustris,* Linné, *Hedge nettle.* Europe and North America, in wet situations. This, with other species of *Stachys,* has been employed as a topical and general stimulant.

Ballota nigra, Linné, *Black horehound.*—New England, naturalized. Has been used as a stimulant, antispasmodic, and vermifuge.

Galeopsis Tetrahit, Linné, *Hemp nettle.*—Formerly used in *bronchitis* and *intermittent fever.*

LEPTANDRA (U. S. P.)—LEPTANDRA.

"The rhizome and rootlets of *Veronica virginica,* Linné" (*Leptandra virginica,* Nuttall).

Nat. Ord.—Scrophularineæ.

Common Names: *Black root, Culver's root,* etc. (see *History*).

Illustration: Bentley and Trimen, *Med. Plants,* 196.

Botanical Source.—This is the *Veronica virginica,* of Linnæus, and *Leptandra virginica,* of Nuttall. It is an indigenous, perennial plant, with a simple, straight, smooth, herbaceous stem, from 2 to 5 feet in height. The leaves are whorled in fours to sevens, short-petioled, lanceolate, acuminate, finely serrate, and glaucous beneath. The flowers are white, numerous, nearly sessile, in long, terminal, and verticillate, sub-terminal spikes. Spikes panicled and crowded; bracts very small. Calyx 4-parted. The corolla is small, nearly white, with a deeply 4-cleft, spreading border, the lateral or lower segments narrower than the others, tubular and pubescent inside; the tube of the corolla is longer than its limb, and much longer than the calyx. Stamens 2, very much exserted. Capsule oblong-ovate, not notched, opening by 4 teeth at the apex, and many-seeded (G.—W.).

History.—Leptandra is one of the very old Eclectic drugs. Like most medicinal plants it is known by several popular names, as Black root, Culver's root, Culver's physic, Bowman root, Tall speedwell, Veronica, Tall veronica, Physic root, and Whorlywort. Its name Veronica is probably derived from St. Veronica. Black root is found more or less plentifully throughout the United States, from Vermont to Wisconsin, and southward, growing in wet, or moist, rich ground near streams, in woods, thickets, glades, and open plains. It is particularly plentiful in limestone districts. It is a perennial herb, growing from 1 to 5 feet high, with an upright stalk, having whorls of leaves, and surmounted by spikes of crowded white flowers. It blooms in July and August. The rhizome is perennial, and should be gathered in the fall of its second year. When fresh, it has a faint, almond-like odor, and a bitter, nauseous taste, which is somewhat lessened by drying, and yields its properties to water at 100° C. (212° F.), or still better to alcohol. Age does not impair its virtues.

This drug was well-known to the Indian Herb Doctor Peter Smith, and to Dr. Hough. To the former it was known as Culver's, or Brinton's root, and he states that his father "used to cure the pleurisy with amazing speed" with it. Hough said of it that it was "a most mild and efficacious purge in fevers, in disorders of the stomach, or the bowels, to destroy vicious humors in the blood, to remove costiveness, or to cool fevers." The Wyandots were acquainted with its virtues, and regarded it as "a very good healing purge." The early Eclectic physicians considered it one of their most valuable therapeutic agents.

Specific Leptandra, the most extensively used preparation, has a dark-brown color, the peculiar, and markedly so, odor of the drug, and a bitter taste that is accompanied by the aroma of the root from which it is prepared. When dropped into water it produces a turbidity or milkiness. If specific leptandra be allowed to evaporate by rubbing a few drops in the palm of the hand the skin is impregnated with the strong odor of leptandra in an intensified degree.

Description.—Leptandra is officially described as "of horizontal growth, from 10 to 15 Cm. (4 to 6 inches) long, and about 5 Mm. ($\frac{1}{5}$ inch) thick, somewhat flattened, bent, and branched, deep blackish-brown, with cup-shaped scars on the upper side, hard, of a woody fracture, with a thin, blackish bark, a hard, yellowish wood, and a large, purplish-brown, about 6-rayed pith; roots thin, wrinkled, very fragile; inodorous; taste bitter and feebly acrid"—(*U. S. P.*). (See also illustration of the microscopic structure of leptandra, by A. P. Breithaupt, *Amer. Jour. Pharm.*, 1897, p. 235.)

Chemical Composition.—The root of leptandra, as well as its preparations, possesses a peculiar, strong odor, and yields, with diluted sulphuric acid, an acid distillate of an unpleasant odor, and containing traces of *formic acid* (F. F. Mayer, *Amer. Jour. Pharm.*, 1863, p. 298). Prof. E. S. Wayne procured a bitter principle by the following process: The root, in coarse powder, was treated with water in a percolator until the infusion was no longer bitter; subacetate of lead was added to this, and the precipitate removed by filtration; carbonate of sodium was then added to remove excess of lead, and the liquid again filtered. The pale-yellow liquid was then allowed to filter through a column of purified animal charcoal. The liquid that passed through was totally devoid of taste and color. The coal was then washed with water until this commenced to have a bitter taste; it was then dried and treated with boiling alcohol, and the alcoholic solution allowed to evaporate spontaneously. It dried to a dark-green mass, no signs of crystallization being observed during the time. It was again dissolved in water, treated with ether, and allowed to evaporate, when a number of bitter, pale-green, needle-shaped crystals were obtained (*Amer. Jour. Pharm.*, Vol. CXXV, p. 510).

G. Steinmann (*Amer. Jour. Pharm.*, 1887, p. 229) obtained a bitter principle by pouring a concentrated tincture of the root into water, which precipitates the resin. The filtrate was acidulated and shaken out with benzol. Upon evaporation of this solvent, 0.1 per cent of a crystalline and very bitter residue was left, which was again crystallized from ether. The pale, lemon-yellow crystals are insoluble in petroleum benzin, soluble in alcohol, ether, benzol, hot water, and yield no precipitate with Mayer's solution, nor with tannic acid; neither does it reduce Fehling's solution after being boiled with diluted sulphuric acid. The resinous matter, precipitated by water and purified by repeated precipitation is absolutely inert (see *Leptandrin*). The filtrate from the first precipitation of the resin contains *mannit* (E. S. Wayne, *Amer. Jour. Pharm.*, 1859, p. 557). J. U. Lloyd (*Amer. Jour. Pharm.*, 1880, p. 491) calls attention to the fact that the bitterness of the tincture of leptandra disappears when in prolonged contact with diluted sulphuric acid, or more rapidly upon boiling. An inert resin is formed in both cases, and the solution contains a great amount of reducing substance.

LEPTANDRIN.—Leptandrin was discovered and introduced about the year 1850, by Mr. William Stanley Merrell. It was one of the class of Eclectic concentrations or resinoids and followed podophyllin, macrotin and irisin, which were previously discovered by Prof. John King. As found in commerce it is prepared by pouring an evaporated alcoholic tincture of leptandra, of a thick, syrupy consistence, into cold water. A black, tarry substance is thrown down. This precipitate is then washed with pure cold water and becomes tasteless. This product has a deep-black color, resembling asphaltum, and breaks with a shiny fracture. By this process the bitter principle of leptandra remains dissolved in the water used as a precipitant. The *leptandrin* made by the foregoing process (Greve) is inferior as a medicine. Prof. Lloyd agrees with Dr. Greve, that a dried alcoholic extract (not precipitated in water) possesses more nearly the medicinal qualities of the drug. He further states that the dried precipitated resin differs so markedly from the dried alcoholic extract as to forbid their substitution for each other. If the resin be rubbed with distilled water and filtered the filtrate will be colorless, nearly tasteless, and without bitterness, while the filtrate from the dried alcoholic extract, similarly treated, is dark-colored and extremely bitter. The resin of leptandra, or *leptandrin*, will not run together nor lump in any temperature or in any atmosphere. Under like conditions, or if not well dried, the alcoholic extract will run together and form a hard mass. The root, which should be well dried and at least one year old after collecting, yields about 6 per cent of resin. Of the alcoholic extract the yield is about 10 per cent. The yield of resin increases with age and exposure after collection, consequently the roots of two or more years of age are preferable for the production of *leptandrin*. Prof. John King, to whom may be ascribed the popularity of leptandra as a medicinal agent, did not employ the so-called "*leptandrin*," but found the therapeutic value of the drug to depend upon a mixture of the aqueous and alcoholic extracts (see *Amer. Pharm. Assoc. Proc.*, Vol. XXVIII, p. 421). In this connection the following remarks from former editions of this work may be used to indicate the opinion of Prof. King concerning the preparation sold under the name *leptandrin*.

"Dr. T. L. A. Greve states that 'under the name of *leptandrin* various preparations have been sold. Originally, the soft resin was simply dried and powdered but it was found to be nearly inert. The alcoholic extract, dried and powdered, makes a good preparation, and would, probably, be better if deprived of its resin. It is very difficult, however, to dry it without the addition of magnesia or some other absorbent. Most of the so-called leptandrin made at present for medicinal purposes, is merely a dried aqueous extract, so that our practitioners may observe how much they have been imposed upon heretofore by the representations of some manufacturers of the concentrated principles as to their modes of preparation, etc. (N. B.—The powder known heretofore by the name 'leptandrin,' being at this day prepared so as to be nearly worthless, I have substituted the extract for it in nearly all the formulæ in this work where its use occurs)" (King.)

At present, neither leptandrin nor other "resinoids" are used to any great extent by Eclectic physicians.

Action, Medical Uses, and Dosage.—Physiologically, leptandra acts upon the gastric, hepatic, and intestinal apparatus. The fresh root is actively and dangerously cathartic, and has produced violent emesis and bloody purging, accompanied by vertigo, and administered to the pregnant female has produced miscarriage. In this state, it is totally unfit for a cathartic, but upon drying the root loses its drastic qualities, and becomes a safe cholagogue, laxative, and cathartic. In ordinary doses it does not produce copious alvine discharges, but gently stimulates the functions of the liver. It does not debilitate nor lower the tone of the bowels or the general system, but gently stimulates and strengthens the functional activity of the whole intestinal appendages. It favors normal intestinal excretion and improves digestion. Prof. Scudder regarded it as a gastro-intestinal tonic, and thought it indicated where there is enfeebled circulation with tendency to stasis. The only condition in which the green root has been used was for *intermittent fever*, but as we possess better remedies for this state, its use as a cathartic is at least injudicious.

No better laxative can be used in atonic states of the system than leptandra. No matter how great the intestinal atony, it will be found to operate gently and without systemic disturbance. It is an exceedingly useful drug for conditions depending upon hepatic torpor. Small doses restore the liver to its normal condition. The cathartic action of leptandra is beneficial in the forming stages of *fevers* and in the early stages of *dysentery*. It relieves the constipated upper bowel, increases the biliary secretions, and acts as an unirritating intestinal tonic, and the dysenteric discharges are speedily checked. In *acute dysentery* it should be used early. It is an admirable remedy for *chronic dysentery*, with *chronic enteritis*, accompanied by dizziness, cold extremities, headache, abdominal and hepatic pain, with mental depression. It is a good agent for *atonicity of the stomach and liver.* The indications pointing to its use are drowsiness, coldness of the extremities, hot, dry skin, sluggish circulation, abdominal plethora, dull aching pain in hepatic region and in left shoulder, and dull heavy frontal headache, sallow or yellow skin, with a pale, white-coated, broad, thick tongue, and a bitter, disagreeable taste.

Leptandra stimulates the glandular system to activity, and is valuable in *chronic diseases of the mucous membranes.* For *indigestion*, with deficient secretion and constipation, it may be combined with podophyllin triturate (1 in 100). When the stools are clay-colored, with a deficiency of the biliary secretion, it may be used to bring about bilious discharges, even though diarrhœa be already present. In *dyspepsia*, with an unpleasant frontal headache, yellow, furred tongue, with nausea and yellowness of the skin and conjunctiva, specific leptandra will be found an excellent drug. In gastric atony, if necessary, it may be combined with hydrastis, xanthoxylum, chelone, and the milder bitter tonics in general. Black root is a good remedy in *diarrhœa* when indicated. There is a passage of undigested aliment, the liver is inactive, there is dull abdominal pain, and the stools may be of a light clay color. Here leptandra will be found to act kindly. Another condition in which it will prove serviceable, is in the diarrhœa of children passing through the period of *dentition.* Chamomilla or rhubarb may be exhibited with it, when specifically indicated. When the skin shows a jaundiced condition, and there is hepatic tenderness, ℞ Compound syrup of rhubarb and potassa fl℥iij, specific leptandra fl℥i. Mix. Sig. Ten to 20 drops every hour until the diarrhœa ceases.

Leptandra is a useful remedy in disorders of the liver. It is a valuable agent in that state known as "*biliousness.*" In *acute hepatitis* combine the dried alcoholic extract with a small portion of diaphoretic powder to relieve the congested viscus. An occasional dose is not without good effect in *chronic inflammation of the liver.* Specific leptandra may be employed after the passage of *biliary calculi.* Combined with hydrastis, it will materially alter the condition upon which the formation of the concretions depends. In *jaundice* it may be combined with dioscorea, chionanthus, or chelidonium, as indicated. It has been successfully employed in *acute muco-enteritis* and *chronic enteritis.* In the formative stage of *fevers*, particularly *bilious fever*, its cathartic action will be appreciated. Many times it checks the morbid process, and puts the patient on the road to recovery. It has been used with advantage in *typhoid fever* in malarious districts, though it is questionable whether, as a rule, any agent should be employed which has a tendency to increase the intestinal secretions and alvine evacuations. It is better suited to those cases showing typhoid characteristics, but not evidencing lesions of Peyer's patches.

Leptandra has been found useful in *malaria.* The chill should first be broken with quinine and followed by a cathartic dose of leptandra. Many contend that by its exhibition in this manner, the abnormal condition producing the chill is rectified and a return of the unpleasantness is wholly averted, while under the influence of quinine alone, though the chill be broken, there is likely to be a return of the malady. *Dropsy* has been quite successfully treated with leptandra. In *hydrocephalus* its cathartic action is desirable. It should be combined with cream of tartar and mentha viridis for this purpose. In *ascites*, with hepatic congestion and great mental depression, it will be administered both with a view to removing the excess of fluid and to prevent its further accumulation. Dose of the powdered root as a cathartic, from 20 to 60 grains, which may be given in sweetened water; of the infusion, in typhoid conditions, ½ fluid ounce every hour until it operates, and to be repeated daily. Dose of the alcoholic extract, which is one of its best forms of administration, from 1 to 5 grains in form of pills, Specific leptandra, 2 drops to 1 fluid drachm.

Specific Indications and Uses.—Drowsiness, dizziness, and mental depression, with tenderness and heavy pain in the hepatic region; the tongue is coated markedly white, the skin is yellow, there is a bitter taste cold extremities, nausea, and dull frontal headache; thirst, with inability to drink; restlessness, with insomnia; diarrhœa, with half-digested passages, or clay-colored evacuations; enfeebled portal circulation, with lassitude and gloomy and depressed mental state.

LEUCANTHEMUM.—OX-EYE DAISY.

The whole plant of *Chrysanthemum Leucanthemum*, Linné (*Leucanthemum vulgare*, Lamarck).

Nat. Ord.—Compositæ.

Common Names: *Ox-eye daisy, White weed, Great ox-eye, Field daisy, Moon daisy, Maudlin daisy, White daisy, Horse gowan, Grande Marguerite, Goldens.*

Botanical Source.—*Chrysanthemum Leucanthemum*, of Linnæus (*Leucanthemum vulgare*, of Lamarck), generally known as Ox-eye daisy, is a perennial herb, with an erect, branching, furrowed stem, growing from 1 to 2 feet high. The leaves are comparatively few, small, alternate, amplexicaul, lanceolate, serrate, and cut-pinnatifid at the base; the lower ones petiolate, with deep, irregular teeth; the upper ones small, subulate, and those of the middle sessile, deeply cut at base, with remote teeth above. The heads are large, terminal, and solitary. Disk yellow. Rays numerous and white (W.).

Fig. 159.

Chrysanthemum Leucanthemum.

History.—This plant was introduced into this country from Europe, and is a very troublesome weed to farmers in nearly every section. It generally grows from 1 to 2 feet high, and bears white flowers in June and July. In the eastern states it is now used for fodder. The leaves are odorous and somewhat acid; the flowers are bitterish; they impart their virtues to water.

Action, Medical Uses, and Dosage.—Tonic, diuretic, and antispasmodic. Large doses emetic. Used as a tonic instead of chamomile flowers, and has been found serviceable in *whooping-cough*, *asthma*, and *nervous excitability*. Very beneficial externally and internally in *leucorrhœa;* and its internal use has been highly recommended in *colliquative perspiration*. When used locally for the latter purpose, as it sometimes is, it stains the skin. Externally, it has been used as a local application to *wounds*, *ulcers*, *scald-head*, and some other *cutaneous diseases*. Dose of the decoction, from 2 to 4 ounces, 2 or 3 times a day. Said to destroy or drive away fleas.

LIATRIS.—LIATRIS.

The rhizomes of several species of *Liatris*.

Nat. Ord.—Compositæ.

Botanical Source and History.—Liatris spicata, Willdenow, *Button snakeroot*. This plant, also known by the names of *Gay-feather*, *Devil's bit*, etc., has a perennial, tuberous root, an erect, annual stem, 2 to 5 feet in height, mostly stout, and very leafy. The leaves are linear, glabrous, alternate, punctate, ciliate at base, lower ones 3 to 5-nerved, and narrowed at base. The flowers are sessile, of a bright-purple color; the heads many, densely crowded in a long, terminal spike, and from 8 to 12-flowered. The scales of the cylindrical, bell-shaped involucre are oblong or oval, and appressed, with slight scarious margins. Achenia pubescent, obconic. Pappus permanent, colored, barbellate, not evidently plumose to the naked eye. Receptacle naked. This plant is found in moist places in the middle and southern states, and in abundance in the prairies (G.—W.).

Liatris squarrosa, Willdenow, or *Blazing-star*, has a perennial, tuberous root, with a stem 2 to 3 feet high, thickly beset with long-linear, nerved leaves; the lower ones attenuated at the base. The heads are few, sessile or nearly so, with brilliant purple flowers; the racemes flexuous and leafy; the involucre ovate-cylindric, and the scales of the involucre large, numerous, squarrose-spreading; outer ones larger and leafy, inner ones mucronate-acuminate, and scarcely colored. Pappus plumose. This plant is found in the middle and southern states, in dry soil, and is known in the South by the name of *Rattlesnake's master* (G.—W.).

Liatris scariosa, Willdenow, or *Gay-feather*, has a perennial, tuberous root, with a stout, scabrous-pubescent stem, 4 to 5 feet in height, whitish above. The leaves are numerous, lanceolate, tapering at both ends, glabrous, with rough margins, entire, lower ones on long petioles, 3 to 9 inches long, upper ones 1 to 3 inches in length by 1 to 3 lines in width. The heads number from 5 to 20, an inch in diameter, and are disposed in a long raceme, with 20 to 40 purple flowers. The involucre is globose-hemispherical; the scales of the involucre obovate or spatulate, very obtuse, with dry and scarious margins, often colored. Pappus scabrous. This plant is found in dry woods and sandy fields from New England to Wisconsin, and extending southward (G.—W.).

Liatris odoratissima, Willdenow.—This plant, known as *Deer's tongue* or *Vanilla plant*, has radical and stem leaves; the former are obovate-spatulate, tapering below, generally 7-veined, and sometimes slightly obtusely toothed. The stem leaves are oblong and clasping. The leaves are more or less glaucous and fleshy. The flower-heads are arranged in a panicle or corymb, and are from 4 to 10-flowered, the blossoms being of a vivid purple hue. The involucre has but few scales, and these are spatulate-oblong, and imbricated. Pappus not plumose, but finely barbellate. The rhizome of this species is not tuberous. Deer's tongue is found from Virginia south, and flowers in September and October. The leaves, when dry, have a pleasant odor.

History and Chemical Composition.—All the above plants are splendid natives, and flowering through August, September, and October. There are several other species of this genus which appear to possess medicinal properties analogous to each other, and which deserve further investigation—*e. g.*, *L. cylindracea*, *L. graminifolia*, etc. The roots are the medicinal parts; they are all tuberous, except *L. odoratissima*, with fibers, and have a hot, somewhat bitter taste, with considerable acrimony, and an agreeable, turpentine odor. They appear to contain a resinous substance, volatile oil, and a bitter principle. Their virtues are extracted by alcohol, and partially by hot water in infusion. The leaves of *L. odoratissima* are often covered with glistening crystals of *coumarin* ($C_9H_6O_2$) (Procter, *Amer. Jour. Pharm.*, 1859, p. 556). On account of this constituent, it is used in North Carolina for keeping moths out of clothes. Deer's tongue is also of interest as a reputed adulterant of tobacco, it being said to be especially employed in the making of cigarettes, the deleterious effects of which have been attributed, by some, to the coumarin present in them. *Liatris spicata* was analyzed by W. F. Henry (*Amer. Jour. Pharm.*, 1892, p. 603). It contained 0.09 per cent of volatile oil, about 4.5 per cent of resin, 2.3 per cent of a caoutchouc like body, 16 per cent of inulin, also mucilage, glucose, etc., but no glucosid nor alkaloid.

Action, Medical Uses, and Dosage.—These plants are diuretic, with tonic, stimulant, and emmenagogue properties. A decoction of them is very efficient in *gonorrhœa*, *gleet*, and *nephritic diseases*, in doses of from 2 to 4 fluid ounces, 3 or 4 times a day. It is also reputed beneficial in *scrofula*, *dysmenorrhœa*, *amenorrhœa*, *after-pains*, etc. It is likewise of advantage used as a gargle, in *sore throat*, and *chronic irritation of the throat*, with relaxed tissues, and in injection has proved useful in *leucorrhœa*. It acts kindly on the stomach, and is of some value in *dyspepsia* associated with renal torpor. While it relieves *colic* and other *spasmodic bowel affections of children*, it has some reputation as a remedy for *pain and weakness in the lumbar region*. Said to be beneficial in Bright's disease (?) in connection with Lycopus virginicus and Aletris farinosa; equal parts of each in decoction. These plants are celebrated for their alexipharmic powers in *bites of venomous snakes*. Pursh states that, when bitten, the inhabitants of the southern states bruise the bulbous roots, and apply them to the wound, at the same time drinking freely of a decoction of them in milk. This requires corroboration. The eliminative action of liatris may be taken advantage of in removing morbific products left in the system after serious forms of illness. The decoction is prepared from an ounce of the root to 1 pint of water. Dose, 1 fluid drachm to 4 fluid ounces.

LIGUSTRUM.—PRIVET.

The leaves of *Ligustrum vulgare*, Linné.

Nat. Ord.—Oleaceæ.

Common Names: *Privet*, *Privy*, *Prim*.

Botanical Source.—This plant is a smooth shrub, growing 5 or 6 feet high, with wand-like branches. The leaves are dark-green, 1 or 2 inches in length, about half as wide; opposite, entire, smooth, lanceolate, and obovate, obtuse, or acute, and borne on short petioles. The flowers are small, numerous, white, in tetramerous, thyrsoid, terminal panicles. The calyx is minutely 4-toothed, deciduous, and short-tubular; the corolla funnel-form, tube short, limb with 4 spreading, ovate, obtuse lobes. The stamens are 2, on the tube of the corolla; the anthers large and exserted. Style very short; stigma 2-cleft. Berries spherical, black, in conical bunches, 2-celled, from 2 to 4-seeded; seeds convex on one side, angular on the other (W.—G.).

Fig. 160.

Ligustrum vulgare.

History, Description, and Chemical Composition.—Privet is found growing wild in woods and thickets, and along the roadsides from New England to Virginia, and west to Missouri, flowering in May and June. It is used in England for hedges, from which place it is supposed to be introduced; but it is indigenous in Missouri. It is often cultivated in gardens. The leaves are the medicinal parts; they have but little odor, and an agreeable, bitterish, and astringent taste; they yield their virtues to water or alcohol. The flowers have been employed for similar purposes with the leaves. The berries have a sweetish-bitter taste, are reputed cathartic, and to render the urine brown; they have been used for dyeing. Probably the bark will be found equal if not superior in efficacy to the leaves. M. G. Polex (1841) found the bark to contain sugar, mannit, starch, bitter resin, and a peculiar substance which he called *ligustrin*, which has since been shown by Kromayer (*Archiv der Pharm.*, 1863, Vol. CLXIII, p. 19), to be identical with *syringin* ($C_{19}H_{28}O_{10}.H_2O$), a crystallizable glucosid occurring in our common lilac (see *Related Species*). It is odorless and tasteless, soluble in hot water and alcohol, insoluble in ether. Kromayer found, in addition, a bitter crystalline body named by him *ligustron*, soluble in water, alcohol, and ether. A third principle, amorphous and of bitter taste, *syringopikrin*, probably also occurs in the bark of ligustrum. (For details regarding the chemistry of these substances, see Husemann and Hilger, *Pflanzenstoffe*, 1884, p. 1273.)

Action, Medical Uses, and Dosage.—Privet leaves are astringent; a decoction of them is very valuable in *chronic bowel complaints*, *ulceration of stomach and bowels*, as a gargle for *ulcers of mouth and throat*, for which it is peculiarly effective, and as an injection for *ulcerated ears*, with offensive discharges, *leucorrhœa*, *gleet*, and *ulceration of the bladder*, likewise in *diabetes*. They may be employed either in decoction or powder. Dose of the powdered leaves, from 30 to 60 grains. 3 times a day; of the decoction, from 2 to 4 fluid ounces.

Specific Indications and Uses.—Aphthous sore mouth; sore throat.

Related Species.—*Syringa vulgaris*, *Common lilac*. A well-known shrub, the fruit and leaves of which are bitterish and sub-acrid. Besides a sweet principle Petroz and Robinet found a bitter glucosid ($C_{19}H_{28}O_{10}.H_2O$, Kromayer, 1863), the *lilacin* of Meillet, and *syringin* of Bernays, and identical with the *ligustrin* of Polex. This body, when pure, is not bitter, but tasteless (see *Ligustrum* above). Dilute acids split it into sugar and *syringenin* ($C_{13}H_{18}O_5$), an amorphous, pale, rose-colored mass soluble in alcohol, but not in ether and water. The fruit and leaves are antiperiodic and tonic.

LILIUM CANDIDUM.—MEADOW LILY.

The bulb of *Lilium candidum*.

Nat. Ord.—Liliaceæ.

COMMON NAMES: *White lily*, *Meadow lily*.

Botanical Source.—This plant has a perennial root or bulb, composed of imbricated fleshy scales, from which arises a thick stem 3 to 4 feet in height. The leaves are scattered, lanceolate, and narrowed at the base. The flowers are large, snow-white, campanulate, smooth inside, and borne in a terminal raceme (W.).

History.—This is an exotic, a native of Syria and Asia Minor, and is much cultivated in this country on account of its beautiful white flowers, which have long been regarded as the emblems of purity, and which appear in June and

July. The bulb is the part used; it is inodorous, but has a mucilaginous, amarous, rather unpleasant taste. Mucilage enters largely into its constitution, together with a small quantity of an acrid substance, which disappears by heat. Water extracts its virtues.

Action, Medical Uses, and Dosage.—Meadow lily, or white lily, as it is sometimes called, is mucilaginous, demulcent, tonic, and astringent. Useful in *leucorrhœa* and *prolapsus uteri*, the decoction taken internally and employed in injection; it is more decided in its effects when combined with senecio. Boiled in milk, it forms an excellent poultice for *ulcers*, *external inflammations*, *tumors*, etc. The recent root is stated to have been useful in *dropsy*. The flowers are very fragrant, which property they communicate to oily or fatty bodies, forming liniments or ointments useful to relieve the heat and pain attending *local inflammations;* the oil obtained from the petals is reputed efficient in *pains of the womb*, and in *otitis*.

Related Species.—*Lilium tigrinum* or *Tiger lily*. The tiger lily, so-called from the fact that the flowers are spotted after the manner of the skin of the tiger, is a native of Japan and China, but has been widely cultivated as a garden plant. The flowers, which appear in July and August, are large and borne in a pyramidal cluster at the top of the stem. They are of a dark-orange hue and marked with somewhat elevated black or deep crimson spots. A tincture of the plant, in flower, is used quite largely by homœopathic physicians, to whom it was introduced by Dr. W. E. Payne.

Tincture of tiger lily has acquired considerable of a reputation as a remedy for *uterine irritation and congestion*, its effects being slowly produced. It has relieved the *nausea of uterine irritation*, and the *nausea of pregnancy*, and excellent results are reported of its efficacy in *congestive dysmenorrhœa*. It is reputed a leading remedy for *chronic ovarian neuralgia*, being indicated by darting, burning pains in the ovaries. When pelvic weight and prolonged lochia accompany a tardy recovery from parturition, this remedy promises relief, and much testimony points to its value in relieving the bearing-down sensations incident to *uterine prolapse*. The dose is from ½ drop to 5 drops of a strong tincture of the fresh plant. The remedy deserves a careful study. Vomiting, purging, and drowsiness were the symptoms produced in a little girl poisoned by the pollen of tiger lily (Wyman, 1863).

Phormium tenax, Forster. *New Zealand flax*, *New Zealand hemp*. *Nat. Ord.* Liliaceæ. A tall flowering plant, indigenous to some of the South Pacific Islands and introduced into other countries, and frequently found in hot-houses. The leaf-fibers constitute the silky appearing and cream-colored, tough *New Zealand flax*, used for cordage. The roots and leaf-bases, in concentrated decoction, with the addition of carbolic acid, have been employed as a surgical dressing in *amputations* and other fresh *wounds*. It is said to reduce or prevent excessive suppuration (Monckton). It needs further investigation.

LIMON.—LEMON.

The rind and juice of *Citrus* (*Limon*) *Limonum*, Risso (*Citrus medica*, var. *B.*, Linne).

Nat. Ord.—Rutaceæ.

Common Name: *Lemon*.

Illustration: Bentley and Trimen, *Med. Plants*, 54.

Official Parts.—I. Limonis Cortex (*U. S. P.*), *Lemon peel*. "The rind of the recent fruit of *Citrus Limonum*, Risso (*Nat. Ord.*—Rutaceæ)"—(*U. S. P.*).

II. Limonis Succus (*U. S. P.*), *Lemon juice*.—"The freshly expressed juice of the ripe fruit of *Citrus Limonum*, Risso (*Nat. Ord.*—Rutaceæ)."

Botanical Source.—The lemon tree is an evergreen, about 15 or 20 feet in height, with branches easily bent. The leaves are alternate, ovate-oblong, usually serrulated, smooth, glossy, and dark-green, with a winged petiole. The flowers are middle-sized, white, purple externally, and odoriferous. The calyx and petals are similar to those of the orange. The fruit is an oblong-spheroid, sometimes almost globular, with a thin, pale-yellow rind, and a juicy, very acid pulp (L.).

History, Description, and Chemical Composition. This plant, as well as those varieties of it producing the *citron* and the *lime*, is of Asiatic origin, and cultivated in the West Indies, and some other tropical countries. The exterior rind of the lemon and the juice of its pulp are official. The finest lemons are those which are smoothest and thinnest in the skin.

Limonis Cortex (*U. S. P.*).—The rind, or *lemon peel*, as officially used, is described by the *U. S. P.* as occurring "in narrow, thin bands or in elliptical segments, with very little of a spongy, white, inner layer adhering to them; outer surface deep lemon yellow, and ruggedly glandular; odor fragrant; taste aromatic and bitterish. The spongy, inner layer usually present in the segments should be removed before the lemon peel is used"—(*U. S. P.*).

Lemon peel imparts its properties to alcohol, wine, or water. These depend upon a volatile oil contained in the minute vesicles with which it is filled, and, when obtained by distillation with water, or by expression, it forms the oil of lemon of commerce (see *Oleum Limonis*). The white portion of the rind contains *hesperidin* ($C_{22}H_{26}O_{12}$), a bitter, crystalline glucosid, splitting, when heated with diluted acids, into glucose and *hesperetin* ($C_{16}H_{14}O_6$) (see *Aurantii Amari Cortex*). The seeds of the fruit contain bitter *limonin*, soluble in cold alcohol, almost insoluble in water.

LIMONIS SUCCUS (*U. S. P.*).—*Lemon juice*, according to the official description, is "a slightly turbid, yellowish liquid, usually having an odor of lemon, due to the accidental presence of some of the volatile oil of the rind. Taste acid, and often slightly bitter. Specific gravity not less than 1.030 at 15° C. (59° F.). It has an acid reaction upon litmus paper, due to the presence of about 7 per cent of citric acid. On evaporating 100 Gm. of the juice to dryness, and igniting the residue, not more than 0.5 Gm. of ash should remain"—(*U. S. P.*).

One part of brandy or alcohol added to 10 parts of lemon juice, and then filtered to separate the mucilage, will preserve the acid for a long time; it will become slightly bitterish, but retains its strong acidity undiminished. The juice is frequently preserved in sugar, forming lemon syrup, which, however, is apt to spoil by age. Hence, citric acid in solution may be substituted for it, about 4 drachms of the acid being dissolved in 8 fluid ounces of water, which may be flavored with a few drops of oil or essence of lemon. The strained juice has been preserved for some time by putting it into a bottle, and pouring upon it a layer of sweet, or almond oil. The juice may be concentrated by gentle evaporation or by freezing. All methods, however, are rather unsatisfactory, the juice either spoiling or becoming altered in flavor. Lemon juice, as stated above, contains about 7 per cent of citric acid; furthermore mucilage, malic acid, and salts of potassium and calcium are present. However, its proportion of acid is rather variable. As high as 44 grains of citric acid to the ounce of juice were obtained by Stoddard.

Action, Medical Uses, and Dosage.—Lemon peel is used in cookery and confectionery, and also in medicine to correct the taste and augment the power of bitter infusions and tinctures, its virtues being similar to that of the orange peel. The juice of lemon is tonic, refrigerant, and antiscorbutic, forming a refreshing and agreeable drink, called *lemonade*, possessing some medicinal influence, and which, as with orange juice, may be used freely and advantageously in the *febrile* and *inflammatory diseases*, with reddened mucous membranes, for which this last has been recommended. It may also be added to the nutritive drinks of the sick, as gum-water, gruel, barley-water, etc. Its power in preventing and arresting *scurvy* is unequaled by any other remedy, except a liberal supply of fresh vegetables of the cruciform family. In scurvy, an ounce or an ounce and a half of the juice per day, is a preventive dose, and when the disease manifests itself, 4 or 6 ounces per day will arrest it. Occasionally, but rarely, it fails to effect any benefit in this disease. Ships about to make long voyages, should be furnished with a bountiful supply of citric acid and oil of lemon, or lemon syrup, with a small portion of brandy added. *Scrotal pruritis* and *uterine hemorrhage* have been benefited by a local application of the juice. Prof. A. J. Howe, M. D., states that although chloroform will arrest a paroxysm of *hiccough* temporarily, yet, if a permanent subsidence of the spasmodic action of the stomach and diaphragm be required, lemon juice is superior to all other known remedies; in several instances he has cured obstinate and dangerous hiccough with it. Both citric acid and lemon juice appear to exert considerable influence in preventing or modifying *Asiatic cholera*. When the mucous membranes and tongue are very red and the urine alkaline, *rheumatism* is benefited by lemon juice. One or two daily applications of lemon juice with a camel's-hair pencil will reduce *enlarged uvula* and *tonsils*. It also gives temporary relief in *hoarseness*, and has benefited some cases of *malaria*.

Specific Indications and Uses.—Fevers and inflammations, with very red membranes; rheumatic pain, with very red tongue and mucous tissues and alkaline urine; obstinate hiccough; scurvy; and should be given a trial in Asiatic cholera.

Related Varieties.—*Citrus acida*, Roxburgh. The lime is a tree about 8 feet in height, with a crooked trunk and diffuse branches with prickles. Leaves ovate, obovate, oblong, and serrate, being placed upon petioles not winged as in the orange and lemon. Flowers small, white. Stamens 30. Fruit ovate or roundish, pale-yellow, with a boss at the point, and about 1½ inches in diameter. Cysts in the rind concave. Pulp very acid, flat, slightly bitter.

The lime is of considerably less size than the lemon, globular or oval, of a similar color, but frequently with a green or greenish tinge. Its outer coat is not so thick and rough as that of the lemon, and its internal pulp contains a large amount of juice of an excessively acid taste. This juice is chiefly used in the manufacture of citric acid. A variety of the lime tree, *C. Limetta*, furnishes a fruit from the rind of which is obtained the *Oil of Bergamot*. (For *varieties of Lime*, see below.)

De Candolle (*Origin of Cultivated Plants*) gives *Citrus medica*, Linné, as the name of the tree giving rise to the varieties, *lemon*, *lime*, *citron*, etc., and gives as such varieties those four enumerated by Brandis and Sir Joseph Hooker, viz.:

I. *Citrus medica proper*, or the CITRON of the English (*cedro* of the Italian, and *cédratier* of the French). The fruit of this variety is oblong and large, not spherical, has an aromatic, lumpy rind, and a juice neither very acid nor very plenty. This is the *Citrus medica* of Risso.

II. *Citrus medica Limonum*, the LEMON.

III. *Citrus medica acida*, *Citrus acida*, Roxburgh.—Juice very acid, fruit small and of variable shape, and flowers small. The LIME, SOUR LIME. *Citrus acris*, Miller, and other varieties, probably furnish a part of the sour limes.

IV. *Citrus medica Limetta* (*C. Limetta* and *C. Lumia* of Risso), SWEET LIME.—Fruit spherical, with non-aromatic, sweet juice.

LINARIA.—TOAD FLAX.

The plant *Linaria vulgaris*, Miller (*Antirrhinum Linaria*, Linné).

Nat. Ord.—Scrophulariaceæ.

COMMON NAMES: *Snap-dragon*, *Butter and eggs*, *Toad flax*, *Ramsted.*

Botanical Source.—This plant is a perennial whose stem reaches a height of from 1 to 2 feet, and has pale-green, smooth, lance-linear, crowded, sessile, alternate leaves. The flowers, yellow and orange in color, are dense and imbricate, and borne in a showy terminal spike or raceme. . The corolla is personate and its base extended into a spur. The calyx is smooth and not so long as the curved spur.

History.—Linaria is a native of Europe, but is naturalized in this country, where it is common in waste places, and sometimes becomes so plentiful in fields as to become a nuisance. When fresh the plant has a nauseously unpleasant odor, which it loses for the most part upon drying. Its taste is subacrid, bitter, and slightly saline. It should be gathered when in bloom, which is in July and August, quickly and carefully dried, and placed in close containers protected from light and air. A yellow coloring substance (*anthokirrin*) was obtained by Rigel, in 1843, from the blossoms. Walz, in 1854, isolated *antirrhinic acid* (a peculiar volatile substance); *linarosmin* (an oily residue from the distillation with water); bitter crystalline *linariin*, an acrid resin *linaracrin*, and tannic and citric acids, gum, sugar, mineral matters, etc.

Action, Medical Uses, and Dosage.—This plant is recommended for "*bad blood*," *splenic* and *hepatic hypertrophies*, *jaundice*, *skin diseases*, and *scrofula*. An ointment prepared by covering 1 part of the bruised fresh plant with 10 parts of hot lard or mutton tallow, forms a soothing application for *hemorrhoids* and similar conditions. A strong tincture (℥viii to alcohol 98 per cent Oj), may be given in doses of a fraction of a drop to 10 drops. A decoction is prepared from 1 ounce of the plant to 1 pint of water.

LINDERA.—SPICE-BUSH.

The bark and berries of *Lindera Benzoin*, Meissner (*Benzoin odoriferum*, Nees; *Laurus Benzoin*, Linné).

Nat. Ord.—Lauraceæ.

COMMON NAMES: *Spice-bush*, *Fever-bush*, *Wild allspice*, *Spicewood*, *Feverwood*, *Benjamin bush.*

Botanical Source.—Spice-bush is an indigenous shrub growing from 5 to 12 feet in height, with obovate-lanceolate, veinless, entire deciduous leaves, green on each side, and slightly pubescent beneath. The flowers, which are yellow, in little naked umbels on the naked branches, often diœcious; the buds and pedicels are smooth; the fruit is the size of an olive, bright-red, borne in clusters, and contains an ovate, pointed nut. The calyx is 6-cleft, with oblong segments (W.).

History.—This shrub grows in damp woods, along streams and shaded places, in the United States and Canada, bearing greenish-yellow flowers in March and April, before the leaves are unfolded, and maturing its fruit, which consists of bright, crimson-colored, ovoid berries, growing in small bunches, in the middle of autumn. The whole plant has a pleasant, aromatic taste, owing chiefly to a volatile oil, and yields its virtues to boiling water or alcohol. The dried berries were used during the American Revolution, and in the South during the late Rebellion, as a substitute for allspice.

Description.—BARK. Benzoin bark occurs in quills or thin, curved fragments, externally black-brown, somewhat shining and smooth, except where covered with small cork-like warts. In older specimens the corky warts are more conspicuous and the bark is more of an ashen color. Internally it is smooth, and yellow or light brown in color. Its fracture is abrupt and granular. It has a faint aromatic odor, and to the taste is sharp and astringent.

FRUIT.—The fruit is a long, red, ovate drupe, with a circular depression indicating the point of attachment of the pedicel. It contains 1 white seed, quite large, possessing an oleaginous taste. The integuments of the fruit become very dark—almost black—on drying, appearing granular, and have an agreeable odor and spice-like flavor.

Chemical Composition.—J. Morris Jones (*Amer. Jour. Pharm.*, 1873, p. 301), found in the bark a volatile oil, probably of the cinnamyl series, developing, on treatment with oxidizing substances, a bitter-almond odor. He also found sugar, resin, starch, and tannin. From the berries Dr. A.W. Miller (*Proc. Amer. Pharm. Assoc.*, 1878, p. 772), obtained by warm expression and extraction with gasoline, 50 per cent of fatty and volatile oil of a greenish-brown color. By distilling this oil with steam, about 1 per cent of a pale-green, volatile oil was obtained, of a specific gravity of 0.850, and possessing a warm aromatic taste resembling that of allspice. Mr. P. M. Gleim (*Amer. Jour. Pharm.*, 1875, p. 246), obtained by the distillation of fresh berries the unusual yield of 5 per cent of a colorless, fragrant, volatile oil, having a density of 0.87.

Action, Medical Uses, and Dosage.—Aromatic, tonic, and stimulant. An infusion or decoction has been successfully used in the treatment of *ague* and *typhoid forms of fever;* also as an anthelmintic. The berries afford a stimulant oil much esteemed as an application to *bruises, chronic rheumatism, itch*, etc., and has some reputation as a carminative in *flatulence, flatulent colic*, etc. The bark, in decoction, is said to be refrigerant and exhilarating, and exceedingly useful in all kinds of *fever*, for allaying excessive heat and uneasiness; a warm decoction is employed to produce diaphoresis. The decoction may be drank freely.

Related Species.—*Lindera sericea*, Blume. Japan. Tonic and stimulant. Source of the Japanese *kuromoji oil*, an essential oil distilled from the leaves and young twigs, and having considerable fragrance (see Schimmel & Co.'s *Report*, April, 1897; also see analysis by W. Kwasnik, *Archiv der Pharm.*, 1892, p. 265).

Lindera triloba, Blume. Japan. Tonic and stimulant.

LINIMENTA.—LINIMENTS.

SYNONYMS: *Embrocations.*

These preparations are designed for external application, and should always be of a consistence which will enable them to be applied to the skin by gently rubbing with the naked hand, or flannel. They are usually composed of oily, spirituous, gummy, or saponaceous substances, are more fluid than the ointments, denser than water, and at the temperature of the body are always liquid. Water is seldom employed as a vehicle. The benefit derived from them depends either upon their counter-irritating influences, or from absorption of their active constituents. Liniments are usually prescribed extemporaneously by physicians, each having a preference; yet it is absolutely necessary that there be some established rule in relation to them, and that the official preparations be generally known. A solution of ammonium chloride formed the basis of many liniments employed by Prof. King, who was not an admirer of greasy embrocations.

LINIMENTUM ACONITI.—ACONITE LINIMENT.

SYNONYM: *Linimentum aconiti radicis.*

Preparation.—Take of aconite root, in powder, 4 ounces; glycerin, 2 fluid drachms; alcohol, a sufficient quantity. Macerate the aconite with ½ pint of alcohol for 24 hours, then pack it in a small percolator, and add alcohol gradually until a pint of tincture has passed. Distill off 12 fluid ounces, and evaporate the residue until it measures 12 fluid drachms. To this add alcohol, 2 fluid drachms, and the glycerin, and mix them. This preparation was offered by W. Procter, Jr., as a substitute for aconitine as an external anæsthetic application. It is twice the strength of the root, and is exceedingly active. The glycerin is added for the purpose of retarding evaporation after application of the liniment to the skin, and which may be further secured by using oiled silk.

Aconite liniment, based on Procter's formula, was official in the *U. S. P.*, 1870. A similar liniment may be prepared by mixing together ½ fluid ounce of glycerine with 4 fluid ounces of fluid extract of aconite root. Evaporate to 4 fluid ounces.

Action and Medical Uses.—This liniment may be used in all cases in which aconitine would prove useful, as in *gout*, *neuralgia*, and *rheumatism*. It is to be used as follows: Cut a piece of lint or muslin of the size and form of the part to be treated, lay it on a plate or waiter, and by means of a camel's-hair brush, saturate it with the liniment. Thus prepared, it should be applied to the surface, a piece of oiled silk laid over and kept in place by an adhesive edge, or by a bandage. Care should be taken not to apply it to an abraded surface, and in its use the patient should be informed of its character, and avoid bringing it in contact with the eyes, nostrils, or lips.

LINIMENTUM ACONITI ET CHLOROFORMI.—LINIMENT OF ACONITE AND CHLOROFORM.

Preparation.—Take of castor oil, 2 fluid drachms; chloroform, water of ammonia, tincture of aconite root, each, 2 fluid drachms; camphorated tincture of soap, 1 fluid ounce. Mix them well together.

The *National Formulary* prepares this liniment as follows: "Tincture of aconite (*U. S. P.*), one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; chloroform, one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; soap liniment (*U. S. P.*), seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏]. Mix them"—(*Nat. Form.*).

Action and Medical Uses.—This forms a liniment useful in *rheumatic* and *neuralgic pains*, and wherever such a combination is desired. If the solution above does not readily form a perfectly homogeneous mixture, a few moments' heating in a water-bath will effect it (W. Procter, Jr.).

The following form excellent liniments, which have been found very efficient in *rheumatic and neuralgic pains:* (1) Take of fluid extract of aconite, 2 fluid ounces; American petroleum, 6 fluid ounces. Mix. (2) Take of fluid extract of aconite, chloroform, each, 2 fluid ounces; benzol, 4 fluid ounces. Mix (J. King).

LINIMENTUM ACONITINÆ COMPOSITUM.—COMPOUND LINIMENT OF ACONITINE.

SYNONYM: *Anodyne pomade.*

Preparation.—Take of glycerin, diluted hydrocyanic acid, each, 1 fluid drachm; aconitine, 1 grain. Rub the glycerin and aconitine thoroughly together, and then add the hydrocyanic acid; when thoroughly mixed, put in a well-stoppered vial.

In preparing this, care should be employed not to inhale any of the mixture, and after the addition of the hydrocyanic acid, the mixture should be bottled as quickly as possible.

Action and Medical Uses.—Anodyne; to be applied locally by means of a camel's-hair pencil, over parts affected with *neuralgia;* when painted on the regions about the eye it will allay the pains incident to several affections of the internal coats of the eye (Prof. A. J. Howe, M. D.).

LINIMENTUM AMMONIÆ (U. S. P.)—AMMONIA LINIMENT.

SYNONYMS: *Volatile liniment*, *Common liniment.*

Preparation.—"Ammonia water, three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏]; alcohol, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; cotton seed oil, six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏]. To make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix them by agitation in a bottle, which should be well stoppered. This liniment should be freshly prepared when wanted"—(*U. S. P.*).

Or, take of solution of ammonia, 1 fluid ounce; olive oil, 2 fluid ounces. Mix and agitate them well together (*Ed.—Lond.*). The *British Pharmacopœia* (1898) formula differs from the latter in adding 1 fluid ounce of almond oil. In this liniment a soap is formed by the union of the oil and ammonia, which is but imperfectly dissolved, and a white oleo-compound of ammonium is formed with some glycerin.

The *U. S. P.* formula gives a liniment fluid at ordinary temperature, and differs from that of 1870 in the substitution of cotton seed oil for olive oil. This liniment is liable to separate into two parts. The alcohol is designed to retard this separation. It has been suggested by Prof. Maisch that if ⅙ portion of olive oil be substituted for a like amount of cotton seed oil, a better liniment would result. Lard oil is said to form quite a uniform mixture. By substituting camphor liniment for the olive oil *Camphorated volatile liniment* (*Linimentum Ammoniæ Camphoratum*) may be formed.

Action and Medical Uses.—This preparation is used as a rubefacient in *rheumatic and neuralgic pains*, *sore throat*, *pleurisy*, *sprains*, *bruises*, etc. It may be applied over the part on flannel, or the skin may be gently rubbed with it. If it becomes too active, it must be weakened with a sufficient quantity of oil. It will vesicate if evaporation be prevented. Care should be exercised in applying it to children and to old people lest blistering occurs.

LINIMENTUM BELLADONNÆ (U. S. P.)—BELLADONNA LINIMENT.

Preparation.—"Camphor, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; fluid extract of belladonna root, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the camphor in about two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of the fluid extract, and then add enough of the latter to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly"—(*U. S. P.*).

Action and Medical Uses.—This preparation may be applied locally to *rheumatic and neuralgic parts*, *sprains*, and other *painful conditions*, particularly when there is also spasmodic muscular action.

LINIMENTUM CAJUPUTI COMPOSITUM.—COMPOUND CAJEPUT LINIMENT.

Preparation.—Take of oils of sassafras, cajeput, and hemlock, each, 1 ounce; soap, a sufficient quantity. Mix them together and form a liniment.

Action and Medical Uses.—This forms a valuable stimulating and discutient application. It is principally used in *indolent scrofulous tumors*, and in the *mammary inflammations* of nursing women (J. King).

LINIMENTUM CALCIS (U. S. P.)—LIME LINIMENT.

SYNONYM: *Carron oil.*

Preparation.—"Solution of lime, linseed oil, of each, 1 volume. Mix them by agitation"—(*U. S. P.*).

Or, take of olive oil, or linseed oil, and lime-water, equal parts. Mix and agitate them together (*Ed.—Lond.*).

The lime and oil unite and form a calcareous soap, the oleate of calcium, with some glycerin. It is called *Carron oil.* Turpentine may be sometimes advantageously added to it.

Action and Medical Uses.—This is a very useful and probably the best application to recent *burns* and *scalds;* it is best applied on carded cotton. It is recommended to prevent the pitting of *variola.* The following is also reputed beneficial in *burns:* Take of lime-water, 2 fluid ounces; oil of turpentine, olive oil, each, 1 fluid ounce. Mix. If it be used immediately after the accident, add oil of pennyroyal, 1 fluid ounce.

LINIMENTUM CAMPHORÆ (U. S. P.)—CAMPHOR LINIMENT.

SYNONYMS: *Linimentum camphoratum, Camphorated oil.*

Preparation.—"Camphor, in coarse powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; cotton seed oil, eight hundred grammes (800 Gm.) [1 lb. av., 12 ozs., 96 grs.]; to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Introduce the camphor and the cotton seed oil into a suitable flask, and apply a gentle heat, by means of a water-bath, loosely stoppering the flask during the operation. Agitate from time to time, until the camphor is dissolved"—(*U. S. P.*).

Action and Medical Uses.—This forms a stimulant and anodyne application in *contusions, sprains, bedsores, rheumatic, neuralgic,* and other *pains.* In *glandular enlargements* it is used as a resolvent, being particularly employed in the forming stage of *mastitis,* both as a resolvent and to assist in checking the secretion of milk. For the latter purpose, it should be applied as warm as can be borne.

LINIMENTUM CAMPHORÆ COMPOSITA.—COMPOUND LINIMENT OF CAMPHOR.

SYNONYMS: *Rheumatic liniment,* or *drops, Tinctura camphoræ composita, Compound tincture of camphor, Rheumatic tincture.*

Preparation.—Take of camphor, 1 pound; oil of origanum, oil of hemlock, each, ½ pound; oil of sassafras, oil of cajeput, each, 2 ounces; oil of turpentine, 1 ounce; capsicum, 4 ounces; alcohol, 1 gallon. Macerate for 14 days and filter.

Action and Medical Uses.—This is exceedingly efficient as an external application in almost every painful affection, and is of advantage in *chronic rheumatism, pains* in various parts of the system, *bruises, sprains, chilblains, contusions, lameness, numbness, white swellings,* and other *swellings,* etc. In ordinary cases apply 2 to 4 teaspoonfuls to the affected part, and rub it well by the fire, and apply warm flannel over the region of the affected part several times a day. Internally, take 20 drops on sugar, but in severe and obstinate cases, after bathing as above directed, apply an additional piece of flannel, which must be kept constantly wet with the drops, until relieved. When applied to the teeth, wet a small quantity of cotton, and introduce it into the *decaying teeth.* If the face is swollen, bathe with it likewise (J. King). That of the *British Pharmacopœia* (1885) is stimulant and rubefacient on account of the stronger ammonia employed. It may be employed in *local painful conditions.*

LINIMENTUM CAPSICI COMPOSITUM.—COMPOUND CAPSICUM LINIMENT.

Preparation.—Take of tincture of capsicum, 2 fluid ounces; tincture of opium and aqua ammoniæ, each, 3 fluid drachms; oil of origanum, 2 fluid drachms; oil of cinnamon and tincture of camphor, each, 1 fluid drachm. Mix.

Action and Medical Uses.—This is a very efficient application in *rheumatic*, *pleuritic*, *neuralgic*, and other *pains*.

LINIMENTUM CANTHARIDIS (N. F.)—CANTHARIDES LINIMENT.

Preparation.—"Cantharides, in No. 60 powder, one hundred and fifty grammes (150 Gm.) [5 oz. av., 127 grs.]; oil of turpentine, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Digest the cantharides with one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of oil of turpentine, in a closed vessel, by means of a water-bath, for 3 hours; then strain, and add enough oil of turpentine through the strainer to make the liniment measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*Nat. Form.*).

Uses.—(See *Cantharis.*)

LINIMENTUM CHLOROFORMI (U. S. P.)—CHLOROFORM LINIMENT.

Preparation.—"Chloroform, three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏]; soap liniment, seven hundred cubic centimeters (700 Cc.) [23 fl℥, 321 ♏]; to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix them by agitation"—(*U. S. P.*).

The *Linimentum Chloroformi* of the *British Pharmacopœia* (1885) is prepared by combining equal parts of camphor liniment and chloroform.

Action and Medical Uses.—Employed as a local anæsthetic for *neuralgias* and other *superficial pains.*

LINIMENTUM CROTONIS.—CROTON-OIL LINIMENT.

Preparation.—"Take of croton oil, 1 fluid ounce; oil of turpentine, 7 fluid ounces. Mix together with agitation"—(*Dub.*).

Action and Medical Uses.—This acts as a prompt rubefacient, and when used for some time, produces pustulation. From 10 to 30 minims may be placed upon a limited surface, and rubbed in; and when pustulation is required, this should be repeated two or more times every day.

Related Preparation.—The *National Formulary* directs besides Croton-oil liniment, the following:

Linimentum Tiglii Compositum (N. F.), *Compound croton-oil liniment:* "Croton oil, twenty cubic centimeters (20 Cc.) [325 ♏]; oil of sassafras, twenty cubic centimeters (20 Cc.) [325 ♏]; oil of turpentine, twenty cubic centimeters (20 Cc.) [325 ♏]; oil of olive, forty cubic centimeters (40 Cc.) [1 fl℥, 169 ♏]. Mix them"—(*Nat. Form.*).

LINIMENTUM IODI.—LINIMENT OF IODINE.

Preparation.—The *National Formulary* directs: "Iodine, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; potassium iodide, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; glycerin, thirty-five cubic centimeters (35 Cc.) [1 fl℥, 88 ♏]; water, sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix eight hundred cubic centimeters (800 Cc.) [27 fl℥.

25 ♏] of alcohol with the other ingredients, and dissolve the solids by agitation. Then add enough alcohol to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. *Note.*—The proportion of the ingredients above given yields a product practically identical with that prescribed by the *British Pharmacopœia*, 1885"—(*Nat. Form.*).

Action and Medical Uses.—The uses of this liniment are those of iodine (see *Iodinum*).

Related Preparation.—Linimentum Ammonii Iodidi (N. F.), *Liniment of ammonium iodide.* "Iodine, four grammes (4 Gm.) [62 grs.]; oil of rosemary, fifteen cubic centimeters (15 Cc.) [243 ♏]; oil of lavender, fifteen cubic centimeters (15 Cc.) [243 ♏]; camphor, thirty grammes (30 Gm.) [463 grs.]; water of ammonia (U. S. P.), one hundred and ten cubic centimeters (110 Cc.) [3 fl℥, 345 ♏]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the iodine, the oils, and the camphor, in seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol, and then add the water of ammonia, and lastly, enough alcohol to make one thousand cubic centimeters [33 fl℥, 391 ♏]. *Note.*—On standing, the liquid will become colorless, and there will, usually, be a slight precipitate, which may be separated by filtration"—(*Nat. Form.*). This liniment is designed for the purpose of using iodine locally in a form that will not stain.

LINIMENTUM NIGRUM.—BLACK LINIMENT.

Preparation.—Take of olive oil, 1½ fluid ounces; sulphuric acid, 1 fluid drachm; mix well together, and then add oil of turpentine, ½ fluid ounce.

Action and Medical Uses.—An active counter-irritant, but does not vesicate. To be rubbed on the part with a piece of lint twice a day until the skin becomes tender and inflamed. It may be used in *indolent swellings of the joints*, *rheumatic pains*, and wherever active counter-irritation is indicated (Brodie).

LINIMENTUM OLEORUM.—LINIMENT OF OILS.

Synonym: *Linimentum olei.*

Preparation.—Take of oils of cedar, cajeput, cloves, and sassafras, of each, 1 fluid ounce. Mix.

Action and Medical Uses.—This forms an efficient application to *rheumatic* and other *painful affections;* it should also be rubbed on affected part, 3 or 4 times daily.

Related Preparation.—Linimentum Olei Compositum, *Compound liniment of oils, Concentrated liniment.* Take of oils of origanum, hemlock, cajeput, and camphor, each, 4 ounces, by weight; capsicum, 2 ounces. Mix the oils and dissolve the camphor in the mixture; then add the capsicum and let it macerate for 14 days, frequently agitating. Then filter. This is a powerful counter-irritant, and may be employed with advantage in *indolent tumors, indurated mammæ, rheumatic and other pains*, and to the spine, in *epilepsy, nervous debility*, etc. (J. King).

LINIMENTUM OPII.—LINIMENT OF OPIUM.

Synonym: *Anodyne liniment.*

Preparation.—Tincture of opium, liniment of soap, each, 2 fluid ounces. Mix—(*Br. Pharm.*, 1885).

Action and Medical Uses.—This is an anodyne and mild rubefacient application in *contusions, sprains, neuralgic and rheumatic pains*, etc.

Related Liniment.—Linimentum Opii Compositum (N. F.), *Compound liniment of opium, Canada liniment.* "Tincture of opium (U. S. P.), one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; camphor, seventeen and one-half grammes (17.5 Gm.) [270 grs.]; alcohol, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; oil of peppermint, twenty-five cubic centimeters (25 Cc.) [406 ♏]; water of ammonia (U. S. P.), three hundred and seventy-five cubic centimeters (375 Cc.) [12 fl℥, 327 ♏]; oil of turpentine, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the camphor and the oil of peppermint in the alcohol, then add the tincture of opium, water of ammonia, and enough oil of turpentine to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Shake the mixture whenever any of it is to be dispensed. *Note.*—This liniment will separate a short time after it has been mixed. It may be made somewhat more permanent by adding twenty-five cubic centimeters (25 Cc.) [406 ♏] of tincture of quillaja (*U. S. P.*), to the water of ammonia, before adding it to the mixture"—(*Nat. Form.*).

LINIMENTUM PETROLEI COMPOSITUM.—COMPOUND LINIMENT OF PETROLEUM.

Preparation.—Take of American petroleum (sp. gr. 40° to 42° Baumé), 6 fluid ounces; aqua ammoniæ, tincture of opium, each, 1 fluid ounce; camphor 60 grains. Mix.

Action and Medical Uses.—This forms a very useful application in *rheumatism*, *sprains*, *bruises*, *sore throat*, and *painful affections*. A *Camphorated petroleum* for similar purposes may be prepared by dissolving 1 ounce of camphor in 1 pint of American petroleum (40° to 45° Baumé).

LINIMENTUM PLUMBI SUBACETATIS (N. F.)—LINIMENT OF LEAD SUBACETATE.

Preparation.—"Solution of lead subacetate (*U. S. P.*), three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏]; cotton seed oil, six hundred and fifty cubic centimeters (650 Cc.) [21 fl℥, 470 ♏]. Mix them."

Action and Medical Uses.—This agent was used chiefly as a discutient, and is applicable to *chilblains*, *chapped hands*, *contusions*, *sprains*, and *glandular inflammations*. It is no longer official.

LINIMENTUM POTASSII IODIDI CUM SAPONE.—LINIMENT OF POTASSIUM IODIDE AND SOAP.

Preparation.—Powder 1½ ounces (av.) of potassium iodide in a mortar. Then mix with 10 fluid ounces (Imp.) of distilled water, 1 fluid ounce (Imp.) of glycerin, and into the mixture, contained in a porcelain dish, introduce 2 ounces (av.) of curd soap, cut small, and dissolve over a water-bath. Next pour the liquefied soap upon the potassium iodide in the mortar, and triturate briskly until the mixture becomes cold. After setting it aside for 1 hour, rub well into the creamy mixture 1 fluid drachm of oil of lemon. This accords with the *British Pharmacopœia*, 1885.

Action and Medical Uses.—This liniment is designed to give a topical preparation of iodide of potassium. Probably a concentrated solution of the potassium salt in water alone will be more effectual, being more readily absorbed.

LINIMENTUM SAPONIS (U. S. P.)—SOAP LINIMENT.

SYNONYMS: *Tinctura saponis camphorata* (*U. S. P.*, 1850), *Camphorated tincture of soap; Liquid opodeldoc, Spiritus nervinus camphoratus.*

Preparation.—"Soap, in fine powder, seventy grammes (70 Gm.) [2 ozs. av., 205 grs.]; camphor, in small pieces, forty-five grammes (45 Gm.) [1 oz. av., 257 grs.]; oil of rosemary, ten cubic centimeters (10 Cc.) [162 ♏]; alcohol, seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Introduce the camphor and the alcohol into a suitable bottle, and shake until the camphor is dissolved. Then add the soap and oil of rosemary, and shake the bottle well for a few minutes. Lastly, add enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and again shake until the liquid becomes clear. Set it aside, in a cool place, for 24 hours, then filter"—(*U. S. P.*).

On account of its greater solubility in alcohol, soap made from soda and olive oil, and not that made from animal fats, should be employed. Castor oil

(Sayre) has been recommended, as has a potassa-soap prepared with rape-seed oil (Barckhausen).

Action and Medical Uses.—This forms a very useful stimulating and anodyne application in *contusions, sprains, rheumatic and other painful affections.*

LINIMENTUM SAPONIS CAMPHORATUM.—CAMPHORATED SOAP LINIMENT.

SYNONYM: *Opodeldoc.*

Preparation.—Take of common white soap, 2 ounces; camphor, 1 ounce; oil of rosemary, 3 drachms; oil of origanum, 2 drachms; aqua ammoniæ (*U. S. P.*), 1 ounce; alcohol, 1½ pints. Place the soap in the alcohol and digest on a sand-bath; when the soap is dissolved, add the ammonia, oils, and camphor; agitate until they are dissolved, and immediately pour into wide-mouthed vials. When cold, this liniment becomes of a semi-solid consistence.

This liniment assumes an appearance of solidity, which is owing to its formation with a soap made with animal oil, instead of one with vegetable or olive oil. It is yellowish-white, translucent, and becomes fluid at the temperature of the body. Before cooling it is usually placed in 2 or 4-ounce vials with wide mouths, and is known by the name of *Opodeldoc*. The *Opodeldoc* of the *U. S. P.* (1850) was prepared by digesting, on a sand-bath, common soap (sliced), 3 ounces, in alcohol, 1 pint. When dissolved, add camphor, 1 ounce; oils of rosemary and origanum, each, 1 fluid drachm. Pour into wide-mouthed bottles. There are other formulas for opodeldoc. The *National Formulary* directs:

LINIMENTUM SAPONATO-CAMPHORATUM (N. F.), *Camphorated soap liniment, Opodeldoc, Solid opodeldoc:* "White castile soap, dried and powdered, seventy-five grammes (75 Gm.) [2 ozs. av., 284 grs.]; camphor, twenty-five grammes (25 Gm. [386 grs.]; alcohol, nine hundred and fifty cubic centimeters (950 Cc.) [32 fl℥, 59 ♏]; oil of thyme, three cubic centimeters (3 Cc.) [49 ♏]; oil of rosemary, six cubic centimeters (6 Cc.) [97 ♏]; stronger water of ammonia (*U. S. P.*), fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]. Introduce the castile soap, camphor, and alcohol, into a flask or suitable bottle, and apply a gentle heat until solution is effected, taking care that no loss of alcohol be incurred by evaporation. Filter the liquid, while hot, into another flask or bottle; warm again, if necessary, to render the contents liquid, add the oils and stronger water of ammonia, and when the whole has been thoroughly mixed, pour it into small dry vials, which should have been previously warmed, and should immediately be corked and cooled. *Note.*—The quantity above given is usually divided into from 18 to 20 vials. Solid opodeldoc is directed by the *German Pharmacopœia* to be prepared with soap made from animal fats; but pure, white castile soap may be used, provided it has been previously deprived of water. The stronger water of ammonia should be of the full strength prescribed by the *U. S. P.*"—(*Nat. Form.*).

Action and Medical Uses.—Camphorated soap liniment is an excellent anodyne embrocation in all *local pains, rheumatism, contusions, sprains, sore throat*, etc.

LINIMENTUM SAPONIS MOLLIS (U. S. P.)—LINIMENT OF SOFT SOAP.

SYNONYM: *Tinctura saponis viridis* (*Pharm.*, 1880).

Preparation.—"Soft soap, six hundred and fifty grammes (650 Gm.) [1 lb. av., 6 ozs., 406 grs.]; oil of lavender flowers, twenty cubic centimeters (20 Cc.) [325 ♏]; alcohol, three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the oil of lavender with the alcohol, dissolve in this the soft soap by stirring or agitation, and set the solution aside for 24 hours. Then filter it through paper, and pass enough water through the filter to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly"—(*U. S. P.*).

Action and Medical Uses.—This is *Hebra's tincture of green soap*, so-called. It is used in *cutaneous disorders*, especially in *eczema, prurigo, lichen*, and *psoriasis*.

LINIMENTUM SINAPIS COMPOSITUM (U. S. P.)—COMPOUND LINIMENT OF MUSTARD.

Preparation.—"Volatile oil of mustard, thirty cubic centimeters (30 Cc.) [1 fl℥, 7 ♏]; fluid extract of mezereum, two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏]; camphor, sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; castor oil, one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏]; alcohol, a sufficient quantity to made one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the camphor in five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of alcohol, and add the fluid extract of mezereum; then add the oil of mustard and the castor oil, and finally, enough alcohol to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly"—(*U. S. P.*).

Action and Medical Uses.—This is powerfully counter-irritant, and may be employed as a revulsive. Care should be exercised in its use, however, as the sores produced by both mustard and mezereum are sometimes productive of great harm, and are difficult to heal.

LINIMENTUM STILLINGIÆ COMPOSITUM.—COMPOUND LINIMENT OF STILLINGIA.

SYNONYMS: *Stillingia liniment, Compound tincture of stillingia.*

Preparation.—Take of oil of stillingia, 1 fluid ounce; oil of lobelia, oil of cajeput, of each, ½ fluid ounce; alcohol and glycerin, of each, 2 fluid ounces. Mix in the order named. This formula is that revised by Prof. W. E. Bloyer, and is far preferable to the formula given below. Prepared in this manner, the component parts of the liniment do not separate as readily as in the old preparation, the formula for which is as follows: Take of oil of stillingia, 1 fluid ounce; oil of cajeput, ½ fluid ounce; oil of lobelia, 2 fluid drachms; alcohol, 2 fluid ounces. Mix together.

Stillingia liniment is prone to precipitate, and often thickens to a magma or jelly. It should be well shaken before being used. If it has solidified, it should be replaced by a fresh supply.

Action and Medical Uses.—This forms a peculiar kind of liniment, possessing stimulant and relaxant properties. It is used in *chronic asthma, croup, epilepsy, chorea*, etc. In *asthma* and *croup*, the throat, chest, and neck are to be bathed with it 3 or 4 times a day. With Prof. Scudder it was regarded as of great value externally in *croup*, and given internally it forms a good remedy for *irritative* and *chronic coughs*. It may be given on sugar, discs, or in syrup. In *chorea, epilepsy*, and *spasmodic diseases*, the whole vertebral column is to be bathed with it. In *rheumatism, sprains*, and *painful affections*, the diseased parts are to be bathed with it. In asthma its action is very prompt and effectual, relieving and ultimately curing some very obstinate cases. In the majority of instances, when applied to the chest, neck, etc., the patient experiences a peculiar taste in the mouth, somewhat resembling that of the lobelia and stillingia combined. It is often used of less strength, as—Take of oil of stillingia, ½ fluid ounce; oil of cajeput, ½ fluid ounce; oil of lobelia, 1 fluid drachm; alcohol, 3 fluid ounces. Mix. It is an agent peculiar to Eclectic practice, and is very active and efficient (R. S. Newton). The dose of stillingia liniment is from 1 to 5 drops.

LINIMENTUM SUCCINI COMPOSITUM.—COMPOUND LINIMENT OF OIL OF AMBER.

Preparation.—Take of oil of stillingia, rectified oil of amber, each, 1 fluid ounce; oil of lobelia, 3 fluid drachms; olive oil, 2 fluid ounces. Mix.

Action and Medical Uses.—I have found this preparation very efficient in *chronic asthma, croup, pertussis, chorea, epilepsy, rheumatism, sciatica*, and various other *spasmodic and painful affections;* in many instances being much superior to the compound liniment of stillingia. Its manner of application is the same as recommended for the preceding liniment. In very severe cases, it may be applied every hour, or half-hour, and continued until vomiting ensues. It acts as a stimulant, relaxant, and antispasmodic. In many of the above diseases it will effect a cure without the exhibition of any internal medicine, and is especially useful among children to whom it is difficult to administer remedies by mouth, or in cases where the stomach rejects all medicines. Care must be taken not to use too much of this liniment at any one application. Owing to the presence of stillingia in this preparation, the liniment is prone to precipitation (see remarks concerning *Compound Stillingia Liniment*) (J. King).

LINIMENTUM TEREBINTHINÆ (U. S. P.)—TURPENTINE LINIMENT.

Preparation.—"Resin cerate, six hundred and fifty grammes (650 Gm.) [1 lb. av., 6 ozs., 406 grs.]; oil of turpentine, three hundred and fifty grammes (350 Gm.) [12 ozs. av., 151 grs.]; to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Melt the resin cerate in a capsule, on a water-bath, then add the oil of turpentine, and mix them thoroughly"—(*U. S. P*).

This is *Kentish liniment.* In its preparation a low heat should be employed to melt the cerate, after which the oil may be added gradually with constant stirring.

Action and Medical Uses.—This was at one time highly praised as an application to *burns* and *scalds.* It should be applied as soon as possible after the accident, and be allowed to remain on for at least a day. It should be applied on lint, care being taken to keep it from contact with the sound tissues. After healthy granulations set in, it should be discontinued. It may be employed in *erythematous* and *erysipelatous conditions*, when superficial or arising from injury, and in *frost-bites.*

LINIMENTUM TEREBINTHINÆ COMPOSITUM.—COMPOUND LINIMENT OF TURPENTINE.

SYNONYM: *White liniment.*

Preparation.—Take of rose-water, 2½ fluid ounces; yolk of egg, 1; oil of turpentine, 3 fluid ounces; oil of lemon, ½ fluid drachm; pyroligneous acid (or in its absence acetic acid), 1 fluid ounce. To the yolk slowly add the rose-water, and rub together in a mortar, then add the turpentine and oil of lemon. Pour the mixture into a pint bottle, and agitate to mix thoroughly; then add the acid, and agitate quickly and briskly. It must be kept well corked.

Action and Medical Uses.—Used in *asthma* and *inflammation of the lungs*, rubbing it on the throat and chest with a sponge or cloth, from the epiglottic region to the epigastric; also useful whenever a counter-irritant is required.

Related Preparation.—The *National Formulary* gives the following formula and name: LINIMENTUM TEREBINTHINÆ ACETICUM (N. F.), *Acetic turpentine liniment, Linimentum album, Stokes' liniment, St. John Long's liniment.*—"Oil of turpentine, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; fresh egg, albumen and yolk, one (1); oil of lemon, four cubic centimeters (4 Cc.) [65 ♏]; acetic acid (*U. S. P.*), twenty cubic centimeters (20 Cc.) [325 ♏]; rose-water (*U. S. P.*), eighty-five cubic centimeters (85 Cc.) [2 fl℥, 420 ♏]. Triturate or beat the contents of the fresh egg with the oil of turpentine and the oil of lemon in a mortar until they are thoroughly mixed. Then incorporate the acetic acid and rose-water. Shake the mixture, whenever any of it is to be dispensed"—(*Nat. Form.*).

As this last preparation bears the same name as the *Br. Pharm. Linimentum Terebinthinæ Aceticum* (glacial acetic acid, 1 fluid part; liniment of camphor and oil of turpentine, each, 4 fluid parts; mix), the two should not be confounded with each other. Acetic turpentine liniment is rubefacient and vesicatory. It may be applied to relieve *localized pains* or *inflammatory swellings*, and has been found useful in *neuralgia* and *muscular rheumatism*, and is a counter-irritant in *gastric inflammations* to allay irritation and vomiting.

LINTEUM.—LINT.

SYNONYMS: *Linteum carptum, Charpie* (of the French).

Source, Preparation, and Description.—Originally, lint was prepared by scraping with a knife bleached linen, such as towels, shirts, table cloths, sheets, etc., until soft and fleecy. As thus prepared, it was designated hand-made lint, to distinguish it from that afterward made by mechanical appliances, and known as machine-made lint. It is now, however, made almost wholly by machinery from a cloth especially prepared, and is known as *patent lint.* When prepared from cotton, as is often the case, it is called cotton lint. The latter, however, is not so useful as linen lint, for, upon becoming wet, it quickly loses its elasticity, and, unless the oil has been well removed, it fails to properly absorb fluids. Besides, the fibers of the linen are much softer and do not irritate like cotton. Good lint should be soft, flocculent, and unirritating, yet firm enough to be torn in any one direction, and also be capable of taking upon its surfaces, cerates, etc., should be sufficiently loose to absorb discharges, and should be compact enough to leave no detached portions in the wound to which it is applied. Patent lint comes in soft, fleecy sheets of considerable thickness. Microscopically, the linen lint presents its fibers as long, almost straight, cylindrical tubes, with a small, central cavity; cotton fibers are flattened, often twisted, and have a wide, central canal (see also article on *Lint*, in *Amer. Jour. Pharm.*, 1861, p. 359).

Tests.—Aside from microscopical differences exhibited by cotton and linen fibers, they also present some differences in their behavior toward chemical reagents. Linen fiber, dipped first in *rosolic acid* (*aurin*, *yellow corallin*) solution, and afterward in strong sodium carbonate solution, becomes rose-red; while cotton, under like treatment, remains colorless. Tincture of madder colors linen orange-red. cotton pale-yellow. Linen fiber becomes translucent when rubbed with a fixed oil, while cotton remains an opaque white. Cotton fiber is destroyed and dissolved in less than two minutes by cold sulphuric acid (concentrated), while linen is not appreciably altered in the same time. Linen is turned bright-yellow by boiling caustic potash solution, while cotton is either not altered or becomes but faintly yellow. This test must be quickly applied, as the color fades rapidly.

Surgical Uses.—Lint is used as a surgical dressing to protect *injured parts*, absorb discharges, to prevent too great pressure from surgical appliances and bandages, etc. It should be soft and unirritating. Cotton lint quickly loses its elasticity when wet, and is, therefore, not so useful as charpie and linen lint.

Related Substances.—SPANISH MOSS, PEAT MOSS, and WOOL WOOD, or WOOL CLOTH, a spongy tissue composed of wood fibre, have been applied like lint.

OAKUM is a substance introduced, in 1862, by Dr. L. A. Sayre, of the United States Navy. It is composed of the hempen fibers of old rope impregnated with tar. It is often preferred for wounds discharging pus. Tow has been similarly used. (See Dr. Ruschenberger, in *Amer. Jour. Pharm.*, 1863, p. 161, for comparative tests of the absorbing power of equal weights of cotton, oakum, tow, coarse-scraped and patent lint. Oakum absorbed only one-fourth, but patent lint seven and a half times its weight of water.)

CHARPIE.—Strictly speaking, *charpie*, as used by the French surgeons, consisted of bundles (4 or 5 inches in length) of straight, unravelled threads of linen, but the name has also become synonymous with scraped lint.

LINUM (U. S. P.)—LINSEED.

"The seed of *Linum usitatissimum*, Linné"—(*U. S. P.*).

Nat. Ord.—Lineæ.

COMMON NAMES: *Flaxseed*, *Linseed* (*Lini semina*, *Br. Pharm.*, 1885).

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 39.

Botanical Source.—Flax is an annual plant, very smooth, with a slender fibrous root, and 1 or more straight, round, leafy corymbose stems, 1 or 2 feet in height. The leaves are small, alternate, sessile, acute, 3-veined, and rather glaucous; the lowermost short and blunt. The flowers are several, large, blue, erect, borne in a terminal, corymbose panicle, on long footstalks. The calyx is persistent, consists of 5 ovate, acute sepals, which are 3-veined at base, and membranaceous on the margin, The corolla is composed of 5 thin, delicate, roundish, wedge-shaped, crenate petals, which are glossy, have numerous veins, and readily drop off. Stamens 5, straight, and awl-shaped. Anthers 2-celled, and arrow-shaped. Ovary ovate, superior; styles 5; stigmas obtuse. The fruit is a round capsule, 5-celled, the cells nearly divided by a false dissepiment; seeds 2 in each cell, ovate, compressed, brown, smooth, and glossy (L.—W.—Torrey and Gray).

History.—The native country of flax is unknown, though supposed to be derived from Egypt, or from Central Asia. It has been known from remote antiquity (see *Gen.* xli, 42, and *Exod.* ix, 31). It is now naturalized in nearly all civilized countries. It blossoms from May to August, and matures its seeds early in autumn. The seeds and their expressed oil are used in medicine. The seeds are described by the *U. S. P.* as follows:

"About 4 or 5 Mm. ($\frac{1}{6}$ to $\frac{1}{5}$ inch) long, oblong-ovate, flattened, obliquely pointed at one end, brown, glossy, covered with a transparent, mucilaginous epithelium, which swells considerably in water; the embryo whitish or pale greenish, with 2 large, oily, plano-convex cotyledons, and a thin perisperm; inodorous; taste mucilaginous, oily, and bitter. *Ground linseed* (linseed meal, or flaxseed meal), for medicinal purposes, should be recently prepared, free from unpleasant or rancid odor. When extracted with carbon disulphide, it should yield not less than 25 per cent of fixed oil. The filtered infusion of ground linseed, prepared with boiling water and allowed to cool, has an insipid, mucilaginous taste, and should not be colored blue by iodine T.S. (absence of starch)"—(*U. S. P.*). In this connection see paper by J. U. Lloyd, on the testing of flaxseed for starch, in the *Pharm. Rundschau*, 1895, p. 210.

Oil-cake (*cake-meal*, when ground) is the compressed refuse portion remaining after the oil has been pressed out; it contains the mucilage of the husk and all of the nitrogenous matter of the seed in condensed form (about 5 per cent nitrogen), and is therefore used to feed cattle. Starch should be absent from the cake, and the ash should not exceed 5 per cent. The seeds finely ground, furnish a dark, ash-colored powder, *flaxseed meal*, which forms with hot water a tenacious substance, used for luting in chemical operations. For poultices, the official (*Ground linseed*, *Farina lini*, or *Linseed meal*) is the best.

Chemical Composition.—The chief constituents of flax seeds are *mucilage* (about 6 per cent), residing in the epithelial cells of the epidermis, and *fixed oil* (see *Oleum Lini*, linseed oil), contained in the cotyledons (from 25 to 33 per cent; as high as 38 per cent, W. A. Puckner, *Amer. Jour. Pharm.*, 1889, p. 442). Starch is absent in ripe seeds. (An adulteration of linseed meal with 40 per cent of corn meal is on record; see G. M. Beringer, *Amer. Jour. Pharm.*, 1889, p. 167.) The mucilage probably has its origin in the starch occurring in the unripe seeds. When the unbruised seeds are covered with water, a viscid, odorless, and almost tasteless mucilage is obtained, precipitable by alcohol. When deprived of its ash (amounting to 10 per cent), the composition of the mucilage corresponds to the formula $C_{12}H_{20}O_{10}$ (Tollens & Kirchner, 1874). It is precipitated also by basic acetate of lead, but not by tannic acid. It is not colored blue by the addition of iodine and sulphuric acid, nor does it redden litmus when in fresh condition. Boiling with diluted sulphuric acid produces mostly a dextro-rotatory sugar, and about 5 per cent of insoluble cellulose. Nitric acid converts it partly into *mucic acid*, oxalic acid being likewise formed.

Flax seeds contain about 4 per cent of nitrogen, corresponding to about 25 per cent of *protein bodies*. Part of the nitrogen is due, however, to the presence of a crystallizable, bitter substance formerly believed to be *amygdalin*, but differentiated from it as *linamarin* (Jorissen and Hairs, see *Jahresb. der Pharm.*, 1891, p. 114). The presence of this substance gives rise to the frequently observed formation of *hydrocyanic acid* in ground flaxseed meal by spontaneous fermentation (see A. Jorissen, *Jahresb. der Pharm.*, 1883 and 1894; and W. O. Senior, *Pharm. Jour. Trans.*, 1885, Vol. XVI, p. 514). The seeds contain on an average 3.6 per cent of ash, which is rich in phosphoric acid (*Amer. Jour. Pharm.*, 1881, p. 552). (As regards the manufacture and composition of linseed cake and meal, as well as enumeration of the possible impurities by weeds, etc., consult interesting article in *Amer. Jour. Pharm.*, 1893, p. 195.)

Action, Medical Uses, and Dosage.—Flaxseed is used as a demulcent and emollient. An infusion of the entire seeds, an ounce to a quart of water at 100° C. (212° F.), forms a mucilaginous draught which is much employed in *ardor urinæ* and *urinary diseases*, *nephritic pains*, *coughs*, *colds*, *colo-rectitis*, *pulmonary*, *gastro-enteric*, and *urinary inflammations*. When not contraindicated, the addition of lemon juice improves the flavor, or it may be sweetened with loaf sugar or honey. An infusion of flaxseed, or of flaxseed meal, forms an excellent laxative injection;

and the meal added to boiling water, and made of the proper consistence, makes an excellent cataplasm (see *Cataplasma Lini*). Dose of the infusion, 1 or 2 pints daily. Linseed oil in doses of 2 fluid ounces twice a day, is said to have cured severe cases of *piles* within 2 or 3 weeks; while using it liquors and stimulating diet are to be avoided. It is likewise reputed beneficial when internally administered in *dysentery*, *colic*, and *lumbricus*. Used as an enema it is advantageous in *dysentery*, *hemorrhoids*, and *ascarides;* and combined with lime-water, it forms Carron oil, an excellent application to *burns*. One pint of linseed oil, combined with ½ ounce each, of oils of origanum and wintergreen, forms a pleasant cathartic; to be given in the same doses as castor oil.

Related Species.—*Linum catharticum, Purging flax.* This is a European annual bearing very small white flowers, and having a very bitter subacrid taste. Water extracts its virtues, the infusion being yellow. The active cathartic principle is *linin*, which occurs in neutral, white, silky, and lustrous crystals. It is most abundant in the plant just after the flowers have fallen. Its alcoholic solution is persistently and strongly bitter. For further details, see Husemann and Hilger, *Pflanzenstoffe*, 1884, p. 829.) Purging flax has the reputation on the continent of being mildly purgative, and has been employed in *hepatic, catarrhal,* and *rheumatic disorders.* The dose of the powdered plant is 1 drachm; of the extract, 4 to 8 grains. Diuretic properties are also ascribed to it.

LIQUIDAMBAR.—SWEET-GUM.

The balsamic exudate, or concrete juice of *Liquidambar styraciflua*, Linne.
Nat. Ord.—Hamamelaceæ.

Common Names: (Tree) *Sweet-gum tree, Bilsted, Copalm;* (Gum) *Sweet-gum, Gum wax.*

Botanical Source.—The sweet-gum tree attains the height of 50 to 60 feet, with a diameter of 3 to 5 feet. It is covered with a gray, deeply furrowed bark, with corky ridges on the branchlets. The leaves are palmate, deeply 5 to 7-lobed, rounded, smooth, shining, of a rich green color; the lobes finely glandular, serrate, and acuminate; the veins villous at their bases. When bruised the leaves, which are fragrant, turn crimson or deep-red in autumn. The sterile flowers are in a conical cluster of several globular heads, naked or achlamydeous; the aments monœcious, roundish, and surrounded with a 4-leaved involucre; the stamens numerous and intermixed with minute scales; the filaments short, and the anthers numerous, oblong, and subsessile. The fertile flowers consist of 2-celled ovaries, subtended by minute scales, all more or less cohering and hardening in fruit, forming a spherical catkin or head. The catkins are racemed, nodding, inclosed in the bud by a 4-leaved, deciduous involucre. Styles 2, long. Fruit a kind of strobile, composed of the indurated scales and capsules. Capsules or pods 2-beaked, 2-celled, opening between the two awl-shaped, or prickly diverging styles. Seeds small, several, amphitropous, with sparing albumen, and a straight embryo; cotyledons foliaceous (G.—W.).

Fig. 161.

Liquidambar styraciflua.

History and Description.—This is a large and beautiful tree, with fine-grained wood, growing throughout the United States in moist woods from Connecticut and New Jersey, southward; but found in greater abundance in the southern and middle states, as well as in Guatemala and Mexico. In warm climates, a whitish-yellow, somewhat limpid juice exudes from the incisions made into the tree, especially during the warm seasons; it has the density of thick syrup, but by standing it forms a soft, resinous-like, adhesive mass, somewhat like white turpentine, but opaque and almost black. Or, it may become hard, breaking with a resinous fracture. It is known as *Sweet-gum, Gum wax*, or *Liquidambar* (*Liquidum Liquidambar Styraciflua*); it has a pleasant, benzoinic odor, and a benzoinic, somewhat bitter, and pungent taste. It is soluble in alcohol, chloroform, ether, oil, lard, or fats, softens in warm weather, and becomes harder in cold. Its tincture slightly reddens litmus paper.

Chemical Composition.—Liquidambar is closely allied in its composition to *storax*, an exudation of the bark of *Liquidambar orientalis*. Miller (see *Styrax*).

William L. Harrison (*Amer. Jour. Pharm.*, 1874, p. 161), from a semiliquid specimen collected in Virginia, obtained by distillation with an aqueous solution of sodium carbonate 1.5 per cent of volatile *styrol*, a hydrocarbon of a peculiar aromatic odor. The yield is stated to have been as high as 7 per cent (Bonastre). When extracting sweet-gum with petroleum benzin, a mixture of *cinnamic acid* ($C_6H_5CH{:}CH.COOH$) and *styracin* (*cinnamyl-cinnamate*, [$C_6H_5CH{:}CH.COO.C_9H_9$], discovered by Bonastre, 1827), results, from which diluted ammonia extracts all of the cinnamic acid which may be precipitated by means of diluted acids (see Prof. Maisch, *Amer. Jour. Pharm.*, 1874, p. 166). The total yield of cinnamic acid was 5½ per cent. No benzoic acid could be detected.

W. von Miller (*Archiv der Pharm.*, 1882, p. 648), obtained by the distillation with steam of a rather firm specimen of the resin *styrol* contaminated with an oxygenated oil; in the residue was found *cinnamic acid*, melting at 133° C. (271.4° F.), but no benzoic acid; *styracin*, in beautiful crystals, melting at 44° C. (112° F.) and a thick, yellow oil, consisting chiefly of *phenyl-propyl-cinnamate* ($C_6H_5.CH{:}CH.COO.CH_2CH_2CH_2C_6H_5$). The ethyl- and benzyl-esters of cinnamic acid were found to be absent. *Storesin*, a peculiar, complex alcohol occurring in storax free and as cinnamate, in large quantity (von Miller, 1877), is also present in liquidambar. The *leaves* of Liquidambar styraciflua contain tannin and small quantities of a volatile oil. Sweet-gum contains nearly 10 per cent of impurities, such as portions of the bark, etc.

Action, Medical Uses, and Dosage.—Sweet-gum probably has virtues similar to the concrete juice of *Styrax officinale*, which see. It makes an excellent and agreeable ointment when melted with equal parts of lard or tallow, which I have found decidedly useful in *hemorrhoids*, *psora*, *ringworm of the scalp*, *porrigo scutulata*, and many other *cutaneous affections;* also in that *indolent species of ulcer*, known as "*fever sores on the legs*." In *anal fistula*, it maintains an increased discharge, softens the callosity of the walls of the sinus, and produces a normal result, and effects this without pain to the patient. If necessary, in *fistula*, a little creosote, or other stimulant may be added to it. This employment of sweet-gum is not generally known, and physicians would do well to avail themselves of its use in the above diseases. It is also used in *chronic catarrh*, *coughs*, and *pulmonary affections*. The dose internally is from 10 to 20 grains (J. King).

LIQUORES.—SOLUTIONS.

Under the term *liquor*, or *solution*, the *U. S. P.* includes all aqueous solutions of substances wholly soluble in that menstruum, and not containing sugar, volatile oils, or gases. This excludes such aqueous preparations as infusions, decoctions, medicated waters and syrups.

LIQUOR ACIDI ARSENOSI (U. S. P.)—SOLUTION OF ARSENOUS ACID.

SYNONYMS: *Liquor arsenici chloridi* (*U. S. P.*, 1870), *Liquor arsenici hydrochloricus* (*Br. Pharm.*, 1885), *Solution of arsenic chloride*, *Hydrochloric solution of arsenic*.

Preparation.—"Arsenous acid, ten grammes (10 Gm.) [154 grs.]; diluted hydrochloric acid, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; distilled water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the diluted hydrochloric acid with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of distilled water, add the arsenous acid, and boil the mixture until all the arsenous acid is dissolved. Filter the solution and pass enough distilled water through the filter to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly"—(*U. S. P.*).

This contains the two acids (arsenous and hydrochloric) uncombined, the latter acid simply aiding in dissolving the former. The name, solution of arsenic chloride is, therefore, erroneous and misleading. The strength of the *U. S. P.* solution is 1 per cent (4.56 grains to fluid ounce; density, 1.009).

Description and Tests.—"A clear, colorless liquid, odorless, having an acidulous taste and an acid reaction. If 24.7 Cc. of solution of arsenous acid be boiled for a few minutes with 2 Gm. of sodium bicarbonate, the liquid cooled, diluted with water to 100 Cc., and mixed with a little starch T.S., it should require from 49.4 to 50 Cc. of decinormal iodine V.S. to produce the blue tint of iodide of starch (corresponding to 1 Gm. of arsenous acid in 100 Cc. of the solution "—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This agent is used for the same purposes as Fowler's solution of arsenic. The dose is from ⅛ to 3 minims, well diluted, after food.

Related Preparations.—De Valangin's Solution. "*Liquor arsenici chloridi*," *Solution of chloride of arsenic*, or *De Valangin's solutio solventis mineralis*. To distilled water, 1 fluid ounce, add hydrochloric acid, 1½ fluid drachms, and arsenous acid, in small pieces, ½ drachm. Boil until the arsenic is dissolved, then add distilled water, a sufficient quantity to make the whole measure 1 pint. The dose is from ⅛ to 3 drops, 3 times a day, beginning with the smallest dose and gradually increasing.

Liquor Potassii Arsenatis et Bromidi (N. F.), *Solution of potassium arsenate and bromide, Liquor arsenii bromidi, Solution of bromide of arsenic, Clemens' solution.*—"Arsenous acid, ten grammes (10 Gm.) [154 grs.]; potassium bicarbonate, ten grammes (10 Gm.) [154 grs.]; bromine, fifteen and one-half grammes (15½ Gm.) [239 grs.]: water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Boil the arsenous acid with the potassium bicarbonate and one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏] of water, until solution is effected. Allow this to cool, add six hundred and twenty-five cubic centimeters (625 Cc.) [21 fl℥, 64 ♏] of water, then the bromine, and afterward enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Let the mixture stand a few hours, agitating it occasionally, then filter. This solution contains an amount of arsenic in combination, corresponding to 1 per cent of arsenous acid. *Note.*—The title, "Solution of Bromide of Arsenic" (*Liquor Arsenii Bromidi*), which is often applied to Clemens' solution or similar preparations, is a misnomer, since arsenic bromide can not exist, as such, in presence of water, but is split up into hydrobromic and arsenous acids. The proportions of the ingredients, in the formula above given, have been adjusted, as closely as practicable, so as to yield definite compounds, viz.: arsenate and bromide of potassium. In order to prevent injury to the balances by weighing a definite amount of bromine, the plan suggested in the note to No. 213 may be applied to this preparation, viz.: To prepare such a quantity of the latter at one time as will be commensurate to the actual contents of an original vial of bromine"—(*Nat. Form.*).

A somewhat similar, but modified, Clemens' solution is the following:

Liquor Arsenici Bromidi.—Mix powdered arsenous acid (1 part) with potassium carbonate (1 part) and dissolve them in boiling water (10 parts). Add water (80 parts) and bromine (2 parts). Set aside in moderate atmosphere until the liquid is decolorized, and, lastly, add enough water to bring the solution to 100 parts by weight. This solution is probably one of potassium bromide and potassium arsenate. It improves on keeping. Pure ingredients must be used in making it.

Liquor Auri et Arsenii Bromidi (N. F.), *Solution of bromide of gold and arsenic.*—"Arsenous acid, two and one-half grammes (2½ Gm.) [39 grs.]; tribromide of gold, three and one-fourth grammes (3¼ Gm.) [50 grs.]; bromine water, distilled water, of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Introduce the arsenous acid and about one hundred and thirty-five cubic centimeters (135 Cc.) [4 fl℥, 271 ♏] of bromine water into a flask and heat gently until all free bromine has disappeared. Then add bromine water, twenty (20) to thirty (30) drops at a time, until it will be present in slight excess, or until the solution does not become colorless after some time. Transfer the solution to a porcelain capsule, expel the excess of bromine with the aid of gentle heat, dilute it with water to about nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏], and dissolve in this the tribromide of gold, adding enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Ten (10) minims of this solution contains $\frac{1}{32}$ grain of tribromide of gold and the equivalent of $\frac{1}{16}$ grain of tribromide of arsenic. *Note.*—Bromine water is made by shaking bromine with about 30 times its weight of water, occasionally during several hours, and decanting the water from the undissolved bromine"—(*Nat. Form.*).

LIQUOR ACIDI CARBOLICI.—SOLUTION OF CARBOLIC ACID.

Preparation.—Take of carbolic acid (commercial), 1 part; oil of lemon, 3 parts; alcohol, 100 parts. Mix.

Action and Medical Uses.—This forms an intimate and permanent solution, which is deprived of the unpleasant odor of the carbolic acid without impairing its properties, by the presence of the lemon oil. It may be used wherever carbolic acid is indicated, and may be more or less diluted as required.

LIQUOR ACIDI CHROMICI.—SOLUTION OF CHROMIC ACID

Preparation.—Dissolve chromic acid, 1 ounce (av.) in distilled water, 3 fluid ounces (Imp.).

Description.—This accords with the *British Pharmacopœia*, and, according to that authority, contains the equivalent of 25 per cent of chromic anhydride (CrO_3); or 29.5 per cent of real chromic acid (H_2CrO_4). It is a caustic and strongly acid, odorless, orange-red liquid.

Action and Medical Uses.—May be used as a caustic, as it is simply an aqueous solution of chromic acid (see *Acidum Chromicum*).

LIQUOR ACIDI PHOSPHORICI COMPOSITUS (N. F.)—COMPOUND SOLUTION OF PHOSPHORIC ACID.

Synonym: *Solution of acid phosphates.*

Preparation.—"Bone ash, in fine powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; sulphuric acid (sp. gr. 1.830), seven hundred and eighty grammes (780 Gm.) [1 lb. av., 11 ozs., 225 grs.]; water, four thousand cubic centimeters (4000 Cc.) [135 fl℥, 122 ♏]. Mix the bone ash with one thousand cubic centimeters (1000 Cc. [33 fl℥, 391 ♏] of water, add the sulphuric acid, diluted with two thousand cubic centimeters (2000 Cc.) [67 fl℥, 362 ♏] of water, and mix thoroughly with a porcelain or glass stirrer. Now add the remainder of the water and set the mixture aside for 24 hours, stirring occasionally. Then transfer the mixture to a strong muslin strainer, and subject this to a gradual pressure (avoiding contact with metals), so as to express as much of the liquid as possible. Lastly, filter this through paper. The specific gravity of this solution is about 1.113 at 15° C. (59° F.). *Note.*—The quantity of the product obtained depends on the degree of force used in pressing. By strong pressure about 3500 parts may be obtained. If desired, the magma may also be poured into a glass percolator, the neck of which contains a layer of fine quartz sand or asbestos, previously deprived of matters soluble in sulphuric or phosphoric acids. On cautiously pouring water on top, so as not to mix it with the magma, the acid solution will be displaced. But the percolation must be interrupted as soon as the specific gravity of the percolate begins to fall below 1.113. The sulphuric acid used in this preparation may be the commercial variety, provided it is free from arsenic, and of a specific gravity not less than 1.830"—(*Nat. Form.*).

Medical Uses.—(See *Acidum Phosphoricum.*)

LIQUOR ALUMINI ACETATIS (N. F.)—SOLUTION OF ALUMINUM ACETATE.

Preparation.—"Aluminum sulphate, crystallized, three hundred grammes (300 Gm.) [10 ozs. av., 255 grs.]; acetic acid (*U. S. P.*), three hundred grammes (300 Gm.) [10 ozs. av., 255 grs.]; calcium carbonate, one hundred and thirty grammes (130 Gm.) [4 ozs. av., 256 grs.]; water, one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the calcium carbonate in the acetic acid mixed with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of water, and the aluminum sulphate in eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏]. Mix the two solutions, and allow the mixture to stand for 24 hours, agitating occasionally. Then pour off the clear solution and filter. The solution contains from 7.5 to 8 per cent of basic aluminum acetate. *Note.*—Practically identical with the *Liquor Aluminii Acetici* of the *German Pharm.*"—(*Nat. Form.*).

Uses.—(See *Aluminum Acetate.*)

Related Preparation.—Liquor Alumini Acetico-tartratis (N. F.), *Solution of aluminum acetico-tartrate*: "Alum (*U. S. P.*), seven hundred and fifty grammes (750 Gm.) [1 lb. av., 10 ozs., 199 grs.]; sodium carbonate, seven hundred grammes (700 Gm.) [1 lb. av., 8 ozs., 303 grs.]; glacial acetic acid (*U. S. P.*), one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]; tartaric acid, one hundred and thirty-five grammes (135 Gm.) [4 ozs. av., 333 grs.];

water, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Dissolve the alum and the sodium carbonate each in ten thousand cubic centimeters (10,000 Cc.) [338 fl℥, 66 ♏] of water; mix the solutions and wash the precipitate with water, first by decantation, and afterward on a strainer, until the washings run off tasteless. Allow the precipitate to drain and to shrink in volume by exposure on the strainer. Then transfer it to a tared capsule, add the glacial acetic and the tartaric acids, and apply heat until solution has been effected. Finally, evaporate the liquid to one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. The product contains about 50 per cent of dry, so-called aluminum acetico-tartrate. *Note.*—The dry salt may be obtained by evaporating the solution"—(*Nat. Form.*). This agent is a disinfectant and caustic. Diluted one-half, it has been employed in *affections of the naso-pharynx and fauces.*

LIQUOR AMMONII ACETATIS (U. S. P.)—SOLUTION OF AMMONIUM ACETATE.

"An aqueous solution of ammonium acetate ($NH_4C_2H_3O_2=76.87$), containing about 7 per cent of the salt, together with small amounts of acetic and carbonic acids"—(*U. S. P.*).

SYNONYMS: *Spiritus Mindereri, Spirit of Mindererus, Acetas ammonicus liquidus.*

Preparation.—"Ammonium carbonate, five grammes (5 Gm.) [77 grs.]; diluted acetic acid, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Add the ammonium carbonate (which should be in translucent pieces, free from white, pulverulent bicarbonate), gradually to the cold diluted acetic acid, and stir until it is dissolved. This preparation should be freshly made when wanted"—(*U. S. P.*).

If the above directions be exactly followed a uniform product of definite strength will be obtained, provided a good ammonium carbonate has been employed. Ammonium carbonate which has been kept loose in the drawers of pharmacies will not answer for this purpose, for as a rule, a large share of the active portion (*ammonium carbamate*), has become dissipated, and the bulk of the material left is but ammonium bicarbonate, of no worth so far as the value of the above solution is concerned. The solution should be prepared *only* when needed for immediate use. The *Br. Pharm.* (1885) directs: Strong solution of acetate of ammonium, 4 fluid ounces (Imp.); distilled water, enough to make 20 fluid ounces (Imp.). Keep in bottles free from lead. Density, 1.022.

LIQUOR AMMONII ACETATIS FORTIOR (*Br.*, 1885) is made by gradually adding to acetic acid (45 ounces), crushed ammonium carbonate (17½ ounces). Then add more acetic acid (usually about 5 ounces), until the liquid is neutralized. Lastly, by means of water, bring the product to measure 60 fluid ounces (Imp.). Keep in vessels free from lead (see also *Related Preparations*).

Description.—"A clear, colorless liquid, free from empyreuma, of a mildly saline acidulous taste, and an acid reaction. It is wholly volatilized by heat. When solution of acetate of ammonium is heated with potassium or sodium hydrate, vapor of ammonia is evolved. When heated with sulphuric acid, the solution gives off vapor of acetic acid"—(*U. S. P.*).

Liquor ammonii acetatis is colorless, has a faint smell of acetic acid and ammonia, a feeble saline and somewhat bitter taste, in which that of ammonia is perceptible. This taste of ammonia, which is also perceptible in other salts of this base having a neutral reaction, is caused by the free or feebly combined soda in the saliva combining with the acid and evolving the ammonia. It should not be kept any considerable time, as it undergoes decomposition, and should be made only in small quantities at a time. It is subject to all the impurities named under the heads of acetic acid and carbonate of ammonium. If the solution be colored, this may generally be removed by filtering it through animal charcoal. If quite neutral, neither litmus nor turmeric papers will be affected by it. The tests of its impurities are the same as named in aqua ammoniæ, and carbonate of ammonium. Good liquor ammonii acetatis yields soluble crystals of acetate of silver with nitrate of silver; evolves ammoniacal gas if lime or potassa be added Liquor ammonii acetatis is incompatible with the alkalies, strong acids, corrosive sublimate, nitrate of silver, metallic sulphates, lime-water, alum, chloride of calcium, magnesia, and some of its salts, etc.

Action, Medical Uses, and Dosage.—In small doses this solution is regarded as a refrigerant; in large doses diaphoretic and diuretic. The diuretic influence is more obvious when the patient is kept cool; the diaphoretic, when he is kept warm. It is principally used in *fevers* and *inflammatory affections* when not of a high grade, and is frequently associated with opium, tincture of camphor, nitrate of potassium, etc. Its diuretic influence is more marked when combined with sweet spirit of nitre. It is useful in the *exanthemata* when the circulation is feeble and eruption tardy, overcoming both of these conditions, while in the declining stages, with depression of the nervous system, dry skin, and renal inactivity, it may be given in ½-drachm doses to reestablish the secretions. Spirit of Mindererus may be given where alcohol can not be administered, being a stimulant of a different character, and it is frequently used as a sobering agent for *drunkenness*. This use of it to overcome the effects of alcohol is quite popular in some localities. When a stimulant that will not disturb the brain is required in low forms of *typhoid fever*, this agent may be selected, and often the *sick headache of depression* may be relieved by ½-drachm doses of the solution. *Uterine colic* and *dysmenorrhœa* are sometimes relieved by it, tincture of opium (20 drops), being used with it in the first-named trouble. *Gout*, *rheumatism*, and some forms of *dropsy* and *heart disease* have been benefited by its use. It is an excellent agent in *influenza* and the initial stages of *acute catarrh*. Applied on cloths, moistened with it, it has been found useful in *hydrocele* and *mumps*, and resolves *glandular enlargements* and early stage of *mammitis*. Four parts of the solution added to 28 parts of rose-water and 1 part of tincture of opium, form a very excellent collyrium in some *chronic inflammations of the eye*. Its dose is from ½ fluid drachm to 1 fluid ounce, in some sweetened water, which may be repeated every 3, 4, or 6 hours.

Specific Indications and Uses.—Impaired capillary circulation, with tardy eruption in the exanthemata; alcoholic intoxication; sick headache with depression.

Related Preparations.—The following preparation has been recommended as an elegant and pleasant anodyne, and diaphoretic in *fevers*, worthy the notice of the profession:

LIQUOR AMMONII ACETATIS ET MORPHINÆ: Take of solution of acetate of ammonium, 1 fluid drachm; acetate of morphine, 1 grain; syrup of lemon, enough to make 1 fluid ounce; mix together. The dose is from ½ to 1 fluid drachm, to be taken in water. Each fluid drachm contains ⅛ grain of acetate of morphine (W. S. Merrell).

LIQUOR AMMONII ACETATIS CONCENTRATUS (N. F.), *Concentrated solution of ammonium acetate:* "Acetic acid (*U. S. P.*), five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]; ammonium carbonate, water, of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Neutralize the acetic acid with a sufficient quantity of ammonium carbonate, carefully avoiding an excess. Then add enough water to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. *Note.*—The product is about 3 times the strength of the official *Liquor Ammonii Acetatis*. *Note.*—It is not recommended to keep this solution on hand for the preparation of the official *Liquor Ammonii Acetatis*, as this is preferably made fresh when wanted for use. When it is, however, required or deemed of advantage, to dispense the concentrated solution, it is suggested that it be diluted with carbonic acid water, or be directed to be diluted with this at the time of administration"—(*Nat. Form.*).

LIQUOR AMMONII CITRATIS.—SOLUTION OF CITRATE OF AMMONIUM.

Preparation.—Dilute 5 fluid ounces (Imp.) of strong solution of citrate of ammonium with enough distilled water to make 20 fluid ounces (Imp.). Density, 1.062.

Description.—A clear, colorless fluid, saline to the taste, and should be unaffected by either litmus or turmeric papers. Keep in bottles free from lead.

Action, Medical Uses, and Dosage.—(Same as for *Liquor Ammonii Acetatis*, which see.) Dose, 2 to 6 fluid drachms.

Related Preparation.—LIQUOR AMMONII CITRATIS FORTIOR, *Strong solution of citrate of ammonium:* Neutralize citric acid, 12 ounces (av.) with strong solution of ammonia, 11 fluid ounces (Imp.), or a sufficient amount, and by means of distilled water bring the product to measure 20 fluid ounces (Imp.). Density, 1.209. Dose, 25 to 75 minims. This is used in preparing the solution of citrate of ammonium. Both solutions were official in the *British Pharmacopœia* 1885. (See also *Liquor Ammonii Citratis Fortior*.)

LIQUOR AMMONII CITRATIS FORTIOR (N. F.)—STRONGER SOLUTION OF AMMONIUM CITRATE.

Preparation.—"Citric acid, five hundred and sixty grammes (560 Gm.) [1 lb. av., 3 ozs., 329 grs.]; stronger water of ammonia (*U. S. P.*), water, of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Neutralize the citric acid with the stronger water of ammonia, and add enough water to make one thousand cubic centimeters (1000 Cc. [33 fl℥. 391 ♏]. The solution should be kept in bottles free from lead. Each fluid drachm contains about 40 grains of ammonium citrate. *Note.*—This solution is apt to take up notable quantities of lead if kept in bottles made of flint glass. *Liquor Ammonii Citratis* (*Br. Pharm.*) may be prepared from this solution by mixing 1 volume of it with 4 volumes of water"—(*Nat. Form.*).

Uses.—This preparation is employed in making mixtures of liquids from tannin-yielding drugs and tincture of chloride of iron. It blends them together so as to prevent the inkiness otherwise a factor in such mixtures.

LIQUOR ANTIMONII CHLORIDI.—SOLUTION OF CHLORIDE OF ANTIMONY.

SYNONYMS: *Liquor antimonii terchloridi, Solution of terchloride of antimony, Liquid butter of antimony, Antimony trichloride, Butter of antimony, Butyrum antimonii, Butyrum stibii, Liquor stibii chlorati, Chloridum stibicum, Chloruretum stibicum, Antimonium muriaticum liquidum.*

Preparation.—"Take of purified black antimony, 1 pound; hydrochloric acid, 4 pints. Place the purified black antimony in a porcelain vessel, pour upon it the hydrochloric acid, and, constantly stirring, apply to the mixture, beneath a flue with a good draught, a little heat, which must be gradually augmented as the evolution of gas begins to slacken, until the liquid boils. Maintain it at this temperature for 15 minutes, then remove the vessel from the fire, and filter the liquid through calico into another vessel, returning what passes through first, that a perfectly clear solution may be obtained. Boil this down to the bulk of 2 pints and preserve it in a stoppered bottle"—(*Br. Pharm.*, 1885). Weights, avoidupois; measures, Imperial.

History.—In earlier days butter of antimony was prepared by distilling the evaporated solution of antimony trisulphide in hydrochloric acid. A white, semi-transparent, crystalline mass resulted. The red color of the solution, as prepared by the above official process, is due to the impurities present, chiefly of iron and other metals. If this be distilled a colorless solution of antimony trichloride ($SbCl_3$) will be obtained. In the process above given double decomposition ensues, antimony trichloride is formed, and hydrogen sulphide escapes with effervescence. The operation should be conducted under a hood.

Description.—Butter of antimony is a heavy, yellow-red fluid of about the specific gravity 1.47. When a little of it is dropped into water a white precipitate falls, which is colored orange upon treatment with hydrogen sulphide. After filtering out the white deposit the filtrate gives an abundant precipitate with silver nitrate. "One fluid drachm of it mixed with a solution of ¼ ounce of tartaric acid in 4 fluid ounces of water, forms a clear solution, which, if treated with sulphuretted hydrogen, gives an orange precipitate, weighing, when washed and dried at 212° F. (100° C.) about 22 grains"—(*Br. Pharm.*, 1885). The white powder which falls upon the addition of water is the *powder of Algaroth*, or antimonous oxychloride ($2SbCl_3.5Sb_2O_3$). The antimonium chloride of the *French Codex* is the soft, crystalline mass above referred to. It fumes in the air and is very deliquescent. It is a powerful caustic. The impurities are likely to be iron, lead, copper, and arsenic. Copper will strike blue with an excess of ammonia; lead crystallizes out from the cold liquid; that remaining may be detected with sulphuric acid.

Action, Medical Uses, and Dosage.—This article is used only as a caustic to *fungous growths, poisonous bites of reptiles or animals, malignant pustules, chancres,* etc. Having first carefully removed the blood, which decomposes it, apply the caustic liquid to the *wound* or *tumor* by means of a camel's-hair pencil, or on a dossil of lint. This agent is a poison, a charred surface and symptoms of collapse resulting from its use. The antidotes are tannin solutions, magnesia, and magnesium and calcium carbonates. These should be followed by demulcent drinks. The agent is not used in Eclectic medicine.

LIQUOR ARSENI ET HYDRARGYRI IODIDI (U. S. P.)—SOLUTION OF ARSENIC AND MERCURIC IODIDE.

SYNONYMS: *Donovan's solution, Solutio Donovani, Solution of hydriodate of arsenic and mercury.*

Preparation.—"Arsenic iodide, ten grammes (10 Gm.) [154 grs.]; red mercuric iodide, ten grammes (10 Gm.) [154 grs.]; distilled water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Powder the arsenic iodide, and mix it with the red mercuric iodide by trituration. Add one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏] of distilled water, and continue the trituration until solution is effected. Filter the solution, and pass enough distilled water through the filter to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly"—(*U. S. P.*).

Description.—A clear, pale-yellowish liquid, without odor, but having a disagreeable, metallic taste. It is a 1 per cent solution each of arsenic iodide and red mercuric iodide (4.56 grains each to the ounce). It should be kept in the dark, and should free iodine be apparent, as evinced by its odor, or should it become orange or yellow-red, it should not be dispensed. It is not compatible with the soluble compounds of morphine, nor with tincture of opium. Alkalies and silver, and alkaloidal salts produce precipitates with it.

Action, Medical Uses, and Dosage.—Donovan's solution is one of the few preparations containing mercury that have been endorsed by Eclectic teachers. Its use in our school, however, is limited, the indications being those mentioned below. Our use of it is chiefly in *secondary syphilis*. It is said to be useful, in doses of from 10 to 30 drops, 2 or 3 times a day, in *lupus, lepra, diseases of the scalp, psoriasis, impetigo, venereal eruptions*, and other *obstinate cutaneous affections*. This dose, however, is too large, and the quantities employed for its specific uses are small, the usual proportion being from 1 to 10 drops in 4 fluid ounces of water, the dose of which solution is a teaspoonful.

Specific Indications and Uses.—Small, contracted, elongated, and pointed tongue, with prominent papillæ and increased redness.

Related Preparation.—LIQUOR HYDRARGYRI ET POTASSII IODIDI (N. F.), *Solution of iodide of mercury and potassium, Solution of potassium iodohydrargyrate, Channing's solution.* "Red iodide of mercury, ten grammes (10 Gm.) [154 grs.]; potassium iodide, eight grammes (8 Gm.) [123 grs.]; distilled water, one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the salts in the distilled water"—(*Nat. Form.*).

LIQUOR ATROPINÆ SULPHATIS.—SOLUTION OF SULPHATE OF ATROPINE.

Preparation.—Dissolve 9 grains of sulphate of atropine (1 part) in 16½ fluid drachms of camphor water (99 fluid parts). Contains 1 per cent of atropine sulphate. This accords with the *British Pharmacopœa*, 1885. This solution decomposes after a time, and should be prepared in small amounts only, or as needed. The *British Pharmacopœia* (1898) employs distilled water and salicylic acid, one-ninth the quantity of atropine sulphate.

Action, Medical Uses, and Dosage.—(See *Atropina*.) A drop may be instilled upon the eye for effecting dilatation of the pupil whenever this is desired for ophthalmoscopic examinations, or for operations on this organ. Dose, 1 to 4 minims.

Related Liquor.—LIQUOR ATROPINÆ SALICYLATIS, *Solution of atropine salicylate.* Atropine, 2.7 grains; salicylic acid, 1.3 grains; distilled water, 1 ounce. This solution is said to keep for any length of time (Tichborne).

LIQUOR BISMUTHI ET AMMONII CITRATIS.—SOLUTION OF BISMUTH AND AMMONIUM CITRATE.

SYNONYMS: *Liquor bismuthi, Liquor bismuth, Solution of ammonio-citrate of bismuth.*

Preparation.—Take bismuth oxynitrate and potassium citrate, of each, 613 grains (Imp.) or 70 grammes (metric); potassium carbonate, 175 grains (Imp.) or 20 grammes; nitric acid, 1 fluid ounce (Imp.) or 50 cubic centimeters; solution of ammonia, distilled water, of each a sufficient quantity. "Dissolve the bismuth oxynitrate in the nitric acid, diluted with an equal volume of distilled water; add distilled water with constant stirring until the liquid is very faintly opalescent; add the potassium citrate and carbonate dissolved in a little distilled water; heat the liquid to the boiling point; cool; separate the precipitate; wash it with distilled water until free from nitrates. Gradually add solution of ammonia to the moist precipitate until it is just dissolved; dilute with distilled water to 1 pint (or one thousand cubic centimeters). Filter"—(*Br. Pharm.*, 1898).

This compound originated in a secret preparation termed *Liquor Bismuthi*, prepared by Mr. Schacht, of England. Various formulæ have from time to time been given for the preparation of an identical liquid, one of these being that of Mr. C. H. Wood, in the *Lond. Pharm. Jour.*, March, 1868.

Description.—As prepared by the British process, *Liquor Bismuthi* is a colorless solution having a slightly metallic taste and a density of 1.07. It mixes freely with water, and has a neutral or but feebly alkaline reaction. Heated in the presence of the alkalies ammonia is expelled and a white precipitate falls. If the solution be evaporated and the dry residue be ignited a "charred mass" with a yellow edge is left behind. The bismuth contained in a fluid drachm of the solution is about equivalent to 3 grains or 5 per cent of bismuth oxide. "A mixture of 10 cubic centimeters of the solution with 40 cubic centimeters of water, treated with hydrogen sulphide in excess, yields a black precipitate, which, when washed and dried, should weigh at least 0.55 gramme"—(*Br. Pharm.*, 1898). In case the solution precipitates by reason of the escape of ammonia, a small amount of ammonia added thereto will redissolve it.

Action, Medical Uses, and Dosage.—The salts of bismuth are extensively employed to allay gastro-intestinal irritation. For gastric irritation alone small doses of the subnitrate are efficient, but larger doses are required where the intestinal tract is also involved. Preferable to the impalpable powder—the subnitrate—for *chronic gastro-intestinal irritation* with diarrhœa, Eclectic physicians have used the liquor bismuth or solution of bismuth and ammonium citrate. It is equally valuable in the *diarrhœa of typhoid fever*, and in *dysenteric diarrhœa*. It is especially serviceable in many forms of *diarrhœa* accompanied with pain, and due to irritation of the stomach and bowels from undigested aliment. Watery diarrhœa coming in sudden gushes is frequently best controlled with liquor bismuth. The indications for its selection are given below. Dose, ½ to 1 fluid drachm, 4 times a day.

Specific Indications and Uses.—Long, pointed, red tongue, irritation, uneasy or painful sensations in the stomach, with heat; eructations of acrid or acid material; irritative diarrhœa.

Related Preparation.—LIQUOR BISMUTHI (N. F.), *Solution of bismuth, Liquid bismuth:* "Glycerite of bismuth (F. 185), one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; alcohol, one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; distilled water, seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏]. Mix the glycerite of bismuth with the distilled water, then add the alcohol.

Solution of bismuth may also be prepared in the following manner: "Bismuth and ammonium citrate, seventeen and one-half grammes (17.5 Gm.) [270 grs.]; alcohol, one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; glycerin, sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; water of ammonia (*U. S. P.*), distilled water, of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the bismuth and ammonium citrate in seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of distilled water and allow the solution to stand a short time. Should any insoluble matter have deposited, pour off the clear liquid and add just enough water of ammonia to the residue to dissolve it, or to cause it to retain a faint odor of ammonia. Then filter the united liquids, add the alcohol, the glycerin, and enough distilled water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. This preparation should be freshly made when wanted for use. Each fluid drachm represents 1 grain of bismuth and ammonium citrate" (*Nat. Form.*).

LIQUOR BROMI (N. F.)—SOLUTION OF BROMINE.

SYNONYM: *Smith's solution of bromine.*

Preparation.—"Bromine, twenty-five grammes (25 Gm.) [386 grs.]; potassium bromide, twelve and one-half grammes (12.5 Gm.) [193 grs.]; water, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Dissolve the potassium bromide in the water contained in a bottle, add the bromine, and shake the mixture until this is dissolved. Keep the solution in glass-stoppered vials in a dark place. *Note.*—As bromine vapor is very injurious to the respiratory passages and destructive to balances, it is often preferable to take the contents of an original bottle of bromine—weighing the bottle, both before opening it and after emptying it, in order to ascertain the exact weight of the bromine contained therein—and then to use a quantity of potassium bromide and of water proportionate to the quantities above given"—(*Nat. Form.*).

Uses.—(See *Bromine.*)

LIQUOR CALCIS (U. S. P.)—SOLUTION OF LIME.

"A saturated, aqueous solution of calcium hydrate ($Ca[OH]_2=73.83$). The percentage of calcium hydrate varies with the temperature, being somewhat over 0.17 per cent at 15° C. (59° F.), and diminishing as the temperature rises"—(*U. S. P.*).

SYNONYMS: *Aqua calcis, Solution of calcium hydrate, Lime-water, Aqua calcariæ ustæ, Calcaria soluta, Oxydum calcicum aqua solutum.*

Preparation.—"Lime, twelve grammes (12 Gm.) [185 grs.]; distilled water, a sufficient quantity. Slake the lime by the gradual addition of seventy cubic centimeters (70 Cc.) [2 fl℥, 176 ♏] of distilled water, then add three hundred and sixty cubic centimeters (360 Cc.) [12 fl℥, 83 ♏] more of distilled water, and agitate occasionally during ½ hour. Allow the mixture to settle, decant the liquid, and throw it away. Then add to the residue thirty-six hundred cubic centimeters (3600 Cc.) [121 fl℥, 351 ♏] of distilled water, agitate thoroughly, wait a short time for the coarser particles to subside, and pour the liquid, holding the undissolved lime in suspension, into a glass-stoppered bottle. From time to time shake the bottle, so as to keep the solution saturated. Pour off the clear liquid when it is wanted for use"—(*U. S. P.*).

Description and Tests.—Lime from marble should be preferred if it can be obtained. By the action of the water the calcium oxide is converted into calcium hydroxide ($Ca[OH]_2$), and this is dissolved in the water. As lime is more soluble in cold than in hot water, the former should be used in making this preparation. The purpose of throwing away the first washings in the above-given official process, is to get rid of the water-soluble alkali salts frequently contained in ordinary lime. If marble is employed in the preparation of the latter, this precaution is superfluous. The *U. S. P.* describes *Liquor Calcis* as "a clear, colorless liquid, without odor, and having a saline and feebly caustic taste. It absorbs carbon dioxide from the air, so that a pellicle of calcium carbonate forms on the surface of the liquid. On being heated, it becomes turbid from separation of calcium hydrate, which redissolves again when the liquid is cooled. It gives a strongly alkaline reaction with litmus paper"—(*U. S. P.*). Bottles containing it should always have an excess of lime, and be kept well stopped.

It is not a good plan to keep adding water to the excess of lime in the container as the liquor is poured off, as is done by some pharmacists. "The alkaline reaction of the solution should entirely disappear after it has been saturated with carbon dioxide, and subsequently boiled (absence of alkalies and their carbonates). In other respects it should conform to the reactions and tests given under lime (see *Calx*). Fifty cubic centimeters of solution of lime should require, for complete neutralization, about 20 Cc. of decinormal oxalic acid V.S. (corresponding to about 0.14 [0.148] per cent of calcium hydrate), phenolphtalein being used as an indicator"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Lime-water is astringent (topical and internal), and styptic, but not caustic. Taken internally it counteracts acidity, but is probably not all neutralized by the gastric acids, for after passing the stomach it still acts as an astringent in *diarrhœa*. It has been found useful in *pyrosis*, *gastrodynia*, and other *painful gastric symptoms* due to deranged digestion, likewise in *epilepsy*, and other *spasmodic and chronic diseases*, which are accompanied with *acidity of the stomach*. It is specifically indicated in *indigestion* and *dyspepsia* caused by the development of lactic acid from the decomposition of the food. In *scrofula* and *scrofulous skin affections* with deposits in all parts but the lymphatic glands, it is peculiarly effective. In *dyspepsia*, *phthisis*, and other forms of disease. where, from acidity or irritability of the stomach, the usual food is rejected, or if retained gives rise to uneasiness and many unpleasant symptoms, 1 part of lime-water added to 1, 2, or 3 parts of good sweet milk, will be found useful as an antacid, calmative and diet. It frequently cures *thrush*. A tablespoonful of lime-water will often allay troublesome *vomiting*. When in *infantile dyspepsia* with passages of green stools, and the child vomits curdled milk, it is specifically indicated. Lime-water has proved beneficial as an astringent in *chronic diarrhœa* and *dysentery*, and *diabetes*, especially when given in combination with a decoction of white-oak bark. It acts specially upon the subcutaneous cellular tissues, subduing inflammation, is a specific in cases of obstinate and repeated formation of *boils*, and is advantageous in cases where there is an *excess of uric acid*. It relieves irritation of the cellular tissues, checks determination of blood, and promotes absorption of the exudation products of the inflammatory process. It is sometimes used in combination with wormseed oil, or other fluid anthelmintics, for the removal of *worms;* and will be found more especially efficient in cases attended with great acidity. It has been advantageously used as an injection in *gleet*, *gonorrhœa*, *leucorrhœa*, *ulceration*, and increased discharges from the bladder, etc., and in fact is a very simple and useful wash for mucous or purulent profluvia from any of the mucous surfaces.

Externally, it has been employed as a wash in various affections of the skin, as *scabies*, *prurigo*, *lepra*, *psoriasis*, *ringworm of the scalp*, *eczema capitis*, and also in *scrofulous and indolent ulcers*. Mixed with linseed oil, it forms a calcareous soap or liniment, now official and well known as *Carron Oil*, which is very valuable in *scalds* and *burns*, being probably the best immediate application for these accidents. Oil of turpentine is sometimes advantageously added to it. Lime-water has been asserted to dissolve false membranes. Whether this be true or not, the use of a dilution of 1 part of lime-water to 10 or 15 parts of water, used as a spray or gargle, or better still, this proceedure alternated with exposure to the vapor of slaking lime, has contributed as much as any method to what little success has been attained in the treatment of *diphtheria*, *pseudo-membranous croup*, and allied disorders. Lime-water should not be given during the presence of active inflammation; nor should its use be too long continued, as it weakens the stomach and digestive powers. Its dose is from ½ fluid ounce to 4 fluid ounces, and may be taken alone, in milk, or in some aromatic water. An overdose occasions unpleasant symptoms, which are best combated by bland and mucilaginous fluids.

Specific Indications and Uses.—Infantile dyspepsia with green stools and vomiting of curdled milk; successive formation of boils, and other cellular inflammations resulting in suppuration; indigestion from the formation of lactic acid from food decomposition. Locally (*Carron Oil*) in burns and scalds.

LIQUOR CALCIS CHLORINATÆ.—SOLUTION OF CHLORINATED LIME.

Preparation.—"Take of chlorinated lime, 1 pound (av.); distilled water, 1 gallon (Imp.). Mix well the water and the chlorinated lime by trituration in a mortar, and, having poured the mixture into a stoppered bottle, let it be well shaken several times for the space of 3 hours. Pour out now the contents of the bottle on a calico filter, and let the solution which passes through be preserved in a stoppered bottle"—(*Br. Pharm.*, 1885).

Description.—This liquor has the general properties of chlorinated lime. "Specific gravity about 1.055. Eighty grains, by weight, mixed with 20 grains of iodide of potassium, dissolved in 4 fluid ounces of water, when acidulated with 2 fluid drachms of hydrochloric acid, gives a red solution, which requires for the discharge of its color not less than 450 grain-measures of the volumetric solution of hyposulphite of sodium, corresponding to about 2 per cent of available chlorine" (*Br. Pharm.*, 1885).

Action, Medical Uses, and Dosage.—Solution of chlorinated lime is an excellent deodorizer. It has the general uses of chlorinated lime, being particularly employed as a stimulant to the skin in *low febrile states* and *chronic skin eruptions*. The dose is from 20 to 60 minims; for external use, from half to full strength. It antidotes hydrogen and potassium sulphides, hydrocyanic acid, and ammonium sulphydrate.

Related Preparation.—Liquor Calcii Chloridi, *Solution of chloride of calcium*. The *British Pharmacopœia* (1885) directs 88 grains (1 part) of chloride of calcium to be dissolved in 1 fluid ounce (5 fluid parts, Imp.) of distilled water, and filtered, if necessary. Density, 1.145. (For uses, see *Calcii Chloridum*.) Dose, 15 to 50 minims.

LIQUOR CALCIS SULPHURATÆ (N. F.)—SOLUTION OF SULPHURATED LIME.

Synonyms: *Solution of oxysulphuret of calcium*, *Vleminck's solution* (or *lotion*).

Preparation.—"Lime, freshly slaked, one hundred and sixty-five grammes (165 Gm. [5 ozs. av., 359 grs.]; sublimed sulphur, two hundred and fifty grammes (250 Gm. [8 ozs. av., 358 grs.]; water, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Mix the slaked lime with the sulphur, and add the mixture gradually to sixteen hundred and fifty grammes (1650 Gm.) [3 lbs. av., 10 ozs., 88 grs.] of boiling water. Then boil the whole, under constant stirring, until it is reduced to one thousand grammes (1000 Gm. [2 lbs. av., 3 ozs., 120 grs.]; strain, and, having allowed the solution to become clear by standing in a well-stoppered bottle, decant the clear, brown liquid, and keep it in completely filled and well-stoppered bottles"—(*Nat. Form.*).

Action and Medical Uses.—This solution is very efficient as a local application in *itch*, *tinea capitis*, *pityriasis*, and other *parasitic cutaneous affections*. In itch, the patient should be thoroughly washed with warm soap suds, and then well dried; following this, the solution is to be applied, which must not be rubbed off. Upon drying, the sulphide is left upon the skin in the form of a thin coating, which may be removed in 20 or 30 minutes. Two or 3 applications at most effect the cure. It is probably the promptest and surest agent for this purpose.

LIQUOR CARMINI (N. F.)—SOLUTION OF CARMINE.

Preparation.—"Carmine, sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; water of ammonia (*U. S. P.*), three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏]; glycerin, three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the carmine to a fine powder in a wedgewood mortar, gradually add the water of ammonia, and afterward the glycerin, under constant trituration. Transfer the mixture to a porcelain capsule, and heat it upon a water-bath, constantly stirring, until the liquid is entirely free from ammoniacal odor. Then cool and add enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. *Note.*—The best quality of carmine, known in commerce as 'No. 40,' should be used for this preparation"—(*Nat. Form.*).

Uses.—Solution of carmine is employed as a coloring agent for medicines and for syrups.

Related Preparation.—Liquor Coccineus (N. F.), *Cochineal color*. "Cochineal, in No. 50 powder, sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; potassium carbonate, thirty grammes (30 Gm. [oz. av., 25 grs.]; alum, thirty grammes (30 Gm.) [1 oz. av., 25 grs.]; potassium bitartrate, sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; glycerin, five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]; alcohol, thirty cubic centimeters (30 Cc.) [1 fl℥, 7 ♏], water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the cochineal intimately with the potassium carbonate and five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of water. Then add the alum and potassium bitartrate successively, heat the mixture to boiling in a capacious vessel, then set it aside to cool, add to it the glycerin and alcohol, filter, and pass enough water through the filter to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*Nat. Form.* . This agent is used in pharmacy as a coloring substance.

LIQUOR COCAINÆ HYDROCHLORATIS.—SOLUTION OF COCAINE HYDROCHLORATE.

Preparation.—"Cocaine hydrochlorate, 33 grains; salicylic acid, $\frac{1}{2}$ grain; distilled water, sufficient to produce 6 fluid drachms. Boil the water, add the salicylic acid, and then the cocaine hydrochlorate; cool, and add water, if necessary, to produce the required volume"—(*Br. Pharm. Add.*, 1885).

Each minim contains about $\frac{1}{11}$ grain of cocaine, or 5.5 grains to the fluid drachm.

Action, Medical Uses, and Dosage.—(See *Cocainæ Hydrochloras.*) Dose, 1 to 5 minims. The custom in America is to make a 4 per cent solution of cocaine hydrochlorate by dissolving 4 grains of the salt in 96 grains of distilled water. The preparation looses its energy by keeping, and must be frequently replaced.

LIQUOR CUPRI ALKALINUS (N. F.)—ALKALINE SOLUTION OF COPPER.

SYNONYM: *Fehling's solution.*

Preparation.—I. THE COPPER SOLUTION. "Sulphate of copper, pure, thirty-four and six hundred and thirty-nine one thousandths grammes (34.639 Gm.) [1 oz. av., 97 grs.]; distilled water, enough to make five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]. Dissolve the sulphate of copper which, before being weighed, should have been reduced to powder and pressed between blotting paper, in a sufficient quantity of distilled water to produce the volume required by the corresponding formula above given.

II. THE ALKALINE SOLUTION.—"Tartrate of potassium and sodium, one hundred and seventy-three grammes (173 Gm.) [6 ozs. av., 45 grs.]; soda (*U. S. P.*, 1880), sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; distilled water, enough to make five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]. Dissolve the tartrate of potassium and sodium and the soda in a sufficient quantity of distilled water to produce the volume required by the corresponding formula above given. Set the mixture aside until the suspended impurities have been deposited; then remove the clear solution with a siphon.

"Keep both solutions, separately, in small, well-stoppered vials, in a cool and dark place. For use, mix exactly equal volumes of the two solutions by pouring the copper solution into the alkaline solution. *Note.*—The two solutions should be prepared with cold distilled water, and should be made up to their respective volumes at one and the same temperature. They should also be at the same temperature at the time of mixing. On diluting a small quantity of the mixed reagent with about 3 volumes of distilled water, and heating the liquid in a test-tube to boiling, it should remain entirely clear, without any trace of discoloration or precipitate. After the solutions have been mixed for use, and assuming that they have been prepared and mixed at the average indoor temperature, 10 Cc. of the mixture, prepared by metric weight and measure, correspond to 0.05 Gm. of glucose. Of the mixture, prepared by apothecaries' weight and measure, 210 minims correspond to 1 grain of glucose"—(*Nat. Form.*).

Uses.—This is the well-known Fehling's test solution for the detection of glucose in urine.

LIQUOR ELECTROPOEICUS (N. F.)—BATTERY FLUID.

A.—For the Carbon and Zinc Battery.

Preparation.—I. FOR ORDINARY USE. "Sodium bichromate, in coarse powder, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; sulphuric acid, commercial, one hundred and twenty-five cubic centimeters (125 Cc.)

[4 fl℥, 109 ♏]; water, cold, one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Pour the sulphuric acid upon the powdered bichromate, and stir the mixture occasionally during 1 hour. Then slowly add the water"—(*Nat. Form.*).

II. For Use with the Galvano-Cautery.—"Sodium bichromate, in coarse powder, one hundred and forty grammes (140 Gm.) [4 ozs. av., 411 grs.]; sulphuric acid, commercial, three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏]; water, cold, one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Proceed in the same manner as directed under No. 1. *Note.* Sodium bichromate is more soluble than the potassium salt, and its products of decomposition, in the battery, are also more soluble. As it is also much cheaper, it is now preferred in all large electric laboratories. When it can not be obtained, potassium bichromate may be used in place of it, as heretofore. The two salts may be substituted for each other, weight for weight."

B.—For the Leclanché Battery.

"Ammonium chloride, three hundred and twenty-five grammes (325 Gm.) [11 ozs. av., 203 grs.]; water, enough to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the salt in the water"—(*Nat. Form.*).

Uses.—These fluids are used for charging electric batteries.

LIQUOR EPISPASTICUS.—BLISTERING LIQUID.

Synonym: *Linimentum cantharidis.*

Preparation.—"Take of cantharides, in powder, 5 ounces (av.); acetic ether, a sufficiency. Mix the cantharides with 3 fluid ounces of acetic ether; pack in a percolator, and, at the expiration of 24 hours, pour acetic ether over the contents of the percolator, and allow the solution to pass slowly through until 20 fluid ounces are obtained. Keep the liquid in a stoppered bottle"—(*Br. Pharm.*, 1885). The preparation of the *British Pharmacopœia* (1898) has twice the strength of the above.

Action and Medical Uses.—This is designed for rapid vesication of the parts to which it is applied. It should be used only upon limited areas, and rubbed upon the skin by means of a sponge, or like body, having a handle attached. When the parts become red, enough has been used to raise a blister.

LIQUOR ERGOTINÆ.—LIQUOR OF ERGOTIN.

Synonym: *M. Yvon's solution of ergotin.*

Preparation and Description.—Coarsely powder ergot and deprive it of its fixed oil by washing it with rectified disulphide of carbon, then dry it in the open air and protected from the light until the odor of the solvent has entirely disappeared. Introduce this powder into a cylindrical percolator, and exhaust it in the cold by distilled water, to every one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of which two grammes (2 Gm.) [31 grs.] of tartaric acid have been added. Heat the liquid obtained, so as to coagulate any albuminous matters that may be present in it, then filter, and by means of a water-bath, evaporate it to about one-third of its volume. When cool, filter, digest the filtered liquid with a slight excess of recently precipitated carbonate of calcium so as to saturate the excess of tartaric acid. Filter, evaporate to the consistence of thick syrup, and precipitate with alcohol of sp. gr. 0.822, added in such quantity as to furnish with the aqueous liquid an alcohol of sp. gr. 0.871. Again filter, and then evaporate to drive off the alcohol. Exhaust the residuum by the addition of distilled water in quantity slightly less than that of the weight of the ergot employed, a little animal charcoal being used. Again filter, and to the filtered liquid add, for each one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.] of ergot employed, fifteen centigrammes (15 Cgm.) [2⅓ grs.] of salicylic acid. Complete the process by adding distilled water, in such quantity as to obtain a weight of liquid equal to that of the ergot employed in the preparation of the solution. Allow this to rest for several days in a cool place, and then pour it into small vials having well-fitted, ground stoppers.

Hypodermatic injections of ergotin have rapidly come into favor with the profession, being employed in various forms of disease. One great objection formerly to their employment has been the irritating quality of the solutions used, occasioning abscesses and indurations. M. Yvon succeeded in forming a solution wholly free from irritating principles, the process for preparing which, as described by himself, we have deemed proper to present. The liquid obtained by this process is of a fine amber color, clear, non-fermentable, and keeps well; all the reagents of the alkaloids form abundant precipitates with it. One Gm. of this solution represents 1 Gm. of ergot, and it contains the obstetrical and hemostatic principles of this drug.

Action, Medical Uses, and Dosage.—(See *Ergota.*)

LIQUOR EXTRACTI GLYCYRRHIZÆ (N. F.)—SOLUTION OF EXTRACT OF GLYCYRRHIZA.

SYNONYM: *Solution of extract of liquorice.*

Preparation.—"Purified extract of glycyrrhiza (F. 158), a sufficient quantity; alcohol, one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; glycerin, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. In a small portion of purified extract of glycyrrhiza, weighed into a tared capsule, determine the amount of water, by drying it to a constant weight. Then take of the purified extract a quantity equivalent to two hundred and fifty grammes (250 Gm.) [8 ozs. av., 358 grs.] of dry extract, dissolve this on a water-bath, in two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water, add the glycerin, and allow the liquid to cool. Lastly, add the alcohol and enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents 15 grains of dry extract of glycyrrhiza"—(*Nat. Form.*).

Action and Medical Uses.—(See *Glycyrrhiza.*)

LIQUOR FERRI ACETATIS (U. S. P.)—SOLUTION OF FERRIC ACETATE.

"An aqueous solution of ferric acetate ($Fe_2[C_2H_3O_2]_6$=464.92), containing about 31 per cent of the anhydrous salt, and corresponding to about 7.5 per cent of metallic iron"—(*U. S. P.*).

Preparation.—"Solution of ferric sulphate, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; glacial acetic acid, two hundred and sixty grammes (260 Gm.) [9 ozs. av., 75 grs.]; ammonia water, eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏]; water, distilled water, each, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Mix the ammonia water with three thousand cubic centimeters (3000 Cc.) [101 fl℥, 212 ♏] of cold water, and the solution of ferric sulphate with ten thousand cubic centimeters (10,000 Cc.) [338 fl℥, 66 ♏] of cold water. Add the latter solution slowly to the diluted ammonia water, stirring constantly. Let the mixture stand until the precipitate has subsided as far as practicable, and then decant the supernatant liquid. Add to the precipitate six thousand cubic centimeters (6000 Cc.) [202 fl℥, 424 ♏] of boiling water, mix well, and again set the mixture aside, as before. Repeat the washing with successive portions of boiling water, in the same manner, until the washings are no longer affected by sodium cobaltic nitrite test solution (showing the removal of ammonia and its salts). Transfer the mixture to a wet muslin strainer, allow the precipitate to drain completely, and press it folded in the strainer, until its weight is reduced to seven hundred grammes (700 Gm.) [1 lb. av., 8 ozs., 303 grs.], or less. Now add the precipitate gradually to the glacial acetic acid contained in a tared jar provided with a glass stopper, stirring the mixture after each addition until each portion added is nearly dissolved before adding another portion. Finally, add enough distilled water to make the product weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]: mix thoroughly, allow it to become clear by subsidence, and decant the clear solution. Keep the product in well-stoppered bottles, in a cool place, protected from light"—(*U. S. P.*).

Description and Tests.—"A dark reddish-brown, clear liquid, of an acetous odor, a sweetish, acidulous, somewhat styptic taste, and a slightly acid reaction. Specific gravity, about 1.160 at 15° C. (59° F.). The diluted solution yields a brownish-red precipitate with ammonia water, and a blue one with potassium ferrocyanide T.S. When heated to boiling the solution yields a brownish-red precipitate, and when heated with sulphuric acid, it emits acetous vapors. If the iron be completely precipitated from a portion of the solution by an excess of ammonia water, the filtrate should be colorless, and should not yield a white or dark-colored precipitate with hydrogen sulphide T.S. (absence of zinc or copper), nor should it leave a residue on evaporation and gentle ignition (absence of salts of the fixed alkalies). If to a small portion of the solution, diluted with about 10 volumes of water, a few drops of freshly prepared potassium ferricyanide T.S. be added, a pure brown color should be produced, without a tinge of green or greenish-blue (absence of ferrous salt). If 1.12 (1.1176) Gm. of the solution be introduced into a glass-stoppered bottle (having a capacity of about 100 Cc.), together with 15 Cc. of water and 2 Cc. of hydrochloric acid, and after the addition of 1 Gm. of potassium iodide, the mixture be kept for half an hour at a temperature of 40° C. (104° F.), then cooled, and mixed with a few drops of starch T.S., it should require about 15 Cc. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each cubic centimeter of the volumetric solution indicating 0.5 per cent of metallic iron)"—(*U. S. P.*).

The LIQUOR FERRI ACETATIS of the *British Pharmacopœia* (1898) has a specific gravity of 1.031, and contains only 1.57 per cent of metallic iron.

Action, Medical Uses, and Dosage.—(See *Tinctura Ferri Acetatis.*) Dose, 1 to 15 minims.

LIQUOR FERRI CHLORIDI (U. S. P.)—SOLUTION OF FERRIC CHLORIDE.

"An aqueous solution of ferric chloride (Fe_2Cl_6=323.98), containing about 37.8 per cent of the anhydrous salt, corresponding to 62.9 per cent of the crystallized salt ($Fe_2Cl_6+12H_2O$=539.5), or to about 13 per cent of metallic iron"—(*U. S. P.*).

SYNONYMS: *Solution of chloride of iron, Strong solution of perchloride of iron, Ferrum sesquichloratum solutum, Liquor ferri muriatici oxydati.*

Preparation.—"Iron, in the form of fine, bright wire, and cut into small pieces, one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]; hydrochloric acid, eight hundred and seventy grammes (870 Gm.) [1 lb. av., 14 ozs., 301 grs.]; nitric acid, distilled water, each, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Introduce the iron wire into a flask having a capacity of about two thousand cubic centimeters (2000 Cc.) [67 fl℥, 301 ♏], pour upon it a mixture of five hundred and forty grammes (540 Gm.) [1 lb. av., 3 ozs., 21 grs.] of hydrochloric acid and two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of distilled water, and let the mixture stand in a moderately warm place until effervescence ceases; then heat it to the boiling point, filter it through paper, and, having rinsed the flask and iron wire with a little hot distilled water, pass the rinsings through the filter. To the filtered liquid add two hundred and eighty grammes (280 Gm.) [9 ozs. av., 384 grs.] of hydrochloric acid, add the mixture slowly and gradually, in a stream, to eighty grammes (80 Gm.) [2 ozs. av., 360 grs.] of nitric acid contained in a capacious porcelain vessel, and warm gently. After effervescence ceases, apply heat, by means of a sand-bath, until the liquid is free from nitrous odor. Then test a few drops of the liquid, diluted with water, with freshly prepared potassium ferricyanide test-solution. Should this reagent produce a blue color, add a little more nitric acid, drop by drop, as long as effervescence is observed, and evaporate off the excess. Finally, add the remaining fifty grammes (50 Gm.) [1 oz. av., 334 grs.] of hydrochloric acid and enough distilled water to make the solution weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]"—(*U. S. P.*).

Description and Tests.—"A reddish-brown liquid, having a faint odor of hydrochloric acid, an acid, strongly styptic taste, and an acid reaction. Specific gravity about 1.387 at 15° C. (59° F.). The diluted solution yields a brownish-red precipitate with ammonia water, a blue one with potassium ferrocyanide T.S., and a white one, insoluble in nitric acid, with silver nitrate T.S. If the iron be completely precipitated from a portion of the solution by an excess of ammonia water, the filtrate should be colorless, and should not yield a white or a dark-colored precipitate with hydrogen sulphide T.S. (absence of zinc or copper); nor should it leave a fixed residue on evaporation and gentle ignition (absence of salts of the fixed alkalies). On adding a clear crystal of ferrous sulphate to a cooled mixture of equal volumes of concentrated sulphuric acid and a moderately dilute portion of the solution, the crystal should not become colored brown, nor should there be a brownish-black color developed around it (absence of nitric acid). If to a diluted portion of the solution a few drops of freshly prepared potassium ferricyanide T.S. be added, a pure brown color should be produced, without a tinge of green or greenish-blue (absence of ferrous salt). On diluting 1 Cc. of the solution with water, to 40 Cc., and boiling, the liquid should remain clear (absence of oxychloride). If 1.12 (1.1176) Gm. of the solution be introduced into a glass-stoppered bottle (having a capacity of about 100 Cc.), together with 15 Cc. of water and 2 Cc. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for ½ an hour at a temperature of 40° C. (104° F.), then cooled, and mixed with a few drops of starch T.S., it should require about 26 Cc. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each cubic centimeter of the volumetric solution indicating 0.5 per cent of metallic iron) "—(*U. S. P.*).

This preparation is also known as Liquor Ferri Perchloridi and Solution of Perchloride of Iron. It is used mainly for making tincture of chloride of iron, which see. The solution of this name in the latest *British Pharmacopœia* (Liquor Ferri Perchloridi) has the strength of the tincture in the same work; both are prepared from a strong solution of ferric chloride (Liquor Ferri Perchloridi Fortis), containing 22.5 Gm. of iron in 100 Cc. of the preparation.

Action and Medical Uses.—(See *Ferri Chloridum.*) Solution of ferric chloride may be kept on hand for the preparation of freshly precipitated hydroxide of iron, the antidote for arsenic and its compounds. A solution of Liquor Ferri Chloridi in alcohol forms the well-known muriated tincture of iron (tincture of **iron**, or tincture of chloride of iron) (see *Tinctura Ferri Chloridi*).

Related Solution.—Liquor Ferri Protochloridi (N. F.), *Solution of protochloride of iron, Solution of ferrous chloride.* "Iron, in the form of fine, bright, and finely cut wire, one hundred and sixty grammes (160 Gm.) [5 ozs. av., 282 grs.]; hydrochloric acid (*U. S. P.*), six hundred and twenty-five grammes (625 Gm.) [1 lb. av., 6 ozs., 20 grs.]; glycerin, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; diluted hypophosphorous acid (*U. S. P.*), ten cubic centimeters (10 Cc.) [162 ♏]; distilled water a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. To the iron, contained in a flask, add three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of distilled water, and the hydrochloric acid, and apply a gentle heat until effervescence ceases. Then raise the liquid to boiling, keep it at this temperature for a short time so that the iron may be brought into solution as far as possible, filter the solution through a pellet of absorbent cotton placed in the neck of a funnel, and wash the cotton with a little distilled water. Evaporate the filtrate, over a boiling water-bath, until crystals begin to form, and the escaping vapors cease to redden, or only slightly affect, moistened blue litmus paper. Now add the glycerin and the diluted hypophosphorous acid, continue the heat, if necessary, until a perfect solution is obtained; then transfer the liquid to a graduated bottle, allow it to cool, and add enough distilled water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents about 20 grains of protochloride of iron (ferrous chloride)"—(*Nat. Form.*).

Other Solutions of Iron Salts.—Liquor Ferri Oxysulphatis (N. F.), *Solution of oxysulphate of iron.* "Sulphate of iron, one hundred and sixty-five grammes (165 Gm.) [5 ozs. av., 359 grs.]; nitric acid (*U. S. P.*), one hundred and sixty-five grammes (165 Gm.) [5 ozs. av., 359 grs.]; distilled water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the sulphate of iron in eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of boiling distilled water, in a flask, gradually add the nitric acid, and continue the heat until the escaping vapors cease to have a nitrous odor. When the reaction is completed, allow the liquid to cool, and add enough distilled water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*Nat. Form.*).

Howe's Acid Solution of Iron.—This solution is prepared by triturating ferrous sulphate (2 parts) in a mortar, and adding 10 parts of water and 1 part of nitric acid. No heat is to be employed. When the liquid assumes a clear, amber color it is to be bottled. This preparation contains excess of nitric acid, and, probably, also part of the unexpelled nitrous acid. Its medicinal value probably consists in the associated actions of these substances as well as the iron salt. Howe's acid solution of iron is a favorite preparation with Eclectic physicians to fulfil the indications for iron and an acid. It is less apt than any other fluid preparation of iron to provoke febrile phenomena. It is an excellent agent in *chronic catarrhal affections*, *anæmia*, *chlorosis*, and *general debility*. We have found it best adapted to cases exhibiting a pallid, waxy skin and cherry-red mucous membranes. The dose should be about 2 drops, 3 or 4 times a day. A very pleasant preparation is the following: ℞ Acid solution of iron, fl℥i; syrup of orange, fl℥iv. Mix. Sig. Dose, 1 teaspoonful, given preferably before meals and at bedtime. This is the best preparation of iron for use in *phthisis* and other wasting diseases.

Loeffler's Solution.—Various solutions, to be used for the disinfection of the throats of *diphtheria* patients, have been devised by Prof. Loeffler, of Greifswald. Chief among these is that prepared after the following formula: ℞ Menthol, ten grammes (10 Gm.) [154 grs.]; toluene, a sufficient quantity to make thirty-six cubic centimeters (36 Cc.) [1 fl℥, 104 ♏]; then add creolin, two cubic centimeters (2 Cc.) [33 ♏]; solution of chloride of iron, four cubic centimeters (4 Cc.) [65 ♏]; alcohol, sufficient to make one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Of all the solutions recommended by Loeffler the preceding is preferred for children and sensitive individuals, being applied as follows: After first cleansing the throat of mucus by means of a piece of dry cotton, carried by means of forceps or wire applicator, neatly wrap a piece of cotton upon the wire applicator and saturate it with the solution. Pass the application to the throat and gently, but firmly, press against the diphtheritic exudate for 10 seconds, immediately repeating the application. Continue the application every 3 or 4 hours for several days, or until the local manifestations have disappeared. This should be followed in the course of 20 minutes with an irrigation of the nose and throat with antiseptic cleansing solutions, such as of hydrogen peroxide, listerine, lime-water, Dobell's solution, etc. Other solutions recommended by Loeffler are as follows: (1) Carbolic acid, 1 part; alcohol, 25 parts; turpentine, 25 parts. (2) Alcohol, 16 parts; toluene, 9 parts. (3) Alcohol, 16 parts; benzene, 9 parts.

Liquor Ferri Iodidi (N. F.), *Solution of iodide of iron.*—"Iron, in the form of fine, bright, and finely cut wire, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; iodine, six hundred and sixty-four grammes (664 Gm.) [1 lb. av., 7 ozs., 185 grs.]; diluted hypophosphorous acid (*U. S. P.*), twenty-five cubic centimeters (25 Cc.) [406 ♏]; distilled water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the iron with seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of distilled water in a flask, add about one-half of the iodine, and agitate continuously until the liquid becomes hot. Then moderate the reaction by placing the flask in cold water, or by allowing cold water to flow over it, meanwhile keeping up the agitation. When the reaction has moderated, add one-half of the remaining iodine at a time, and carefully moderate the reaction each time, in the manner above directed. Finally, raise the contents of the flask to boiling, and filter immediately through moistened pure filtering paper (the point of the filter being supported by a pellet of absorbent cotton) into a bottle containing the diluted hypophosphorous acid. When all the liquid has passed, rinse the flask with thirty-five cubic centimeters (35 Cc.) [1 fl℥, 88 ♏] of boiling distilled water, and pass this through the filter. Cork the bottle and set it aside to cool. Finally, add enough distilled water to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. *Note.*—This solution contains about 85 per cent of iodide of iron (ferrous). On mixing 1 volume with 7 volumes of syrup (*U. S. P.*), the product will be practically identical with syrup of iodide of iron (*U. S. P.*)"—(*Nat. Form.*).

Liquor Ferri Hypophosphitis (N. F.), *Solution of hypophosphite of iron*, *Solution of ferric hypophosphite.*—"Iron and ammonium sulphate (*U. S. P.*), in perfect crystals, three hundred and thirty grammes (330 Gm.) [11 ozs. av., 280 grs.]; sodium hypophosphite, two hundred and twenty grammes (220 Gm.) [7 ozs. av., 333 grs.]; potassium citrate, two hundred and fifteen grammes (215 Gm.) [7 ozs. av., 255 grs.]; glycerin, one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the iron and ammonium sulphate, and the sodium hypophosphite, each, in fifteen hundred cubic centimeters (1500 Cc.) [50 fl℥, 364 ♏] of water, and, if necessary, filter each solution. Then mix them, and stir thoroughly; after a few minutes transfer the resulting magma to a close linen or muslin strainer, and wash the precipitate with about five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of water. Allow it to drain, and then press it forcibly in the strainer, so as to remove as much of the liquid as possible. Transfer the precipitate from the strainer to a mortar, add to it the potassium citrate, and triturate until a perfectly smooth paste results. Then add the glycerin, and gradually, while stirring, enough water to make the solution measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Place it for several days in a cold place, if convenient; then pour off the clear solution from any precipitate or crystals that may have formed, and keep the solution in small, completely filled and well-corked bottles"—(*Nat. Form.*).

Solution of hypophosphite of iron (ferric) may also be prepared in the following manner: "Hypophosphite of iron (F. 183), one hundred and sixty-five grammes (165 Gm.) [5 ozs. av., 359 grs.]; potassium citrate, two hundred and fifteen grammes (215 Gm.) [7 ozs. av., 255 grs.]; glycerin, one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the hypophosphite of iron with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of water to a perfectly smooth mixture, then add the potassium citrate and glycerin, and apply a gentle heat, until solution has been effected. Allow the liquid to cool, and add enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Place the solution for several days in a cold place, if convenient; then pour off the clear solution from any precipitate or crystals that may have formed, and keep the solution in small, completely-filled and well-corked bottles. About 6 minims of this solution represent 1 grain of hypophosphite of iron (ferric)"—(*Nat. Form.*).

LIQUOR FERRI CITRATIS (U. S. P.)—SOLUTION OF FERRIC CITRATE.

"An aqueous solution of ferric citrate, corresponding to about 7.5 per cent of metallic iron"—(*U. S. P.*).

Synonyms: *Liquor ferri citrici, Citras ferricus liquidus.*

Preparation.—"Solution of ferric sulphate, one thousand and fifty grammes (1050 Gm.) [2 lbs. av., 5 ozs., 17 grs.]; citric acid, three hundred grammes (300 Gm.) [10 ozs. av., 255 grs.]; ammonia water, eight hundred and eighty cubic centimeters (880 Cc.) [29 fl℥, 363 ♏]; water, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Mix the ammonia water with three thousand cubic centimeters (3000 Cc.) [101 fl℥, 212 ♏] of cold water and the solution of ferric sulphate with ten thousand cubic centimeters (10,000 Cc.) [338 fl℥, 66 ♏] of cold water. Add the latter solution slowly to the diluted ammonia water with constant stirring. Pour the mixture on a wet muslin strainer, and allow the liquid to run off and the precipitate to drain. Then remove the moist mass from the strainer, mix it well with six thousand cubic centimeters (6000 Cc.) [676 fl℥, 132 ♏] of cold water, again pour it on the strainer, and let it drain. Repeat this washing with several successive portions of cold water in the same manner, until the washings cease to produce more than a slight cloudiness with barium chloride test-solution. Then allow the precipitate to drain completely, transfer it to a porcelain capsule, add the citric acid, and heat the mixture on a water-bath, to 60° C. (140° F.), stirring constantly until the precipitate is dissolved. Lastly, filter the liquid, and evaporate it, at the above-mentioned temperature, until it weighs one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]"—(*U. S. P.*).

In this process ferric hydroxide is first produced, and as this holds a large amount of water, the preparation becomes liquid as the citric acid is added, and citrate of iron is produced. The heat should be maintained at about 60° C. (140° F.), never more than a few degrees higher, until the ferric hydroxide is dissolved.

Description and Tests.—According to the *U. S. P.*, this solution is "a dark-brown liquid, odorless, and possessing a slightly ferruginous taste. Specific gravity, about 1.250 at 15° (59° F.). Upon evaporating 100 Gm. of the solution in a thin layer, on plates of glass, about 42.5 to 43 Gm. of garnet-red scales will be obtained. The solution has an acid reaction upon litmus paper, and is not precipitated, but rendered darker in color, by ammonia water. With potassium ferrocyanide T.S., it affords a bluish-green color or precipitate, which is increased and rendered dark blue by the subsequent addition of hydrochloric acid. On heating the solution with potassium or sodium hydrate T.S., it will yield a brown precipitate, without evolving vapor of ammonia. If a portion of the solution, diluted with 4 volumes of water, be deprived of its iron by boiling it with an excess of potassium or sodium hydrate T.S., and the filtrate slightly acidulated with acetic acid, a portion of this liquid, when allowed to stand for some time, should not give a white, crystalline precipitate (absence of tartrate). If to another portion of the acidulated and cooled filtrate a little calcium chloride T.S. be added, and the liquid heated to boiling, it should gradually deposit a white, crystalline precipitate. If 1.12 (1.1176) Gm. of the solution be introduced into a glass-stoppered bottle (having a capacity of about 100 Cc.), together with 15 Cc. of water and 2 Cc. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for half an hour at a temperature of 40° C. (104° F.), then cooled, and mixed with a few drops of starch T.S., it should require about 15 Cc. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each cubic centimeter of the volumetric solution indicating 0.5 per cent of metallic iron)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—(See *Ferri Citras*, or *Ferri et Ammonii Citras.*) Dose, 1 to 10 minims.

LIQUOR FERRI ET AMMONII ACETATIS (U. S. P.)—SOLUTION OF IRON AND AMMONIUM ACETATE.

SYNONYMS: *Mistura ferri et ammonii acetatis* (*Pharm.*, 1880), *Basham's mixture.*

Preparation.—"Tincture of ferric chloride, twenty cubic centimeters (20 Cc.) [325 ♏]; diluted acetic acid, thirty cubic centimeters (30 Cc.) [1 fl℥, 7 ♏]; solution of ammonium acetate, two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏]; aromatic elixir, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; glycerin, one hundred and twenty cubic centimeters (120 Cc.) [4 fl℥, 28 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. To the solution of ammonium acetate (which should not be alkaline) add, successively, the diluted acetic acid, the tincture of ferric chloride, the aromatic elixir, and the glycerin, and, lastly, enough water to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. This preparation should be freshly made when wanted"—(*U. S. P.*).

The reaction here, by double decomposition, produces ferric acetate and ammonium chloride. A large proportion, however, of the ammonium acetate remains uncombined. While this solution may keep for quite a length of time, it should, to insure a good and fresh preparation, be made only as needed for use. It is a bright-red, transparent fluid.

Action, Medical Uses, and Dosage.—This agent is diuretic and acts kindly upon the stomach. In doses of ¼ to 1 fluid ounce, it has been administered in *albuminuria*. Said to be most valuable when *tubular nephritis* is present.

LIQUOR FERRI NITRATIS (U. S. P.)—SOLUTION OF FERRIC NITRATE.

"An aqueous solution of ferric nitrate ($Fe_2[NO_3]_6=483.1$), containing about 6.2 per cent of the anhydrous salt, and corresponding to about 1.4 per cent of metallic iron"—(*U. S. P.*).

SYNONYMS: *Liquor ferri pernitratis, Solution of pernitrate of iron.*

Preparation.—"Solution of ferric sulphate, one hundred and eighty grammes (180 Gm.) [6 oz. av., 153 grs.]; ammonia water, one hundred and sixty cubic centimeters (160 Cc.) [5 fl℥, 197 ♏]; nitric acid, seventy-one grammes (71 Gm.) [2 ozs. av., 221 grs.]; distilled water, water, each, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Mix the ammonia water with five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of cold water, and the solution of ferric sulphate with fifteen hundred cubic centimeters (1500 Cc.) [50 fl℥, 346 ♏] of cold water. Add the latter solution slowly to the diluted ammonia water, with constant stirring. Let the mixture stand until the precipitate has subsided as far as practicable, and then decant the supernatant liquid. Add to the precipitate one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of cold water, mix well, and again set the mixture aside, as before. Repeat the washing with successive portions of cold water, in the same manner, until the washings produce but a slight cloudiness with barium chloride test-solution. Pour the washed ferric hydrate on a wet muslin strainer, and let it drain thoroughly. Then transfer it to a porcelain capsule, add the nitric acid, and stir with a glass rod until a clear solution is obtained. Finally, add enough distilled water to make the finished product weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Filter, if necessary"—(*U. S. P.*).

History.—Mr. William Kerr introduced this preparation to the profession in 1832 (*Ed. Med. and Surg. Jour.*, XXXVII, p. 99). When correctly made it is of a deep-red color (amber-colored if an excess of acid be present), clear, and powerfully astringent. On standing, sesquioxide of iron forms, which at first destroys the transparency of the liquid, but is finally deposited, and which may be prevented by the addition of a drachm of hydrochloric acid. On account of the great liability to change in this preparation, various suggestions have been made for the purpose of procuring a permanent solution; among them a process offered by

W. Procter, Jr., of Philadelphia, which forms the basis for the *U. S. P.* process (*Amer. Jour. Pharm.*, Vol. XXIX, p. 306).

Description.—"A clear, amber-colored, or reddish liquid, odorless, having an acid, styptic taste, and an acid reaction. Specific gravity about 1.050 at 15° C. (59° F.). The solution gives a brownish-red precipitate with ammonia water, and a blue one with potassium ferrocyanide T.S. If a clear crystal of ferrous sulphate be added to a cooled mixture of equal parts of the solution and of concentrated sulphuric acid, the crystal will become brown and be surrounded by a brownish-black zone. If 1.12 (1.1176) Gm. of the solution be introduced into a glass-stoppered bottle (having a capacity of about 100 Cc.), together with 15 Cc. of water and 2 Cc. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for ½ an hour at a temperature of 40° C. (104° F.), then cooled, and mixed with a few drops of starch T.S., it should require about 2.8 Cc. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each cubic centimeter of the volumetric solution indicating 0.5 per cent of metallic iron)"—(*U. S. P*).

Action, Medical Uses, and Dosage.—Solution of nitrate of iron is astringent, and possesses the property of diminishing tenderness and irritability of the mucous membranes with which it comes in contact. It has been found useful in *chronic diarrhœa*, where intestinal ulceration is absent, and in the *diarrhœa* of weak and nervous persons. It is contraindicated if inflammatory symptoms are present. It has also been used in *hæmatemesis*, *hemorrhage from the bowels*, *uterine hemorrhage*, and *menorrhagia*, especially in pale, feeble, and languid constitutions. It has also been found advantageous as an injection, and by mouth, in *leucorrhœa*. In the *colliquative diarrhœa of tuberculous phthisis*, it has afforded much benefit, as well as in *chronic diarrhœa* and *cholera infantum* of anemic or scrofulous patients. The dose is from 5 drops, gradually increased to 15 or 20 drops, or more, sufficiently diluted with water, and repeated 3 or 4 times a day; the ordinary dose to commence with is 10 or 12 drops. Injected into the vagina, it will cause considerable irritation, unless previously weakened with water.

LIQUOR FERRI SUBSULPHATIS (U. S. P.)—SOLUTION OF FERRIC SUBSULPHATE.

An aqueous solution of basic ferric sulphate (of variable chemical composition), corresponding to about 13.6 per cent of metallic iron.

Synonyms: *Solution of basic ferric sulphate*, *Monsel's solution*, *Solution of persulphate of iron* (erroneously).

Preparation.—"Ferrous sulphate, in clear crystals, six hundred and seventy-five grammes (675 Gm.) [1 lb. av., 7 ozs., 354 grs.]; sulphuric acid, sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.]; nitric acid, distilled water, each, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Add the sulphuric acid to five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of distilled water in a capacious porcelain capsule, heat the mixture to nearly 100° C. (212° F.), then add sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.] of nitric acid, and mix well. Divide the ferrous sulphate, coarsely powdered, into 4 equal portions, and add these portions, one at a time, to the hot liquid, stirring after each addition until effervescence ceases. When all of the ferrous sulphate is dissolved, add a few drops of nitric acid, and, if this causes a further evolution of red fumes, continue to add nitric acid, a few drops at a time, until it no longer causes red fumes to be evolved; then boil the solution until it assumes a ruby-red color, and is free from nitrous odor. Lastly, add enough distilled water to make the product weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Keep the product in well-stoppered bottles, in a moderately warm place (not under 22° C. or 71.6° F.), protected from light. This solution will sometimes crystallize, forming a semi-solid, whitish mass. When this occurs the application of a gentle heat to the bottle will restore the liquid condition. *Note.*—Solution of ferric subsulphate is to be dispensed when solution of persulphate of iron has been prescribed by the physician"—(*U. S. P.*).

History.—This process is practically that of Dr. E. R. Squibb (186[illegible]). The ferrous sulphate is changed into ferric sulphate, but as there is not a sufficient quantity of the sulphuric acid present to produce the normal ferric sulphate, an oxysulphate, basic or subsulphate is formed, of the approximate composition $Fe_4(SO_4)_5(OH)_2$.

Description and Tests.—"A dark reddish-brown liquid, odorless or nearly so, of an acid, strongly styptic taste, and an acid reaction. Specific gravity, about 1.550 at 15° C. (59° F.). Miscible with water and alcohol, in all proportions, without decomposition. The diluted solution yields a brownish-red precipitate with ammonia water, a blue one with potassium ferrocyanide T.S., and a white one, insoluble in hydrochloric acid, with barium chloride T.S. On slowly mixing 2 volumes of the solution with 1 volume of concentrated sulphuric acid, in a beaker, a semisolid, white mass will separate on standing (difference from tersulphate). On adding a clear crystal of ferrous sulphate to a cooled mixture of equal volumes of concentrated sulphuric acid and a diluted portion of the solution, the crystal should not become brown, nor should there be a brownish-black color developed around it (absence of nitric acid). If to a small portion of the solution, diluted with about 10 volumes of water, a few drops of freshly prepared potassium ferricyanide T.S. be added, a pure brown color should be produced, without a tinge of green or greenish-blue (absence of ferrous salt). If 1.12 (1.1176) Gm. of the solution be introduced into a glass-stoppered bottle (having a capacity of about 100 Cc.), together with 15 Cc. of water and 2 Cc. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for ½ hour at a temperature of 40° C. (104° F.), then cooled, and mixed with a few drops of starch T.S., it should require about 27.2 Cc. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each cubic centimeter of the volumetric solution indicating 0.5 per cent of metallic iron)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This agent is an almost unirritating styptic. Its action on blood and albumen is powerful; with the former it produces a voluminous clot, absolutely insoluble, which continues to enlarge for several hours after its application, and becomes quite hard and firm. If applied to a *superficial wound* as soon as made, not a drop of blood escapes, and no pain results from the application. It acts by producing instantaneous coagulation of the blood, and will be found invaluable in *hemorrhages from the mouth, nose,* and *throat*, when it is impossible to ligate the vessels, and may be equally efficient in alarming *uterine hemorrhage*. The solution is readily applied by a glass or wooden brush, or by saturating cotton or sponge, or may be used diluted with water as an injection. The dry salt (*Monsel's salt*), is very deliquescent, and speedily dissolves in water. A solution of from 1 to 10 drops of Monsel's solution in a fluid ounce of water, has been successfully used by atomization in *hemoptysis*. From 1 to 5 minims in water, is useful in *hematemesis*. Instances have occurred in which the coagulating power of this solution upon blood has produced mischief, followed by gangrene of the parts to which it was applied.

LIQUOR FERRI TERSULPHATIS (U. S. P.)—SOLUTION OF FERRIC SULPHATE.

"An aqueous solution of normal ferric sulphate ($Fe_2[SO_4]_3$=399.22), containing about 28.7 per cent of the salt, and corresponding to about 8 per cent of metallic iron"—(*U. S. P.*).

SYNONYMS: *Liquor ferri persulphatis, Solution of persulphate of iron, Solution of normal ferric sulphate.*

Preparation.—"Ferrous sulphate, in clear crystals, four hundred grammes (400 Gm.) [14 ozs. av., 48 grs.]; sulphuric acid, seventy-eight grammes (78 Gm.) [2 ozs. av., 329 grs.]; nitric acid, distilled water, each, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Add the sulphuric acid to two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of distilled water in a capacious porcelain capsule, heat the mixture to nearly 100° C. (212° F.), then add fifty-five grammes (55 Gm.) [1 oz. av., 411 grs.] of nitric acid, and mix well. Divide the ferrous sulphate, coarsely powdered, into 4 equal portions, and add these portions, one at a time, to the hot liquid, stirring after each addition until effervescence ceases. When all of the ferrous sulphate is dissolved, add a few drops of nitric acid, and, if this causes a further evolution of red fumes, continue to add nitric acid, a few drops at a time, until it no longer causes red fumes to be evolved; then boil the solution until it assumes a reddish-brown color and is free from nitrous odor. Lastly, add enough distilled water to make the product weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Filter, if necessary"—(*U. S. P.*).

By clear crystals, as directed, is meant the uneffloresced salt. The reaction here taking place is precisely the same as when *Liquor Ferri Subsulphatis* is formed, excepting that sufficient sulphuric acid is employed to produce the non-basic or normal ferric sulphate ($Fe_2[SO_4]_3$). The equation $6FeSO_4+3H_2SO_4+2NO_3H=4H_2O+3Fe_2(SO_4)_3+N_2O_2$ illustrates the reaction.

Description and Tests.—"A dark reddish-brown liquid, almost odorless, having an acid, strongly styptic taste, and an acid reaction. Specific gravity, about 1.320 at 15° C. (59° F.). Miscible with water and alcohol, in all proportions, without decomposition. The diluted solution yields a brownish-red precipitate with ammonia water, a blue one with potassium ferrocyanide T.S., and a white one, insoluble in hydrochloric acid, with barium chloride T.S. On slowly mixing 2 volumes of the solution with 1 volume of concentrated sulphuric acid, in a beaker, no solid, white mass will separate on standing (difference from subsulphate). On adding a clear crystal of ferrous sulphate to a cooled mixture of equal volumes of concentrated sulphuric acid and a moderately diluted portion of the solution, the crystal should not become brown, nor should there be a brownish-black color developed around it (absence of nitric acid). If to a small portion of the solution, diluted with about 10 volumes of water, a few drops of freshly prepared potassium ferricyanide T.S. be added, a pure brown color should be produced, without a tinge of green or greenish-blue (absence of ferrous salt). If 1.12 (1.1176) Gm. of the solution be introduced into a glass-stoppered bottle (having a capacity of about 100 Cc.), together with 15 Cc. of water and 2 Cc. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for ½ hour at a temperature of 40° C. (104° F.), then cooled, and mixed with a few drops of starch T.S., it should require about 16 Cc. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each cubic centimeter of the volumetric solution indicating 0.5 per cent of metallic iron)"—(*U. S. P.*).

Action and Medical Uses.—May be used like Monsel's solution, but is less desirable because not so astringent, and is more strongly irritant. It should be kept on hand for the preparation of freshly precipitated hydroxide of iron, the antidote for arsenic.

LIQUOR GUTTA-PERCHÆ (N. F.)—SOLUTION OF GUTTA-PERCHA.

Preparation.—"Gutta-percha, in thin slices, fifteen grammes (15 Gm.) [231 grs.]; commercial chloroform, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; lead carbonate, in fine powder, seventeen grammes (17 Gm.) [262 grs.]. Add the gutta-percha to seventy-five cubic centimeters (75 Cc.) [2 fl℥, 257 ♏] of the chloroform contained in a bottle, cork it well, and shake it occasionally until the gutta-percha is dissolved. Then add the lead carbonate, previously mixed with the remainder of the chloroform, and, having several times shaken the whole together, at intervals of ½ hour, set the mixture aside until the insoluble matters have subsided and the solution has become perfectly clear. Lastly, decant the liquid and preserve it in small, cork-stoppered vials"—(*Nat. Form.*).

As chloroform does not make a clear solution of gutta-percha, Maschke proposed agitation of the solution with water (1 to 1½ per cent), to hasten the collection of the impurities at the top of the solution. Others have proposed heavy, insoluble substances to carry with them in precipitation the insoluble matter. Chief among these was lead carbonate, proposed by Wm. Hodgson, Jr., in 1861, which, by causing the impurities to subside with it, renders the solution clear and colorless, or nearly so. The liquid may then be decanted. On account of its character it can not be filtered. Should it by evaporation become too dense, a little chloroform may be added. Under the name TRAUMATICINE, Auspitz, of Vienna, introduced a solution of gutta-percha (1 part) in chloroform (10 parts).

Action and Medical Uses.—An adhesive protective. (For uses, see *Gutta-percha.*)

LIQUOR HYDRARGYRI NITRATIS (U. S. P.)—SOLUTION OF MERCURIC NITRATE.

"A liquid containing about 60 per cent of mercuric nitrate ($Hg[NO_3]_2$ 323.58), together with about 11 per cent of free nitric acid"—(*U. S. P.*).

SYNONYMS: *Liquor hydrargyri nitratis acidus, Liquor hydrargyri nitrici oxydati, Acid solution of nitrate of mercury, Solution of nitrate of mercury, Solution of pernitrate of mercury, Hydrargyrum oxydatum nitricum solutum.*

Preparation.—"Red mercuric oxide, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; nitric acid, forty-five grammes (45 Gm.) [1 oz. av., 257 grs.]; distilled water, fifteen grammes (15 Gm.) [231 grs.]; to make one hundred grammes (100 Gm.) [3 oz. av., 231 grs.]. Mix the nitric acid with the distilled water, and dissolve red mercuric oxide in the mixture. Keep the product in glass-stoppered bottles"—(*U. S. P.*).

Description and Tests.—In the foregoing process the mercuric oxide combines with the nitric acid as follows: $HgO+2HNO_3 = Hg(NO_3)_2+H_2O$. It is "a clear, nearly colorless, heavy liquid, having a faint odor of nitric acid, and a strongly acid reaction. Specific gravity, about 2.100 at 15° C. (59° F.). On evaporating a few drops of the solution in a porcelain capsule, a white residue is left, which, on being heated, becomes successively yellow, red, and brown, and is finally completely volatilized. On a bright surface of copper, the solution deposits a coating of metallic mercury. The solution, diluted with water, yields with potassium or sodium hydrate T.S. a yellow precipitate; and with potassium iodide T.S. a bright red one, soluble in an excess of the reagent. A clear crystal of the ferrous sulphate dropped into the solution rapidly acquires a brown color, and becomes surrounded by a brownish-black zone. No precipitation or cloudiness should occur in the solution on the addition of water, or of diluted hydrochloric acid (absence of mercurous salt)"—(*U. S. P.*). When strong nitric acid is added to this solution a deliquescent, crystalline mass of mercuric nitrate may be obtained, and this salt may be obtained in large crystals, having the composition $2Hg(NO_3)_2.H_2O$, by slowly evaporating the solution over sulphuric acid. If alcohol be mixed with this solution and heated, the dangerous explosive, *fulminating mercury*, is produced, and great care must be used to avoid such a compound.

Action and Medical Uses.—This forms a thick, heavy, very caustic solution, which has been employed with some success in *lupus, ulcerated cervix uteri, obstinate lepra, psoriasis, porrigo, herpes exedens,* etc., *syphilitic and scrofulous ulcers.* It is applied by means of a camel's-hair pencil to a surface not exceeding an inch in diameter at any one time, and over this a pledget of lint is applied, which has been previously dampened with some of the solution. It whitens the part at once, a kind of erysipelatous inflammation is induced in the neighboring parts, and a scab of yellow color forms and falls off in 3, 4, or 5 days. In *ulcerated cervix uteri*, one application is said to have materially improved the character of the sore. As salivation has been caused by a single application, Mialhe proposed to prevent absorption of the mercury by washing the cauterized part immediately after the caustic has been applied (P.). It is seldom, if ever, employed by the Eclectic physicians.

Related Preparations.—MILLON'S TEST SOLUTION. Dissolve by means of a gentle heat an equal weight of mercury in concentrated nitric acid, add twice its bulk of water, and decant from the precipitate which forms. This reagent, which must contain some uncombined nitric and nitrous acid, is employed as a test for proteids, the latter imparting to it a red coloration upon warming.

LIQUOR HYDRARGYRI NITRICI OXYDULATI (*Liquor Bellostii*, or *Hydrargyrum oxydulatum solutum*).—Take mercurous nitrate, 100 parts; nitric acid, 15 parts; enough water to make 1000 parts. Dissolve without heat. If exposed to the air this solution changes to mercuric nitrate through oxidation.

LIQUOR HYDRARGYRI PERCHLORIDI.—SOLUTION OF PERCHLORIDE OF MERCURY.

SYNONYMS: *Liquor hydrargyri bichloridi, Solution of mercuric chloride, Solution of corrosive sublimate.*

Preparation.—"Take of perchloride of mercury, chloride of ammonium, of each, 10 grains; distilled water, 1 pint. Dissolve"—(*Br. Pharm.*, 1885). The *British Pharmacopœia* (1898) omits chloride of ammonium.

Description.—A colorless liquid having a saline, metallic taste, and containing $\frac{1}{2}$ grain of mercuric chloride in the Imperial fluid ounce. It is decomposed by the alkalies and alkaline carbonates, medicinal extracts, and the juices of vegetables. It is a solution of the alchemist's *Sal Alembroth.* By substituting for the water bitter almond emulsion, *Gowland's Cosmetic Lotion* is formed. *Van Swieten's Liquor* (*Liqueur de Van Swieten*, of the *French Codex*), contains mercuric chloride. 1 part; alcohol, 100 parts; water, 900 parts.

Action, Medical Uses, and Dosage.—(See *Hydrargyrum Chloridum Corrosivum.*) Dose, $\frac{1}{4}$ to 1 fluid drachm (equal to $\frac{1}{48}$ to $\frac{1}{16}$ grain of corrosive sublimate).

LIQUOR HYPOPHOSPHITUM (N. F.)—SOLUTION OF HYPOPHOSPHITES.

Preparation.—"Calcium hypophosphite, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.] sodium hypophosphite, twenty grammes (20 Gm.) [309 grs.]; potassium hypophosphite, seventeen and one-half grammes (17.5 Gm.) [270 grs.]; citric acid, sixteen grammes (16 Gm.) [247 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the salts and citric acid in water so as to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]; filter, if necessary, and pass enough water through the filter to restore the original volume. Each fluid drachm contains 2 grains of calcium hypophosphite, $1\frac{1}{4}$ grains of sodium hypophosphite, and 1 grain of potassium hypophosphite"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—(See the respective hypophosphites. Dose, 1 drachm.

LIQUOR IODI COMPOSITUS (U. S. P.)—COMPOUND SOLUTION OF IODINE.

SYNONYMS: *Solution of iodine, Lugol's solution.*

Preparation.—"Iodine, five grammes (5 Gm.) [77 grs.]; potassium iodide, ten grammes (10 Gm.) [154 grs.]; distilled water, a sufficient quantity to make one hundred grammes (100 Gm.) [3 oz. av., 231 grs.]. Dissolve the iodine and potassium iodide in a sufficient quantity of distilled water to make the product weigh one hundred grammes (100 Gm.) [3 oz. av., 231 grs.]. Keep the solution in glass-stoppered bottles"—(*U. S. P.*).

Metallic iodine is very slightly dissolved by water, but is extremely soluble in a solution of iodide of potassium. In preparing this solution, 2 parts of the iodide are generally added with 1 of iodine, forming a concentrated solution of iodine, which is the active medicinal agent in the solution. The solution loses its strength by exposure to the air, in consequence of the evaporation of the iodine; light also appears to exert a deleterious influence upon it. It should, therefore, be kept in well-stoppered bottles, and in a dark place.

Description.—Lugol's solution is a deep brownish-red fluid having the characteristic, caustic, iodine taste. Starch paste is colored blue by it. A portion of the iodine is driven off on boiling it. It may be decolorized by shaking it with ether, chloroform, or carbon disulphide. "If 12.66 Gm. of the solution be mixe with a few drops of starch T.S., it should require, for complete decoloration, from 49.3 to 50 Cc. of decinormal sodium hyposulphite V.S. (each cubic centimeter of the volumetric solution corresponding to 0.1 per cent of iodine)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Compound solution of iodine possesses all the virtues of iodine, and may be used advantageously in *scrofulous*, *syphilitic*, and all *tuberculous diseases*, or wherever iodine is indicated. The dose is 5 drops in a tablespoonful of water, sweetened if desired, and gradually increased to 20 or 30 drops; the dose to be repeated 3 times a day. Twelve drops are equal to about ½ grain of iodine.

Related Preparations.—LUGOL'S CAUSTIC, *Causticum iodi*. One part each of iodine and potassium iodide, dissolved in 2 parts of water.

HEBRA'S IODINE CAUSTIC.—One part each of iodine and iodide of potassium, dissolved in 2 parts of glycerin.

LIQUOR IODI CAUSTICUS (N. F.), *Caustic solution of iodine, Iodine caustic, Churchill's iodine caustic*.—"Iodine, twenty-five grammes (25 Gm. [386 grs.]; potassium iodide, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; water, one hundred cubic centimeters (100 Cc. [3 fl℥, 183 ♏]. Dissolve the potassium iodide and the iodine in the water"—(*Nat. Form.*).

LIQUOR IODI CARBOLATUS (N. F.), *Carbolized solution of iodine, Boulton's solution, French mixture*.—"Compound tincture of iodine (*U. S. P.*), fifteen cubic centimeters (15 Cc. [243 ♏]; carbolic acid, liquefied by a gentle heat, five and one-half cubic centimeters (5.5 Cc.) [89 ♏]; glycerin, one hundred and sixty-five cubic centimeters (165 Cc. [5 fl℥, 278 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the glycerin with the carbolic acid and compound tincture of iodine, add enough water to make one thousand cubic centimeters (1000 Cc. [33 fl℥, 391 ♏], and expose the mixture to sunlight until it has become colorless"—(*Nat. Form.*).

LIQUOR MAGNESII CITRATIS (U. S. P.)—SOLUTION OF MAGNESIUM CITRATE.

SYNONYMS: *Solution of citrate of magnesium, Liquor magnesii citrici.*

Preparation.—"Magnesium carbonate, fifteen grammes (15 Gm.) [231 grs.]; citric acid, thirty grammes (30 Gm.) [463 grs.]; syrup of citric acid, one hundred and twenty cubic centimeters (120 Cc.) [4 fl℥, 28 ♏]; potassium bicarbonate, two and one-half grammes (2.5 Gm.) [39 grs.]; water, a sufficient quantity. Dissolve the citric acid in one hundred and twenty cubic centimeters (120 Cc.) [4 fl℥, 28 ♏] of water, and, having added the magnesium carbonate, stir, until it is dissolved. Filter the solution into a strong bottle of the capacity of about three hundred and sixty cubic centimeters (360 Cc.) [12 fl℥, 83 ♏], containing the syrup of citric acid. Then add enough water to nearly fill the bottle, drop in the potassium bicarbonate, immediately close the bottle with a cork, and secure it with twine. Lastly, shake the mixture occasionally, until the potassium bicarbonate is dissolved"—(*U. S. P.*).

This solution is more effervescent than that formerly official. It is colorless, pleasantly acidulous, not bitter, and should deposit no sediment at first, although it does so in time, under which conditions its medicinal properties are impaired. It should preferably be prepared for immediate use. Liquid citrate of magnesia is preferred to magnesium citrate in powder, because the latter is only slowly soluble in water, and does not readily make a clear solution. This preparation, about 1863-65, was very popular. It was made on a large scale by dissolving freshly precipitated magnesium carbonate in water under pressure of carbon dioxide. This solution was then poured into a citrate of magnesia bottle, and at the bottom, through a funnel tube, enough syrup of citric acid was carefully added to produce magnesium citrate. The bottles were then corked, tied over with strong twine, and finally agitated. This carbonated liquid was a great favorite with physicians The writer's early experience in pharmacy consisted largely in making and filling "Effervescing Solutions of Citrate of Magnesia." The following is the formula employed:

Solution No. 1.—Take of carbonate of sodium, 8½ ounces; dissolve this in tepid water, 2 pints; likewise dissolve in another vessel sulphate of magnesium, 8 ounces, in tepid water, 2 pints. After the two solutions are perfected and clear, mix them in a convenient vessel, when a precipitate will take place. The precipitate, when completed, must be washed frequently until the excess of sulphate of sodium is removed. The hydrate of magnesium thus formed, is to be mixed with clear water, 4 pints, and the mixture charged with carbonic acid gas until all the hydrate is dissolved, which will require a pressure of 100 or 110 pounds.

Solution No. 2.—Take of citric acid, 8 ounces; calcined magnesia, 10 drachms; simple syrup, 2½ pounds; tepid water, 2 pints. Dissolve the citric acid in the tepid water, then add the magnesia gradually until it is taken up and forms a clear solution, and then add the syrup.

To place in bottles.—Take bottles of 12 fluid ounces each, fill them at first two-thirds with Solution No. 1, and then one-third with Solution No. 2, pouring the second solution through a long-stemmed funnel to the bottom of the bottle, corking immediately. This forms a pleasant, cooling purgative, operating without pain or griping. The dose is the contents of one bottle, one-half of which, or 6 fluid ounces, will prove gently laxative. (See M. E. Robiquet's process for a soluble citrate of magnesium, in *Amer. Jour. Pharm.*, Vol. XXVII, p. 317.)

Action, Medical Uses, and Dosage.—Solution of citrate of magnesium is a pleasant, cooling purgative, acting mildly upon the bowels, operating without pain or griping. It is best administered in broken doses of 4 to 6 fluid ounces. The dose, as a cathartic, is about 12 fluid ounces; as a laxative, 6 fluid ounces.

Other Magnesia Solutions.—LIQUOR MAGNESII BISULPHITIS. Archibald prepared this solution by acting upon magnesium carbonate with sulphurous acid, forming thereby a sulphite, 16 grains of which he added to an ounce of water, and passed through the mixture enough sulphur dioxide to render the solution transparent. This solution he proposed as a remedy for *pyrosis*, as butyric acid fermentation is checked by this sulphite.

SOLUTION OF CHLORINATED MAGNESIA.—This preparation may be prepared after R. E. Fairthorne's process (*Amer. Jour. Pharm.*, 1868). In 2 pints of water dissolve ½ pound (av.), of magnesium sulphate; to this add a solution made by triturating in a mortar a like quantity of water and 33 drachms of chlorinated lime. Agitate the mixture occasionally, and after allowing it to stand ½ day, pour off the overlying fluid. Nearly 9 grains of magnesia are contained in each fluid ounce. It was proposed by its author as an internal medicament, being less irritant than its corresponding sodium and potassium solutions.

LIQUOR MAGNESII SULPHATIS EFFERVESCENS (N. F.), *Liquor magnesiæ effervescens, Effervescent solution of magnesium sulphate.*—"Magnesium sulphate, twenty-five grammes (25 Gm.) [386 grs.]; citric acid, four grammes (4 Gm.) [62 grs.]; syrup of citric acid (*U. S. P.*), sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏]; potassium bicarbonate, crystals, two and one-half grammes (2.5 Gm.) [39 grs.]; water, a sufficient quantity to make three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏]. Dissolve the magnesium sulphate and the citric acid in two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water, add the syrup of citric acid, and filter the solution into a strong bottle of about three hundred and sixty cubic centimeters (360 Cc.) [12 fl℥, 83 ♏) capacity. Then add enough water to nearly fill the bottle, drop in the crystals of potassium bicarbonate, immediately close the bottle with a cork, and secure it with twine. Lastly, shake the bottle occasionally, until the crystals are dissolved"—(*Nat. Form.*).

LIQUOR MAGNESII BROMIDI (N. F.), *Solution of magnesium bromide.*—"Diluted hydrobromic acid (*U. S. P.*), one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]; magnesium carbonate, a sufficient quantity. Saturate the diluted hydrobromic acid with a sufficient quantity, about sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.] of magnesium carbonate. When effervescence has ceased, filter. Each fluid drachm contains about 7 grains of magnesium bromide"—(*Nat. Form.*).

LIQUOR MAGNESII CARBONATIS, *Solution of carbonate of magnesium, Fluid magnesia, Aqua magnesio-efferrescens.*—"Take of sulphate of magnesium, 2 ounces; carbonate of sodium, 2½ ounces; distilled water, a sufficiency. Dissolve the two salts separately, each in ½ pint of water. Heat the solution of sulphate of magnesium to the boiling point, then add to it the solution of carbonate of sodium, and boil them together until carbonic acid gas ceases to be evolved. Collect the precipitated carbonate of magnesium on a calico filter, and wash it with distilled water until what passes ceases to give a precipitate with chloride of barium. Mix the washed precipitate with a pint of distilled water, and putting them into a suitable apparatus, force into it pure washed carbonic acid gas, obtained by the action of sulphuric acid on chalk. Let the mixture remain in contact with excess of carbonic acid, retained there under pressure of about 3 atmospheres for 24 hours or longer, then filter the liquid to remove any undissolved carbonate of magnesium, and again pass carbonic acid gas into the filtered solution. Finally keep the solution in a bottle securely closed, to prevent the escape of carbonic acid. This solution contains nearly 10 grains of the official carbonate of magnesium in a fluid ounce, or about 2 per cent"—(*Br. Pharm.*, 1885). (Weights, avoirdupois; measures, Imperial.) Magnesium carbonate is insoluble in water, but soluble in carbonic acid water, the freshly prepared hydrated carbonate being more readily dissolved than the normal carbonate which has been prepared for some time. Hence, the directions leading to the production of the oxycarbonate of magnesium, $4(MgCO_3).Mg(OH)_2$.

This solution is clear, slightly acidulous, and free from bitterness. Upon opening the container for the first time, it may slightly effervesce, due to the escape of carbon dioxide. The white residue left upon evaporating a fluid ounce of the solution to dryness, should, upon being calcined, weigh about 4 grains, and answer to the tests for magnesia. This is an agreeable form in which to administer magnesia in cases of excessive *acidity of the system* and where *acid deposits* occur in the urine. It is used in England in *constitutional gout.* Dose, 1 to 2 fluid ounces.

LIQUOR MORPHINÆ ACETATIS.—SOLUTION OF ACETATE OF MORPHINE.

Preparation.—"Take of acetate of morphine, 9 grains; diluted acetic acid, 18 minims; rectified spirit, ½ fluid ounce; distilled water, 1½ fluid ounces. Mix the acid, the spirit, and the water, and dissolve the acetate of morphine in the mixture" (*Br. Pharm.*, 1885).

Freshly prepared acetate of morphine should be used. The strength is about 1 in 100. Each fluid drachm contains ½ grain of morphine acetate. The spirit is present as a preservative.

Action, Medical Uses, and Dosage.—(See *Morphina.*) Dose, 10 to 60 minims.

LIQUOR MORPHINÆ BIMECONATIS.—SOLUTION OF BIMECONATE OF MORPHINE.

Preparation.—"Take of hydrochlorate of morphine, 9 grains; solution of ammonia, a sufficiency; meconic acid, 6 grains; rectified spirit, ½ fluid ounce; distilled water, a sufficiency. Dissolve the hydrochlorate of morphine in 2 or 3 drachms of distilled water, aiding the solution by warmth; then add solution of ammonia until morphine ceases to be precipitated; cool; filter; wash the precipitate with distilled water, until the washings cease to give a precipitate with nitrate of silver; drain; mix the precipitate with sufficient water to produce 1½ ounces; add the rectified spirit and the meconic acid; dissolve"—(*Br. Pharm.*, 1885). See also *Morphinæ Bimeconas*, under *Morphina.*)

Description.—A colorless or nearly colorless solution, each fluid ounce containing about 5½ grains of morphine bimeconate. Solutions of morphine bimeconate are sometimes colored with burnt sugar. Dose, 5 to 40 minims. The solution mentioned under *Morphinæ Bimeconas* is an excellent preparation. These preparations are free from many of the disagreeable features of morphine sulphate.

LIQUOR MORPHINÆ HYDROCHLORATIS.—SOLUTION OF HYDROCHLORATE OF MORPHINE.

Preparation.—"Take of hydrochlorate of morphine, 9 grains; diluted hydrochloric acid, 18 minims; rectified spirit, ½ fluid ounce; distilled water, 1½ fluid ounces. Mix the hydrochloric acid, the spirit, and the water, and dissolve the hydrochlorate of morphine in the mixture"—(*Br. Pharm.*, 1885).

This solution contains 1 per cent of morphine hydrochlorate, or 1 part in 100. Each fluid drachm contains ½ grain of the morphine salt.

Action, Medical Uses, and Dosage.—(See *Morphina.*) Dose, 10 to 60 minims.

LIQUOR MORPHINÆ HYPODERMICUS (N. F.)—HYPODERMIC SOLUTION OF MORPHINE.

SYNONYM: *Magendie's solution of morphine.*

Preparation.—"Morphine sulphate, three and one-half grammes (3.5 Gm.) [54 grs.]; distilled water, warm, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Dissolve the morphine sulphate in the warm distilled water, and filter the solution through a small pellet of absorbent cotton. When the solution is cold, pass a little distilled water through the cotton, if necessary, to make the filtrate measure one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Keep the solution in well-stoppered vials in a dark place. *Note.*—Particular care should be taken in dispensing and labelling this solution, so that it may not be mistaken for the so-called United States Solution of Morphine (*Liquor Morphiæ Sulphatis, U. S. P.*, 1870), containing only 1 grain of morphine sulphate in each fluid ounce, which is still used in some parts of this country. The development of fungoid growths or micro-organisms in this and similar solutions used hypodermatically, may be prevented, or at least greatly retarded, by using chloroform water instead of plain distilled water as a solvent. This should, however, be done only with the knowledge, or by the direction, of the physician. Another efficient method to preserve such solutions, is to sprinkle a little benzoic acid on the surface of the absorbent cotton, through which the solutions are filtered. Or, about 5 grains of boric acid may be added to each fluid ounce"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—(See *Morphina.*) Each fluid drachm contains about 3 grains of morphine sulphate; 1623 minims contain 54 grains.

Related Morphine Solutions.—Liquor Morphinæ Sulphatis of the *British Addenda*, is composed of 35 grains of morphine sulphate dissolved in sufficient distilled water and rectified spirit (2 fluid ounces), to make 8 fluid ounces of finished product. About ½ grain of morphine sulphate is contained in each fluid drachm. Dose, 10 to 60 minims.

Liquor Morphinæ Citratis (N. F.), *Solution of morphine citrate.*—"Morphine (alkaloid), three and one-half grammes (3.5 Gm.) [54 grs.]; citric acid, three grammes (3 Gm.) [46 grs.]; cochineal, one-tenth of a gramme (0.1 Gm.) [1.5 grs.]; alcohol, twelve and one-half cubic centimeters (12.5 Cc.) [203 ♏]; distilled water, a sufficient quantity to make one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Triturate the solids with the alcohol and eighty cubic centimeters (80 Cc.) [2 fl℥, 339 ♏] of water: filter, and pass enough distilled water through the filter to make one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. This solution should not be kept on hand, but prepared only when required. Each fluid drachm contains 2 grains of morphine in the form of citrate"—(*Nat. Form.*).

LIQUOR PHOSPHORI (N. F.)—SOLUTION OF PHOSPHORUS.

Synonym: *Thompson's solution of phosphorus.*

Preparation.—"Phosphorus, seven centigrammes (0.07 Gm.) [1 gr.]; absolute alcohol, thirty-five cubic centimeters (35 Cc.) [1 fl℥, 88 ♏]; spirit of peppermint (*U. S. P.*), one-half cubic centimeter (0.5 Cc.) [8 ♏]; glycerin, sixty-four and one-half cubic centimeters (64.5 Cc.) [2 fl℥, 87 ♏]. Dissolve the phosphorus in thirty cubic centimeters (30 Cc.) [1 fl℥, 7 ♏] of absolute alcohol, in a stoppered vial or test-tube, by immersion in a water-bath and frequent agitation, taking care that any loss of alcohol by evaporation, be made up from time to time. Allow the solution to become nearly cold, and then add to it the remainder of the absolute alcohol and the glycerin, previously mixed and slightly warmed. Finally, add the spirit of peppermint. Keep the solution in a well-stoppered bottle, in the dark. Each fluid drachm contains about $\frac{1}{24}$ grain of phosphorus. *Note.*—This solution must not be confounded with the Spiritus Phosphori (*U. S. P.*), which is not intended to be administered as such, but is only to be used in compounding the elixir or other preparations of phosphorus. The phosphorus should be perfectly translucent, cut and weighed under water, and quickly dried with filtering paper before being dropped into the alcohol"—(*Nat. Form.*).

Uses.—(See *Phosphorus.*)

LIQUOR PICIS ALKALINUS (N. F.)—ALKALINE SOLUTION OF TAR.

Preparation.—"Tar, two hundred and fifty grammes (250 Gm.) [8 ozs. av., 358 grs.]; potassa, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; water, six hundred and twenty-five cubic centimeters (625 Cc.) [21 fl℥, 64 ♏]. Dissolve the potassa in the water. Shake the solution with the tar so that the latter may be dissolved, and strain the solution through muslin"—(*Nat. Form.*).

Medical Uses.—(See *Pix Liquida.*)

LIQUOR PLUMBI SUBACETATIS (U. S. P.)—SOLUTION OF LEAD SUBACETATE.

"An aqueous liquid, containing in solution about 25 per cent of lead subacetate (approximately $Pb_2O[C_2H_3O_2]_2 = 546.48$)"—*U. S. P.*

Synonyms: *Goulard's extract, Acetum plumbicum, Acetum saturni, Subacetas plumbicus liquidus, Plumbum hydrico-aceticum solutum.*

Preparation.—"Lead acetate, one hundred and seventy grammes (170 Gm.) [5 ozs. av., 436 grs.]; lead oxide, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; distilled water, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Dissolve the lead acetate in eight hundred grammes (800 Gm.) [1 lb. av., 12 ozs., 96 grs.] of boiling distilled water, in a glass or porcelain vessel. Then add the lead oxide, previously passed through a fine sieve, and boil for ½ hour, occasionally adding hot distilled water to make up the loss by evaporation. Remove the heat, allow the liquid to cool, and add enough distilled water, previously boiled and cooled, to make the product weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Finally, filter the liquid in a closely-covered funnel. Keep the product in well-stoppered bottles"—(*U. S. P.*).

This solution contains basic acetates, the character of it depending upon the relative proportions of the two lead compounds employed. If molecular proportions be used (and this is aimed at in the official process), a basic salt of the composition $Pb(C_2H_3O)_2.Pb(OH)_2$ is chiefly formed. This preparation changes on keeping, and in reality, like many similar compounds, has the exact pharmacopœial composition but once in its existence, and that is immediately after it is finished.

Description and Tests.—"A clear colorless liquid, odorless, having a sweetish astringent taste, and an alkaline reaction. On exposure to the air it absorbs carbon dioxide, which causes the formation of a white precipitate. Specific gravity, about 1.195 at 15° C. (59° F.). When solution of lead subacetate is added to a solution of acacia, it produces a dense, white precipitate (distinction from an aqueous solution of normal lead acetate). In other respects the solution conforms to the reactions and tests given under lead acetate (see *Plumbi Acetas*). If 13.67 Gm. of the solution be diluted with 50 Cc. of water, there will be required, for complete precipitation of the lead about 25 Cc. of normal sulphuric acid (each cubic centimeter corresponding to 1 per cent of lead subacetate), methyl-orange being used as indicator"—(*U. S. P.*).

Action and Medical Uses.—This agent has not been used to any extent in Eclectic practice. By some practitioners it is applied as a topical sedative and astringent to allay *inflammation*, and to lessen *discharges from relaxed tissues. Sprains, bruises, burns, abscesses, inflammatory skin eruptions*, etc., are asserted to have been benefited by its employment. It should never be given internally, nor should it be applied to denuded surfaces, as excoriations, in which it is occasionally recommended, lest lead poisoning should result from its absorption. The diluted form (see *Liquor Plumbi Subacetatis Dilutus*), is more generally preferred.

LIQUOR PLUMBI SUBACETATIS DILUTUS (U. S. P.)—DILUTED SOLUTION OF LEAD SUBACETATE.

SYNONYMS: *Lead water, Aqua plumbica, Aqua saturnina.*

Preparation.—"Solution of lead subacetate, thirty cubic centimeters (30 Cc.) [487 ♏]; distilled water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏). Mix the solution of lead subacetate with enough distilled water, previously boiled and cooled, to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Keep the solution in well-stoppered bottles"—(*U. S. P.*).

Lest this solution become cloudy in preparation, great care should be exercised that a previously boiled, pure distilled water be employed, and that the finished product be excluded from the air. As usually dispensed, however, it is somewhat opalescent. It is best prepared in small amount.

Action and Medical Uses.—(Same as *Liquor Plumbi Subacetatis.*)

LIQUOR POTASSÆ (U. S. P.)—SOLUTION OF POTASSA.

"An aqueous solution of potassium hydrate (KOH=55.99), containing about 5 per cent of the hydrate"—(*U. S. P.*).

SYNONYMS: *Solution of potassium hydrate, Solution of potash, Kali hydricum solutum, Lixivium causticum.*

Preparation.—"Potassium bicarbonate, eighty-five grammes (85 Gm.) [3 ozs. av.]; lime, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; distilled water, a sufficient quantity. Dissolve the potassium bicarbonate in four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of distilled water, heat the solution until effervescence ceases, and then increase the heat to the boiling point of the liquid. Slake the lime with about twenty cubic centimeters (20 Cc.) [325 ♏] of distilled water, then mix it well with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of distilled water, pour the mixture into a tared flask, and, having heated it to boiling, gradually add to it the solution of potassium bicarbonate, and boil during 10 minutes. Then add enough distilled water to the flask to make the contents weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.], and set the flask aside, well-stoppered, until the contents are cold. Lastly, strain the liquid through linen, set it aside in a well-stoppered bottle until it has become clear by subsidence, and separate the clear solution by decantation or by means of a siphon"—(*U. S. P.*). The directions of the Pharmacopœia aim at the separation of the carbonic acid radical from the carbonates employed, which is accomplished by the slaked lime. The *U. S. P.* prefers the use of potassium bicarbonate to the carbonates, on account of its greater purity.

Solution of Potassa may also be prepared in the following manner: "Potassa, fifty-six grammes (56 Gm.) [1 oz. av., 427 grs.]; distilled water, nine hundred and forty-four grammes (944 Gm.) [2 lbs. av., 1 oz., 131 grs.]. To make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Dissolve the potassa in the distilled water. The potassa used in this process should be of the full strength directed by the Pharmacopœia (90 per cent). Potassa of any other strength, however, may be used, if a proportionately larger or smaller quantity be taken; the proper amount for the above formula being ascertained by dividing 5000 by the percentage of absolute potassa (potassium hydrate) contained therein. Solution of potassa should be kept in bottles made of green glass, and provided with glass stoppers coated with paraffin or petrolatum"—(*U. S. P.*).

Description and Tests.—"Official Liquor Potassæ is a clear, colorless liquid, odorless, having a very acrid and caustic taste, and a strongly alkaline reaction. Specific gravity, about 1.036 at 15° C. (59° F.). It should conform to the same reactions and tests as an aqueous solution of potassa (see *Potassa*). To neutralize 28 Gm. of solution of potassa should require about 25 Cc. of normal sulphuric acid (each cubic centimeter of the volumetric solution indicating 0.2 per cent of absolute potassium hydrate, phenolphtalein being used as an indicator)"—(*U. S. P.*). A brownish color in liquor potassæ indicates organic matter. It causes a soap-like sensation when rubbed between the fingers, and reddens yellow turmeric paper. It strongly attracts carbon dioxide from the atmosphere, and should, therefore, be kept in closed vessels. It corrodes flint glass, and should be preserved in green glass bottles.

According to Dr. A. B. Garrod, liquor potassæ destroys or renders inert the active principle of hyoscyamus, stramonium, belladonna, etc.; and other caustic alkalies produce similar results. The carbonates or bicarbonates of these alkalies have not the property of destroying the activity of the plants named.

Liquor potassæ decomposes all the alkaloidal salts, and tannin and compounds derived from it. Wool, skins, animal tissue, and some vegetable structures are destroyed by it. Fats are decomposed by it, a soluble soap resulting. The *British Pharmacopœia* (1898) requires liquor potassæ to be of the specific gravity of 1.058, and to contain 5.85 per cent by weight, of hydroxide of potassium, KOH.

Action, Medical Uses, and Dosage.—Solution of potassa, when rubbed between the fingers imparts to them a soapy sensation, which is due to the union of the caustic potash with the oily matter of the skin, producing a soft soap. When the stomach is active, as it is after a meal, solution of potassa in ordinary doses unites with the free gastric acids; but if the stomach be empty and inactive, the solution is absorbed, enters the circulation, neutralizing acidity, and particularly overcoming the acidity of the urine, for it is chiefly eliminated by the kidneys. Hence, if its action on the urine be desired, it should be given between meals, when the stomach is at rest. Symptoms closely resembling those of scurvy are the effect of its continued use. (For acute poisoning with Liquor Potassæ and treatment therefor, see *Potassa*.)

Liquor potassæ is used as an antacid in conjunction with a bitter tonic infusion in *acidity of the stomach.* The solutions of the carbonates are, however, preferable as an antacid. It has also been recommended to remove the tendency to formation of *uric acid in the urine*, but is inferior to the carbonates, which may be used for a longer time, and without debilitating the stomach so soon as the liquor potassæ. This fluid has been found useful as a resolvent in *induration* and *enlargement of the lymphatic glands*, and especially in excessive *enlargement of the glandulæ papillæ* at the end of the tongue. In *scalding of the urethra* accompanying *gonorrhœa*, combined with 10 or 12 drops of laudanum, liquor potassæ will be found to afford prompt relief. It has also been used in *gout* and *rheumatism*, attended with uric acid in the urine, to diminish the viscidity of the mucus in *chronic bronchitis* (injurious in consumption), and in some *chronic skin diseases;* externally it has been used as an application to *ulcers*, and in weak solution in some *skin diseases.* It softens *corns, bunions, warts*, and is employed to destroy *ingrown nails.* The dose is from 5 minims to ½ drachm; it should be taken in some mucilage, or sweetened water, and be repeated 2, 3, or 4 times a day. When taken in quantities to injure the stomach, or in an undiluted state, the proper antidotes are acids which neutralize the alkali, as vinegar, or solutions of acetic or citric acid, or oil may be given to convert it into a harmless soap. If a concentrated solution has been swallowed, and in large quantities, the stomach pump should be preferred to emetics.

Specific Indications and Uses.—Frequent desire to urinate, with a sense of perineal constriction, difficult urination, or strangury; leaden pallor of the tongue and mucous tissues; feeble, tremulous muscles; fullness of muscles; debility all out of proportion to the diseased condition.

LIQUOR POTASSÆ EFFERVESCENS.—EFFERVESCING SOLUTION OF POTASH.

SYNONYMS. *Aqua potassæ effervescens, Potash-water.*

Preparation.—Dissolve potassium bicarbonate, 30 grains, in water, 1 pint (Imp.). Filter. Into the solution pass as much pure washed carbon dioxide (that has been prepared by acting upon chalk with sulphuric acid) as can be forced into it with a pressure of 4 atmospheres. Keep in securely-stoppered bottles to prevent the escape of the imprisoned gas. This accords with the *British Pharmacopœia*, 1885.

Description.—A clear, colorless, sparkling solution, strongly effervescing from the liberation of carbonic acid gas, when the stopper is removed from the container. It has a pleasant acidulous taste.

Medical Uses.—(Same as *Liquor Magnesii Carbonatis.*)

Related Solutions.—LIQUOR SODÆ EFFERVESCENS, *Effervescing solution of soda, Soda water, Aqua sodæ effervescens, Aqua alcalmia effervescens.* This is prepared precisely like the above solution, employing the same quantities, excepting that sodium bicarbonate is used instead of potassium bicarbonate. Its properties and uses are likewise the same as for *Effervescing Solution of Potash.*

LIQUOR LITHIÆ EFFERVESCENS, *Effervescing solution of lithia, Lithia water, Aqua lithiæ effervescens.*—Lithium carbonate, 10 grains; water, 1 pint (Imp.). Prepare precisely like *Effervescing Solution of Potash.* This is a sparkling, clear liquid of a pleasantly acidulous taste. Upon evaporation, each fluid ounce (Imp.) should yield ½ grain of lithium carbonate. For uses, see *Lithii Carbonas.* Dose, 4 to 12 fluid ounces.

LIQUOR SODII CITRO-TARTRATIS EFFERVESCENS (N. F.), *Effervescent solution of sodium citro-tartrate, Tartro-citric lemonade.*—"Sodium bicarbonate, twenty-six grammes (26 Gm.) [401 grs.]; tartaric acid, twenty-four grammes (24 Gm.) [370 grs.]; citric acid, two grammes (2 Gm.) [31 grs.]; syrup of citric acid (*U. S. P.*), fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏︎]; water, a sufficient quantity to make three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏︎]. Dissolve twenty-four grammes (24 Gm.) [370 grs.] of the sodium bicarbonate in two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏︎] of water, add the tartaric and citric acids, and when they are dissolved, the syrup of citric acid. Filter the solution into a strong bottle of about three hundred and sixty cubic centimeters (360 Cc.) [12 fl℥, 83 ♏︎] capacity, and pass enough water through the filter to make the filtrate measure three hundred and twenty cubic centimeters (320 Cc.) [10 fl℥, 394 ♏︎]. Dissolve the remainder of the sodium bicarbonate (2 Gm.) [31 grs.] in thirty cubic centimeters (30 Cc.) [487 ♏︎] of water, filter the solution, pour it on top of the solution in the bottle, which close immediately with a cork, and secure it with twine. Then shake the bottle"—(*Nat. Form.*).

LIQUOR POTASSII ARSENITIS (U. S. P.)—SOLUTION OF POTASSIUM ARSENITE.

Synonyms: *Fowler's solution, Solutio arsenicalis Fowleri, Arsenical solution, Kali arsenicosum solutum.*

Preparation.—"Arsenous acid, in fine powder, ten grammes (10 Gm.) [154 grs.]; potassium bicarbonate, twenty grammes (20 Gm.) [309 grs.]; compound tincture of lavender, thirty cubic centimeters (30 Cc.) [487 ♏]; distilled water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Boil the arsenous acid and potassium bicarbonate with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of distilled water until solution has been effected. Then add enough distilled water to make the solution, when cold, measure nine hundred and seventy cubic centimeters (970 Cc.) [32 fl℥, 384 ♏], and, lastly, add then the compound tincture of lavender. Filter through paper"—(*U. S. P.*).

Fowler's solution should be prepared every 4 or 5 months instead of being made in large batches to be kept for a longer period, for by oxidation the arsenous acid is gradually changed to arsenic acid, thus rendering the preparation weaker. A fungous vegetation is likewise liable to form in it when long kept. Care should be exercised in the selection of the arsenous acid.

Description.—Fowler's solution is at first an opalescent, afterward pinkish or reddish fluid, having an agreeable slight odor of lavender. It is alkaline in reaction. "If 24.7 Cc. of the solution be boiled for a few minutes with 2 Gm. of sodium bicarbonate, and the liquor, when cold, diluted with water to 100 Cc., and mixed with a little starch T.S., it should require from 46.4 to 50 Cc. of decinormal iodine V.S. to produce the blue tint of iodide of starch (corresponding to 1 Gm. of arsenous acid in 100 Cc. of the solution)"—(*U. S. P.*).

Fowler's solution was introduced into medicine by Dr. Fowler, of Stafford, England, to take the place of a remedy then known as "*tasteless ague drop.*" It is still a question as to whether it be a solution of potassium arsenite, as many believe, or whether it is simply an alkaline solution of arsenous acid.

Action, Medical Uses, and Dosage.—(See *Acidum Arsenosum.*) Dose, ¼ to 5 minims, well diluted, after meals.

LIQUOR POTASSII CITRATIS (U. S. P.)—SOLUTION OF POTASSIUM CITRATE.

"An aqueous liquid, containing in solution about 9 per cent of anhydrous potassium citrate ($K_3C_6H_5O_7$=305.63), together with small amounts of citric and carbonic acids"—(*U. S. P.*).

Synonyms: *Mistura potassii citratis, Liquor kali citrici.*

Preparation.—"Potassium bicarbonate, eight grammes (8 Gm.) [123 grs.]; citric acid, six grammes (6 Gm.) [93 grs.]; water, a sufficient quantity. Dissolve the potassium bicarbonate and the citric acid, each, in forty cubic centimeters (40 Cc.) [1 fl℥, 169 ♏] of water. Filter the solutions separately, and wash the filters with enough water to obtain, in each case, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]. Finally, mix the two solutions, and, when effervescence has nearly ceased, transfer the liquid to a bottle. This preparation should be freshly made, when wanted"—(*U. S. P.*).

Description.—"A clear, colorless liquid, odorless, having a mildly saline taste, and a slightly acid reaction. It should conform to the reactions and tests of potassium citrate (see *Potassii Citras*)"—(*U. S. P.*). This preparation is designed to take the place of the less stable, but more agreeable *Mistura Potassii Citratis* (*U. S. P.*, 1880), or *Neutral Mixture*, the formula for which was as follows: "Fresh lemon-juice, strained, 100 parts; bicarbonate of potassium, about 10 parts, or a sufficient quantity. Add the bicarbonate of potassium gradually to the lemon juice until it is neutralized. This preparation should be freshly made when wanted for use"—(*U. S. P.*, 1880). This differs from the official solution in possessing the agreeable flavor of lemons, and in having a yellowish hue. It has been suggested that the two solutions be prepared as above directed and kept separately in proper containers, to be mixed when called for. This, in our opinion, is unwise, inasmuch as solutions of citric acid are prone to decomposition, becoming moldy, and developing, among other substances, free acetic acid, when kept on hand for any great length of time. The old formula of this Dispensatory is as follows:

Triturate citric acid, 2 drachms, with oil of lemons, 2 minims, and then with water, 4 fluid ounces; when the solution is perfected, gradually add crystallized bicarbonate of potassium until effervescence no longer takes place, and filter. In this formula the alkaline salt is decomposed by the citric acid; carbonic acid is given off with effervescence, and citrate of potassium is formed by the combination of the citric acid and the alkali, which is held in solution with some free carbonic acid. When the acid is saturated by the alkali, the solution, after the carbonic acid has been allowed to pass off, will exert no action on blue or red litmus paper. This preparation is similar in medicinal virtue, to the official solution, the citric acid and lemon oil being intended to supply the absence of the lemon juice. It is proper to filter, in order to remove foreign or undissolved substances.

This preparation, like solution of ammonium citrate and solution of sodium citrate, has the power of preventing the inkiness that follows the mixing of ferric salts, such as tincture of chloride of iron, and vegetable astringents. The dry citrates have the same property. The preparation known as *Tasteless Tincture of Iron* is a mixture of tincture of chloride of iron and one of the above salts or solutions. It has a greenish color, an insipid, ferruginous taste, and mixes clear with liquids containing vegetable astringents.

Action, Medical Uses, and Dosage.—This solution is a refrigerant preparation, acting mildly on the skin, bowels, and kidneys. It is very useful in allaying *gastric irritability*. Its sedative and diaphoretic properties may be augmented by the addition of aconite or of digitalis; its diuretic influence is rendered more certain by combining it with sweet spirit of niter; and in *diarrhœa* or *irritable bowels*, some opium or morphine may be added to it. It forms a very grateful draught for fever patients, and may be sweetened with sugar if needed. The dose is a tablespoonful, diluted with about an equal measure of water, and repeated 5 or 6 times, or oftener, in the course of the day. A similar preparation may be given as an effervescent drink, by forming one solution of lemon juice and water, each, ½ fluid ounce; and another, by dissolving bicarbonate of potassium, 1½ drachms in 4 fluid ounces of water. The two solutions are to be mixed, and the whole taken at a draught during the effervescence.

Related Preparation.—Liquor Sodii Citratis (N. F.), *Solution of sodium citrate, Mistura sodii citratis, Saturatio, Potio riveri* (*Ger. Pharm.*). "Citric acid, twenty grammes (20 Gm.) [309 grs.]; sodium bicarbonate, twenty-five grammes (25 Gm.) [386 grs.]; water, one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the citric acid in water contained in a bottle, add the sodium bicarbonate, dissolve it by agitation, and immediately stopper the bottle securely. This preparation should be fresbly prepared when wanted for use. *Note.*—The *German Pharmacopœia* directs that when *Saturatio* is prescribed, without any specification of the ingredients or strength, *Potio Riveri*, represented here by *Liquor Sodii Citratis*, be dispensed"—*Nat. Form.*).

LIQUOR POTASSII PERMANGANATIS.—SOLUTION OF PERMANGANATE OF POTASSIUM.

Preparation.—We prefer the old formula of this work, as follows: "Take of permanganate of potassium, 1 part; distilled water, 9 parts; mix and dissolve." This is prepared by the *British Pharmacopœia* (1885), by dissolving permanganate of potassium, 88 grains (1 part), in distilled water, 1 pint (Imp.) (99 fluid parts). This contains, therefore, 1 per cent of the potassium salt. It has the characteristic purple color, but is not a permanent preparation, as upon exposure it decomposes with the deposition of oxides of manganese. It is too weak for some uses and too strong for others. The dose, according to the *British Pharmacopœia* (1885 and 1898), is from 2 to 4 fluid drachms (equal to 1.2 to 2.4 grains of the permanganate).

Description and Medical Uses.—The first-named solution contains 10 per cent of the permanganate, but may be diluted to whatever extent is deemed necessary. It may be used in all cases where the potassium salt is indicated. One part of the solution added to 200 or more parts of distilled water may be used as a local application in *ozæna, putrid sore throat, leucorrhœa, gonorrhœa, offensive otorrhœa*, and to remove the unpleasant odor from the hands after making dissections.

LIQUOR SACCHARINI (N. F.)—SOLUTION OF SACCHARIN.

Preparation.—"Saccharin, seventy grammes (70 Gm.) [2 ozs. av., 205 grs.]; sodium bicarbonate, thirty-three grammes (33 Gm.) [1 oz. av., 72 grs.]; alcohol, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc. [33 fl℥, 391 ♏]. Dissolve the saccharin and the sodium bicarbonate in six hundred and fifty cubic centimeters (650 Cc.) [21 fl℥, 470 ♏] of water, filter the solution, add the alcohol to the filtrate, and pass enough water through the filter to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents 4 grains of saccharin. *Note.*—The saccharin directed in the above formula is, properly speaking, 'anhydro-ortho-sulphamine-benzoic acid,' an artificially prepared member of the so-called aromatic series of organic chemicals. It is a body having feebly acid properties, soluble in about 333 parts of water and in 33 parts of alcohol at 15° C. (59° F.). When neutralized by an alkali, it is quite soluble in water. The solution of saccharin is intended to be used for sweetening liquids or solids, when the use of sugar is objectionable, or when a sweet taste is to be imparted to a liquid without increasing its density"—(*Nat. Form.*).

Uses.—(See *Saccharinum.*)

LIQUOR SODÆ (U. S. P.)—SOLUTION OF SODA.

"An aqueous solution of sodium hydrate ($NaOH = 39.96$), containing about 5 per cent of the hydrate"—(*U. S. P.*).

SYNONYMS: *Solution of sodium hydrate, Solution of caustic soda.*

Preparation.—"Sodium carbonate, one hundred and seventy grammes (170 Gm.) [5 ozs. av., 436 grs.]; lime, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; distilled water, a sufficient quantity. Dissolve the sodium carbonate in four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of boiling distilled water. Slake the lime with about thirty cubic centimeters (30 Cc.) [1 fl℥, 7 ♏] of distilled water, then mix it well with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of distilled water, pour the mixture into a tared flask, and, having heated it to boiling, gradually add to it the solution of sodium carbonate, and boil during 10 minutes. Then add enough distilled water to the flask to make the contents weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.], and set the flask aside, well stoppered, until the contents are cold. Lastly, strain the liquid through linen, set it aside in a well-stoppered bottle until it has become clear by subsidence, and separate the clear solution by decantation, or by means of a siphon."

Solution of soda may also be prepared in the following manner: "Soda, fifty-six grammes (56 Gm.) [1 oz. av., 427 grs.]; distilled water, nine hundred and forty-four grammes (944 Gm.) [2 lbs. av., 1 oz., 131 grs.]; to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Dissolve the soda in the distilled water. The soda used in this process should be of the full strength directed by the Pharmacopœia (90 per cent). Soda of any other strength, however, may be used, if a proportionately larger or smaller quantity be taken; the proper amount for the above formula being ascertained by dividing 5000 by the percentage of absolute soda (sodium hydrate) contained therein. Solution of soda should be kept in bottles made of green glass, and provided with glass stoppers coated with paraffin or petrolatum"—(*U. S. P.*).

Description.—"A clear, colorless liquid, odorless, having a very acrid and caustic taste, and a strongly alkaline reaction. Specific gravity, about 1.059 at 15° C. (59° F.). It should conform to the same reactions and tests as an aqueous solution of soda (see *Soda*). To neutralize 20 Gm. of solution of soda should require about 25 Cc. of normal sulphuric acid (each cubic centimeter of the volumetric solution indicating 0.2 per cent of absolute sodium hydrate), phenolphtalein being used as an indicator"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Formerly used in hepatic torpor, in doses of 5 to 40 drops, well diluted. Seldom now employed internally, but used in the preparation of sodium hydroxide, and other sodium compounds.

LIQUOR SODÆ CHLORATÆ (U. S. P.)—SOLUTION OF CHLORINATED SODA.

"An aqueous solution of several chlorine compounds of sodium, containing at least 2.6 per cent, by weight, of available chlorine"—(*U. S. P.*).

SYNONYMS: *Labarraque's solution, Liquor natri chlorati, Liquor natri hypochlorosi, Liquor sodæ chlorinatæ (Br.), Labarraque's disinfecting liquid.*

Preparation.—"Sodium carbonate, one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]; chlorinated lime, seventy-five grammes (75 Gm.) [2 ozs. av., 282 grs.]; water, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Triturate the chlorinated lime with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of water, gradually added, until a uniform mixture results. Allow the heavier particles to subside, and transfer the thinner, supernatant portion to a filter. Then triturate the residue again with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of water, transfer the whole to the filter, and when the liquid has drained off, wash the filter and contents with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of water. Dissolve the sodium carbonate in three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of hot water, and add this solution to the previously obtained filtrate contained in a suitable vessel. Stir or shake the mixture thoroughly, and, if it should become gelatinous, warm the vessel until the contents liquefy. Then transfer the mixture to a new filter, and, when no more liquid drains from it, wash the filter and contents with enough water to make the product weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Keep the solution in well-stoppered bottles, protected from light"—(*U. S. P.*).

Mr. Chas. H. La Wall (*Amer. Jour. Pharm.*, 1895, p. 203) pointed out that the process of the *U. S. P.* (1880) is preferable to that given above. This conclusion is fully confirmed by our own experience. The process is as follows: Take of "carbonate of sodium, 100 parts; chlorinated lime, 80 parts; water, a sufficient quantity to make 1000 parts. Mix the chlorinated lime intimately with 400 parts of water in a tared vessel provided with a tightly fitting cover. Dissolve the carbonate of sodium in 400 parts of boiling water, and immediately pour the latter solution into the former. Cover the vessel tightly, and, when the contents are cold, add enough water to make them weigh 1000 parts. Lastly, strain the mixture through muslin, allow the precipitate to subside, and remove the clear solution by means of a siphon"—(*U. S. P.*, 1880). We prefer, however, to stir the sodium carbonate solution, cold, into the lime magma. The mass gradually thickens, forming a stiff dough, but soon, and rather suddenly, breaks up into a thin liquid from which the calcium carbonate readily separates. The clear solution may then be siphoned off and after being assayed, is diluted to its proper strength by the addition of water.

The disinfecting power of this preparation was discovered by Labarraque about 1820. By the above processes double decomposition occurs; hypochlorite of sodium and chloride of sodium are formed in solution, while carbonate of calcium is precipitated according to the equation $Ca(ClO)_2+Na_2CO_3=2NaClO+CaCO_3$.

Description and Tests.—"A clear, pale-greenish liquid, having a faint odor of chlorine, and a disagreeable, alkaline taste. Specific gravity, about 1.052 at 15° C. (59° F.). The solution at first colors red litmus paper blue, and then bleaches it. The addition of hydrochloric acid to the solution causes an effervescence of chlorine and carbonic acid gas. If 6.7 (6.74) Gm. of the solution be mixed with 50 Cc. of water, then 2 Gm. of potassium iodide and 10 Cc. of hydrochloric acid added, together with a few drops of starch T.S., it should require not less than 50 Cc. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish tint of the liquid (each cubic centimeter of the volumetric solution corresponding to 0.052 per cent of available chlorine)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This solution, in large doses, is an irritant poison. In small doses it has been used as an antiseptic in all conditions of the system attended with great prostration, dry, brown-coated tongue, and offensive excretions, as in *malignant fevers*, *exanthematous diseases*, *dysentery*, *putrid sore throat*, *anthrax*, *gangrene*, *mercurial salivation*, etc. It has also been used as a local application to remove *fetor*, check *ulceration* and *sloughing*, in *sore nipples*, *burns*, *ozœna*, and in *foul vaginal discharges*; also in some diseases of the skin, as *eczema*, *scald-head*, *prurigo*, etc. Its dose is 20 drops or more, diluted with some mild aqueous liquid. Under the continued use of it, *glandular enlargements* and *chronic mucous discharges* have disappeared, and the secretion of urine is generally increased. When used externally it must be diluted with from 5 to 30 parts of water, according to the sensibility of the tissues or organs to be acted upon by it. In *contagious* or *malignant diseases*, it may be sprinkled around the rooms of the sick, being one of our most valuable disinfectants. The chlorine emanations given off in the room readily penetrate every crevice and corner, and search out the offending particles, without the liquid coming in direct contact.

Related Preparations.—Liquor Potassæ Chloratæ (Chlorinatæ), *Chlorinated potassa solution*. The *Eau de Javelle* of the French is prepared by substituting for the sodium carbonate (in above process) an equal quantity of potassium carbonate. Its composition and bleaching qualities are analogons to those of Labarraque's Solution. It will remove stains of fruits from linen. The *National Formulary* process is as follows:

Liquor Potassæ Chloratæ (N. F.), *Solution of chlorinated potassa*, *Liquor potassæ chlorinatæ*, *Javelle water*.—"Potassium carbonate, fifty-eight grammes (58 Gm.) [2 ozs. av., 20 grs.]; chlorinated lime (*U. S. P.*), eighty grammes (80 Gm.) [2 ozs. av., 360 grs.]; water, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Mix the chlorinated lime, contained in a tared flask, with four hundred grammes (400 Gm.) [14 ozs. av., 48 grs.] of water. Dissolve the potassium carbonate in three hundred grammes (300 Gm.) [10 ozs. av., 255 grs.] of boiling water, and pour the hot solution into the mixture first prepared. Shake the flask well, stopper it, set it aside to cool, and then add enough water to make the contents weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Allow the suspended matters to subside, and remove the clear solution by means of a siphon, or by straining through muslin. Keep the product in well-stoppered bottles. *Note*.—The chlorinated lime should not contain less than 25 per cent of available chlorine"—(*Nat. Form.*).

Solution of Chlorinated Magnesia.—Fairthorne (1868) proposed this solution as less irritating for internal use. His method of preparation was to dissolve magnesium sulphate (8 ounces) in water (2 pints). Then in a mortar, triturate chlorinated lime (33 drachms) in water (2 pints). Mix the solutions, occasionally agitate the mixture, and after allowing it to stand a half day, pour off the overlying fluid. A little less than 9 grains of magnesia is contained in each ounce.

LIQUOR SODII ARSENATIS (U. S. P.)—SOLUTION OF SODIUM ARSENATE.

Synonyms: *Solution of arseniate of sodium*, *Liquor sodii arseniatis* (*Br.*, 1885).

Preparation.—"Sodium arsenate, deprived of its water of crystallization by a heat not exceeding 149° C. (300.2° F.), one gramme (1 Gm.) [15.5 grs.]; distilled water, a sufficient quantity to make one hundred cubic centimeters (100 Cc.) [3 fl℥. 183 ♏]. Dissolve the sodium arsenate in a sufficient quantity of distilled water to make one hundred cubic centimeters (100 Cc.) [3 fl℥. 183 ♏]. The solution conforms to the reactions and tests of sodium arsenate (see *Sodii Arsenas*)"—(*U. S. P.*).

Description.—A colorless solution containing 1 per cent of anhydrous sodium arsenate. The British process directs 9 grains of the salt to 2 fluid ounces (Imp.) of distilled water, and is, therefore, a 1 per cent solution. This preparation is practically the same as that directed by the *British Pharmacopœia*, 1898.

Pearson's Arsenical Solution (*Liqueur arsénicale de Pearson*, *French Codex*) is a solution of crystallized sodium arsenate (1 part) in distilled water (600 parts). The *National Formulary* directs as follows:

Liquor Sodii Arsenatis, Pearson (N. F.), *Pearson's solution of sodium arsenate*.—"Sodium arsenate, in perfect crystals, one gramme (1 Gm.) [15.5 grs.]; distilled water, six hundred cubic centimeters (600 Cc.) [20 fl℥. 138 ♏]. Dissolve the sodium arsenate in the distilled water, and filter, if necessary. *Pearson's solu-*

tion of sodium arsenate may also be prepared as follows: Solution of sodium arsenate (*U. S. P.*), ten cubic centimeters (10 Cc.) [162 ♏]; distilled water, ninety cubic centimeters (90 Cc.) [3 fl℥, 21 ♏]. Mix the solution of sodium arsenate with the distilled water. This solution contains about $\frac{1}{10}$ per cent of anhydrous sodium arsenate. *Note.*—This preparation should not be confounded with the *Liquor Sodii Arsenatis* (*U. S. P.*), which is ten times stronger than the above preparation. Pearson's solution is recognized in the *French Pharmacopœia* under the title *Soluté d'Arséniate de Soude* (or *Solution Arsénicale de Pearson*). It is recommended that Pearson's solution be dispensed only when expressly designated as 'Pearson's' "—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—(Uses same as for Fowler's Solution of Arsenic.) Dose $\frac{1}{4}$ to 5 minims.

LIQUOR SODII BORATIS COMPOSITUS (N. F.)—COMPOUND SOLUTION OF SODIUM BORATE.

SYNONYM: *Dobell's solution.*

Preparation.—"Sodium borate, fifteen grammes (15 Gm.) [231 grs.]; sodium bicarbonate, fifteen grammes (15 Gm.) [231 grs.]; carbolic acid, crystallized, three grammes (3 Gm.) [46 grs.]; glycerin, thirty-five cubic centimeters (35 Cc.) [1 fl℥, 88 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the salts in about five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of water, then add the glycerin, and the carbolic acid, previously liquefied by warming, and, lastly, enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*Nat. Form.*).

Action and Medical Uses.—Dobell's solution is largely used as a cleansing and antiseptic wash in *catarrhal affections of the nose and throat.*

LIQUOR SODII CARBOLATIS (N. F.)—SOLUTION OF SODIUM CARBOLATE.

SYNONYM: *Phénol sodique.*

Preparation.—"Carbolic acid, crystallized, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; soda (*U. S. P.*), three and one-half grammes (3.5 Gm.) [54 grs.]; water, forty-six and one-half grammes (46.5 Gm.) [1 oz. av., 280 grs.]. Dissolve the soda in the water, add the carbolic acid, and warm gently until it is dissolved. This preparation should be made freshly when wanted for use. *Note.*—The formula is based upon that of the *German Pharmacopœia*, I, 1872"—(*Nat. Form.*).

Action and Medical Uses.—(See *Sodium Carbolate.*)

LIQUOR SODII ETHYLATIS.—SOLUTION OF SODIUM ETHYLATE.

Preparation.—"Take of metallic sodium, free from oxide, 22 grains (1 part); ethylic alcohol (absolute alcohol), 1 fluid ounce (20 fluid parts). Dissolve the sodium in the ethylic alcohol contained in a flask, the latter being kept cool in a stream of cold water. The solution should be recently prepared"—*Br. Pharm.*, 1885. The *British Pharmacopœia* (1898) uses the same proportions.

Description.—A syrupy, colorless liquor of the specific gravity 0.867. Upon keeping, it becomes brown. The solution contains 18 per cent of solid sodium ethylate (NaC_2H_5O). It boils when heated, giving off alcoholic vapors, leaving a white residue, which, upon being heated, strongly chars. Mixed with water and heated, this salt yields alcohol, and, upon evaporation of the solution, a white residue, mostly caustic soda, remains. Water should be kept away from this solution. In warm situations it has been known to explode.

Action and Medical Uses.—This agent has been praised by Richardson and Brunton as a local destructive agent, limited in action to the part to which it is applied and causing far less pain than most similar escharotics. But little effect further than redness is produced by its application to the skin until the agent begins to abstract the moisture from the tissues, thereby causing the formation of caustic soda, which gradually attacks the part. Should bleeding take place, it is in part at least checked by the coagulating effect of the alcohol upon the albuminous constituents of the blood. Besides these effects, it is said to prevent the destroyed tissues from putrefactive decomposition. Its action may be controlled by dropping upon the surface a few drops of chloroform. *Vascular nævi* have been successfully destroyed by this agent, and *mother's marks*, *tattoo*, *warts*, *nasal polypi*, *ringworm*, *pile tumors*, *lupus*, *melanotic growths*, and *hypertrichosis* have yielded to its action. It is said to leave but little scarring. It is recommended that *poisoned wounds* and *cystic tumors* be treated with it. It should be applied with a camel's-hair pencil, and, if it causes too much pain, tincture of opium may be combined with it (Richardson).

Related Preparation.—SODIUM ETHYLATE, *Caustic alcohol* (C_2H_5NaO). The pure salt is prepared by the action of absolute alcohol upon metallic sodium. It is a white powder, occasionally tinted brownish. Water dissolves it with a hissing noise, and even a very small quantity of that fluid causes it to split up into alcohol and sodium hydroxide.

LIQUOR SODII OLEATIS (N. F.)—SOLUTION OF SODIUM OLEATE.

Preparation.—"White castile soap, dry and powdered, six hundred and twenty-five grammes (625 Gm.) [1 lb. av., 6 ozs., 20 grs.]; water, a sufficient quantity to make ten thousand cubic centimeters (10,000 Cc.) [338 fl℥, 66 ♏]. Mix the castile soap with twenty-five hundred cubic centimeters (2500 Cc.) [84 fl℥, 257 ♏] of water, so as to produce a uniform and gelatinous mixture. Then add sixty-five hundred cubic centimeters (6500 Cc.) [219 fl℥, 379 ♏] more of water, apply heat until the soap is dissolved, allow the liquid to cool, and add enough water to make it measure ten thousand cubic centimeters (10,000 Cc.) [338 fl℥, 66 ♏]. *Note.*—This solution is intended to be used in the preparation of *Oleates*"—(*Nat. Form.*).

Uses.—(See above.)

LIQUOR SODII SILICATIS (U. S. P.)—SOLUTION OF SODIUM SILICATE.

"Solution of sodium silicate should be kept in well-stoppered bottles"—(*U. S. P.*).

SYNONYMS: *Vitrium solubile*, *Soluble glass*, *Natrum silicium solutum*, *Liquid glass*.

Preparation.—The ingredients used and the proportions vary with the use to be made of the preparation. As a rule, silicate of sodium is prepared by fusing together fine sand (or flint), 1 part, and dried sodium carbonate, 2 parts. The product so obtained is dissolved in boiling water, filtered, and evaporated. Another method is that of fusing a mixture of charcoal, 1 part; exsiccated sodium carbonate, 8 parts; and fine sand, 15 parts. It is never prepared by the pharmacist.

History.—The base (silicium) of this compound is an important constituent of certain rocks and minerals, always as an oxide, often forming whole mountain chains. *Flint*, *sand*, *quartz*, *agate*, *chalcedony*, *amethyst*, and *tridymite*, or *opal*, all contain silicic oxide (SiO_2). This oxide, also known as silica, is present in a pure state in *rock-crystal*. The element *silicon* (*silicium*) has the symbol Si, and the atomic weight 28.3. In combination it forms a large portion of the crust of the earth, and is found in plants, especially in hickory bark, and constitutes the glossy surface of straw. Glass is a mixture of silicates with an excess of silica, and, when colored, the tints are produced by metallic oxides. Hydrochloric acid will dissolve amorphous silicon, while nitro-hydrochloric acid dissolves the crystalline modification. Van Helmont (1640) was the first to observe that a salt of silicon (SiO_2) and salt of tartar (potassium carbonate) would become fluid in the presence of dampness, and the fluid so produced was called the "*liquor of flints*" (*liquor silicum*). Nearly two centuries thereafter (1818), Fuchs demonstrated that such a solution would render substances incombustible, and soon afterward, soda having been substituted for potassa, the preparation became an article of importance under the name "soluble (or liquid) glass," the potassium preparation also bearing this name. In medicine, solution of sodium silicate is used chiefly as a protective dressing; in the arts it is extensively employed in calico printing, making artificial stone, is added to the cheaper soaps, used in fresco painting, for cements, and various other purposes. It is said to have been used instead of gum Arabic in the production of cheap gum-drops. Substances protected with sodium silicate are not readily inflammable, hence the name "*indestructible varnish*" once applied to it.

Description.—Sodium silicate is a transparent, glassy mass. With variable amounts of water of crystallization it may be obtained in crystals of the formula Na_2SiO_3. Upon exposure it becomes opaque on the surface. Boiling water slowly dissolves it, and a thick, syrup-like fluid may be obtained by evaporating an alkaline solution of it. The solution is officially described as "a semi-transparent, almost colorless, or yellowish, or pale greenish-yellow, viscid liquid, odorless, having a sharp, saline, and alkaline taste, and an alkaline reaction. Specific gravity 1.300 to 1.400 at 15° C. (59° F.). A drop of the solution, when held in a non-luminous flame, imparts to it an intensely yellow color. If a portion of the solution, largely diluted with water, be supersaturated with nitric acid, a gelatinous or pulverulent, white precipitate of silicic hydrate will be produced"—(*U. S. P.*).

Sodium silicate falls as a gelatinous deposit upon adding alcohol to it. It should be preserved in glass or stone containers, stoppered with paraffin-coated glass or stone stoppers, or good cork or rubber stoppers may be used instead. The cheap "office mucilage" of commerce is likely to be solution of sodium silicate. In some instances we have known fine plate-glass windows to be ruined by the corrosive action of the silicate "mucilage" which had been used to stick posters thereon.

Action and Medical Uses.—When pure, this agent is claimed by Löwenhaupt to lack antiseptic properties. The ordinary solution, however, is endorsed by many as an antiseptic, having extraordinary control over putrefactive processes. Solutions of ½ of 1 per cent have been used to check the discharges in *vaginitis*, *ulceration of the womb*, *chronic cystitis*, *gonorrhœa*, and in *ozœna*. This agent has also been recommended as a surgical dressing for *fractures*. Over the roller, next to the skin, a layer of cotton should be applied, and this should be wound with *washed* bandages (lest shrinking should strangulate the parts). The solution should then be painted upon the bandage as applied. The limb should remain at rest until 1 or 2 hours have elapsed, when the bandage will have dried. To remove the bandage, soften it with warm water and cut with scissors.

Related Products.—SODIUM SILICO-FLUORIDE (Na_2SiF_6). *Sodium fluosilicate.* If fluor-spar (calcium fluoride, CaF_2) be acted upon by sulphuric acid in the presence of fragments of glass, and the gaseous product—silicon fluoride (SiF_4)—be passed into water, hydrogen silico-fluoride (H_2SiF_6) is formed. This, when neutralized with sodium hydroxide (or the carbonate), will yield sodium silico-fluoride. It does not readily dissolve in water. A solution of it is known as *salufer*. This agent corrodes steel surgical instruments, and was brought forward as a deodorant and antiseptic, and has been claimed by some to be non-toxic, others claiming to have observed poisonous effects from its use. A solution of ½ part to 2000 of water has been used as a topical antiseptic in *ocular*, *aural*, *obstetrical*, and *surgical disorders*, being preferred by some to corrosive sublimate; later observers, however, deny its equality with the latter as a germicide. Undiluted, it is irritant and caustic.

POTASSII SILICAS (K_2SiO_3), *Potassium silicate*, *Soluble glass.*—This compound resembles the sodium salt, but it is more readily melted. It is prepared by fusing together charcoal, 1 part; potassium carbonate, 10 parts; and fine sand, 15 parts. This agent has been used for the same purposes as sodium silicate.

MAGNESII SILICAS.—This compound is native in several minerals, among them being *asbestos*, *talc*, or *French chalk* (see below), sometimes known as *steatite*; *meerschaum* ($2MgO.3SiO_2$), and *soapstone*, a silicate of magnesium and aluminum. The mineral yields a slippery, soft, tasteless, and insoluble powder. *Talc* was formerly used in the *chronic diarrhœa of tuberculosis*. Large doses, in milk, were administered. The treatment, however, is not admired. Talc is an ingredient of some dusting or infant powders.

TALCUM, or *French chalk*, *Talc* ($4MgO.5SiO_2.H_2O$).—This widely disseminated mineral is found in many countries, notably in Austria, Sweden, Bohemia, Shetland Islands, and in this country in New Jersey. It is often called *steatite* or *soapstone*, though, properly the latter differs in containing some aluminum. It is found in masses which split in only one direction. It is unctuous, compact, and glossy, of a whitish or greenish-gray color, and may be easily scratched. Pure talc is practically insoluble in acids and other fluids. Calcium, aluminum, and ferrous compounds are apt to be present in it. When purified of these it forms a good filtering medium. French chalk is largely used by tailors in marking upon cloth and for removing grease stains.

Talcum Purificatum (N. F.), *Purified talcum*.—"Talcum, in fine powder, 100 parts; hydrochloric acid, 15 parts; water, a sufficient quantity. Mix 500 parts of boiling water with the talcum, gradually add 10 parts of the hydrochloric acid, and boil the mixture during 15 minutes. Then allow the suspended talcum to subside, pour off the supernatant liquid, and boil the residue again with 500 parts of water, mixed with the remainder of the hydrochloric acid. Again allow the mixture to become clear by settling, pour off the supernatant liquid, and wash the residue with water, by repeated decantation, until a portion of the wash-water, filtered and placed in a test-tube, ceases to produce a precipitate with test-solution of silver nitrate acidified with nitric acid. Then transfer the magma to a close linen or muslin strainer, allow it to drain, and dry it by heat. *Note.*—Purified talcum is used as an aid in filtering turbid liquids containing finely-divided matters in suspension, which are apt to pass through the filter, or stop up its pores"—(*Nat. Form.*).

LIQUOR STRYCHNINÆ ACETATIS (N. F.)—SOLUTION OF STRYCHNINE ACETATE.

Synonym: *Hall's solution of strychnine.*

Preparation.—"Strychnine acetate, two and one-tenth grammes (2.1 Gm) [32 grs.]; diluted acetic acid (*U. S. P.*), thirty-five cubic centimeters (35 Cc.) [1 fl℥, 88 ♏]; alcohol, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; compound tincture of cardamom (*U. S. P.*), ten cubic centimeters (10 Cc.) [162 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc. [33 fl℥, 391 ♏]. Dissolve the strychnine acetate in about five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of water mixed with the diluted acetic acid, then add the alcohol, compound tincture of cardamom, and lastly, enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Allow the mixture to stand a few days, if convenient, and filter. Each fluid drachm contains $\frac{1}{8}$ grain of strychnine acetate.

Note.—"The *British Pharmacopœia* (1885) directs a *Liquor Strychninæ Hydrochloratis* (with synonym: *Liquor Strychniæ*) which is much stronger, and should not be confounded with the above preparation. It should never be dispensed unless expressly designated. It may be prepared by dissolving 1 grain of crystallized strychnine (alkaloid) in 80 minims of water with the aid of 2 drops of diluted hydrochloric acid, and then adding 20 minims of alcohol. The product contains $\frac{3}{5}$ grain of strychnine in each fluid drachm"—(*Nat. Form.*).

Action and Medical Uses.—(See *Strychnina.*) One-eighth grain of strychnine acetate is contained in each fluid drachm.

LIQUOR STRYCHNINÆ HYDROCHLORATIS.—SOLUTION OF STRYCHNINE HYDROCHLORATE.

Synonym: *Liquor strychninæ* (see note to *Liquor Strychninæ Acetatis*).

Preparation.—Mix 14 minims of hydrochloric acid with $\frac{1}{2}$ fluid ounce of distilled water, and by the aid of heat dissolve in the mixture 9 grains of strychnine, in crystals. Add rectified spirit, $\frac{1}{2}$ fluid ounce, and distilled water, 1 fluid ounce (Imperial measure). This accords with the *British Pharmacopœia*, 1885. The *British Pharmacopœia* (1898) directs a preparation of the same strength, but starts from the hydrochloride of strychnine, one part of which is dissolved in twenty-five fluid parts of alcohol mixed with sufficient water to make one hundred fluid parts.

Action, Medical Uses, and Dosage.—This is a permanent solution containing 1 per cent of strychnine hydrochlorate. It may be employed where strychnine is indicated. Dose, 5 to 10 minims (equal to $\frac{1}{24}$ and $\frac{1}{12}$ grain of the salt).

LIQUOR STRYCHNINÆ NITRATIS.—SOLUTION OF STRYCHNINE NITRATE.

Preparation.—Take of strychnine, in crystals, 4 grains; nitric acid, 6 minims; distilled water, 1 fluid ounce. Add the strychnine to the water, and then add the acid, and agitate until the strychnine is dissolved. This forms a clear, permanent solution.

Action, Medical Uses, and Dosage. May be employed in cases where strychnine is indicated, whether externally or internally. Ten minims contain $\frac{1}{12}$ grain of strychnine. One part of this solution added to three parts of distilled water forms an excellent local application for *weakness of the eyes* following inflammatory attacks of these organs, for *gleet*, *gonorrhœa*, *leucorrhœa* with enfeebled vaginal walls, and *diarrhœa* with debility of the intestines or walls of the rectum. By hypodermatic injection, strychnine may be used in doses of $\frac{1}{100}$ to $\frac{1}{20}$ of a grain; 1 minim of the above solution contains $\frac{1}{120}$ of a grain of strychnine.

LIQUOR ZINCI CHLORIDI (U. S. P.)—SOLUTION OF ZINC CHLORIDE.

"An aqueous solution of zinc chloride ($ZnCl_2$=135.84), containing about 50 per cent. by weight, of the salt"—(*U. S. P.*).

Preparation.—"Zinc, granulated, two hundred and forty grammes (240 Gm.) [8 ozs. av., 204 grs.]; hydrochloric acid, eight hundred and forty grammes (840 Gm.) [1 lb. av., 13 ozs., 276 grs.]; nitric acid, twelve grammes (12 Gm.) [185 grs.]; precipitated zinc carbonate, twelve grammes (12 Gm.) [185 grs.]; distilled water, a sufficient quantity. To the zinc contained in a glass or porcelain vessel, add one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏] of distilled water; then gradually add the hydrochloric acid, and digest, until the acid is saturated. Pour off the solution, add the nitric acid, evaporate the solution to dryness, and heat the dry mass to fusion at a temperature not exceeding 115° C. (239° F.). Let it cool, and dissolve it in a sufficient amount of distilled water to make the product weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Then add the precipitated zinc carbonate, agitate the mixture occasionally during twenty-four hours, and then set it aside until it has become clear by subsidence. Finally, separate the clear solution by decantation, or by means of a siphon"—(*U. S. P.*).

Description.—"A clear, colorless liquid, odorless, having a very astringent, sweetish taste, and an acid reaction. Specific gravity, about 1.535 at 15° C. (59° F.). It conforms to the reactions and tests of an aqueous solution of zinc chloride (see *Zinci Chloridum*)"—(*U. S. P.*). The *British Pharmacopœia* (1898) solution has a density of 1.530, and contains about 40 grammes of zinc (or about 83 grammes of zinc chloride) in 100 Cc. of the preparation. An aqueous solution of zinc chloride was introduced in 1840, as a disinfectant, by Sir William Burnett, and known as *Burnett's Disinfecting Fluid*. Its density is 2.00; contained 200 grains of zinc to the fluid ounce (Imp.).

Action and Medical Uses.—This agent is destructive to some forms of bacteria, and is used chiefly as a disinfectant and deodorant for sinks, vaults, sewers, hospitals, dissecting rooms, and has been injected into cadavers for their preservation, which it accomplishes, but they are rendered unfit for dissection on account of the corrosive action of the preservative upon the scalpel. Internally taken, it has proved fatal. From 10 to 20 drops in 4 fluid ounces of water, have been used in *leucorrhœa* and *gonorrhœa*, and as a collyrium for *ophthalmia*, the result of the latter disease, and of *diphtheria*. Great care should be exercised in its use.

Related Preparations.—Liquor Zinci et Alumini Compositus (N. F.), *Compound solution of zinc and aluminum.* "Zinc sulphate, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; aluminum sulphate, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; naphthol, three grammes (3 Gm.) [46 grs.]; oil of thyme, ten cubic centimeters (10 Cc.) [162 ♏]; water, a sufficient quantity to make five thousand cubic centimeters (5000 Cc.) [169 fl℥, 33 ♏]. Dissolve the zinc sulphate and aluminum sulphate in five thousand cubic centimeters (5000 Cc.) [169 fl℥, 33 ♏] of water, by the aid of heat, add the naphthol and oil of thyme, and shake the mixture occasionally, in a stoppered bottle, until it cools. Set it aside for a few days, if convenient, and then pass it through a wetted filter, following it with enough water to make five thousand cubic centimeters (5000 Cc.) [169 fl℥, 33 ♏]. *Note.*—The commercial aluminum sulphate (*not* alum) may be used for this preparation. This generally contains a trace of iron, but by allowing the liquid to stand, this will be gradually precipitated"—(*Nat. Form.*).

Liquor Zinci et Ferri Compositus (N. F.), *Compound solution of zinc and iron, Deodorant solution.*—"Zinc sulphate, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; ferrous sulphate, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; copper sulphate, three hundred and twenty-five grammes (325 Gm.) [11 oz. av., 203 grs.]; naphthol, three grammes (3 Gm.) [46 grs.]; oil of thyme, ten cubic centimeters (10 Cc.) [162 ♏]; diluted hypophosphorous acid (*U. S. P.*), twenty cubic centimeters (20 Cc.) [325 ♏]; water, a sufficient quantity to make five thousand cubic centimeters (5000 Cc.) [169 fl℥, 33 ♏]. Dissolve the zinc sulphate, ferrous sulphate, and copper sulphate, in five thousand cubic centimeters (5000 Cc.) [169 fl℥, 33 ♏] of boiling water, add the naphthol, and oil of thyme, and shake the mixture occasionally, in a stoppered bottle, until it is cold. Then add the diluted hypophosphorous acid, filter the liquid through a wetted filter, and lastly, pass enough water through the filter to make five thousand cubic centimeters (5000 Cc.) [169 fl℥, 33 ♏]. *Note.*—This solution is used as a simple deodorant and antiseptic for common domestic uses when it is unnecessary or impracticable to employ more powerful agents. When a deodorant solution is required for purposes where iron is objectionable, as for instance where woven fabrics are to be steeped in it, the compound solution of zinc and aluminum (F. 248) may be employed"—(*Nat. Form.*).

LIQUOR ZINGIBERIS (N. F.)—SOLUTION OF GINGER.

Synonym: *Soluble essence of ginger.*

Preparation.—"Fluid extract of ginger (*U. S. P.*), three hundred and thirty-five cubic centimeters (335 Cc.) [11 fl℥, 157 ♏]; pumice, in moderately fine powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.,]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Pour the fluid extract of ginger into a bottle, add to it the pumice, and shake the mixture thoroughly and repeatedly in the course of several hours. Then add the water in portions of about one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏], shaking well and frequently after each addition. When all is added, repeat the agitation occasionally during 24 hours, then filter, returning the first portions of the filtrate until it runs through clear, and, if necessary, pass enough water through the filter to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*Nat. Form.*).

Action and Medical Uses.—(Those of *Zingiber.*)

LIRIODENDRON.—TULIP TREE.

The bark of *Liriodendron Tulipifera*, Linné.

Nat. Ord.—Magnoliaceæ.

Common Names: *Tulip tree*, *Yellow wood*, *White wood*, *Poplar*, *Yellow poplar*, *Canoe wood.*

Illustration: Lloyd's *Drugs and Medicines of North America*, Vol. II. Pl. 26.

Botanical Source.—This tree is ordinarily about 80 feet high, with a diameter of 2 or 3 feet, but in favorable situations it frequently attains a height of 140 feet, with a diameter of 8 or 9 feet. The trunk is perfectly straight, cylindric, covered with a bark of a brown or grayish-brown color, smooth when young, rough and furrowed when old. At the top it divides rather abruptly into coarse, crooked branches, in somewhat regular order, giving a symmetrical aspect to the tree; the bark of the young branches is bluish or of a reddish tinge. The leaves are large, bright-green, alternate, on long petioles, smooth, shining, 3-lobed, lateral lobes ovate, middle one truncated, appearing as if cut off by a broad, shallow notch. Lateral lobes of the large leaves furnished with a tooth or additional lobe on their outside. There is a variety with the lobes of the leaves not pointed, but very obtuse. The flowers are large, solitary, terminal, tulip-shaped, yellowish, and 4 to 6 inches in diameter. The bracts are 2, triangular, falling off as the flower expands. The calyx is double, the inner and proper sepals being 3, large, oval, concave, veined, of a pale-green color, spreading at first, and afterward reflexed. The corolla consists of 6, 7, or more petals, which are obtuse, concave, veined, of a pale, yellowish-green color, marked with an irregular indented crescent of a bright-orange on both sides toward the base. Stamens numerous, with short filaments, and long linear, adnate anthers. Pistil a large, conical, acute body, upper half covered with minute, blackish, recurved stigmas; lower furrowed, being a mass of coalescing styles and ovaries. The fruit is a cone of imbricated seed-vessels, which are woody, and solid, their upper portion formed by the long, lanceolate style; the seeds are 2, blackish, and ovate, and one or both often abortive (L.—B.—W.).

History and Description.—This is one of the most magnificent and remarkable trees in the American forests, on account of its size, its elegant appearance when in flower, its therapeutical virtues, and its serviceable wood. It is found in rich soils from Maine to the Gulf of Mexico, and reaches its greatest size in the middle and southwestern states; its flowers appear in May and June. The wood is compact and light, and is extensively used as a substitute for pine. It is but slightly affected by dampness in the air, and is seldom injured by worms. The medicinal part is the bark of the trunk and root. It is whitish, with a yellow tinge when its epidermis is removed, light, fibrous, easily broken, of an unpleasant, somewhat aromatic odor, and an aromatic, pungent, slightly camphoraceous and amarous taste. The root-bark is colored the darkest. When fresh both kinds of bark are white, that of the root turning orange-colored on the surface next the bark, and finally gives the whole piece a streaked aspect; the tree bark turns yellowish. The fresh root bark is much the stronger, being "intensely acrid and bitter, producing, when chewed, a painful, biting sensation approaching to pepperiness" (Lloyd, in *D. and M. of N. A.*, Vol. II, p. 12). The virtues of this bark are somewhat impaired by time, though it may possess some activity after several years' keeping. Water or alcohol take up its active properties, which are dissipated by a continued heat at 100° C. (212° F.). The bark should be collected during the winter. Squirrels are fond of the mature flower buds, which have an aromatic, terebinthinate, bitter taste, and a turpentine-like odor. The leaves are purely bitter, and not acrid.

Chemical Composition.—Prof. J. P. Emmet (*Amer. Jour. Pharm.*, 1831, p. 5) discovered in the bark a peculiar, putty-like principle which he named *liriodendrin*, and which he considered as a camphor and intermediate between the volatile oils and the resins. Emmet obtained it in colorless scales or in needles, insoluble in cold water, soluble in alcohol, ether, or nitric acid, and having an aromatic, bitter, and somewhat acrid taste.

Prof. J. U. Lloyd, as well as Prof. Coblentz, failed to obtain liriodendrin in crystals. Wallace Procter (1872) was likewise unsuccessful. According to Lloyd, "the characteristic principles, aside from the ordinary constituents of plants, are a bitter extractive, volatile oils, resin, coloring principles, and an alkaloid. The aroma of the fresh bark depends upon the volatile oils; the acridity upon the resin; the bitterness (especially of the green leaves), upon the bitter extractive matter; the coloring matter and the alkaloid are not perceptible to either taste or smell" (*D. and M. of N. A.*, Vol. II, p. 15). The active constituent of the bark, according to the physiological investigations of Prof. Roberts Bartholow, is the alkaloid *tulipiferine* first obtained by Prof. J. U. Lloyd in 1886. According to Lloyd's description, it is colorless, odorless, tasteless, slightly soluble in water, but freely in diluted acids. Ammonia water in small amount precipitates it from aqueous solution, and an excess of ammonia dissolves it. All the alkaloidal reagents afford precipitates with solutions of its salts (*D. and M. of N. A.*, Vol. II, p. 16). (For account of color reactions, by Coblentz and Lloyd, see same authority.) The alkaloid was small in amount. A small quantity of a glucosid, soluble in benzol, was separated by Prof. Coblentz.

Action, Medical Uses, and Dosage.—Tulip-tree bark is an aromatic stimulant tonic, and has proved beneficial in *intermittents*, *chronic rheumatism*, *chronic gastric* and *intestinal diseases*, *worms*, and *hysteria*. In *hysteria*, combined with a small quantity of laudanum, it is said to be speedy, certain, and effectual, and also to abate the *hectic fever*, *night-sweats*, and *colliquative diarrhœa of phthisis*. The warm infusion is diaphoretic, and under certain states of the system has proven diuretic. It is now seldom used. Prof. Bartholow found the alkaloid tulipiferine to act energetically upon the nervous system of frogs and rabbits. Dose of the powdered bark, from 20 grains to 2 drachms; of the saturated tincture, which is the best form of administration, 1 fluid drachm; of the infusion, from 1 to 2 fluid ounces; of liriodendrin, from 5 to 10 grains.

Related Drug.—*Calycanthus floridus*, Linné, *Florida allspice*. *Nat. Ord.*—Calycanthaceæ. A shrub, native of the southern states, and common in cultivation both in this country and Europe. The stem is from 6 to 8 feet high and much branched. The leaves are opposite, entire, coriaceous, oval, and borne on short leaf-stalks. The entire plant is pervaded with an aromatic, camphoraceous odor, which is especially the case with the bark and roots. The flowers are nearly sessile and borne near the ends of the branchlets. They are of a brownish-purple color, and exhale, especially when wilted or crushed, an abundant fragrance compared by some to that of the strawberry.

This shrub, in common with other species of Calycanthus, is known also as *Carolina allspice*, *Sweet-scented shrub*, or "*Bubby.*" The *C. lævigatus*, Willdenow, and *C. glaucus*, are similar plants. The Californian *C. occidentalis*, Arnott and Hooker, is called *Spice bush.* The bark contains resin, volatile oil, tannin, and an acrid principle, and the seeds of *C. glaucus* yield fixed oils, albumen, starch, and 2.25 per cent of an alkaloid *calycanthine*, discovered by R. G. Eccles (*Proc. Amer. Pharm. Assoc.*, 1888, p. 84). It dissolves freely in chloroform and ether, and but slightly in water, and is easily decomposable by caustic alkalies, a new crystallizable alkaloid resulting. A strong sweet odor like that of oil of ylang-ylang is at the same time developed. The seeds of calycanthus contain no essential oil, while the bark, flowers, and leaves do. Dr. H. W. Wiley (*Amer. Chem. Jour.*, 1889; see also *Amer. Jour. Pharm.*, 1890, p. 96), confirms the occurrence of *calycanthine* in the seeds of *Calycanthus glaucus*, as well as the reactions described by Dr. Eccles, and obtained 47 per cent of fatty oil from the seeds. This plant has been suggested for use in medicine as a stimulant, antiperiodic, and aromatic; its virtues in these respects are, very probably, in no way superior to the many agents already named in our materia medicas, possessing similar properties.

LITHII BENZOAS (U. S. P.)—LITHIUM BENZOATE.

SYNONYMS: *Lithium benzoicum, Benzoas lithicus.*

FORMULA: $LiC_7H_5O_2$. MOLECULAR WEIGHT: 127.72.

Preparation.—Add carbonate of lithium to benzoic acid mixed with hot water, until effervescence ceases and the acid is dissolved and saturated; then filter and evaporate the filtrate to dryness upon a water-bath, thus: $Li_2CO_3 + 2HC_7H_5O_2 = 2LiC_7H_5O_2 + H_2O + CO_2$. The salt may be obtained in permanent crystals, by evaporating the solution and setting the capsule or vessel aside. In our own experience, 32 parts of benzoic acid, mixed with 128 parts of water, require 11 parts of carbonate of lithium; and the yield is, practically, about that of the weight of the acid employed. The impurities to be expected are such as accompany carbonate of lithium.

Description and Tests.—The official salt is "a light, white powder, or small, shining, crystalline scales; odorless, or of faint benzoin-like odor, and of a cooling, sweetish taste; permanent in the air. Soluble at 15° C. (59° F.), in 4 parts of water, and in 12 parts of alcohol; in 2.5 parts of boiling water and in 10 parts of boiling alcohol. The presence of sodium benzoate increases the solubility in water and lessens that in alcohol. When heated, the salt fuses; at a higher temperature it chars, emits inflammable vapors having a benzoin-like odor, and finally leaves a residue of lithium carbonate mixed with carbon. This residue imparts a crimson color to a non-luminous flame, and its aqueous solution has an alkaline reaction upon litmus paper. The aqueous solution (1 in 20) of lithium benzoate has a faintly acid reaction upon litmus. If 2 Cc. of ferric chloride T.S. be mixed with a small drop of ammonia water, and added to 2 Cc. of an aqueous solution of the salt, a voluminous brownish-pink precipitate of basic ferric benzoate will result. If 1 Cc. of diluted nitric acid be added to 0.2 Gm. of lithium benzoate dissolved in 2 Cc. of water, and the precipitated benzoic acid be removed by filtration, the clear filtrate should not be rendered turbid on addition of silver nitrate T.S. (absence of chloride), or of barium nitrate T.S. (absence of sulphate). If a concentrated solution of the salt be mixed with hydrochloric acid, a white precipitate of benzoic acid will be formed, which, after being separated from the liquid, and thoroughly washed and dried, should respond to the tests of purity given under *Acidum Benzoicum.* If the filtrate from this precipitate be evaporated to dryness and ignited, 1 part of the residue should be soluble in 5 parts of absolute alcohol. If to this alcoholic solution an equal volume of ether be added, no precipitate or turbidity should appear (limit of other alkalies). The aqueous solution (1 in 20) of the salt should remain unaffected by hydrogen sulphide T.S., or ammonium sulphide T.S. (absence of arsenic, lead, iron, aluminum, etc.), or by ammonium oxalate T.S. (absence of calcium), or by sodium cobaltic nitrite T.S. (limit of potassium); nor should silver nitrate T.S., or barium nitrate T.S., produce in it more than a very slight turbidity (limit of chloride and sulphate). If 1 Gm. of dry lithium benzoate be thoroughly ignited in a porcelain crucible, so as to burn off most of the carbonaceous matter, and the residue be mixed with 20 Cc. of water, it should require, for complete neutralization, not less than 7.8 Cc.

of normal sulphuric acid (corresponding to not less than 99.6 per cent of the pure salt), methyl-orange being used as indicator"—(*U. S. P.*).

Action, Medical Uses, and Dosage. The employment of lithium compounds in medicine is due to the fact that the urate of lithium is much more soluble than the other alkaline urates. Benzoate of lithium was recommended by E. B. Shuttleworth, as an agent superior to other compounds of lithium in the treatment of *gout*, and certain *disorders of the urinary organs*, more especially when there is an *excess of urates*, or of *uric acid*. It is a stable, non-deliquescent preparation, and consists of a combination of two agents, each of which have been found valuable in the treatment of certain forms of urinary difficulties, as well as in *chronic inflammation of the neck of the bladder*. It acts as a diuretic, and is especially useful to prevent gouty paroxysms, by preventing the formation and subsequent deposition of insoluble urates in the tissues, to remove the tendency to excessive deposition of uric acid or urates in the urine, and to render this fluid neutral or alkaline. It is useful in *chronic rheumatism*, where uric acid deposits are voided with the urine. It corrects *ammoniacal urine*, relieves *cystic irritation* from the presence of *gravel*, and is reputed to retard the formation of *biliary calculi*, and the consequent *hepatic colic*. The dose is from 1 to 30 grains, dissolved in a wineglassful of water, repeating the dose 3 or 4 times daily. Doses of from 1 to 5 grains are preferable to the larger doses.

Specific Indications and Uses.—Bad taste, fetid breath, and imperfect nutrition, associated with continuous urinary irritation; lumbar uneasiness extending to the bladder, urine bearing mucus and earthy phosphates, perineum full and tense with frequent desire to micturate, the urine passing with difficulty.

LITHII BROMIDUM (U. S. P.)—LITHIUM BROMIDE.

FORMULA: LiBr. MOLECULAR WEIGHT: 86.77.

SYNONYMS: *Lithium bromatum, Bromuretum lithicum.*

Preparation.—This salt may readily be prepared as follows: To a given amount of solution of hydrobromic acid, in a glass or porcelain evaporating basin, add gradually, with constant stirring, carbonate of lithium until the acid is saturated and effervescence ceases. Then filter, and evaporate the filtrate to dryness. The reaction is represented as follows: $2HBr+Li_2CO_3=2LiBr+H_2O+CO_2$. Owing to the low atomic weight of lithium, its bromide contains about 92 per cent of bromine, while the potassium bromide contains nearly 66 per cent, and the sodium bromide about 78 per cent. Its taste is not so disagreeable as that of the potassium salt, but more so than that of the sodium or ammonium bromides. It is incompatible with solutions of the carbonates of the other alkali metals, forming, by decomposition, carbonate of lithium (Li_2CO_3). "Lithium bromide should be kept in well-stoppered bottles"—(*U. S. P.*).

Description and Tests.—This salt is officially described as "a white, granular salt, odorless, and having a sharp, slightly bitter taste; very deliquescent. Soluble, at 15° C. (59° F.), in 0.6 part of water, and in 0.3 part of boiling water; very soluble in alcohol, also soluble in ether. At a low, red heat the salt fuses, and at a higher heat it is slowly volatilized. It imparts a crimson color to a non-luminous flame. The aqueous solution is neutral to litmus paper. If a few drops of chloroform be added to 5 Cc. of the solution (1 in 20), then 1 Cc. of chlorine water, and the mixture shaken, the liberated bromine will dissolve in the chloroform, communicating to it a yellow, or yellowish-brown color. If 0.5 Cc. of sodium cobaltic nitrite T.S. be added to 5 Cc. of the aqueous solution, no precipitate or turbidity should occur within 10 minutes (limit of potassium). One part of the salt should dissolve, without residue, in 5 parts of absolute alcohol, and the addition of an equal volume of ether should produce no precipitate in this solution (limit of other alkalies). The aqueous solution (1 in 20) should not be affected by hydrogen sulphide T.S. either before or after acidulation with a drop of hydrochloric acid (absence of arsenic, lead, copper, etc.), nor by ammonium sulphide T.S. (absence of iron, aluminum, etc.). In the aqueous solution no turbidity should be produced by the addition of barium chloride T.S (absence of sulphate). If a few drops of starch T.S. be added to 5 Cc. of the aqueous solution, then 1 or 2 drops of chlorine water, no blue color should appear (absence of iodide). If 0.3 Gm. of dry lithium bromide be dissolved in 10 Cc. of water, and 2 drops of potassium chromate T.S. be added, it should require 35.3 Cc. of decinormal silver nitrate V.S. to produce a permanent red color of silver chromate (corresponding to at least 98 per cent of the pure salt)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Roubaud, having investigated the action of this compound, arrived at the following conclusions: That it possesses the lithontriptic properties common to the lithium preparations; that, like other bromides, it affects reflex sensibility, with energy, and without that inconvenient action upon the heart usually following the use of bromide of potassium; and that it is useful as a sedative and antilithic in cases of *uric acid diathesis* accompanied by painful phenomena, or complicating neuroses. E. Levy considers it to have a beneficial effect in *gout*, but less so than some of the other salts of lithium, although its influence in diminishing the quantity of uric acid is very small; being very rich in bromine, it is more active than bromide of potassium, having a marked sedative influence upon the cerebro-spinal axis, without affecting the heart. Dr. S. W. Mitchell has found it to be a rapid and powerful soporific agent, more so than any of the other bromides used in therapeutics, and has employed it advantageously in the milder forms of *epilepsy*, in *headache*, *insomnia*, *wakefulness from mental or physical exertion*, and in *tinnitus aurium*, attended with pain in the temporal region and sleeplessness. It has likewise been found beneficial in certain cases of *spermatorrhœa*, *chronic irritability of the neck of the bladder*, and in *irritable uterus*. It is a remedy for *rheumatism* when dependent on *lithæmia*. The dose is from 3 to 10 grains, in well-diluted solution, which should be repeated 3 or 4 times a day. Owing to its extreme deliquescence, this salt should be kept in aqueous or alcoholic solution.

Specific Indications and Uses.—Flushed countenance; mental depression; insomnia, due to mental and physical exhaustion; severe inter-scapular pain; mild attacks of epilepsy; renal inactivity.

LITHII CARBONAS (U. S. P.)—LITHIUM CARBONATE.

FORMULA: Li_2CO_3. MOLECULAR WEIGHT: 73.87.

SYNONYMS: *Carbonas lithicus*, *Carbonate of lithia*, *Normal carbonate of lithium*.

Preparation.—This salt may be prepared by pouring a concentrated solution of chloride of lithium (LiCl) into a solution of ammonium carbonate, in ammonia water, continuing the process until the precipitate ceases to form upon heating. (For its preparation from the lithium-bearing minerals, *lepidolite*, *petalite*, *spodumene*, etc., see C. Thompson, *Amer. Jour. Pharm.*, 1883, p. 318; also L. F. Kebler, *ibid.*, 1898, p. 600.)

Description and Tests.—"A light, white powder, odorless, and having an alkaline taste; permanent in the air. Soluble in 80 parts of water at 15° C. (59° F.), and in 140 parts of boiling water; much more soluble in water saturated with carbon dioxide; insoluble in alcohol; soluble in diluted acids with active effervescence. At a low, red heat the salt fuses, at a higher temperature it loses some of its carbon dioxide, and is partially converted into lithium oxide. It imparts a crimson color to a non-luminous flame. The aqueous solution has an alkaline reaction upon litmus paper. If 1 Gm. of lithium carbonate be dissolved in 40 Cc. of diluted acetic acid, no insoluble residue should remain. Separate portions of this solution should not be affected by the following reagents: Hydrogen sulphide T.S. (absence of arsenic, lead, etc.), ammonium sulphide T.S. (absence of iron, aluminum, etc.), ammonium oxalate T.S. (calcium), silver nitrate T.S. (chloride), barium chloride T.S. (sulphate), or sodium cobaltic nitrite T.S. (limit of potassium). If 0.5 Gm. of lithium carbonate be dissolved in 2 Cc. of hydrochloric acid, and the clear solution be evaporated to dryness, the dry residue should completely dissolve in 3 Cc. of absolute alcohol, and an addition of 3 Cc. of ether should not render the solution turbid (limit of other alkalies). If 0.5 Gm. of the dry salt be mixed with 20 Cc. of water, it should require, for complete neutralization, not less than 13.4 Cc. of normal sulphuric acid (corresponding to at least 98.98 per cent of the pure salt), methyl orange being used as indicator"—(*U. S. P.*).

The alcohol-ether test serves to distinguish lithium carbonate from the more probable impurities, carbonates of potassium and of sodium, the chlorides of which elements are not soluble, especially in the latter of the menstrua named. Carbonate of lithium has been fraudulently adulterated with sugar of milk. This may be detected by its reduction of the copper salt in Fehling's solution; also by the adulteration emitting a caramel odor and turning black when exposed to calcination heat.

HYDROGEN LITHIUM CARBONATE, or the *Acid lithium carbonate* ($HLiCO_3$), is formed when freshly precipitated normal carbonate of lithium is suspended in water and exposed to a current of carbon dioxide. This salt is more soluble than the common carbonate, about 5 parts dissolving in 100 parts of water. It readily decomposes by exposure, and by evaporation on the water-bath, forming normal carbonate of lithium, carbon dioxide, and water, thus: $2HLiCO_3 = Li_2CO_3 + H_2O + CO_2$. The acid salt is not obtainable in solid form, except, perhaps, upon exceedingly slow evaporation of the bicarbonate solution (A. Goldammer, *Amer. Jour. Pharm.*, 1886, p. 347). It is, probably, the form in which it exists in mineral waters.

Action, Medical Uses, and Dosage.—Carbonate of lithium is considered a diuretic, and an energetic alkalizing agent of the urine. Administered internally, it causes the insoluble urates of the blood to form soluble urates of lithium, and hence has been advised in *gout*, and in *urinary deposits of uric acid* and *urates*, the same as the benzoate and the citrate of this alkali. The action of these agents may fail under certain conditions of the system, which, after having been ascertained, should be removed by appropriate measures previous to the administration of the lithium salts. Lithium carbonate is reputed a powerful solvent of *false membrane*. The dose of carbonate of lithium is from 1 to 4 grains, in a gill or so of hot water, repeating it 3 or 4 times a day. Garrod and Charcot advise it to be taken as follows: Water, charged with carbonic acid, 1 pint; bicarbonate of sodium, 3 grains; carbonate of lithium, 1½ grains. Mix, and keep well-stoppered. This quantity is to be used daily, in wineglassful doses, continuing to prepare and use it for 2 or 3 consecutive weeks.

Specific Indications and Uses.—Indigestion and acid eructations, with urinary deposits; articular swellings; gout.

Lithium and Its Compounds.—LITHIUM, *Lithium*. Symbol: Li. Atomic Weight: 7.01. Lithium is the metallic base of an alkaline oxide, lithia, and as yet has not been employed in medicine nor in the arts. The name, meaning "stony," is derived from the Greek *lithos*, a stone. The alkali was discovered by Arfvedson, in 1817; the element, by Bunsen and Matthiessen, in 1855. Lithium is very widely distributed, but in small quantities, a fact brought out by the development of spectrum analysis by Kirchhoff and Bunsen. The important minerals which contain it are *triphyline* (a phosphate of iron, manganese, sodium, and lithium), *petalite* and *spodumene* (both silicates of aluminum, sodium, and lithium), and *lepidolite* (a silicate of aluminum, potassium, and lithium). *Lithrophilite* and *amblygonite* are lithium-bearing minerals, also, occurring in North Carolina, and containing from 9 to 10 per cent of lithium oxide. Some mineral springs are likewise found to contain it, notably one in the Wheal Clifford Mine, in Cornwall, England. Our Gettysburg Springs, Penn., and the Buffalo Lithia Springs, Mecklenburg County, Va., likewise contain it. Lithium is much less oxidizable, and harder than either potassium or sodium, but softer than lead. When freshly cut it exhibits a silver-like surface which tarnishes by exposure. It melts at 180° C. (356° F.), is the lightest of all known solids, having a specific gravity of 0.5986, floats on benzin and on water, quickly oxidizing in the latter case, but without fusing. Lithium is of interest to the medical profession from the fact that several compounds of it are employed in medicine. They are chiefly the carbonate, benzoate, bromide, salicylate, and citrate, the first being employed in the production of the others. However, the claims as to the curative properties of lithia and lithia-water springs, in cases of gout, rheumatism, and uric acid diathesis, are liable to be exaggerated. It must be borne in mind, as Mr. L. Siebold, in 1889, has pointed out, that lithia owes its distinction over caustic soda or potassa as a uric acid solvent, only to its small molecular weight. Much less of lithia than of soda or potassa is necessary to dissolve the same quantity of uric acid. Furthermore, lithium in the form of chloride, or sulphate, has not the slightest solvent action upon uric acid (see *Amer. Jour. Pharm.*, 1889, p. 530, and 1894, p. 588).

LITHII BOROCITRAS.—Three borocitrates of lithium have been prepared for medicinal purposes—the mono-, the di-, and the tri-borocitrate of lithium. The first ($C_6H_6Li[BO]O_7 + H_2O$) requires for its production lithium carbonate, 4 parts; boric acid, 6 parts; and citric acid, 20 parts. The second ($C_6H_4Li_2[BO]_2O_7 + 2H_2O$) requires lithium carbonate 7 parts; boric acid, 12 parts; and citric acid, 20 parts. The third ($C_6H_5Li_2O_7 + B_2H_3O_6$) is prepared from lithium carbonate, 11 parts; boric acid, 18 parts; citric acid, 20 parts. The ingredients are dissolved in boiling water, evaporated to dryness, and powdered, or the concentrated, syrupy solution may be painted upon glass and scaled (E. Scheibe, 1880; *Amer. Jour. Pharm.*, 1881, p. 66).

Lithii Chloridum, *Lithium chloride*. Symbol: LiCl. Molecular weight: 42.38. This is prepared from *lepidolite*. This compound forms anhydrous octohedra, soluble in water and alcohol. Its taste is saline, and it fuses at a red heat. Exposed to the air it readily deliquesces. Evaporation of its *aqueous* solution produces slight decomposition, traces of hydrochloric acid being evolved, and a corresponding amount of lithium oxide, of an alkaline reaction, being formed. Lithium chloride combines with water of crystallization in two proportions, forming $LiCl+H_2O$ and $LiCl+2H_2O$.

Lithii Iodidum, *Lithium iodide*. Symbol: LiI. Molecular weight: 133.54. This salt may be prepared by the process for making bromide of lithium, excepting that *hydriodic* is substituted for *hydrobromic acid*. Prof. Zeiset, of Vienna, prepared it by double decomposition of ferrous iodide with lithium carbonate (*Amer. Jour. Pharm.*, 1882, p. 308). This salt is crystalline, and forms with $3H_2O$ deliquescent, prismatic crystals which, when exposed, have a tendency to become yellow, on account of the liberation of iodine. It dissolves readily in water and alcohol, and should be kept in tightly-stoppered vials.

Effervescing Lithium Carbonate may be prepared by heating in a flat vessel, to 100° C. (212° F.), with constant stirring until a granular product results, a mixture (all well powdered) of lithium carbonate (10 parts), sodium bicarbonate (50 parts), and citric acid (40 parts). Pass the product through a coarse sieve, and place the granules in closely-stoppered vials.

LITHII CITRAS (U. S. P.)—LITHIUM CITRATE.

Formula: $Li_3C_6H_5O_7$. Molecular Weight: 209.57.

Synonyms: *Lithiæ citras*, *Lithium citricum*, *Citrate of lithia*.

Preparation.—Take of carbonate of lithium, 1 part; citric acid in crystals, 2 parts, or a sufficient quantity; distilled water, a sufficient quantity. Mix the carbonate of lithium with 2 parts of water heated to the temperature of 82.2° C. (180° F.), in a capacious glass or porcelain vessel. Then dissolve the citric acid in 4 parts of water, at the same temperature, and gradually pour a sufficient amount of the acid solution, with constant stirring, into the mixture of carbonate of lithium and water, to dissolve the carbonate. Then raise the temperature to 93.33° C. (200° F.), and cautiously stir into the solution a few grains of carbonate of lithium; if effervescence ensues, continue adding more of the carbonate until it is in *slight* excess; now filter the solution, evaporate, at a gentle heat, to the consistence of syrup; then dry in a warm-air closet, until the salt will pulverize, and inclose it in a well-stoppered bottle.

As usually made, citrate of lithium is a very unsatisfactory preparation, from its proneness to deliquesce. To a great extent, this property is derived from the *excess* of citric acid usually present. We will call attention to the fact that, by reversing the process of the *U. S. Pharmacopœia* (1870) and adding the solution of citric acid (q. s.) to the carbonate of lithium, better results appear to be obtained than with the process of the Pharmacopœia. Citrate of lithium, prepared as above, may contain a *slight* proportion of carbonate of lithium, an unimportant contamination. It is liable to contain all the impurities present in both the citric acid and the carbonate of lithium employed in its preparation. "Lithium citrate should be kept in well-stoppered bottles"—(*U. S. P.*).

Description and Tests.—The *U. S. P.* describes the salt to be "a white powder, odorless, and having a cooling, faintly alkaline taste; deliquescent on exposure to air. Soluble in 2 parts of water at 15° C. (59° F)., and in 0.5 part of boiling water; almost insoluble in alcohol or ether. At a red heat the salt chars, emits inflammable vapors of a pungent odor, and finally leaves a black residue of lithium carbonate mixed with carbon. It imparts a crimson color to a non-luminous flame. The aqueous solution is neutral to litmus paper. If the aqueous solution (1 in 20) of lithium citrate be boiled with an equal volume of calcium chloride T.S., a white precipitate will be deposited"—(*U. S. P.*). Crystallizable lithium citrate is not deliquescent. According to Mr. Nunnery it has the composition $Li_3C_6H_5O_7+4H_2O$, corresponding to 74.3 per cent of anhydrous salt. (For a valuable résume of the methods of its preparation and analysis, see C. Thompson, *Amer. Jour. Pharm.*, 1883, p. 314.)

As regards tests, the *U. S. P.* directs as follows: "Separate portions of the solution, slightly acidulated with acetic acid, should not be affected by hydrogen sulphide T.S. (absence of arsenic, lead, etc.); ammonium sulphide T.S. (iron, aluminum, etc.); ammonium oxalate T.S. (calcium); or sodium cobaltic nitrite T.S. (limit of potassium). With barium nitrate T.S., or with silver nitrate T.S., not more than a slight turbidity should appear (limit of sulphate and of chloride). If the residue obtained by calcining the salt at a red heat be dissolved in a slight excess of diluted hydrochloric acid, and the filtrate evaporated to dryness, a portion of the residue, treated with 5 parts of absolute alcohol, should completely dissolve, and the addition of an equal volume of ether should not render the solution turbid (limit of other alkalies). If 1 gramme of dry lithium citrate be thoroughly ignited in a porcelain crucible, so as to burn off most of the carbonaceous matter, and the residue be mixed with 20 Cc. of water, it should require, for complete neutralization, not less than 14.2 Cc. of normal sulphuric acid (corresponding to at least 99.2 per cent of the pure salt), methyl orange being used as indicator"—(U. S. P.).

Action, Medical Uses, and Dosage.—Citrate of lithium is employed in the same affections as lithium carbonate, and in the same doses; being the more soluble of the two, it has been preferred to that salt. Its dose, as with that of the carbonate, may be carried to from 15 grains to even half a drachm; but these large doses are apt to occasion cardialgic dyspepsia. Lithium citrate is excreted in the urine as a carbonate. The iodide and sulphate of lithium have occasionally been employed therapeutically, but no especial advantage has yet been derived from their use. The specific indications for lithium citrate are those given below.

Specific Indications and Uses.—Indigestion and acid eructations, with urinary deposits; articular swellings; gout.

LITHII CITRAS EFFERVESCENS (U. S. P.)—EFFERVESCENT LITHIUM CITRATE.

Preparation.—"Lithium carbonate, seventy grammes (70 Gm.) [2 ozs. av., 205 grs.]; sodium bicarbonate, two hundred and eighty grammes (280 Gm.) [9 ozs. av., 384 grs.]; citric acid, three hundred and seventy grammes (370 Gm.) [13 ozs. av., 22 grs.]; sugar, in fine powder, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Triturate the citric acid with about two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.] of sugar, and dry the mixture thoroughly. Then incorporate with it, by trituration, the lithium carbonate and sodium bicarbonate, and enough sugar to make the product weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Keep the powder in well-stoppered bottles"—(U. S. P.).

Action, Medical Uses, and Dosage.—(See *Lithii Citras.*) This furnishes a pleasantly acidulous form for the administration of lithium citrate. Dose, ½ to 2 drachms.

LITHII SALICYLAS (U. S. P.)—LITHIUM SALICYLATE.

FORMULA: $LiC_7H_5O_3$. MOLECULAR WEIGHT: 143.68.

SYNONYM: *Lithium salicylicum.*

Preparation.—Heat together, until effervescence ceases, a mixture of lithium carbonate, 3 parts, salicylic acid, 11 parts, and water, 25 parts. Filter, wash, evaporate, and dry the salt, and place it in a closely-stoppered vial.

Description and Tests.—This salt is official as "a white or grayish-white powder, odorless, and having a sweetish taste; deliquescent on exposure to air. Very soluble in water and in alcohol. When heated, the salt is decomposed, emitting the odor of phenol, and finally leaving a residue of lithium carbonate and carbon. It imparts a crimson color to a non-luminous flame. The aqueous solution slightly reddens blue litmus paper. If copper sulphate T.S. be added to an aqueous solution (1 in 20) of the salt, the mixture should have a bright-green color. If a small quantity of ferric chloride T.S. be added to an excess of a concentrated aqueous solution (1 in 4) of lithium salicylate, a deep-red color will be produced, which, after the liquid is largely diluted and mixed with more ferric chloride T.S., will change to a deep bluish-violet tint. Upon adding to 1 Gm. of the salt, in a test-tube, about 1 Cc. of concentrated sulphuric acid, then cautiously, in drops, about 1 Cc. of methylic alcohol, and heating the mixture to boiling, the odor of oil of gaultheria will be evolved. Hydrochloric or sulphuric acid produces in the aqueous solution a voluminous precipitate of salicylic acid, which, when separated and washed, should conform to the reactions and tests given under *Acidum Salicylicum*. The aqueous solution should be colorless (absence of iron and organic coloring matters), and should not effervesce on the addition of diluted acids (absence of carbonate). If 1 part of the salt be agitated with 15 parts of sulphuric acid, no color should be imparted to the acid within 15 minutes (absence of readily carbonizable, organic impurities). If a portion of the residue, left after ignition, be dissolved in diluted acetic acid, separate portions of the filtrate should not be rendered turbid on the addition of a few drops of barium chloride T.S. (absence of sulphate), nor be rendered more than slightly turbid by silver nitrate T.S. (limit of chloride). Other portions of the same filtrate should not be affected by hydrogen sulphide T.S. (absence of arsenic, lead, etc.); nor by ammonium sulphide T.S. (aluminum, etc.); nor by ammonium oxalate T.S. (calcium); nor by sodium cobaltic nitrite T.S. (limit of potassium). If another portion of the residue, left after ignition, be dissolved in diluted hydrochloric acid, and the filtrate evaporated to dryness, a portion of the residue, when treated with 5 parts of absolute alcohol, should completely dissolve, and the addition of an equal volume of ether should not render the solution turbid (limit of other alkalies). If 2 Gm. of dry lithium salicylate be thoroughly ignited in a porcelain crucible, so as to burn off most of the carbonaceous matter, and the residue be mixed with 20 Cc. of water, it should require, for complete neutralization, not less than 13.8 Cc. of normal sulphuric acid (corresponding to at least 99.13 per cent of the pure salt), methyl-orange being used as indicator"—(*U. S. P.*). M. Julliard (*Amer. Jour. Pharm.*, 1887, p. 400) records an adulteration of lithium salicylate with from 12 to 15 per cent of sodium salicylate.

Action, Medical Uses, and Dosage.—This agent, like the other lithium compounds, is employed in *gout*, and, like the sodium salicylate, as a remedy for *rheumatic affections of the joints*, claims having been made that it succeeds where the latter fails. It contains more of the salicylic acid radical than the sodium compound, and large doses have been charged with the induction of persistent, painful diarrhœa. Dizziness, tinnitus, impaired hearing and headache, are also effects of immoderate doses, the latter ceasing first. The average dose is from 1 to 8 grains, though as high as 75 grains have been given in a day. Such large doses are unnecessary and unsafe.

LITHOSPERMUM.—LITHOSPERMUM.

The roots and seeds of *Lithospermum officinale*, Linné.

Nat. Ord.—Borraginaceæ.

Common Name: *Common gromwell.*

Illustration: Woodville's *Medical Botany*, Plate 105.

Fig. 162.

Lithospermum canescens.

Botanical Source and Chemical Composition.—This is a large, rough, hairy weed, a native of Europe, and very common in some parts; it is rarely naturalized in the eastern section of the United States, and is found growing in dry and gravelly soils. The stem is from 1 to 2 feet high, erect, much-branched, and covered with small, stiff hairs. The leaves are numerous, veiny, alternate, sessile, ovate, and acute at the apex. They are covered with a close, grayish pubescence, which is rough and stiff on the upper surface, but softer beneath. The flowers appear in June, and are small, in axillary or terminal, revolute, leafy spikes. The calyx has 5 acute lobes. The corolla is salver-form, slightly exceeds the calyx, and is of a pale-yellow color. The fruit consists generally of one or two smooth, hard, shiny, gray, ovate nutlets, which are attached to the persistent calyx by the base. A native species of Lithospermum, *L. latifolium*, Michaux, closely resembling *L. officinale*, especially in the smooth, polished nutlets, and considered a variety of it by Willdenow, is common in the open woods of the middle states. It has green leaves, and is more loosely branched than the introduced species. The ash of the seeds, according to Hornberger (1875), is rich in calcium carbonate (68.2 per cent) and silica (19.39 per cent). The root bark of *Lithospermum arvense*, Linné, contains a red coloring matter, *lithospermum red*, isolated by Ludwig and Kromayer (*Archiv der Pharm.*, 1858, Vol. CXLVI, p. 278).

Action, Medical Uses, and Dosage.—This plant is diuretic, possessing properties analogous to those of the *Onosmodium Virginianum*, and deserves further investigation. It has proved efficient in both *acute* and *chronic cystitis*, and likewise in certain *calculous affections*. A strong infusion of the dried root, 1 ounce to water 1 pint, may be given every 3 hours in tablespoonful doses. The seeds, in powder, are used in half-teaspoonful doses every 4 or 5 hours (King).

Related Species.—*Lithospermum canescens*, Lehm, *Hoary puccoon*, or *alkanet*; also called in some sections *Indian paint root*. Dr. R. C. Ely (*E. M. J.*, 1882 and 1886) claims for this plant wonderful healing properties in *cuts, wounds, old sores, gunshot wounds, eczema*, and *burns*. The ointment is used. It is prepared by simmering the root in lard or fresh butter. The ointment has a pale-purple color, due to a coloring matter identical with alkanet found in the roots of the species of Lithospermum. (See illustration on page 1198.)

LOBELIA (U. S. P.)—LOBELIA.

"The leaves and tops of *Lobelia inflata*, Linné, collected after a portion of the capsules have become inflated"—(*U. S. P.*).

Nat. Ord.—Lobeliaceæ.

Common Names: *Lobelia, Indian tobacco*, etc. (see *History*).

Illustrations: Lloyd's *Drugs and Med. of N. A.*, Plate 34; Bentley and Trimen, *Med. Plants*, 295.

Fig. 163.

Lobelia inflata.

Botanical Source.—This plant, generally known as Wild, or Indian tobacco, is an annual or biennial indigenous plant, more commonly the latter, with a fibrous, yellowish-white root, and an erect, angular, very hairy stem, in the full-sized plant much branched, and from 6 inches to 3 feet in height. The leaves are alternate, scattered, sessile, ovate-lanceolate, serrate, veiny, and hairy. The flowers are small, numerous, pale-blue, on short peduncles, each originating from the axil of a small leaf. The calyx consists of 5, subulate segments. The corolla is tubular, small, slit on the upper side, ventricose at the base; the limb bilabiate; tube prismatic; segments spreading, acute; two upper ones lanceolate, three lower ones oval. The anthers are united into an oblong, curved body, and of a purple color; filaments white. Style filiform; stigma curved, 2-lobed, inclosed by the anthers. The capsule is 2-celled, ovoid, inflated, striated, 10-angled, crowned with the persistent calyx. The seeds are numerous, small, oblong, and brown (L.—B.—W.).

Fig. 164.

Seed of Lobelia inflata.

History.—Lobelia is very plentiful throughout the United States, and is usually found thriving in dry soil along roadsides, in dry fields, and old pastures, as well as in woodland grazing grounds. It flowers from July to September, or until frost checks its blooming. It grows from a few inches to 2 feet in height, and is peculiar in that it will blossom when the flowering time arrives, even if it be but an inch in height. The plant has alternate leaves, and flowers of a light blue color, inconspicuous, yet very pretty when closely examined, having the characteristic split corolla tube (along the upper side) of the *Lobelias*. The fruit is an inflated pod, resembling a small balloon, easily compressible, and contains an innumerable number of minute brown seeds. The plant, when broken or cut, exudes an acrid, milky juice, imparting a taste very much resembling that of tobacco. The whole plant is active, but the leaves and seeds are more usually employed. The root is supposed to be more energetic, medicinally, than any other part of the plant. The proper time for gathering the plant is from the last of July to the middle of October, during which period the seed-vessels are in great abundance. The plant should be dried in the shade, and then be preserved in packages, or covered vessels, more especially if it be reduced to powder. When dried, it has a faint, nauseous, rather disagreeable odor, and a strong, acrid, nauseous taste developed by chewing, somewhat similar to that of tobacco, which powerfully affects the throat and fauces, occasioning ptyalism and sickness at stomach. The leaves form a greenish powder; the seeds a brownish. Hot water, vinegar, ether, or alcohol take up its medicinal principles, but boiling dissipates them.

Few drugs are more favored among Eclectic physicians than lobelia, and certainly none others have so interesting a history. This plant is vulgarly known as Indian tobacco, though why it should have this name is difficult to say, as there is no distinct record as is the case with other plants (unless we accept the statements made that it was known to the Penobscot tribes), that it was ever employed as a medicine by the natives. As the plant resembles somewhat in taste the common tobacco (*Nicotiana Tabacum*), and was for this reason called Wild tobacco, the authors of "*Drugs and Medicines of North America*" advance the opinion that if known as Wild tobacco it was but a step farther to call it Indian tobacco, on the presumption that a tobacco that was wild would be used by the Indians. The earliest botanists did not use a common name for lobelia, and it was not until 1810 that we find the first popular name—Bladder-pod—given it by Aiton. Following this came Inflated lobelia and Bladder-pod lobelia for obvious reasons. So much for names suggested by the plant itself. When it came to be used in medicine a new set of popular names, having reference to its properties, were applied. Thomson and Cutler called it Emetic weed and Emetic herb. These names suggested those to follow—Puke weed, Vomit weed, and Gag root. Although the term gag root was employed, the root was never used in medicine, statements to the contrary notwithstanding. One of its very old names is Eye-bright—a name properly belonging to *Euphrasia officinalis*, and, from its use as an anti-asthmatic, some writers have referred to it as Asthma weed. Its generic name—lobelia—was given it in honor of Matthias de Lobel (de l'Obel), a distinguished botanist of the sixteenth century; its specific name—inflata—on account of its inflated seed pods.

Though lobelia grows nearly all over this country, much of the drug supply of commerce comes from the mountainous districts of North Carolina. Lobelia was known to the Penobscot Indians, and was also extensively used by the people in New England in domestic practice, long before the time of Samuel Thomson, its assumed discoverer. Though used by a few in domestic practice, the credit for the introduction of lobelia into medical practice is due to Drs. Manasseh Cutler and Samuel Thomson. The latter claims to have been the first to employ it and, indeed, it would seem probable that Cutler learned the use of it from Thomson. As before stated, few drugs have been so notoriously historical as the one under consideration. It became widely known to the people during the early part of the present century, through the famous trials of Drs. Thomson and Frost. The name of lobelia became so odious, that to be known as a "lobelia doctor" was sufficient to subject the physician to all manner of ridicule. The prosecution of Thomson was brought at the instigation of a jealous physician—Dr. French—backed by a jealous profession. While under treatment by Dr. Thomson, one Ezra Lovett, of Beverly, Mass., died after a tedious course of medicine applied after the peculiar method of Thomson. The prosecutors charged the latter with killing Lovett with lobelia. Thomson denied it, claiming the drug employed to be marsh rosemary. The prosecutors showed their ignorance by exhibiting to to the court some of the powder alleged to have been employed, which powder actually proved to be marsh rosemary. Judge Parsons instructed the jury to acquit Thomson. The memory of lobelia was again revived, in 1837, by the tria of Dr. R. K. Frost, of New York City, for the alleged killing of T. G. French. Th charge against Frost was that he put French into a "vapor bath" and "administered to him poisonous decoctions of lobelia, and giving deleterious herbs which no reasonable man would administer to a dog." He was tried for manslaughter, the trial lasting ten days, and the jury found him guilty in the fourth degree, but recommended him to the mercy of the court. The court sentenced him to three months' imprisonment.

The first published account of the use of lobelia in regular medicine, is by the Rev. Manasseh Cutler, LL. D., in his "*Account of Indigenous Vegetables*" (1785), stating that the leaves, if chewed, "produce a giddiness and pain in the head, with a trembling agitation of the whole body." Cutler was a great sufferer from asthma and found this drug to give him more relief than any other, and as Thomson had been in the habit of using lobelia for this complaint, and practicing so near to the home of Cutler, in Massachusetts, it is fair to presume that the latter derived his knowledge of the drug from Thomson. As early as 1820, the first edition of the *U. S. P.* recognized lobelia and it has continued official until the present time.

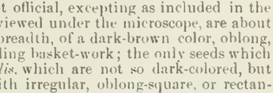
Description.—The *U. S. P.* officially describes lobelia as follows: "Leaves alternate, petiolate, the upper ones sessile, ovate or oblong, about 5 Cm. (2 inches) long, irregularly toothed, pubescent, pale-green; branches hairy, terminating in long racemes of small, pale-blue flowers, having an adherent, 5-toothed calyx, which is inflated in fruit, a bilabiate corolla, and 5 united stamens; odor slight, irritating; taste mild, afterward burning and acrid"—(*U. S. P.*).

LOBELIA SEED.—Lobelia seeds are not official, excepting as included in the inflated pods of the plant. Lobelia seeds, viewed under the microscope, are about $\frac{1}{33}$ of an inch in length, $\frac{1}{35}$ of an inch in breadth, of a dark-brown color, oblong, with ridges and furrows, somewhat resembling basket-work; the only seeds which resemble them are those of the *L. cardinalis*, which are not so dark-colored, but are oval, or almond-shaped, reticulated with irregular, oblong-square, or rectangular reticulations not so well defined, and are of larger size (P.—F. Curtis).

Lobelia in the powdered form enters into the composition of the compound emetic powder, and is a constituent of the compound tincture of lobelia and capsicum (King's Antispasmodic), and the acetous emetic tincture. The oil, as before stated, is contained in the stillingia liniment. Specific lobelia, the preferred preparation of this plant, has a deep wine color and a peculiar fatty odor. When dropped into water it produces a white turbidity, forming a yellowish-white, milky liquid, when viewed by reflected light. It mixes with alcohol without change. The taste is peppery and persistent, leaving a disagreeable acrid impression in the throat and fauces. A few drops only will sicken some persons and even produce emesis. Specific lobelia contains a large amount of oil of lobelia, which preserves the alkaloid in the preparation. Investigations made by Prof. Lloyd demonstrated that solutions devoid of the oil were inferior, being altered by age. Specific lobelia retains its energies indefinitely.

Chemical Composition.—The active principle of lobelia is an acrid, irritating, unstable alkaloid, called *lobeline*, first obtained by Wm. Procter, Jr. (*Amer. Jour. Pharm.*, 1838, p. 98, and 1841, p. 1), as a yellowish liquid of faintly aromatic taste, soluble in water and exhibiting an alkaline reaction. It exists in combination with a vegetable acid—*lobelic acid*—forming precipitates with solutions of metallic salts (Pereira, 1842). Lobeline and its salts are exceedingly active emetics. Though stable when thus combined, it readily decomposes when freed from contact with the other constituents of the plant. Heat applied to either an aqueous preparation or an alcoholic tincture of lobelia, destroys this alkaloid, hence a decoction or hot infusion of this plant is irrational. *Lobeline* was obtained by Prof. Lloyd (see *D. and M. of N. A.*, by J. U. and C. G. Lloyd, Vol. II, pp. 75 and 76), by depriving lobelia seeds of fat by means of benzin, abstracting the seeds with alcohol acidulated with acetic acid in a percolator, and evaporating and extracting the alkaloid with ammoniated ether. As thus obtained, *lobeline*, after further purification, is a colorless, odorless, amorphous, and non-hygroscopic alkaloid, of an alkaline reaction, soluble in alcohol, chloroform, benzol, ether, and carbon bisulphide. It is also somewhat soluble in water and exhibits in solution alkaloidal reactions. No crystallizable salts could be obtained, though Prof. Procter (*loc. cit.*) alludes to a crystallizable muriate, sulphate, nitrate, and oxalate of *lobeline*. Paschkis and Smita obtained from *lobeline* benzoic acid by oxidation with potassium permanganate (*Amer. Jour. Pharm.*, 1890, p. 339).

Fig. 165.



Crystals of Inflatin, typical form.

H. von Rosen (*Amer. Jour. Pharm.*, 1889, p. 393), isolated two alkaloids, one liquid (*lobeline*) and another solid.

According to Prof. Lloyd, the plant also contains a crystallizable, non-basic substance, to which he gave the name *inflatin*. This body exists in the plant, intimately associated with the alkaloid and some *volatile oil* (see below). *Inflatin* is tasteless and odorless, "insoluble in water, or glycerin, but soluble in carbon disulphide, benzol, chloroform, ether, and alcohol, in the order given" (Lloyd, *D. and M. of N. A.*, Vol. II, p. 78). It is not important in a medical sense.

The *lobelacrin* of Enders (1871), which was obtained in warty tufts of a brown color, was regarded by W. H. D. Leurs (*Pharm. Jour. Trans.*, Vol. VIII, 1878, p. 562), as probably *lobeliate of lobeline*. Lobelia contains a non-acrid, *volatile oil* of a pungent odor, possessing but little taste and no acridity. It was named *lobelianin* by Pareira in 1840. In addition, the plant contains about 30 per cent of non-volatile oily matters. The impure oil (so-called) of lobelia, so extensively employed by Eclectic doctors, is simply a syrupy extract of lobelia made with stronger alcohol, preferably acidulated with acetic acid. This so-called oil is the active constituent of that favorite Eclectic preparation, the compound stillingia liniment. The pure or true *fixed oil* of lobelia is non-acrid and bland, but as usually obtained (impure), is acrid and of a green color. The fixed oil of lobelia (impure) may be obtained by bruising the seeds between heated rollers, and pressing while hot in a strong linen cloth, between proper iron plates. Its consistence is nearly like that of linseed oil, and eminently possesses the drying qualities common to many fixed oils. It possesses all the medicinal properties of the seeds.

Action, Medical Uses, and Dosage.—Lobelia, in the ordinary sense of the term, is not a poison. Undoubtedly, its injudicious use has, and might produce death, but the same is true of many other drugs that are not ordinarily considered as poisons. That the alkaloid lobeline will kill animals, has been fully demonstrated. A drop of the alkaloidal solution placed upon the tongue of a strong, healthy man, instantly vomited him. To this property of its alkaloid, is undoubtedly due the failure of lobelia to act as a toxic agent. Its emetic action is so prompt and decided, that the contained alkaloid could not, under ordinary circumstances, produce fatal results. Given in cases *in extremis*, the resulting exhaustion from repeated emesis would very likely hasten death, but death would be more likely due to the act of vomiting exhausting the patient, than to any poisonous effect of the medicine.

If lobelia be chewed, it gives rise to an acrid, prickling, and persistently pungent sensation in the throat and fauces, accompanied by slight nausea and a feeling of warmth and distension along the esophageal tract and in the stomach. The sensation is not very unlike that produced by tobacco. The salivary and buccal glands are impressed, pouring out saliva and mucus in abundance. A sense of epigastric depression succeeds, followed by profound nausea, and if the amount chewed be large enough, severe and thorough emesis results. The gastric mucus is secreted in great abundance and ejected with the contents of the stomach. The emetic action of lobelia is extremely depressing, and is usually accompanied by profuse perspiration. Oppressive prostration, relaxation of the muscular system, and a languid pulse accompany the emetic stage. The depression, however, is of short duration, and is immediately followed by a sense of extreme satisfaction and repose. Under its action the mental powers are unusually acute, and the muscles are powerfully relaxed. The circulation is enfeebled by large and strengthened by small doses, and the bronchial secretions are augmented. When the drug does not prove emetic, it is said that it usually purges. Death, when due to lobeline, is said to result from respiratory paralysis.

Lobelia is nauseant, emetic, expectorant, relaxant, antispasmodic, diaphoretic, sialagogue, sedative, and, secondarily, occasionally cathartic and diuretic and astringent. It is in no sense a narcotic. The earliest use of lobelia, as will be seen from its history, was that of an emetic, and for this purpose it is still employed when we desire the action of a systemic emetic. Though momentarily depressing, its beneficial after-effects cause it to be preferred above other agents, ipecac not excepted, when such an agent is required. Its action is somewhat modified by combination with ipecacuanha, and other vegetable emetics, and rendered safer and more effectual. Such a combination is the emetic powder.

It may be used in forming stages of *febrile affections*, and is especially indicated by a general sluggishness of the whole system with an oppressive feeling, and the tongue is heavily and foully coated at the base. In some chronic diseases its emetic action is salutary in arousing the system from its atonic state. When its emetic action is desired, small doses should be frequently administered until profound nausea is induced, and then the drug should rapidly be pushed to emesis. Copious draughts of warm water will hasten its action and render the act of emesis much easier. Spasmodic movement is incompatible with nervous and muscular relaxation, hence we find prompt relief in many spasmodic conditions by the use of this drug.

The powerfully relaxant properties of lobelia render it a very efficient agent in several conditions, whose chief feature is the *spasmodic element*. For its control over spasmodic movement, nauseant or emetic doses must be given. For this purpose it may be exhibited in *chorea, tetanus*, "*worm fits*" of children, *hysteric* and *infantile convulsions, epileptiform* and other *convulsive disorders*. For *puerperal eclampsia*, chloroform by inhalation, and morphine subcutaneously injected, give better results than lobelia, though the latter drug has been used with success in some cases. Lobelia is of value in obstetrical practice. It powerfully subdues muscular rigidity. It is the remedy to overcome a *rigid os uteri* during parturition, and at the same time it relaxes the perineal tissues. This it does when there is fullness of tissue—a thick, doughy, yet unyielding, os uteri; when, however, the edge of the os is thin and closely drawn, sharp like a knife edge, full doses of gelsemium are indicated. For its antispasmodic action it may be given by mouth and by rectum. *Intestinal obstructions* have been overcome by lobelia when other agents would have been inadmissible, hence it is of value in the reduction of *strangulated hernia*, an enema being employed. *Intussusception* and *fecal impaction* may be treated with this drug when cathartics would result fatally. It is for its antispasmodic effects that it is given in *asthmatic paroxysms, spasmodic croup*, and *whooping-cough*. It has been successfully used to overcome the violent convulsions resulting from *strychnine poisoning*. Chloroform and ether excepted, it is the best antispasmodic drug in the materia medica, and much safer than either of these. In the so-called "*worm fits*" it should be carried to nausea and then followed by santonin, after which a mild purgative may be given.

Lobelia is a stimulant to the sympathetic system. It improves the innervation of the parts supplied by both the pneumogastric and sympathetic nerves. The appetite and digestion are improved by small doses of the drug. It will frequently be found indicated in *indigestion* and *dyspepsia*. We have frequently used it in small doses for *sick headache* due to gastric derangement. It is indicated by the feeling of "qualmishness" and nausea present. Though frequently overlooked when we are looking for a drug to overcome *intestinal atony*, lobelia will be found one of the best drugs at our command for the relief of *habitual constipation*. ℞ Specific lobelia, gtt. i—ij, every 2 hours. Administered with podophyllin it tends to prevent the costiveness so frequently the result after using a "bowel persuader" in cathartic doses. It increases peristalsis. Small doses of it relieve *infantile colic*.

Lobelia is *the* drug for *angina pectoris, neuralgia of the heart*, and *pulmonary apoplexy*. Though evanescent in its action, large doses of specific lobelia (about 20 drops), may be administered with the expectation of relieving the patient. The dose may be repeated if necessary. Lobelia is a cardiac stimulant, thus we class it with the sedatives, for all sedatives in medicinal (small) doses are heart stimulants. When the circulation exhibits a markedly slow pulse-wave it will be better corrected by lobelia than by any other drug we possess. In fact the most prominent indication for the drug is the full, oppressed, sluggish, doughy pulse. Associate this with præcordial oppression, thoracic pain, difficult breathing, soreness or bruised feeling within the chest, nausea with tongue heavily coated at base, fullness of tissue, and we have before us a fair range of the action of lobelia. It is a good remedy in *cardiac congestion*.

Perhaps the most important use for this drug will be in the treatment of respiratory affections. For this class of diseases no remedy is more highly valued by physicians of our school. "Lobelia is an admirable pectoral remedy. As a nauseant expectorant it has no equal. When an emetic is desired in pulmonary complaints it is one of the most efficient that can be employed. It has come to be the first of remedies for *spasmodic asthma*, and is not without utility in *whooping cough*. It improves innervation and the circulation, and is one of the best remedies to employ in congestive conditions. It is frequently indicated in *pleurisy* and *pleuro-pneumonia*. As a sedative it ranks between veratrum and aconite. *Acute pneumonia*, with tendency to congestion, the breathing being oppressed, is quickly relieved by lobelia. All *chronic forms of sore throat*, especially when ulcerated, are benefited by it. *Chronic pneumonia*, *bronchitis*, and *laryngitis* are all conditions in which lobelia will be of great service. In *asthenic laryngitis* of children it is exceedingly useful. It is a remedy of great value in *chronic catarrh*, dry, hard, or barking *coughs*, *colds*, and all forms of *irritation of the respiratory tract*, with oppression. It relaxes the tissues, favors expectoration when a large quantity of mucus is secreted and there is want of power to remove it. The indications for this drug are the full, oppressed, or small, feeble pulse, præcordial oppression, with difficult respiration, oppression anywhere in the chest, with accumulation of the bronchial secretions, cough with loud mucous *rales* within the chest. The "acetous emetic tincture," which contains this agent, may be used to fulfil most of the indications for this drug. Powdered lobelia seeds or leaves, or the "compound powder of lobelia and capsicum," are the best local applications that can be employed in *acute pulmonary complaints*, and give great relief in chronic cases with a sense of suffocation and fullness, accompanied by soreness within the chest" (Felter).

When in the *eruptive diseases* retrocession takes place, lobelia, by promoting determination of blood to the skin, will promptly bring the eruption to the surface. It is also indicated in *scarlatina* and *measles* when the eruption is tardy in making its appearance.

Lobelia was formerly used to a considerable extent in the *eruptive skin diseases*. In the *Western Medical Reformer* for 1838, we find it lauded as a local wash for "*herpes*, *lichen*, *eczema*, *nettlerash*, and *erysipelas*." There is one condition in which its use should not be overlooked, and that is in *poisoning by Rhus Toxicodendron*. An aqueous solution of specific lobelia, or an infusion of the plant should be freely used by wetting the cloths in the lotion and applying frequently to the affected parts. Externally, the infusion has been found useful in *ophthalmic affections;* and the tincture is a valuable local application to *sprains*, *bruises*, *rheumatic pains*, *erysipelas*, and *erysipelatous inflammations*, *tetter*, and other forms of *cutaneous diseases*. A poultice of powdered lobelia and slippery-elm bark, with a weak lye-water, will be found valuable in *erysipelatous diseases*, *bites*, and *stings of poisonous insects*, *spasmodic affections of the limbs*, *pains*, and to produce muscular relaxation. Tincture of lobelia, painted upon the parts before suppuration has begun, is said to abort *felons*.

The oil of lobelia is valuable in *tetanus* and some other extreme cases, as it is easy to introduce enough upon the tongue to relax the whole system immediately. On account of the tendency to produce inflammation of the stomach, it should not be employed alone as a common emetic, but a few drops of it should be triturated with sugar, and diffused in chamomile, boneset, or other emetic infusion. One drop of the oil, triturated with 20 grains of sugar, and divided into from 6 to 12 doses will be found highly useful as an expectorant, nauseant, sedative, and diaphoretic, when given every 1 or 2 hours, as may be required. As a local application, much benefit may be derived from it, where a particular nerve is to be quieted, or a muscle to be relaxed. An excellent liniment may be made of a mixture of ½ ounce, each, of oils of amber and sassafras, 1 drachm of oil of lobelia, and ½ drachm of ethereal oil of capsicum. To be used in *painful neuralgic* and *rheumatic affections*. That lobelia is a valuable remedy will be conceded by all, and that it has been notoriously misrepresented is apparent to all. Carefully used according to its specific indications, it will be better appreciated the more it is used. As an emetic, dose of the powder, from 20 to 60 grains; of the tincture, from 2 to 4 fluid drachms; as a nauseant and expectorant, from 5 to 20 grains. The dose of specific lobelia ranges from 1 to 40 drops, according to use, taken in a little water. When lobelia does not act as an emetic, it is very apt to purge The relaxation caused by lobelia may be counteracted by the stimulating and tonic influence of capsicum.

Specific Indications and Uses.—Lobelia is specifically indicated by the full, labored, doughy pulse; the blood moves with difficulty; pain in chest of a heavy, sore, or oppressive character; angina pectoris; cardiac neuralgia; pulmonary apoplexy; mucus accumulation in bronchiæ; convulsive movements; rigidity of muscular tissues; rigid os uteri, with thick doughy edges; rigid perineum, or vaginal walls; nausea; oppressive sick headache, with nausea. As an emetic when tongue is heavily coated at base.

Related Species.—There are other species of Lobelia, as the *Blue lobelia* (*Lobelia syphilitica*, Linné), and the *Red lobelia* (*L. cardinalis*, Linné). The first is diaphoretic, emetic, and cathartic; also diuretic and antisyphilitic, and a strong infusion of it has cured *gonorrhœa*. It has likewise been used in *dropsy*, *diarrhœa*, and *dysentery*. The root is the part used; dose, from 20 to 60 grains of the powder. The *L. cardinalis* is said to be anthelmintic, nervine, and antispasmodic. These two varieties are seldom, if ever, used in medicine. Wm. Procter, Jr. (1839) obtained a bitter, acrid, aromatic, oily, liquid alkaloidal body from this plant. It was probably a mixture of the alkaloid with impurities (see *D. and M. of N. A.*, Vol. II, p. 106). *Lobelia Kalmii* is the plant shown to Mr. Kalm by Col. Johnson, as the one used by the Indians of some parts of North America to cure *syphilis;* and he was likewise informed that syphilis was known among them previous to their acquaintance with the Europeans, and that they cured it very readily, even when "the patient is half rotten and insupportable to be approached" (*General Practice of Physic*, by R. Brookes, M. D., 7th ed., 1777, Vol. II, pp. 67–71).

LOTIONES.—LOTIONS.

SYNONYM: *Washes.*

These comprise all compounds used as external washes and collyria, in which vegetable or mineral substances are dissolved in water or spirits, but which do not strictly class with infusions, liniments, mixtures, or tinctures. Water is most often used in preparing them.

Glycerin has been proposed as a vehicle for forming lotions with salts of alkaloids, thus: 1. MORPHINE LOTION.—Take of acetate of morphine, 3 grains; glycerin, 5 drachms (troy); dissolve. 2. STRYCHNINE LOTION.—Take of sulphate of strychnine, 6 grains; glycerin, 5 drachms (troy). Dissolve the salt in the glycerin in a porcelain mortar. A teaspoonful of this lotion is applied by friction in *paralysis of the limbs*, on the vertebral column in *chorea*, and on the temple in certain cases of *amaurosis*. 3. VERATRINE LOTION.—Take of veratrine, 15 grains; glycerin, 5 drachms; diluted hydrochloric acid, a sufficient quantity; dissolve. A teaspoonful, applied by friction in *chronic rheumatic pains of the joints*, or in the sacro-lumbar region to relieve *painful menstruation*. 4. ATROPINE LOTION.—Take of atropine, 6 grains; glycerin, 2½ drachms; diluted hydrochloric acid, a sufficient quantity. Dissolve and mix. Forty or 50 drops, 3 times a day, rubbed on the track of the infra- and supra-orbital nerves, on that of the facial nerve, etc.

Liquid preparations in which glycerin forms a large portion of the menstruum, are termed "*Glycerites*," *Glyceroles*, or *Glycerin Solutions* (see *Glycerites*, *Ointments*, and *Plasmæ*).

Other Lotions.—Two mercurial lotions, not employed, however, by Eclectics, are official in the *British Pharmacopœia*. They are also found in the *National Formulary* from which we reproduce them as follows:

LOTIO FLAVA (N. F.), *Yellow lotion, Yellow wash, Aqua phagedænica flava.*—"Corrosive chloride of mercury, three grammes (3 Gm.) [46 grains]; boiling water, solution of lime (*U. S. P.*), of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the corrosive chloride of mercury in thirty-five cubic centimeters (35 Cc.) [1 fl℥, 88 ♏] of boiling water, and add the solution to a sufficient quantity of solution of lime to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. This mixture should be well agitated whenever any of it is to be dispensed"—(*Nat. Form.*).

LOTIO NIGRA (N. F.), *Black lotion, Black wash, Aqua phagedænica nigra.*—"Mild chloride of mercury, seven and one-half grammes (7.5 Gm.) [116 grs.]; water, solution of lime (*U. S. P.*), of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the mild chloride of mercury with thirty-five cubic centimeters (35 Cc.) [1 fl℥, 88 ♏] of water, and gradually add a sufficient quantity of solution of lime to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. This mixture should be well agitated whenever any of it is to be dispensed"—(*Nat. Form.*). Other lotions are:

LOTIO ADSTRINGENS (N. F.), *Astringent lotion, Warren's styptic, Styptic balsam.*—"Sulphuric acid (*U. S. P.*), thirty-eight cubic centimeters (38 Cc.) [1 fl℥, 137 ♏]; oil of turpentine, thirty-one cubic centimeters (31 Cc.) [503 ♏]; alcohol, thirty-one cubic centimeters (31 Cc.) [503 ♏]. To the sulphuric acid, contained in a wedgewood mortar, slowly add the oil of turpentine, in small portions at a time, constantly stirring. Allow the mixture to cool, then add the alcohol cautiously, in the same manner, and continue stirring until no more fumes arise. When the liquid is cold, pour it into a glass-stoppered bottle. *Note.*—In preparing this mixture caution should be used so that the temperature may not rise too high. Particular care is to be observed if a larger quantity of this mixture is to be prepared. In this case it is preferable to prepare it in several portions"—(*Nat. Form.*). This preparation, under the name *Styptic Balsam*, was a favorite with the early Eclectic physicians.

Lotio Plumbi et Opii (N. F.), *Lotion of lead and opium, Lead and opium wash.*—"Lead acetate, seventeen and one-half grammes (17.5 Gm.) [270 grs.]; tincture of opium (*U. S. P.*), thirty-five cubic centimeters (35 Cc.) [1 fl℥, 88 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the lead acetate in about six hundred and fifty cubic centimeters (650 Cc.) [21 fl℥, 470 ♏] of water, add the tincture of opium and enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. This mixture should be well agitated whenever any of it is to be dispensed"—(*Nat. Form.*).

LOTIO ÆTHERIS COMPOSITA.—COMPOUND ETHEREAL LOTION.

Synonym: *Evaporating lotion.*

Preparation.—Take of ether, alcohol, solution of acetate of ammonium, each, 1½ ounces; rose-water, 3½ ounces. Mix together.

Action and Medical Uses.—This lotion may be used to produce a refrigerant or stimulant influence, according to its mode of employment. Applied to the surface and allowed to evaporate by free exposure, it acts as a *refrigerant*, but if the evaporation is prevented by covering the part to which it is applied with the hand or a cloth, it acts as a *stimulant*. The solution of acetate of ammonium, largely diluted (without the addition of ether or alcohol), is a superior cooling lotion in all cases of *fever* where there is a hot and dry state of the surface, often of itself inducing diaphoresis.

LOTIO ALKALINI.—ALKALINE WASH.

Preparation.—Take of carbonate of sodium (sal soda), 2 drachms; warm rain-water, 1 quart. Dissolve; or, make a weak ley, by adding hardwood ashes to hot water.

Action and Medical Uses.—This wash was formerly extensively employed by physicians, as an application to the surface of the body and limbs in all *febrile* and *inflammatory diseases*, and in *chronic affections*. In the former cases it is applied several times a day, especially when the acute symptoms run high; in the latter affections it is commonly used once or twice a week. The surface should be well rubbed and dried immediately after each application. Frequently, when external stimulus is also required, the above proportion of water is lessened ¼ or ½ and the balance of the quantity made up by the addition of whiskey or other spirit.

LOTIO AMMONII CHLORIDI.—LOTION OF AMMONIUM CHLORIDE.

Synonyms: *Lotio ammoniæ hydrochloras, Lotion of hydrochlorate of ammonium.*

Preparation.—Take of chloride of ammonium, 2 drachms; distilled water, 1 fluid ounce; tincture of conium, 1 fluid ounce. Dissolve the ammoniacal salt in the water and add the tincture.

Action and Medical Uses.—This is sedative and resolvent, and is used as a local application to discuss *tumors*, etc. Its external use is sometimes associated with its internal exhibition. Professor King always used a saturated solution of ammonium chloride as a vehicle to carry remedies intended to be used by inunction. His liniments were not fats and oils medicated, but this solution medicated. He claimed for it greater absorptive power, and decidedly greater advantage in cleanliness.

LOTIO BORACIS.—BORAX LOTION.

Synonym: *Cooling wash.*

Preparation.—Take of borax, in powder, 2 drachms; rose water, ½ pint. Dissolve. In this preparation soft river water may be substituted for rose-water, when the latter can not be obtained (Beach's *Amer. Prac.*).

Action and Medical Uses. This forms a cooling application, and may be used in *inflammations of the eyes*, and *inflammation or ulceration of the nipples*, and of the *mouth* and *fauces*, as well as other *irritated or inflamed mucous surfaces.*

LOTIO BORACIS CUM MORPHINÆ.—BORAX LOTION WITH MORPHINE.

Preparation.—Take of borax, in powder, ½ ounce; sulphate of morphine, 6 grains; decoction of golden seal, 8 fluid ounces. Add the borax and morphine to the decoction.

Action and Medical Uses.—This forms a cooling and mild anodyne wash, and may be used in *inflammation of the eyes*, and *sore and inflamed nipples*, *pruritis vulvæ*, *aphthous ulcerations of the mouth and fauces*, and other *irritated or inflamed mucous surfaces.*

LOTIO GLYCERINI. GLYCERIN LOTION.

Preparation.—Take of glycerin, ½ ounce; distilled water, ½ pint. Mix.

Action and Medical Uses.—This lotion has been recommended in *eczema*, *lichen*, and other *cutaneous diseases;* also as an application to the meatus externus in cases of *deafness* owing to want of secretion of cerumen.

LOTIO HYDRASTIS COMPOSITA.—COMPOUND LOTION OF GOLDEN SEAL.

Preparation.—Take of strong infusion of green tea and of golden seal, each, 1 pint; sulphate of zinc, gunpowder, each, 2 drachms. Mix the decoction, then add the remainder of the articles, and agitate briskly. After solution and decomposition have ceased, and the precipitate has subsided, pour off the supernatant liquid.

Action and Medical Uses.—This curious lotion was employed as a collyrium in *chronic ophthalmic diseases*, but it may be advantageously employed in all *chronic affections of mucous surfaces*, as an external application. The affected parts are to be bathed with it several times a day.

LOTIO HYDRASTIS ET ACONITI.—LOTION OF GOLDEN SEAL AND ACONITE.

Preparation.—Take of golden seal, in powder, 4 drachms; boiling water, 4 fluid ounces; tincture of aconite, 1 fluid drachm. Add the golden seal to the water and digest for 3 hours by a gentle heat; then filter and evaporate to 2 fluid ounces, to which add the tincture of aconite.

Action and Medical Uses.—This forms a superior application to the eye in many cases of disease in that organ. It may be applied by means of a camel's-hair pencil, or dropping 1 or 2 minims on the eyeball. I have likewise found immense benefit in these cases by substituting for the tincture of aconite 1 or 2 fluid drachms of the saturated tincture of black cohosh. Some physicians employ the hydrochlorate of berberine in preparing the above formula, but as this is insoluble in water, it can effect but little influence. This preparation, used as a wash or injection, will also be found of service in *chronic mucous difficulties*, as *vaginal leucorrhœa*, etc. (J. King).

LOTIO JUGLANDIS.—WALNUT LOTION.

Preparation.—Take of extract of green walnut shells, 6 grains; distilled water, 50 grains. Mix and dissolve.

Action and Medical Uses.—This is recommended as an efficient agent in *enlargement of the tonsils*, and is stated to be very prompt in its effects. It is applied to the parts by means of a camel's-hair pencil.

LOTIO LOBELIÆ COMPOSITA.—COMPOUND LOBELIA LOTION.

SYNONYM: *Herpetic wash.*

Preparation.—Take of bayberry bark, lobelia leaves and seed, yellow-dock root, each, in powder, 2 drachms; vinegar, 1 pint. Mix all together, and allow them to macerate for 7 days, and filter; or, make the lotion by percolation.

Action and Medical Uses.—This preparation forms an excellent local application to several species of *cutaneous disease*, also to *erysipelas* and *erysipelatous inflammations*. It is frequently prepared with spirits instead of vinegar, especially where more active stimulation is desired. In erysipelas, ½ pint of a saturated solution of chloride of ammonium may be added to the above quantity with advantage.

LOTIO MYRRHÆ COMPOSITA.—COMPOUND MYRRH LOTION.

Preparation.—Take of myrrh, in powder, ½ ounce; acetate of zinc, 1½ drachms; acetate of lead, ½ drachm; water, 2 pints. Add the myrrh to 1½ pints of water, and boil together for 10 or 15 minutes; when cold, add the rest of the water in which the lead and zinc salts have been previously dissolved. Let them stand 24 hours and filter. If necessary, add enough water to pass through the filter to make 2 pints of the lotion (J. King).

Action and Medical Uses.—Compound myrrh lotion was formerly employed in cases of *chronic ophthalmia*. It will, however, be found useful in all *chronic mucous diseases*. It is usually applied 3 or 4 times a day, and must not be used during the presence of inflammation. When too severe, it may be diluted with water.

LOTIO REFRIGERANS.—COOLING LOTION.

SYNONYM: *Saline wash.*

Preparation.—Take of fine salt, ½ ounce; spirits, vinegar, and rain water, each, 4 fluid ounces. Mix the fluids, and then dissolve the salt in them Beach's *Amer. Prac.*).

Action and Medical Uses.—This lotion is extensively employed as a cooling application in cases of pain or determination to the head, during *fevers*, *inflammation of the brain*, *dropsy*, etc. It is used cold or tepid, according to the benefit received from its application at these temperatures.

LOTIO SASSAFRAS.—SASSAFRAS LOTION.

Preparation.—Take of pith of sassafras, 1 drachm; rose water, 1 pint. Mix. Let them stand for 4 hours, and filter (Beach's *Amer. Prac.*). Distilled water may be substituted for the rose water, and the preparation may be made more speedily by boiling the mixture for a few minutes.

Action and Medical Uses.—This is an extemporaneous preparation, and is principally used in *acute ophthalmia*. A similar preparation of marshmallow root, elm bark, or buckhorn brake, will be found equally available.

LOTIO SODII COMPOSITA.—COMPOUND SODA LOTION.

Preparation.—Take of rock salt, 3 ounces; sulphate of zinc, 1 ounce; persulphate of iron, 8 grains; rain water or clear river water, 1 pint. Add the articles together and form a solution.

Action and Medical Uses.—Used as a stimulating collyrium in *chronic ophthalmic diseases.*

LOTIO ZINCI COMPOSITA.—COMPOUND LOTION OF ZINC.

Preparation.—Take of sulphate of zinc, alum, each, 2 grains; distilled water, 2 pints. Mix and, when dissolved, filter.

Action and Medical Uses.—This lotion is used as a stimulating application to the eye in cases of *films*, *specks*, *opacities*, etc.; to abnormal *growths* on mucous surfaces; to *indolent ulcers* with *fungous growths;* and to *gangrene*.

LUPINUS.—LUPIN.

The seeds of *Lupinus albus*, Linné.

Nat. Ord.—Leguminosæ.

COMMON NAMES: *White lupin*, *Lupin*.

Botanical Source.—This is an annual with a stem nearly 2 feet high, having 5 to 7 foliate, palmate leaves, with obovate, oblong leaflets, from 1 to 2 inches in length. They are beset with white hairs beneath, but on their upper surface are smooth. The large, white, short-pedicelled flowers are borne in terminal spikes, or racemes. The fruit is a long, compressed pod, containing from 3 to 6 seeds which are flattish, circular, and of a white color. The seeds have no odor, but a bitterish taste.

History and Chemical Composition.—This plant is indigenous to west Asia and south Europe, besides being met with in our gardens. Various species of Lupinus produce in sheep the so-called lupinose disease. From *Lupinus albus*, a very bitter alkaloid, *lupinine* (or *lupinotoxin* of C. Arnold, *Jahresb. der Pharm.*, 1883, p. 277), was isolated by Campani and Betelli (1882); it was soluble in ether, benzol, chloroform, and alkalized water. H. Weiske (*Jahresb. der Pharm.*, 1883) records the comparative percentage of the toxic principle in various species of Lupinus; *L. Cruikshankii* contained most (1 per cent), *L. hirsutus* least of it (0.02 per cent), while *L. albus* contained 0.5 per cent. A. Soldaini (*Archiv der Pharm.*, 1893, p. 321) found an optically inactive alkaloid ($C_{15}H_{24}N_2O$) melting at 99° C. (230.2° F.), and a deliquescent alkaloid of the same formula. L. Sherman Davis, in Prof. Schmidt's laboratory, ascertained (*Archiv der Pharm.*, 1897, p. 217) that the seeds of *Lupinus albus* contain two alkaloids: 1. *Dextro-lupanin* ($C_{15}H_{24}N_2O$), melting at 44° C. (111.2° F.) and identical with the deliquescent alkaloid of Soldaini, as well as with the *dextro-lupanin* obtained by himself from the seeds of the Blue lupin, *L. angustifolius*, Linne. 2. *Inactive lupanin* ($C_{30}H_{48}N_2O$), composed of equal molecules of *dextro-* and *lævo-lupanin*, which recalls the analogous isomerism existing in the tartaric acid series. The seeds of lupinus also contain the albuminous bodies *conglutin* and *legumin* (Ritthausen, 1883), soluble in diluted alkali, precipitable by acids, and separable by means of salt solution, in which the former is soluble. By distillation of the seeds of *L. albus* with water vapor, Campani and Grimaldi (1888) obtained *vanillin*.

Action and Medical Uses.—The ancients employed lupin medicinally. An enema of 5 ounces of lupin decoction produced, on two occasions, toxic symptoms, as follows: malaise, unpleasant sensations in the head, dimness of vision, palpebral heaviness, dizziness, mental excitation, and laryngeal and pharyngeal constriction (Donnabella [1877], *Practitioner*). Diuretic, anthelmintic, and emmenagogue properties have been ascribed to white lupin seeds, and the same, bruised and soaked in water, were formerly applied to *ulcers*.

Related Species.—*Lupinus hirsutus*, Linné (blue or rose flowers), and *Lupinus luteus*, Linne (yellow flowers), both of south Europe, have similar properties. *L. luteus* is the species that has been most frequently investigated. L. Berend (*Dissert.*, Marburg, 1897) established in the seeds of this species the presence of two alkaloids, viz.: crystallizable *lupinin* [$C_{21}H_{40}N_2O_2$], Baumert, 1881) and liquid *lupinidin* ($C_8H_{15}N$). It is exceedingly probable that the alkaloids of the various species of Lupinus stand in close chemical relationship to one another. E. Schulze and E. Steiger obtained from the germinated seeds of *Lupinus luteus* an alkaloid which they named *arginine*. The young plants likewise contain asparagin, glutanin, leucine, tyrosine, etc., probably as decomposition products from the albuminoids (*Amer. Jour. Pharm.*, 1887, p. 428). E. Steiger (*Amer. Jour. Phar.*, 1886, p. 449) found in the seed of *Lupinus luteus* a peculiar dextrin-like substance, which he named *beta-galactan*. Attempts have also been made to utilize lupinus as food material by depriving it of its bitterness (see Baumert, *Archiv der Pharm.*, 1888, p. 424). Many American species have like properties, among these are *Lupinus perennis*, Linné (blue-flowers), of eastern United States, and *Lupinus densiflorus*, Nuttall, and *Lupinus polyphyllus*, Nuttall, of the western states. The two latter are often found in gardens. (See chemical investigations of *Black lupinus* as well as *L. polyphyllus*, by K. Gerhard, in *Archiv der Pharm.*, 1897, pp. 342–364.

LUPULINUM (U. S. P.)—LUPULIN.

"The glandular powder separated from the strobiles of *Humulus Lupulus*. Linné (*Nat. Ord.*—Urticaceæ)"—(*U. S. P.*).

Preparation.—On beating or rubbing the strobiles of hops, and then sifting them, a glandular powder is separated, and is known in medicine as *Lupulin*. The sifting is necessary to remove the broken bracts and other vegetable parts. About 10 per cent of lupulin is thus obtained from the dried hops.

Description.—"Bright brownish-yellow, becoming yellowish-brown, resinous, consisting of minute granules, which, as seen under the microscope, are subglobular, or rather hood-shaped, and reticulate; aromatic and bitter. When lupulin is agitated with water and the mixture allowed to stand, no considerable sediment (sand, etc.) should be deposited. When ignited, lupulin should not leave more than 10 per cent of ash"—(*U. S. P.*). Lupulin is of a cellular texture and somewhat transparent. The common center around which the cells are arranged, is called the hilum. Lupulin has the odor and taste common to the hop; a gentle heat renders it tenacious; exposed to flame it burns. Owing to the presence of the oil, lupulin, in quantities, is liable to spontaneous combustion (see record of such combustion on board a vessel lying in the Bremen harbor, in *Amer. Jour. Pharm.*, 1893, p. 555). Unless carefully dried it soon loses its properties, which, indeed, under all circumstances are impaired by keeping. It is always preferable to the hop for medicinal purposes. The constituents of lupulin are essentially those described under *Humulus* (hops), which see.

Action, Medical Uses, and Dosage.—(See *Humulus* also.) Lupulin, or its tincture, is used in *delirium tremens*, and wakefulness in connection with nervous irritation, anxiety, or exhaustion; it does not disorder the stomach nor cause constipation, as with opium. Also useful in *after-pains*, to suppress venereal desires, and allay the pain attendant on *gonorrhœa*. Lupulin has been found especially useful in cases of *genito-urinary irritations*, *irritation of the bladder*, as well as in those *irritable conditions of the brain and genital organs*, so often accompanying *nocturnal emissions;* it allays the irritation, promotes sleep, and checks the emissions, in quite a number of cases; it has also been advised as an efficient remedy in *chordee*. In these instances it requires to be given in quite large doses, double or triple the ordinary ones. The ethereal tincture of lupulin forms what was formerly termed the *ethereal oil of lupulin* (see *Oleoresina Lupulini*) by allowing the ether to spontaneously evaporate. It produces at first a stimulant influence, succeded by a very agreeable, calming sensation, and has been used with advantage in some cases of nervous irritability where opium and other narcotics failed. It does not, however, appear to possess any narcotic properties. A mixture of oil of chamomile, 1 fluid drachm, and ethereal oil of lupulin, 1½ fluid drachm, dissolved in sulphuric ether, half a fluid ounce, in doses of from 30 to 60 drops, every 3 or 4 hours, has been found beneficial in *dysmenorrhœa*, and other *painful uterine diseases*. Mr. Duckworth advises as a very remarkable hypnotic, a preparation composed of lupulin, 1 ounce, aromatic spirit of ammonia, half a pint; mix, let them macerate for 7 days, with agitation from time to time, filter, and add more fluid to procure half a pint. The dose is from 15 minims to 1 fluid drachm. The dose of lupulin is from 6 to 10 grains, which may be given in powder, or in pill made by merely rubbing it in a warm mortar till it acquires a pilular consistence. The tincure of lupulin may be given in doses of from 1 to 4 fluid drachms. Tincture of lupulin, as well as tincture of hop, may be used in *dyspepsia*, with marked restlessness, and disposition to brood over trouble. Use it also when fermentation and eructations occur after meals. *Insomnia*, due to worry or neurasthenia, is relieved by lupulin. The odor of lupulin, like that of hop, will cause in susceptible individuals a distressing sick headache, accompanied with extreme and prostrating nausea; on the other hand both lupulin and hop have been employed to relieve various forms of *headache*, chiefly in debilitated subjects, with cerebral hyperemia.

Specific Indications and Uses.—Nervousness, irritability, disposition to brood over trouble, delirium, insomnia, cerebral hyperemia; fermentative dyspepsia, with acid eructations; genital and mental irritability associated with spermatorrhœa.

LYCOPODIUM (U. S. P.)—LYCOPODIUM.

"The spores of *Lycopodium clavatum*, Linné, and of other species of *Lycopodium*"—(*U. S. P.*).

Nat. Ord.—Lycopodiaceæ.

Common Names and Synonym: (Plant) *Club moss;* (Spores) *Lycopodium seed. Pulverized lycopodium, Vegetable sulphur, Sporæ lycopodii.*

Illustration: Bentley and Trimen, *Med. Plants*, 299.

Botanical Source.—Club moss is a creeping perennial with a trailing stem, giving off several ascending leafy branches. The stem is often several feet in length and thickly clothed with lance-linear, awl-shaped, smooth, flat, evergreen leaves, which are imbricated and inflexed. The branches are from 2 to 4 inches high, the fertile ones having a long, terminal peduncle supporting from 1 to 3 erect, long, cylindrical flower spikes, which are clothed with ovate, sharp-pointed bracts, bearing in their axils the yellow reniform sporangia (*thecæ*).

Fig. 166.

Lycopodium clavatum.

History.—Lycopodium, or Common club moss, is found in almost all parts of the earth, especially in northern regions, growing in dry situations, as pastures, mountains, and woods. The spores, the chief medicinal portion, are shaken out of the renal-shaped capsules (*sporangia*) which grow on "the inner side of the bracts covering the fruit spike" (*Pharmacographia*) as a yellowish powder. The drug is gathered in Germany, Russia, and Switzerland, during the months of July and August, by the peasants, who cut the tops from the plants and carry them to their homes, where the powder is obtained by shaking the tops and sifting out the extraneous matter. As the plant fails to be plentiful some years, the annual collection is apt to vary much.

Description.—According to the *U. S. P.*, lycopodium is "a fine powder, pale, yellowish, very mobile, inodorous, tasteless, floating upon water and not wetted by it, but sinking on being boiled with it, and burning quickly when thrown into a flame. Under the microscope the spores are seen to be sphæro-tetrahedral, the surfaces marked with reticulated ridges, and the edges beset with short projections. Lycopodium should be free from pollen, starch, sand, and other impurities, any of which are easily detected by means of the microscope. When ignited with free access of air, lycopodium should not leave more than 5 per cent of ash"—(*U. S. P.*).

If lycopodium be heated slowly it burns with violence, but if brought in contact with a flame, it suddenly catches fire with a vivid flash and a hissing explosiveness. Unlike most bodies, when triturated it becomes darker in color, assuming a somewhat greasy and coherent state. When dried at 100° C. (212° F.), it loses but 4 per cent of moisture (*Pharmacographia*).

Chemical Composition.—Sugar to the extent of 3 per cent (Langer, 1889, 2.1 per cent), was found in lycopodium by Bucholz (1807). *Pollenin* is the name applied to the material composing the walls of the cells. Alfons Langer (*Archiv der Pharm.*, 1889, pp. 241, 289, and 625), obtained from the spores of commercial *Lycopodium clavatum* 49.34 per cent of a greenish-yellow oil having an acid reaction and consisting of about 80 to 86.6 per cent of a peculiar *lycopodium-oleic acid* ($C_{16}H_{30}O_2$ or $[CH_3]_2CH.CH.CH.C[CH_2].(CH_2)_9.COOH$, *decyl-isopropyl acrylic acid*), with varying quantities of glycerin (about 3 to 5 per cent), and solid fatty acids, chiefly *myristic acid*. The spores must be powdered by trituration with quartz-sand if all of the oil is to be extracted (*Pharmacographia*). A Bukowski (*Archiv der Pharm.*, 1889, p. 625), analyzing freshly collected spores, obtained an oil of neutral reaction, and a constant quantity (8.2 per cent) of glycerin. It also differed in chemical composition from that obtained by Langer. The latter found the spores to contain 0.857 per cent of nitrogen, corresponding to 5.3 per cent of protein substance. When heated with solution of caustic potash, the spores yielded *monomethylamine* (CH_3NH_2). Upon being incinerated, they gave 1.16 per cent of ash. The spores have the peculiar property of oxidizing a portion of the alcohol with which they are macerated, to aldehyde.

Adulterations.—Besides the possible adulterants mentioned by the *U. S. P.*, dextrin and spores of other species of *Lycopodium*, gypsum, talc, sulphur, and rosin may be present. According to A. L. Reichert (*Pharm. Review*, 1898, p. 260), most of the specimens of lycopodium examined were practically free from adulteration, containing mostly fragments of the sporangium wall as impurities; one specimen contained 20 per cent of pine pollen, and two other specimens had potato starch, in one amounting to 30 per cent.

Action, Medical Uses, and Dosage.—This agent was for a long time used only as a dusting powder for protective purposes in *erysipelas*, *intertrigo*, *herpes*, *ulcers*, *eczemas*, etc. Druggists used it to prevent pills from adhering to each other in the boxes, and pyrotechnists employed it in the manufacture of their wares. Of recent years it has become quite important as a remedy in our school, the suggestion coming first from the homœopaths, who use it quite extensively. It was introduced to us as a remedy by Prof. Scudder. He prepared a tincture of the fresh plant before it had cast its sporules with 98 per cent alcohol, and also a tincture of the sporules first triturated in a dry mortar until doughy, then placing them in a percolator, covering with alcohol, allowing to macerate 4 days, when the tincture was drawn off. He recommended the tincture of the sporules in "extreme sensitiveness of the surface; sensitiveness of a part, and care to prevent its being touched; slow, painful boils; nodes or swellings; extreme sensitiveness of the organs of special sense, with pale, livid, or dirty complexion" (*Spec. Med.*, 174).

In *fevers* showing an obscure periodicity lycopodium has been found curative. The cases are not distinctly *agues* nor *ordinary intermittents*, and consequently not influenced by quinine. The febrile phenomena are not active, and there may be an irritable stomach, with either *diarrhœa*, *dysentery*, or *constipation*, an obscure *colic* being associated with the latter, and some *sore throat*. The fever, though not active, is intractable, and exceedingly depressing, and the characteristic symptoms guiding the selection of lycopodium are a high-colored red urine staining the clothing, and an afternoon exacerbation, usually occurring in the middle of the afternoon.

Lycopodium is an efficient gastric sedative, and with the high-colored red urine, and the patient suffering more in the afternoon, will be found of value in *dyspepsia*, and especially if constipation and cardiac palpitation are also present. There is tenderness over the stomach and a sense of fullness. *Pyrosis*, with flatulence, is corrected by it, and in *indigestion*, with fermentative changes and borborygmus, it should be remembered when the special indications above alluded to are present. It is reputed useful in *catarrhal gastritis*.

Lycopodium is prominent as a remedy in urinary disorders. *Spasmodic retention of urine* in children, and *catarrhal cystitis* in adults, with deposits of mucus or mucus and blood, with frequent painful micturition, are disorders in which it has rendered good service. It is a remedy for the *lithic acid diathesis*, when there is pain in the kidneys, ureters, and bladder, with unpleasant sensations in micturition, and there are red, sandy deposits in the urine. *Gonorrhœa*, *gleet*, *vesical catarrh*, and *rheumatism* with uric acid diathesis, are said to be benefited by lycopodium. Dr. Scudder recommended the tincture of the plant in *chronic kidney diseases* with blood in the urine; and in cases of "cough with bloody expectoration, congestive headache, dizziness, and tendency to syncope." The usual method of administering lycopodium for its specific effects is as follows: ℞ Specific lycopodium, gtt. x; aqua, fl℥iv. Mix. Sig. Dose, a teaspoonful every 1 or 2 hours.

Specific Indications and Uses.—Intractable forms of fever, not of an active type, showing obscure periodicity, with afternoon exacerbation, and the voiding of a high-colored red urine, staining the clothing; dyspepsia and indigestion with the same urinary symptoms, or with red, sandy deposits in the urine, palpitation, constipation, borborygmus, and water brash; spasmodic retention of urine in children; cystic catarrh in adults, with painful micturition; urine loaded with mucus or blood, or both, or deposits of red sand or phosphates; cough with bloody expectoration, congestive headache, dizziness, and tendency to fainting

Related Species.—There are several varieties of Lycopodium whose spores are sometimes collected with those of *L. clavatum*. Among them may be mentioned the *Lycopodiums—inundatum, complanatum*, and *annotinum*—of Linneus. An alkaloid *lycopodine* ($C_{32}H_{52}N_2O_3$) was obtained from *L. complanatum* by K. Boedeker (1882).

Lycopodium saururus. This plant is the *Piligan* of Brazil. *Piliganine*, a toxic alkaloid not identical with the above lycopodine, was discovered in it by Adrian (*Jahresb. der Pharm.*, 1886 and 1892). A dog succumbed to 2 grains of this alkaloid, which is said to possess emeto-cathartic, and convulsant properties. The plant likewise acts as an emeto-cathartic, doses of 4 grains of the extract producing purgation. As a cathartic, piliganine hydrochlorate may be administered in doses of from ⅙ to ⅓ grain.

LYCOPUS.—BUGLEWEED.

The whole herb of *Lycopus virginicus*, Linné.

Nat. Ord.—Labiatæ.

Common Names: *Bugleweed*, *Sweet bugle*, *Water bugle*, etc. (see below).

Botanical Source.—This plant is an indigenous, perennial herb, with a fibrous root, and a smooth, straight, obtusely four-angled stem, with the sides concave, producing slender runners from the base, and 10 to 20 inches in height. The leaves are opposite, oblong, or ovate lanceolate, toothed, entire toward the base, with glandular dots underneath. The flowers are very small, purplish, in dense, axillary whorls; at the base of each flower are two, small, subulate bracts. The corolla is campanulate, 4-cleft, the tube as long as the calyx, upper segment broadest, and emarginate. The calyx is tubular, 4-cleft, longer than the achenia. Stamens 2, distant, diverging, and simple; anthers erect and bilobed; ovary superior and 4-angled; style straight and slender; stigma bilobate; achenia 4, smooth, obovate, obliquely truncate at apex, compressed, and margins thickened (G.—W.—R.).

History.—Lycopus belongs to a class of perennial herbs somewhat resembling the mints, but lacking their aroma and having but 2 perfect stamens. It is found growing in almost all parts of the United States, being very common, and preferring moist, shady, places, showing particular fondness for wet, boggy soils. It grows from 6 to 18 inches in height, and, like most labiate plants, has a straight, smooth, square stem (obtusely 4-angled), with concave sides, supporting opposite, oblong, ovate or lanceolate, serrately-toothed leaves, having on their under surface small, glandular dots. The entire plant is smooth and often purplish, and the stem occasionally sends off long, slender runners. The flowers, which appear in midsummer (July and August), are very small, and arranged in dense, axillary whorls, or capitate clusters of a purplish color. The whole plant has an agreeable, yet peculiar balsamic, terebinthinate odor, and to most persons, a disagreeable, slightly bitter, balsamic taste. Its virtues are supposed to depend upon a volatile oil and tannin.

Lycopus is popularly known as Bugleweed, Water bugle, Sweet bugle, Water hoarhound, Gypsy-weed, Paul's betony, Green ashangee and Archangel, though the latter name is oftener applied to another plant—the *Archangelica Atropurpurea*. The name lycopus originates from two Greek words—*lukus*, wolf, and *pous*, foot; hence wolf-foot, so called because of a fancied resemblance of the cut leaves to a wolf's foot.

We have evidence that this plant was used early in the present century as a medicine. Schoepf, Ives, and Zollikoffer mention it. In 1828 Rafinesque, whose works were prominently recognized by the early Eclectics, notwithstanding the many liberties he took in his writings on scientific subjects, gave the best account of its introduction into medicine. He wrote of it that it was an excellent sedative, subtonic, subnarcotic, and subastringent. He further states that "it is described as partaking of the properties of digitalis, sanguinaria, cimicifuga, and spigelia; but it is neither diuretic nor anthelmintic, and is rather one of the mildest and best narcotics in existence." The same author claimed "it acts somewhat like digitalis without producing any of its bad effects or accumulating in the system." He complains that volumes have been written on fox-glove, a rank poison, while this excellent substitute has been allowed to pass almost unnoticed.

Among the first to investigate the properties of bugleweed were Drs. Pendleton and Rogers, of New York, who published several cases of hemoptysis and incipient consumption cured by it. In Rafinesque's day it was used to a considerable extent in New York and New Jersey; in the latter state being much employed as a remedy for diarrhœa and dysentery. Rafinesque pointed out that it acted chiefly on the blood vessels, and was especially useful in plethoric and inflammatory states, particularly internal inflammations resulting from inebriety, and for cardiac diseases. While he did not believe that it would cure phthisis, he stated that it was very valuable for hemoptysis, and that it acted on the circulatory system as a sedative, slowing the pulse and thereby allaying irritation and cough.

Until recent years, lycopus has been scarcely mentioned by allopathic writers. It was introduced into homœopathic practice by the late Prof. E. M. Hale, M. D., of Chicago, who first used it on the recommendation of an Eclectic physician in a case of incipient phthisis, for its control over the circulatory apparatus, with marked benefit. At present it is considerably employed by the homœopathic branch of the profession. Since nearly all that has been written on this drug has come from Eclectic pens, we may safely claim the remedy as one of Eclectic development.

Chemical Composition.—The Messrs. Tilden found this plant to contain tannic acid, organic and inorganic matters, bitter principle, and a peculiar principle. Mr. J. L. Weil (*Amer. Jour. Pharm.*, 1890, p. 72) found in it a fat (0.41 per cent) melting at 50° C. (122° F.), a granular, wax-like body (0.68 per cent) fusing at 70° C. (158° F.); a crystalline resin (0.43 per cent) soluble in ether; small amounts of tannic and gallic acids, and a crystallizable glucosid obtainable by extracting an alcoholic extract of the drug with ether. It readily splits into resin and sugar. The herb contains a small quantity (0.075 per cent) of volatile oil (Hennessy, *Amer. Jour. Pharm.*, 1889, p. 70; Schimmel's *Report*, Oct., 1890, p. 62).

Action, Medical Uses, and Dosage.—Lycopus fills an important place in Eclectic therapeutics. Its action is chiefly exhibited on the vascular structures and the sympathetic nervous system. It is a certain sedative, mild narcotic, subastringent, and tonic. Its sedative action is most pronounced and most frequently indicated where the vascular action is tumultuous, the velocity of the pulse rapid, with evident want of cardiac power. It is for this purpose that it is principally employed in advanced stages of acute disease with great debility, and in chronic disease with frequent pulse. It improves the circulation, and its good influence is extended to all the parts under the control of the vegetative system of nerves. As a sedative, Prof. Scudder classes it with aconite and veratrum. It acts somewhat like digitalis in reducing the velocity of the pulse, but is devoid of the dangerous effects resulting from the use of that drug, and hence has proved useful in some *cardiac affections*. It controls excessive vascular excitement, general irritability, and diminishes exalted organic action. Upon the stomach its action is kindly, improving the appetite, and serving as a mild gastric tonic. Normal secretion is established by it, and blood-making and nutrition are improved.

Lycopus is a remedy for *morbid vigilance* and *insomnia* attendant upon either acute or chronic disease. As a remedy for *painful* and *distressing forms of indigestion*, the specific lycopus will be found advantageous as well as a mild tonic in general debility. In the past it has been employed to purify the blood of patients suffering from *old ulcers*, an infusion being employed locally at the same time. Bugleweed, simmered with fresh butter or petrolatum, may be employed as a topical dressing for *burns* and *irritable ulcers*.

Several cases of *diabetes mellitus* have been reported, through the *Eclectic Medical Journal*, as benefited by lycopus. Dr. Gerald (1878) reported an extraordinary case as cured by it, but does not specify which variety of diabetes the patient was afflicted with. Prof. Edwin Freeman, M. D. (1879) used the drug with remarkable results in a case of diabetes, though he did not have the good fortune to see the disease cured, as the patient, who was rapidly improving, moved away and the doctor lost track of the case. Other successful cases were reported by Dr. Ray. Lycopus has proved a good remedy in some cases of *albuminuria* with great irritation and rapid action of the heart. It has given good results in *hemorrhages*, being particularly adapted to those cases in which the bleeding is frequent but small in amount. Under such conditions specific lycopus is valuable in *hemoptysis*, *epistaxis*, *hematemesis*, *hematuria*, and *uterine* and *intestinal hemorrhage*.

Its therapy in *gastro-intestinal affections* is worthy of notice. We have already noticed its use in indigestion. In *dysentery* and *diarrhœa* it may be given with advantage to the patient. It is of special value in the *diarrhœa of phthisis*, and is equally valuable to allay irritation and inflammation in *gastritis* and *enteritis*, especially those acute *gastric disturbances* and *inflammatory diseases* common to the drunkard. Bugleweed has been used both for its sedative effects and for its influence on the gastro-intestinal troubles accompanying *intermittent fevers*.

Cardiac disease, both organic and functional, have been markedly impressed by lycopus. Administered to patients suffering from *endocarditis* and *pericarditis* it quickly subdues the inflammation. It is a good remedy for *cardiac palpitation*, dependent on irritation of the cardiac nerve centers, or when arising from organic lesions. It is best adapted to those forms of heart disease characterized by irritability and irregularity, with dyspnœa and præcordial oppression. Lycopus powerfully increases the contraction of the unstriped muscular fibers, particularly those of the heart and arteries, hence its value in *cardiac dilatation* and *hypertrophy* which have been known to undergo marked improvement under its administration. It quickly relieves the suffering and anxiety nearly always experienced in heart diseases. It has favorably influenced *exophthalmic goitre*.

"Bugleweed is of great value in *acute pulmonary complaints*, and of still greater utility in *chronic lung troubles*. It acts as a gentle sedative and tonic. It reduces the frequency and force of the heart's action, and is indicated in pulmonary lesions with irritation and cough, and with tendency to hemorrhage. It is particularly valuable in chronic cases with copious secretion of mucus or muco-pus. It lessens irritation, allays the distressing cough so frequently encountered in *chronic bronchitis*, *pneumonia*, and *consumption*. By its action as a nervine it gives rest and quiets pain. By its control over the circulatory apparatus it slows the pulse and brings down the temperature. *Tumultuous action of the heart* and consequent increase of the circulation through the lungs are controlled by it. It may be employed in acute cases to control fever and inflammation. Here it gives rest, alleviates the pain, quiets the vascular excitement, besides allaying the irritative cough. It is one of our very best remedies for *hemoptysis*, especially in those cases where the bleeding is small in amount yet frequent, or it may be administered to prevent the tendency to *hemorrhage in phthisis*. In consumption it is a splendid remedy to relieve the distressing symptoms, and may be administered in drop doses every hour. It is valuable in *acute* as well as *chronic pneumonia*. In ordinary *acute catarrh* it may be administered with aconite, eupatorium, and other indicated agents. It is indicated by chronic cough, mucous or muco-purulent expectoration, frequent pulse, high temperature, tubercular deposits, and albuminuria, with vascular excitement" (Felter).

For *pulmonary hemorrhage*, lycopus combined with cinnamon and ipecac, is the best remedy with which we are acquainted. Dose of the powder, from 1 to 2 drachms; of the infusion (℥i to aqua Oj), from 2 drachms to 4 fluid ounces; of a strong tincture (℥viii to alcohol Oj) of the recent plant, from 5 to 60 minims; of specific lycopus, 1 to 30 minims.

Specific Indications and Uses.—Vascular excitement; hemorrhage, in small amounts, resulting from determination of blood to the lungs, kidneys, or gastro-intestinal organs; albuminuria, with frequent pulse; cough, with copious expectoration of mucus or muco-pus, especially debilitating chronic cough; wakefulness and morbid vigilance, with inordinately active circulation; frequent pulse, with high temperature, and in tubercular deposits.

Related Species.—*Lycopus europæus*, Linné; *Water horehound*.—A European plant introduced into this country, is said to possess febrifuge properties, curing severe *intermittents* in doses of 1 or 2 drachms of the powdered plant, every 2 or 4 hours. It has been confounded with the *L. virginicus*, with which it is frequently collected, but may be discriminated by its stem being more *acutely* 4-angled, its leaves not so broad, the lower being somewhat feather-cleft, its flowers more closely grouped, and the calyx divisions presenting short spines. This plant undoubtedly possesses many of the properties of *Lycopus virginicus*.

LYTHRUM.—LOOSESTRIFE.

The *Lythrum Salicaria*, Linné (*Lythrum Salicaria*, var. *pubescens*, Pursh).
Nat. Ord.—Lythraceæ.

Common Names: *Loosestrife*, *Purple willow-herb*, *Milk willow-herb* (*Herba salicariæ*).

Botanical Source.—This plant is a handsome perennial with a woody root branching at the crown, from which arise several erect, acutely quadrangular, either smooth or downy, leafy, generally simple, reddish stems 2 to 5 feet high. The leaves are nearly sessile, lanceolate, acute, entire, 3 to 6 inches long, about one-fourth as wide, the upper ones diminished to sessile bracteas, all mostly opposite, sometimes in whorls of 3 or 4, in which cases the number of angles on the stem is likewise increased. The flowers are large, numerous, showy, nearly sessile, in numerous axillary whorls, six in each, of a variable crimson or purple, composing long, leafy spikes. The calyx is inferior, cylindrical, striated, the limb with 6 broad teeth, and the same number of alternate, smaller, subulate diverging ones; 6 of the teeth long and reddish. Corolla of 6, equal petals. Stamens 12; anthers conspicuous, red, with green or yellow pollen. Capsule small, elliptical, 2-celled, and many-seeded (L.—W.).

History.—This plant grows in several parts of the globe, and is found in wet meadows, ditches, etc., in this country, especially in the northern and eastern states, bearing purple flowers in July and August. It has no odor, but an herb-like, astringent taste, and by chewing, becomes very mucilaginous. The ferruginous salts darken its infusion, and boiling water takes from it a large amount of mucilage, becoming quite viscid. It yields its properties to water. It has not been analyzed, as far as we know, but probably contains tannin and much mucilage.

Action, Medical Uses, and Dosage.—Loosestrife possesses considerable mucilage, rendering it a demulcent, while at the same time its tannic acid gives to it astringent properties. A decoction of it used freely has been serviceable in various affections of the bowels where this class of remedies was indicated, as in *colorectitis*, *summer complaints of children*, *diarrhœa*, etc. Externally, it is very beneficial as a local application in *chronic ophthalmia*, *ulcers*, and some forms of *cutaneous disease;* also in *leucorrhœa*, *gleet*, *chronic gonorrhœa*, etc., being used either as a wash, or in form of poultice. Dose of the decoction, 1, 2, or 3 fluid ounces; of the powder, 30 to 60 grains, repeated every 3 or 4 hours. An infusion is said to be better than a decoction.

Related Species.—*Decodon* (Elliott), or *Lythrum verticillatum*, (*Decodon aquaticum*, Gmelin; *Anonymus aquatica*, Wright), *Swamp willow-herb*, or *Grass-poley*, bearing purple flowers, possesses similar properties to the above; it is said to cause abortion in mares and cows browsing on it in winter, and may, perhaps, exert a medicinal influence on the human uterus. It grows in swamps throughout the United States and Canada, has a stem, woody at the base, often prostrate, and rooting at the summit, 3 to 8 feet long, or when erect 2 to 3 feet in height, and 4 to 6-angled. The leaves are opposite, or in whorls of 3, lanceolate, on short petioles, acute at base, 3 to 5-inches long, gradually acuminate, and acute at apex. The flowers are large, purple, in axillary subsessile umbels of 3 or more, apparently whorled, constituting a long, leafy, terminal, and showy panicle. Calyx short, broadly campanulate, with 5 erect teeth, and 5 elongated, spreading, horn-like processes. Petals 5 or 6. Stamens 10, alternate ones very long; style filiform; capsule globose, included, 3-celled, many-seeded (W.—G.).

Lythrum alatum, Pursh. North America.

Lythrum album, Kunth. Texas.

Lythrum lanceolatum, Elliott. Under the name of *yerba del cancer*, the Mexicans employ these three species in poultices, to be applied to *cancer*.

Cuphea viscosissima, Jacquin. *Nat. Ord.*—Lythraceæ Grows from Massachusetts south and west, flowering in August.

Cuphea lanceolata, Kunth. The *Atlanchana* of the Mexicans. These two plants are reputed useful in *diarrhœa*.

Cuphea microphylla, Kunth. } Branches and leaves employed in South America as an
Cuphea antisyphilitica, Kunth. } antisyphilitic.

MACIS (U. S. P.)—MACE.

"The arillode of the seed of *Myristica fragrans*, Houttuyn (*Nat. Ord.*—Myristicaceæ)"—(*U. S. P.*).

Synonym: *Arillus myristicæ*.

Source and Preparation.—(See *Myristica*.)

After the fruit of the nutmeg-tree is gathered, the outside fleshy pericarp is either thrown away, or made into a preserve, while the arillus, being cautiously removed from the nut, is compressed, exposed to the sun, and when dried, moistened with salt water, in order to aid in its conservation, and is then packed into sacks, forming the mace of commerce.

Description.—"In narrow bands, 25 Mm. (1 inch) or more long, somewhat branched and lobed above, united into broader bands below; brownish-orange; fatty when scratched or pressed; odor fragrant; taste warm and aromatic"—(*U. S. P.*). The best mace (*Banda mace*) is flaky and spread, and of a dingy yellow color. It is seldom used in medicine, being employed chiefly as a flavoring agent. *Bombay mace*, from *Myristica malabarica*, Lamarck, is devoid of aroma, contains much dark, red-brown coloring matter allied to curcuma, and is often used as an adulterant of Banda mace (see description and tests by Tschirch and Hanausek in *Amer. Jour. Pharm.*, 1882, p. 13, and 1890, p. 398; also P. Soltsien, *ibid.*, 1893, p. 457).

Chemical Composition.—By distillation with water, mace yields from 4 to 15 per cent of volatile oil, *oil of mace* (*Oleum Macidis*). It is dextro-rotatory, and contains the hydrocarbons *pinene* and *dipentene* (Wallach, 1889), and the stearopten *myristicin* ($C_{12}H_{14}O_3$) a crystallizable body melting at 30.25° C. (86.5° F.) (F. W. Semmler, *Berichte*, 1890; also see *Amer. Jour. Pharm.*, 1890, p. 442). Prof. Flückiger obtained from mace, by extraction with boiling ether, about 24.5 per cent of a soft, resinous, non-fatty mass, and also found uncrystallizable sugar. Tschirch observed *amylo-dextrin*, a body intermediary between starch and dextrin, yielding a red or violet color with iodine. Starch is not present in mace, hence an adulteration of powdered mace with powdered nutmeg can readily be detected by the starch reaction (P. Soltsien, 1891). The ash of mace should not exceed 2.5 per cent referred to air-dry substance.

Tinctura Macidis, or *Tincture of mace*, is prepared by digesting mace, 1 part, in alcohol, 5 parts. Filter.

Action and Medical Uses.—(See *Myristica*.)

MAGNESIA (U. S. P.)—MAGNESIA.

Formula: MgO. Molecular Weight: 40.26.

Synonyms: *Magnesia usta*, *Magnesia calcinata*, *Calcined magnesia*, *Light magnesia* (*Magnesia levis*), and *Magnesium oxide*.

Preparation.—*Magnesia*, or *Calcined magnesia*, as it is more generally termed, is obtained by placing a convenient quantity of commercial carbonate of magnesium, in small lumps (not finely powdered), in an earthen crucible, which should be firmly packed, nearly filled, loosely covered with a lid, and placed in a good wind furnace. When the crucible is at a dull-red heat, its contents are from time to time carefully stirred with a clean iron spatula; and when the interior portion has also acquired this temperature, a small quantity is withdrawn, and when cool, shaken with sulphuric or hydrochloric acid. If this causes an evolution of gas, the heat must be continued until a small portion, dropped into dilute acid, quietly sinks in the liquid, and after a few minutes dissolves without the slightest evolution of gas. The contents of the crucible are now emptied on a clean copper or iron plate, and before they are quite cool placed in a well-stoppered bottle; the crucible, in the meantime, is filled with a fresh portion, and the heating proceeded with as before. Nine parts of the carbonate yield about four parts of calcined magnesia. The process involved is represented by the following equation: $4MgCO_3.Mg(OH)_2+5H_2O$ (*Magnesium carbonate, U. S. P.*) $=5MgO+6H_2O+4CO_2$. If the heat is continued after the water and carbon dioxide are expelled, the product soon loses it lightness and acquires a compact, lumpy form.

There are two kinds of magnesia known—the *light* and the *heavy*. The former, *Magnesia Levis*, is designated in the *U. S. P.* simply as *Magnesia*. The heavy calcined magnesia, is produced precisely like the light magnesia excepting that *heavy*, instead of *light* magnesium carbonate, is used in its production. The heavy variety is designated by the *U. S. P.* as *Magnesia Ponderosa* or *Heavy magnesia*.

Description.—The official description of light and of heavy magnesia is as follows: Magnesia (*U. S. P.*).—"A white, very light, and very fine powder, without odor, and having an earthy, but not a saline taste. On exposure to the air, it slowly absorbs moisture and carbon dioxide. Almost insoluble in water. and insoluble in alcohol, but soluble in diluted acids. It is not altered by heat, but when very strongly heated its density is increased. When moistened with water, it has a faintly alkaline reaction upon litmus paper. On stirring 1 part of magnesia with 15 parts of water, in a beaker, and allowing the mixture to stand for about half an hour, it will form a gelatinous mass of sufficient consistence to prevent it from dropping out when the glass is inverted. A filtered solution of magnesia in diluted sulphuric acid, mixed with ammonium chloride T.S., and an excess of ammonia water, yields, with sodium phosphate T.S., a white, crystalline precipitate"—(*U. S. P.*).

Magnesia Ponderosa (*U. S. P.*), *Heavy magnesia.*—"A white, dense, and very fine powder, which should conform to the reactions and tests given under *Magnesia.* It differs, however, from the latter in not readily uniting with water to form a gelatinous hydrate"—(*U. S. P.*).

Magnesia crackles slightly when thrown into water. Unlike lime, it evolves scarcely any heat when water is added to it, although this fluid in small quantity is absorbed by it. Water, in large quantity, dissolves traces of it; on heating the aqueous solution it becomes turbid, but clears again on cooling. Its specific gravity is variously given as 2.3, 3.07, and 3.2. Continued trituration will considerably increase its density, so that a bottle which would only contain 1 ounce of it when not triturated, will, by this process, readily hold 4 ounces. It is dissolved by the dilute acids without effervescence; if gas-bubbles are given off, carbonic acid is present. Magnesia should be kept in well-closed containers. In the form of light magnesia, or still better, the gelatinous hydrate, separated from the solution of sulphate of magnesium by caustic potash, and dried, magnesia has been recommended as an antidote to arsenic (arsenous acid, As_2O_3) by Bussy, insoluble magnesium arsenite (AsO_3MgH) being formed; and experiments of Christison, as well as Ph. Hoglan (*Amer. Jour. Pharm.*, 1880, p. 487), show that arsenic is as thoroughly removed from a solution as by freshly precipitated ferric hydrate. This treatment must not be employed, however, in the case of *arsenous sulphide* As_2S_3; the latter is comparatively innocuous because it is insoluble in water, but becomes converted into a soluble, and therefore poisonous, compound upon treatment with magnesia (*Amer. Jour. Pharm.*, 1879, p. 153). For solidifying copaiba, magnesia answers best when perfectly anhydrous (Mialhe).

Tests.—"If a mixture of 0.2 Gm. of magnesia with 10 Cc. of water be heated to boiling, and, after cooling, 5 Cc. of the supernatant liquid be filtered off, this filtrate should not give more than a faintly alkaline reaction with litmus paper, and, when evaporated to dryness, should not leave more than a very slight residue (limit of foreign soluble salts). The magnesia mixed with water remaining from the preceding test, when poured into 5 Cc. of acetic acid, should dissolve without the evolution of more than a few isolated gas bubbles (limit of carbonate). This latter solution, when filtered, should not be rendered more than slightly opalescent by ammonium oxalate T.S. (limit of calcium), or by barium chloride T.S. (limit of sulphate), or, after the addition of a few drops of nitric acid, by silver nitrate T.S. (limit of chloride). If 0.4 Gm. of magnesia be dissolved in 10 Cc. of diluted hydrochloric acid, the solution should be colorless, and should not be affected by hydrogen sulphide T.S., nor, after the addition of a slight excess of ammonia water, should it be immediately affected by ammonium sulphide T.S. (absence of metallic impurities). If magnesia be exposed to a low red heat in a porcelain crucible, it should not lose more than 5 per cent of its weight (limit of water of hydration)"—(*U. S. P.*). If iron be present, the addition of tannic acid will occasion a violet or bluish-black turbidness in the neutral solution in sulphuric acid (Wittstein). Messrs. Keasbey and Mattison, in 1889 (*Amer. Jour. Pharm.*, p. 122), called attention to a spurious commercial brand of English heavy calcined magnesia, which consisted of 79 per cent calcium sulphate and 20.7 per cent of water. An admixture with Rochelle salt is likewise on record (*ibid.*, 1873, p. 13).

Action, Medical Uses, and Dosage.—Magnesia is antacid, antilithic, and laxative. The stools produced by it are feculent (unless acid is present in large quantities), and are not strongly odorous. Whenever a laxative is indicated, and *acidity of stomach and bowels* is present, magnesia should be selected. It acts kindly, seldom causing nausea, or griping. It is slow, requiring 5 or 6 hours, but is mild, thorough, and efficient. It is one of the prompt remedies for *heartburn*. It is useful in *dyspepsia with acidity*, and is preferable to the carbonate as it does not give rise to flatus, and the dose is less; its laxative qualities likewise give it some advantage over alkaline remedies. In all cases attended with acidity and *constipation* it will be found useful. It acts as an antilithic, first by correcting *gastric acidity*, and secondly, by forming with free lithic acid, or lithate of ammonium, the more soluble lithate of magnesium. It is on this account beneficial in *gout*, and *rheumatic gout*, frequently giving material relief. When no acid is present in the stomach or intestines, magnesia is liable to lodge in some part of them, hence, in such instances, its administration should be followed by a draught or two of lemonade. From 5 to 10 grains of rhubarb mixed with 20 to 40 grains of magnesia, and a few grains of ginger, form an excellent laxative and antacid. When the stools are green and excoriating in young children, give 5 grains of magnesia with 2 or 3 grains of rhubarb. *Sick headache*, with sour stomach, is often cut short with magnesia, as is occasionally the *vomiting of pregnancy* with gastric acidity. Taken in laxative doses night and morning for a long period it is said to remove warts.

The following is recommended in cases of poisoning, in which the nature of the poison is unknown: After freely evacuating the stomach by emetics, give the following mixture in a sufficient quantity of water—calcined magnesia, pulverized charcoal, and hydroxide of iron, of each, equal parts, mixed together. It is perfectly innocuous, and as its ingredients are antidotes to the most active and commonest poisons, it is very likely to be efficient. Dose of magnesia as a laxative, from half a drachm to a drachm; for children, 5 to 10 grains; as an antacid, or antilithic, from 10 to 30 grains twice a day.

Specific Indications and Uses.—Gastro-intestinal acidity, pyrosis, heartburn; green, excoriating stools; constipation with acidity.

Related Body.—INDIAN YELLOW. A yellow pigment prepared from an Indian substance known as *Purree*. The latter, Stenhouse believes to be the juice of some plant mixed with magnesia, and boiled to a solid state; others regard it as a body deposited in the urine of camels which have been fed upon the fruit of the mango tree, *Mangifera Indica* (see *Philos. Mag.*, Vol. XXX, and *Chem. Gazette*, 1855). Purree comes in dark-brown balls, yellow within, weighing about a quarter pound. It has a castor-like odor. Stenhouse found it to be composed mainly of the magnesium salt of *purreic acid*. *Purreic acid* (*euxanthic acid*, Erdmann) occurs in the amount of half the weight of purree, forming small, pale-yellow crystals, resembling berberine, and having a sweetish and afterward bitterish taste. Hot alcohol readily dissolves it. In hot water it is quite soluble, but sparingly so in cold water. Nitric acid converts it into yellow needles of *oxypicric acid* (Erdmann).

MAGNESII CARBONAS (U. S. P.)—MAGNESIUM CARBONATE.

FORMULA: "Approximately $([MgCO_3]_4.Mg[OH]_2+5H_2O)$"—(*U. S. P.*). MOLECULAR WEIGHT: 484.62.

SYNONYMS: *Carbonate of magnesia*, *Carbonicus magnesicus*, *Magnesia hydrico-carbonica*. *Magnesia alba*, *Magnesiæ carbonas*.

Source and History.—Native carbonate of magnesium, or *magnesite* ($MgCO_3$, in its purest form), has been found in Moravia; the vicinity of Turin, Piedmont; in the East Indies; and in the island of Eubœa. It constitutes a range of low hills in Hindustan; also in Eubœa there are entire hills of it. At one time, upward of 2000 tons are said to have been annually exported to Smyrna and England. The Eubœan magnesite is almost pure magnesium carbonate. In England, carbonate of magnesium is found in combination with carbonate of calcium, forming what is called magnesian limestone or *dolomite* ($CaCO_3.MgCO_3$). This mineral is also found abundantly in some portions of the United States, notably in the New England and New York states. *Kieserite* ($MgSO_4+H_2O$), found in the Stassfurt salt-beds in Germany, is also a source from which artificially prepared carbonate of magnesium is derived. The preparation magnesium carbonate, the *Magnesia alba* of *Pharm. Lond.*, 1787, formerly bore the name at Rome, of Count Palma's powder, and was kept a secret for many years. The mode of preparation was probably carried from Germany to Italy. Lancisi, in 1717 (and it is said, Valentini, in 1707), and afterward Hoffman, in 1722, made public the process of manufacture. At that time it was extracted from the mother liquor which remains after the crystallization of rough niter (chloride of magnesium) by precipitation with a solution of carbonate of potassium or sodium. The name *Miraculum Chemicum*, was given to it from the circumstance of a precipitate being formed by the mixture of two clear solutions.

Preparation.—Magnesium carbonate may be prepared in several ways, dependent mainly upon the source from which the magnesia is derived, as each mineral requires a different mode of treatment according to its composition. In this connection the reader is referred to an exhaustive article on the occurrence and commercial production of magnesium carbonate in *Pharm. Jour. Trans.*, Vol. XIV, 1855, p. 221. The largest producers of magnesium carbonate in this country are the Keasbey & Mattison Company, of Philadelphia, who prepare it from *dolomite* and *kieserite*. When magnesium is in solution as chloride or sulphate, the carbonate is prepared by precipitating with sodium carbonate. By precipitating magnesium sulphate, for example, with sodium carbonate, the neutral compound $MgCO_3$ is never formed; basic carbonates are invariably precipitated (that recognized by the *U. S. P.*), having the composition $(MgCO_3)_4.Mg(OH)_2+5H_2O$. The process is represented by the following equation: $5MgSO_4+5Na_2CO_3+6H_2O=Mg(CO_3)_4.Mg(OH)_2+5H_2O+5Na_2SO_4+HCO_2$. If the liquid is warm, the carbonic acid gas escapes; if cold it remains and holds magnesium in solution in the form of the soluble *bicarbonate* $Mg(CO_3H)_2$.

The *British Pharmacopœia* (1898) recognizes a *heavy magnesium carbonate* (*Magnesii Carbonas Ponderosus*), and a light magnesium carbonate (*Magnesii Carbonas Levis*), both of the composition $3(MgCO_3)Mg(HO)_2 4H_2O$. *Heavy Carbonate of Magnesium* is directed to be prepared as follows: "Magnesium sulphate, 10 ounces (Imp.) [125 Gm., metric]; sodium carbonate, 12 ounces (Imp.) [150 Gm., metric]; distilled water, boiling, a sufficient quantity. Dissolve the magnesium sulphate and the sodium carbonate, each, in a pint (or 250 Cc.) of the distilled water, mix the solutions, and evaporate to dryness; digest the residue for ½ hour with 2 pints (or 500 Cc.) of the distilled water, and, having collected the insoluble matter on a calico filter, wash it repeatedly with the distilled water, until the washings are free from sulphates; dry the product at a temperature not exceeding 100° C. (212° F.)"—(*Br. Pharm.*, 1898).

Light Magnesium Carbonate is directed to be prepared by using the same materials and amounts as in the preceding case, and dissolving "the magnesium sulphate and the sodium carbonate, each in ½ gallon (or 1 litre) of cold distilled water; mix the two solutions; boil the mixture for 15 minutes; transfer the precipitate to a calico filter; pour upon it boiling distilled water, until the washings are free from sulphates; dry the product at a temperature not exceeding 100° C. (212° F.)"—(*Br. Pharm.*, 1898).

Description.—The official salt is described as "light, white, friable masses, or a light, white powder, without odor, and having a slightly earthy taste; permanent in the air. Almost insoluble in water, to which, however, it imparts a slightly alkaline reaction; insoluble in alcohol, but soluble in diluted acids with active effervescence. When strongly heated, the salt loses water and carbon dioxide, and is converted into magnesia. A filtered solution of the salt in diluted sulphuric acid, when mixed with ammonium chloride T.S. and an excess of ammonia water, yields with sodium phosphate T.S., a white, crystalline precipitate"—(*U. S. P*). Carbonate of magnesium is loose and granular if dense, but somewhat coherent, like starch, if light; more readily soluble in cold than hot water; if the water be charged with carbonic acid, it is rendered much more soluble, requiring only 48 parts of this fluid for its solution. As before stated, it exists in this solution as magnesium bicarbonate. When this solution is heated, carbonic acid is evolved, and basic magnesium carbonate precipitated. "The *incompatible* substances with this salt are acids and acid salts, alkalies and neutral salts, alum, cream of tartar, nitrate of mercury, acetate of mercury, bichloride of mercury, acetate of lead, sulphates of zinc, iron, and copper" (Coxe).

Impurities and Tests.—The impurities of carbonate of magnesium are similar to those of magnesia, and usually occur from carelessness in the process of manufacturing. It is liable to contain traces of sodium carbonate, calcium, iron, sulphates and chlorides, etc., which are detected by employing the following tests of the *U. S. P.*: "If the salt be boiled with water, the filtered liquid, when evaporated to dryness, should not leave more than a very slight residue. A 2 per cent solution of the salt prepared by the addition of acetic acid, should not be rendered more than slightly opalescent by ammonium oxalate T.S. (limit of calcium); nor by barium chloride T.S. (limit of sulphate); nor after the addition of a few drops of nitric acid, by silver nitrate T.S. (limit of chloride). If 0.4 Gm. of the salt be dissolved in 5 Cc. of diluted hydrochloric acid, the solution should be colorless, and should not be affected by hydrogen sulphide T.S., nor, after the addition of an excess of ammonia water, should it be immediately affected by ammonium sulphide T.S. (absence of metallic impurities). If 1 Gm. of the salt be ignited in a porcelain crucible, the residue should weigh not less than 0.4 Gm."—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Carbonate of magnesium is antacid, antilithic, and purgative when it meets with an acid in the alimentary canal, but not without. Hence, it is always useful to give it in combination with lemonade or lemon juice. It has the same uses as magnesium oxide. It has proved useful in cases of *acid stomach*, *gout*, and where the urine contains an *excess of uric acid;* but from its liability to occasion flatus, owing to the escape of its carbonic acid gas, when in the intestines, it is inferior to calcined magnesia, especially for use in children. Doses of a teaspoonful of magnesium carbonate, night and morning, continued for a length of time, are said to be efficient in removing *cutaneous warts.* Dose, as an antacid and antilithic, 1 to 40 grains; as a cathartic, 1 or 2 drachms in water or milk. In preparing camphor, and other medicated waters, carbonate of magnesium by trituration, aids materially in diffusing the essential oils, etc., through the water. Its use for this purpose, however, has been discarded by the Pharmacopœia in favor of precipitated phosphate of calcium.

Magnesium and Its Compounds.—*Magnesium, Magnium, Manganesium.* Symbol: Mg. Atomic weight: 23.94. This element is very abundant in nature, occurring in the form of carbonates, as *magnesite* ($MgCO_3$); *hydromagnesite* (basic carbonate, $3MgCO_3.Mg[OH]_2+3H_2O$); *dolomite* ($MgCO_3.CaCO_3$); as sulphate in *kieserite* ($MgSO_4+H_2O$), and in *Epsom salts* ($MgSO_4+7H_2O$) from bitter-water springs; as an aluminate in *spinell*, and in a great number of silicates, *e. g.*, asbestos, talcum, tourmaline, etc. In the form of magnesium chloride the element exists in comparatively large quantity in sea water, and is also a constituent of the organic world.

Metallic magnesium was first isolated by Davy. Subsequently it was obtained by reduction of molten magnesium chloride with metallic sodium. In more recent years it is prepared by electrolytic decomposition of magnesium chloride (Bunsen), or certain magnesium minerals, *e. g.*, *carnallite.* Magnesium is a silver-white metal, permanent in dry air, but oxidizes on its surface when exposed to moist air. It has the specific gravity 1.75, and melts at slightly below 800° C. (1472° F.) (Victor Meyer, 1887). In commerce it is found both in ribbon and in powder form. When held in a flame, the ribbon ignites and burns with a brilliant white light, rich in chemically active (actinic) rays; hence its use in flash-light photography. White magnesium oxide (MgO) is formed in the combustion of the metal. Magnesium is also used in pyrotechnics as an ingredient of white and red fire. (See formulæ in *Amer. Jour. Pharm.*, 1885, p. 605.) It is likewise recommended as a substitute for zinc in the testing for arsenic, by Marsh's test, on account of its being free from contaminating arsenic. Magnesium decomposes water slowly at boiling temperature, and dissolves in diluted acids with evolution of hydrogen gas, forming a line of salts which is of importance in medicine. Magnesium, under certain conditions, also combines with nitrogen, forming the nitride Mg_3N_2. This reaction became prominent by the part it played in the isolation of argon by Lord Rayleigh and Prof. Ramsay, in 1895. Magnesium also forms alloys with metals and an amalgam with mercury, which is used in analytical chemistry as a reducing agent.

Other Magnesium Compounds.—MAGNESII SALICYLAS, *Magnesium salicylate* ($[C_6H_4.OH.COO]_2MgH_2O$). This salt forms in elongated colorless needles, hygroscopic, and soluble in alcohol and water, and of bitterish taste. B. Fischer (*Pharm. Ztg.*, 1888) prepares it by saturating a solution of salicylic acid in boiling water with magnesium carbonate. It has been used in *typhoid fever*, but has not become popular.

MAGNESII CHLORIDUM, *Magnesium chloride*, $MgCl_2$. This salt is a by-product of the potash and bromine works at Stassfurt. It is a bitter, very deliquescent compound, acting as a mild purgative. It is said to augment the appetite, and promote an increased flow of bile. Dose, ½ to 1 ounce, well diluted.

MAGNESII LACTAS, *Magnesium lactate*, ($Mg[C_3H_5O_3]_2.3H_2O$).—Dissolve separately, in hot water, magnesium sulphate, 5 parts, and calcium lactate, 6 parts. Mix the solutions and filter from the precipitated calcium sulphate. To insure a complete precipitation digest with a small quantity of magnesium carbonate, filter again, evaporate, and crystallize. Or it may be prepared by saturating an aqueous dilution of lactic acid (1 in 10) with an excess of carbonate of magnesium. Filter and evaporate to crystallization. White, crystalline granules or needles, soluble in cold (30), and in boiling water (6), but not soluble in alcohol. It decomposes upon heating.

Asbestos.—A compound of silicon, calcium, and magnesium, most largely of magnesium silicate, occurring in many sections of Europe, and in Canada and the United States. It consists of parallel aggregations of long, silky fibers, which are insoluble, incombustible, and is a poor conductor of heat. Formed into paper, or into pulp-like masses, it is used to protect structures from fire and to retain heat in steam pipes. It is also an excellent filtering substance for fluids which can not be passed through paper. In a finely divided state it is known as *mineral wool.*

MAGNESII CITRAS EFFERVESCENS (U. S. P.)—EFFERVESCENT MAGNESIUM CITRATE.

Preparation.—"Magnesium carbonate, ten grammes (10 Gm.) [154 grs.]; citric acid, forty-six grammes (46 Gm.) [1 oz. av., 272 grs.]; sodium bicarbonate, thirty-four grammes (34 Gm.) [1 oz. av., 87 grs.]; sugar, in fine powder, eight grammes (8 Gm.) [123 grs.]; alcohol, distilled water, each, a sufficient quantity. Mix the magnesium carbonate intimately with thirty grammes (30 Gm.) [1 oz. av., 25 grs.] of citric acid and four cubic centimeters (4 Cc.) [65 ♏] of distilled water, so as to form a thick paste. Dry this at a temperature not exceeding 30° C. (86° F.), and reduce it to a fine powder. Then mix it intimately with the sugar, the sodium bicarbonate, and the remainder of the citric acid previously reduced to a very fine powder. Dampen the powder with a sufficient quantity of alcohol, so as to form a mass, and rub it through a No. 6 tinned-iron sieve. Then dry it, and reduce it to a coarse granular powder. Keep the product in well-closed vessels"—(*U. S. P.*).

Care must be taken to observe these proportions exactly, and especially not to exceed the temperature indicated, in order to obtain a soluble product. In the first part of the process, an acid-soluble magnesium citrate is formed, and the final product is a mixture of acid magnesium citrate, sodium bicarbonate, some slight excess of citric acid, and sugar.

Description and Tests.—"A white, coarsely granular salt, without odor, and having a mildly acidulous, refreshing taste. Deliquescent on exposure to the air. Soluble, with copious effervescence, in 2 parts of water at 15° C. (59° F.), and very soluble in boiling water; almost insoluble in alcohol. The aqueous solution (1 in 20) has an acid reaction, and, after the addition of ammonium chloride T.S. and a slight excess of ammonia water, it yields with sodium phosphate T.S., a white crystalline precipitate. If to another portion of the aqueous solution a little calcium chloride T.S. be added, and then a slight excess of ammonia water, the filtered liquid will deposit a white precipitate on boiling. A saturated, aqueous solution of the salt, when mixed with potassium acetate T.S., and a small quantity of acetic acid, should not yield a white, crystalline precipitate (absence of tartrate)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—A mild laxative. Dose, 2 drachms to 1 ounce, well diluted.

MAGNESII SULPHAS (U. S. P.)—MAGNESIUM SULPHATE.

Formula: $MgSO_4+7H_2O$. Molecular Weight: 245.84.

Synonyms: *Epsom salt, Sulphate of magnesia, Sal Epsomense, Sal Sedlicense, Sal amarum, Sal anglicum, Sulfas magnesicus.*

Source and Preparation.—Sulphate of magnesium, commonly known as *Epsom salt*, exists abundantly in sea water, and in some mineral springs. It was discovered in 1694 by Nehemias Grew, who prepared it from the saline waters of Epsom, in England, from whence it has derived its familiar name *Epsom salt;* it also occurs in the form of the mineral *kieserite* ($MgSO_4+H_2O$), which is found in the celebrated salt-beds of Stassfurt, Germany, with other magnesium-bearing minerals, such as *kainite, polyhalite*, etc. Magnesium sulphate may be prepared from various sources: From the natural bitter-waters by evaporation and recrystallization; from the mother liquors in the preparation of salt from sea water; from *dolomite* (magnesium calcium carbonate); from *kieserite*, by calcination, solution in hot water and crystallization, etc. In large quantities it is obtained as a by-product in the manufacture of carbonic acid gas from *magnesite* ($MgCO_3$) with sulphuric acid.

Crab Orchard Salt, obtained by evaporating the water of certain wells in Kentucky, is an impure magnesium sulphate, its off-color being due to impurities, iron compounds probably contributing somewhat to the discoloration. Wiley (1871) found it to contain magnesium sulphate to the extent of nearly 65 per cent (*Amer. Jour. Pharm.*, 1871, p. 209; also see *ibid.*, 1874, p. 5, and 1875, p. 229).

Description.—Magnesium sulphate occurs in "small, colorless, rhombic prisms, or acicular crystals, without odor, and having a cooling, saline, and bitter taste; slowly efflorescent in dry air. Soluble in 1.5 parts of water at 15° C. (59° F.), and in 0.7 part of boiling water; insoluble in alcohol. When heated to 52° C. (125.6° F.), the salt loses 1 molecule of water, and is converted into a white powder. At about 132° C. (269.6° F.), it still retains 1 molecule of water, and at a temperature of 200° to 238° C. (392° to 460.4° F.), it is rendered anhydrous. The aqueous solution is neutral to litmus paper. When mixed with ammonium chloride T.S. and ammonia water, it yields with sodium phosphate T.S., a white, crystalline precipitate. With barium chloride T.S. it yields a white precipitate insoluble in nitric acid"—(*U. S. P.*). Magnesium sulphate should be kept in well-closed containers to prevent it from efflorescing. Magnesium sulphate is decomposed by the hydroxides of barium, strontium, the alkalies, and all the salts formed by these bases, excepting the alkaline chlorides, nitrates, and sulphates; and by the nitrate, chloride, and carbonate of calcium. Caustic potash and soda, also lime water and aqua ammoniæ precipitate white magnesium hydroxide ($Mg[OH]_2$), which forms a soluble compound with ammonium chloride or any of the other salts of ammonium; hence the precipitation with ammonia water is incomplete, sulphate of ammonium being formed in the reaction. Alkali carbonates precipitate basic magnesium carbonate (see *Magnesium Carbonate*).

The afore-mentioned crystalline precipitate with sodium phosphate in solution of magnesium sulphate to which previously ammonia and ammonium chloride were added, is characteristic for magnesium. It has the composition $PO_4(NH_4)Mg+6H_2O$, and is insoluble in water containing ammonium hydroxide. Heated to redness, it loses ammonia and water, and is transformed into magnesium pyrophosphate ($P_2O_7Mg_2$).

Impurities and Tests.—This salt is liable to various impurities, the most probable being iron and chloride of magnesium. When iron is present the solution gives a violet or bluish-black precipitate with tannic acid, and a blue or bluish-white precipitate with ferrocyanide of potassium. The latter reagent produces a red-brown precipitate if copper is present. If contaminated with chloride of magnesium, the salt will be more or less deliquescent, according to the amount of chloride contained in it. If chloride of calcium be present, oxalate of ammonium will cause a precipitate in the salt solution acidulated with acetic acid. The presence of chlorides may be known by the evolution of hydrochloric acid gas when the sulphate is acted on by sulphuric acid. If the salt is of acid reaction, contamination with zinc sulphate or with oxalic acid may be looked for.

The *U. S. P.* directs the following tests: "When a small portion of the salt is introduced, on a clean platinum wire, into a non-luminous flame, it should not impart to the latter a persistent yellow color (limit of sodium). A 5 per cent aqueous solution of the salt should not be affected by hydrogen sulphide T.S. (absence of metallic impurities); nor produce more than a slight opalescence with silver nitrate T.S. (limit of chloride); nor should 20 Cc. of the same solution give any coloration or precipitate on the addition of 0.5 Cc. of potassium ferrocyanide T.S. (absence of iron, zinc, or copper). If 1 Gm. of the powdered salt be shaken with 3 Cc. of stannous chloride T.S. (see *List of Reagents*, Bettendorff's Test for Arsenic), a small piece of pure tin-foil added, and the test-tube then set aside no coloration should appear within 1 hour (limit of arsenic)"—(*U. S. P.*). The arsenic test is officially given to guard against arsenic being introduced into the salt through the sulphuric acid used in its manufacture.

Action, Medical Uses, and Dosage.—Refrigerant, cathartic, and diuretic. Sulphate of magnesium produces copious and repeated watery evacuations, depending in character largely upon the amount of water in which it is administered. If taken when the stomach is empty, it is prompt in action, and when it can be retained in hot solution a quick action results. Diuresis accompanies the cathartic action and is often quite pronounced if the drug be in small amount and the skin kept cool. Owing to its marked refrigerant properties it should not be given to delicate individuals, except in hot weather. Concentrated doses of 2 ounces have caused death. Collapse without purgation has resulted from its administration in this manner. Chiefly used in *febrile* and *inflammatory affections*, or in cases where a refrigerant, mild, laxative effect is desired. It is specially adapted to *summer disorders* requiring catharsis, though it is lacking in cholagogue properties. It may be dissolved in eight times its quantity of water. The addition of 4 or 5 drops of sulphuric acid to the dose covers the bitter taste of the salt, causes it to sit easier on the stomach, counteracts its refrigerant effects, does not impair its energy, completely removes its tendency to gripe or irritate the rectum, and prevents it from interfering with the appetite or digestion.

Magnesium sulphate is not so extensively used as a cathartic as it was formerly. It is one of the hydragogue cathartics which may be used for a continued length of time, and for that reason it has been of service in *dropsy*. Prof. Locke recommends the following combination: ℞ Magnesium sulphate, potassium bitartrate, aa ℥i; sulphur, ʒi; oil of peppermint, gtt. iij. Mix. Sig. One teaspoonful in plenty of water, every 2 or 3 hours. These doses should be followed by smaller doses after a free evacuation has been provoked. Magnesium sulphate in doses of from 10 grains to 1 drachm, should be frequently repeated for *impacted feces* in any part of the intestinal tract. It is particularly useful where impaction in the right iliac region threatens to provoke inflammatory action, and there is a rise of temperature. Ten-grain doses should be frequently given where other remedies are vomited in these cases. It is a remedy for *constipation*, being given in full laxative doses.

Sulphate of magnesium is one of the most certain of the specific agents employed for the relief of *dysentery*. Occasionally, if the patient has been very costive, the larger dose will be required. But for ordinary cases of dysentery, and for dysentery following diarrhœa, the small doses gradually and surely bring about a cure. The proper dose is about 1 or 2 grains in a tablespoonful of water, every hour. Aconite and ipecac also aid its action, and may be given with it or in alternation. ℞ Magnesium sulphate, grs. xxx to ʒi; specific aconite, gtt. iij; specific ipecac, gtt. x; aqua, fl℥iv. Mix. Sig. Dose, a teaspoonful every hour. This overcomes the derangement of the upper bowel, allays the fever and the inflammation of the lower bowel, checks the outflow of mucus, allays the tormina, and promptly arrests the hemorrhagic manifestations when present. For *acute lead poisoning* or *lead colic*, large doses acidulated with sulphuric acid act specifically. Magnesium sulphate is contraindicated and dangerous in concentrated doses and when the patient is suffering from chills, cholera, or wasting diseases, and in the cases of the old and debilitated. Webster (*Dynam. Therap.*) states that doses of $\frac{1}{10}$ to $\frac{1}{2}$ grain of magnesium sulphate, continued for 2 or 3 weeks are effectual in removing *warts*.

The dose of this salt for its full purgative effect is about 1 ounce, well diluted; for its specific purposes in dysentery and fecal impactions, from 1 to 10 grains to 1 drachm may be employed, though in the former conditions the smaller the dose the better the action. M. Combes states that the bitterness of this salt may be removed by the following means: Take of sulphate of magnesium, 1 ounce; powder of roasted coffee, 2½ drachms; water, about 16 ounces. Place in a vessel (not a tin one), and boil for 2 minutes; remove from the fire, and let the mixture infuse for some minutes, so as to allow time for the development of the aroma; then strain and sweeten to the taste. By this process the salt is not decomposed. Should it be required to increase the amount of the sulphate without augmenting the proportion of coffee, 2 or 3 grains of tannic acid should be added to the boiling decoction.

Specific Indications and Uses.—Dysenteric, mucoid, or muco-sanguineous alvine discharges, with tormina and tenesmus; fecal obstructions; acute lead poisoning or "painters' colic."

Related Preparation.—MAGNESII SULPHAS EXSICCATUS. The *Magnesium Sulphuricum Siccum* of the *German Pharmacopœia* is made by exposing crystalline magnesium sulphate in a warm situation until it loses in weight from 35 to 37 per cent, and then passing it through a sieve. Its properties are those of the crystalline salt, being, of course, of greater strength, bulk for bulk. It is hygroscopic, and consequently should be preserved in well-stoppered bottles.

MAGNESII SULPHIS.—MAGNESIUM SULPHITE.

FORMULA: $MgSO_3.6H_2O$. MOLECULAR WEIGHT: 255.76.

SYNONYM: *Sulphite of magnesium.*

Preparation.—"Dissolve 136 parts of freshly prepared crystallized sulphite of sodium, free from carbonate and sulphate, in the smallest quantity of hot water; filter into this hot liquid a concentrated solution of 123 parts of Epsom salt, and stir the mixture till cold. Drain the mass of fine crystals on a strainer, press, and dry them at a moderate heat. The product should weigh 69 parts (J. C. Sticht in Wittstein's *Vierteljahrsschrift*, 1867, p. 49).

Prof. Joseph P. Remington obtained better results by the following process, published in *Amer. Jour. Pharm.*, 1868, p. 97: Take of pure calcined magnesia, 8 ounces (av.), and make into a paste with distilled water, 1 pint, and then add sulphurous acid (*U. S. P.*), sp. gr. 1.035, stirring constantly until the liquid gives a slight acid reaction; allow the crystals that form to subside, and then decant the clear liquid. Drain the sulphite of magnesium on a muslin strainer, and wash with distilled water until free from impurities, then drain again and dry on bibulous paper. The yield should be 1 pound and 8 ounces of dry crystals.

Description.—Sulphite of magnesium prepared by the above process is obtained in small, white crystals having the peculiar taste of the sulphites, mild and earthy at first, but afterward sulphurous They are soluble in 20 parts of water at 15.5° C. (60° F.); the solution on exposure to air gradually absorbs oxygen and is converted into the sulphate; by exposure to heat they soften, become ductile like gum, and lose 0.45 part in weight; strong heat sets the acid free, leaving pure magnesia behind. The specific gravity of sulphite of magnesium is 1.3802. Chloride of barium produces a precipitate with it which should be completely soluble in hydrochloric acid (absence of sulphate). Sulphite of magnesium destroys the color of a solution of permanganate of potassium, reduces the ferric to ferrous salts, forms a white precipitate of sulphite of silver with the nitrate, and reduces the chloride of gold from its acid solution. It does not so readily become converted into a sulphate, on exposure to the air, as the sulphite of sodium or of calcium, has the least taste of either, and contains a larger proportional quantity of acid than the sodium salt, and hence is more useful and valuable as an internal remedy when the action of the acid is particularly desired. Material in the dissecting room can be preserved for many weeks in a solution of one of these sulphites, without any change being induced in it, and without acting upon the instruments employed, in dissecting it.

Action, Medical Uses, and Dosage.—The sulphites of magnesium ana sodium were introduced to the profession as active azymotic agents, by Prof. Giovanni Polli, of Milan; and his statements of their efficacy have been confirmed by numerous physicians in this country and Europe. Their efficacy is due not wholly to the base, but in part at least to their sulphurous acid radical, which is set free in the stomach, and permeates the whole system, and that without any injury or destruction to the vital principles; though owing to their deoxidizing qualities, their long-continued use is apt to induce œdema and diseases of debility. They are supposed to act by destroying vegetable organisms when present, and by preventing the peculiar fermentation that develops zymotic phenomena; and which prevention may be due either to destruction of the fermentable material, or to a modification effected in its composition. After having taken them they appear in the urine in 20 minutes, but are gradually changed in the system into sulphates. Under ordinary circumstances they are not decomposed in the stomach, but when they are there, there is a manifest production of sulphurous acid gas; when this is the case, the acids of the stomach must be neutralized by a little magnesia.

The hyposulphites are less efficient than the sulphites, are less active azymotics, are more rapidly oxidized in their passage through the system, and hence appear in the urine as sulphates, and often occasion a troublesome diarrhœa, which is not the case with the sulphites. The earlier these are administered in the diseases for which they are used, before the blood corpuscles lose the greater part of their vitality, the more prompt will be their salutary influences. The diseases among others in which they have been found of specific application are *hospital fever*, *puerperal peritonitis*, *pyemia*, *septicemia*, and all *fevers with putridity and purulent absorption; measles*, *scarlatina*, *smallpox*, *erysipelas*, *endemic* or *miasmatic fevers*, *typhus fever*, *irritative fever* from absorption of pus, *infection from wounds* in the dissecting room, *pertussis*, *dysentery*, *diarrhœa*, *cholera*, *influenza*, *diphtheria*, *plague*, *malignant sore throat*, and externally in the dressing of *foul ulcers* or *wounds*, *ichorous*, *gangrenous*, *phagedenic ulcers* or *sinuses*, *indolent ulcers*, and *parasitical* and other *cutaneous diseases*. In fevers they do not cut them short, but gradually diminish the intensity of the symptoms. They are likewise used as prophylactics against zymotic action. These remedies are borne well by the stomach, and to obtain their curative effects rapidly and promptly, the system must be saturated with them as speedily as possible, giving moderately large doses daily, so that the fluids of the body, urine, saliva, and sweat, will contain some of the sulphite. As they are decomposed by all vegetable acids and many of deoxidizing agents, however weak these may be, their use is contraindicated when the sulphites are being taken; such as citric, malic, tartaric, oxalic, nitric, and hydrochloric acids, or food or drinks containing them, as fruits, oranges, lemons or lemonade, apple water, acid jellies, and the like.

For internal use the sulphite of magnesium is an excellent form; it may be given in powder in doses of from 1 to 30 grains, and repeated according to the urgency of the case, every 1, 2, 3, or 4 hours; it may be taken in water, syrup, or other vehicle not contraindicated. Unlike sodium sulphite, which is indicated by the broad, pallid tongue with white, pasty coat, magnesium sulphite is indicated by the deep-red or dusky tongue, with a dark-brown fur, or a smooth, glistening surface. If diarrhœa or vomiting be present, these must be relieved, otherwise the system will not be saturated; or else injections of the solution must be employed. The sulphite may be combined with opium for diarrhœa, pain, etc.; with quinine in cases of obstinate periodicity; with iron when anemia is present, and so on. If the remedy is likely to be efficient, a change for the better will occur in a few days (see *Sulphite of Sodium*).

Specific Indications and Uses.—Typhoid and septic states with deep-red, dusky tongue, coated with a brown fur, or smooth and glistening without the brown coating.

MAGNOLIA.—MAGNOLIA.

The bark of *Magnolia glauca*, Linné; *Magnolia acuminata*, Linné; *Magnolia Umbrella*, Lamarck, and other species of *Magnolia*.

Nat. Ord.—Magnoliaceæ.

COMMON NAMES: (See below.)

Botanical Source and History.—Besides the species herein described, there are four other native species of Magnolia, all probably possessing the same medicinal properties as those herein mentioned. These four are: *Magnolia grandiflora*, Linné; *Magnolia cordata*, Michaux; *Magnolia macrophylla*, Michaux; and *Magnolia Fraseri*, Walter. The *M. macrophylla* and *grandiflora* (fruit only), are figured in Lloyd's *D. and M. of N. A.*, Vol. II. The *Magnolia grandiflora* is the most magnificent forest tree of the extreme south. Its flowers are large and very beautiful. The *M. macrophylla* has the largest leaves of any native tree, they being from 2 to 3 feet in length (C. G. Lloyd).

MAGNOLIA GLAUCA.—This tree is known by several names, as *White bay*, *Beaver-tree*, *Sweet magnolia*, *Swamp sassafras*, *White*, or *Red laurel*, etc.; it varies in height from 6 feet to 30 or more, being taller in the south and shorter in the north; its average height is about 25 feet. Bark of the trunk smooth, ash-colored, that of the young twigs a bright, smooth green, scarred with rings at the insertion of the leaves by the fall of the deciduous stipules. Branches crooked, spreading. Leaves alternate, petioled, regularly elliptical, entire, smooth, thick; their under side, except the midrib, of a pale, glaucous color; when young covered with a silken pubescence. Flowers large, solitary, terminal, cream-colored, of a grateful odor, on a short incrassated peduncle. Calyx composed of 3 spatulate, obtuse, concave sepals; corolla of 8 to 14 obovate, obtuse, and concave petals, contracted at their base. Stamens very numerous, inserted in common with the petals on the sides of a conical receptacle; filaments very short; anthers linear, mucronated, 2-celled, opening inwardly. Ovaries collected into a cone, each divided by a furrow, tipped with a brownish, linear, recurved style. Fruit a cone, consisting of imbricated cells, which open longitudinally at the back for the escape of the seed. Seeds obovate, scarlet, connected to the cone by a funiculus, which suspends them some time after they have fallen out (L.—B.). It is found in swamps and morasses from Massachusetts to the Gulf of Mexico, and always in maritime districts; flowering from May to August, according to the climate in which it is located. At the south it is known as *White-bay*, or *Sweet-bay*. Although the flowers yield a delicate, agreeable odor, yet it sometimes occasions unpleasant symptoms, as difficult breathing, tendency to faint, etc.

MAGNOLIA ACUMINATA, or *Cucumber tree*, sometimes called *Blue*, and *Mountain magnolia*, is a tree reaching from 60 to 80 feet in height, and 4 or 5 feet in diameter, with a perfectly straight trunk. Leaves oval, acuminate, green, a little pubescent beneath, scattered, about 6 inches long, half as broad. Flowers 5 to 6 inches in diameter, bluish, sometimes yellowish-white, numerous, faintly fragrant; petals 6 to 9, obovate, obtusish. Cones about 3 inches long, cylindric, bearing some resemblance to a small cucumber. This tree grows near the Falls of Niagara, and in the mountainous regions in the interior of the country from New York to Georgia; it is more abundant in the southern states. It is most abundant, however, "in the moist valleys in the northern Allegheny Mountains" (C. G. Lloyd). Its flowers appear in May and June (W.—G.—B.).

MAGNOLIA UMBRELLA, Lamarck, or *Umbrella tree*, the *Magnolia tripetala*, of Linne, is a small tree not exceeding 30 feet in height, generally having a sloping trunk. Leaves 16 to 20 inches long, by 6 or 8 in width, obovate, lanceolate, pointed at both ends, silky, when young, soon smooth, often appearing whorled at the ends of the branches in the form of an umbrella, displaying a surface 30 inches or more in diameter. Flowers terminal, white, 7 or 8 inches in diameter, with 5 to 12 narrow, lanceolate, acute petals, the 3 outer curved. Fruit conical, rose-colored, 4 to 5 inches in length. This tree is found growing in shady situations, in strong, deep, fertile soil, in the same range of country as the *M. acuminata*, being, however, more generally confined to the lower grounds. It also flowers in May and June (W.—G.—B.).

Description.—All the species of these trees possess similar therapeutical virtues, which are found especially in the bark and fruit. The bark, either of the trunk or root, is the medicinal part; its odor is aromatic, and its taste warm, bitterish, and pungent, though these properties, with the exception of the bitterness, are lost by age. The bark is taken off during the spring and summer; it is ashen, smooth, and silvery externally, white and fibrous internally. The appearance of the bark varies much, depending upon the species. Magnolia, from these three species, was formerly official. Water or alcohol extracts its virtues.

Chemical Composition.—The various species of Magnolia probably have analogous composition. From the bark of *Magnolia Umbrella* and *M. acuminata*, John Floyd, in 1806, obtained small amounts of an aromatic, volatile oil, a resin, and bitter principles. Dr. Stephen Procter (1842) analyzed the bark of *M. grandiflora* in search for a substance analogous to liriodendrin of Emmet, and found numerous acicular crystals, a resinous body, and volatile oil. W. H. Harrison (1862) obtained from the bark of *M. glauca* a resin, volatile oil, and a crystallizable substance; from the fruit, ether extracted much fixed oil, and a pungent and acrid resin.

Wallace Procter (*Amer. Jour. Pharm.*, 1872, p. 145), observed a deposit of colorless crystals in an evaporated tincture of the fruit of *M. Umbrella* (umbrella tree), which substance he called *magnolin*, having ascertained it to be different from liriodendrin of Emmet. Petroleum benzin readily removed it from the extractive and coloring matters. It is a neutral body, insoluble in cold, crystallizable in small quantity from hot water, freely soluble in alcohol, ether, chloroform, carbon disulphide and petroleum benzin. When pure the crystals are tasteless. A soft, pungent resin, gum, glucose, etc., were likewise found by the author.

Prof. J. U. Lloyd separated from the bark of *Magnolia glauca*, three uncrystallizable resins, differing in their behavior toward solvents; furthermore, a crystallizable glucosid, and a fluorescent substance, probably a product of decomposition. The filtrate from the resins and the glucosid gave reactions for alkaloids, but no alkaloid could be isolated. (See *D. and M. of N. A.*, Vol. II, pp. 42–45, for the early chemical history.) Mr. W. F. Rawlins (1889) obtained from the leaves of *Magnolia glauca* a glucosidal, occasionally crystallizable substance, by abstracting an evaporated alcoholic extract with water and shaking out with chloroform. It is noteworthy that the leaves of *M. glauca* produce upon linen an indelible stain (C. E. Hornberger, *Amer. Jour. Pharm.*, 1876, p. 279). Analysis of the bark of *M. grandiflora*, by B. A. Randolph (1891), showed the presence of volatile oil, tannin, starch, saccharine, and coloring matter; upon incineration, 6½ per cent of ash was left.

Action, Medical Uses, and Dosage.—Magnolia bark is an aromatic tonic bitter, of reputed efficacy, and appears likewise to possess antiperiodic properties. *Intermittent fevers* have been cured by it after cinchona had failed. It is not so apt to disagree with the stomach and bowels, nor to induce fullness of the head as cinchona, and can be continued a longer time with more safety in all respects. Its curative agency is said to be favored by the diaphoretic action which generally follows its administration. In *dyspepsia*, with loss of tone in the stomach, it is very useful as a tonic, and has also proved of much service in the treatment of *remittents with typhoid symptoms*. A warm infusion acts as a gentle laxative and sudorific; a cold one as a tonic and antiperiodic, as does also the tincture and powder. The powder is considered the preferable form of administration. The bark of the *M. Umbrella*, chewed as a substitute for tobacco, has cured an inveterate tobacco chewer of the filthy habit, and deserves a further trial among those who wish to break up the pernicious practice. The bark in powder may be administered in ½-drachm or drachm doses, to be repeated 5 or 6 times a day; the infusion may be taken in wineglassful doses, repeated 5 or 6 times a day. It is used in the above forms of disease, as well as in *chronic rheumatism*. The tincture, made by adding an ounce of the powder to a pint of brandy, and allowing it to macerate for 10 or 12 days, may be given in tablespoon doses 3 times a day, for the same purposes. A tincture made by adding 2 ounces of the cones to a pint of brandy, has long been used as a domestic remedy for *dyspepsia* and *chronic rheumatism;* it is given 3 or 4 times a day in doses of from 1 to 4 fluid drachms. Magnolia is contraindicated whenever inflammatory symptoms are present. Though possessing undoubted tonic properties, magnolia is now seldom employed.

Related Species.—*Telauma mexicana*, Don. This is called, in Mexico, where it abounds, the *yoloxochitl*. *Quercetrin*, volatile oil, resin, tannin, etc., have been found in the fragrant white blossoms, which are reputed antispasmodic and tonic. Antiperiodic virtues are ascribed to the bark.

MALTUM.—MALT.

"The seed of *Hordeum distichum*, Linné (*Nat. Ord.*—Graminaceæ), caused to enter the incipient stage of germination by artificial means and dried"—(*U. S. P.*, 1880).

SYNONYMS: *Maltum hordei, Barley malt.*

Preparation.—If barley, or any other grain, be soaked (steeped) in water and thrown into heaps (couched), it will spontaneously generate heat. By frequent turning, the heat is prevented from becoming too great. The barley is then spread upon the floors (floored), whereupon germination takes place. The grain, after its germ has attained a certain length (usually one-third the length of the seed), is quickly dried in kilns at a temperature not above 71° C. (160° F.), and constitutes what is termed *malt*. What are known as the varieties—*pale malt, pale-amber, amber*, and *amber-brown malt*—is the malt to which different degrees of heat have been applied in drying. For medicinal uses only the *pale malt* or *pale-amber malt* should be employed. *Black*, or *roasted malt*, is that kind, the integuments of which are deep-brown in color, made so by roasting in rapidly revolving cylinders. Should the interior of the grain be of the same hue it is then called *crystal-*

lized malt. (For a very readable, short article on malt and malting, by F X Moerk, see *Amer. Jour. Pharm.*, 1884, p. 305; also see special treatises on the fermentation industries.)

Description and Chemical Composition.—Malt should have a pale or amber color, a sweetish taste, and a somewhat pleasant odor. Its aqueous infusion should be of a deep-yellowish or brown color. Besides the constituents of barley, malt contains the ferment *diastase*, dextrin, and sugar. Diastase resembles *ptyalin*, in that it changes starch into dextrin and sugar (*maltose*), and is, therefore, considered by some as identical with that salivary ferment (also see under *Hordeum*).

Action, Medical Uses, and Dosage.—(For uses of extract of malt, see *Extractum Malti.*) Starchy food is rendered more easily digested by malt and its preparations, which act similarly to *ptyalin*, converting amylaceous matter into sugar and dextrin, and preventing fermentation. An excellent diastatic agent for addition to farinaceous foods, for those suffering from wasting disorders, where nutriment is either passed undigested or is vomited, and especially useful in the *summer disorders of infants*, and for *marasmic and tubercular patients*, is the following cold infusion of malt: Mix 1½ ounces of crushed malt with 4 fluid ounces of cold water. Allow it to stand a half day, then filter it through paper until of a perfectly clear, sherry-brown color. Maltose and diastase are its principal constituents, and it readily ferments, hence but small amounts should be prepared, and those daily. A half ounce of this sweetish infusion added to half pint of any farinaceous gruel, at a moderately warm temperature, will cause the amylaceous products to be converted into glucose and dextrin.

MANGANI DIOXIDUM (U. S. P.)—MANGANESE DIOXIDE.

FORMULA: MnO_2. MOLECULAR WEIGHT: 86.72.

"Native crude manganese dioxide, containing at least 66 per cent of the pure dioxide ($MnO_2 = 86.72$)"—(*U. S. P.*).

SYNONYMS: *Mangani oxidum nigrum* (*U. S. P.*, 1880), *Black oxide of manganese*, *Pyrolusite*, *Manganese peroxide*, *Manganum hyperoxydatum*, *Manganesia vitriariorum*, *Deutoxide of manganese*, *Binoxide of manganese*, *Permanganic oxide*.

Source and History.—Dioxide (also called deutoxide, binoxide, peroxide, or black oxide) of manganese (MnO_2) occurs in considerable abundance, and constitutes the mineral which Haidinger termed *pyrolusite*, from whence all the oxide of manganese used in the arts is obtained. It exists in various parts of Europe, and some in the United States, as in Vermont, Massachusetts, and on Red Island in the Bay of San Francisco; also in Nova Scotia. The purest varieties are found in Great Britain and Germany. Usually it is more or less impure from the presence of lime, alumina, baryta, silica, oxide of iron, and brown *manganite*.

Description.—Manganese dioxide occurs in nature in the form of right rhombic prisms, or needles, or in amorphous masses. The official article is described as follows: "A heavy, grayish-black, more or less gritty powder, without odor or taste; permanent in the air. Insoluble in water or alcohol. It is not affected by cold, concentrated sulphuric acid, but when heated with the latter it is converted into manganous sulphate, with the evolution of oxygen. When heated with hydrochloric acid, it is converted into manganous chloride, with the development of chlorine. At a red heat, the dioxide gives off oxygen gas, and is converted into reddish-brown manganoso-manganic oxide (Mn_3O_4)"—(*U. S. P.*). It is infusible before the blow-pipe, dissolves in fused borax with effervescence, and gives to the globule an amethyst color.

Its specific gravity is stated to vary from 4.7 to 4.9. Chlorine is also evolved when manganese dioxide is heated with a mixture of common salt and sulphuric acid, the reaction taking place as follows: $MnO_2 + 2NaCl + 2H_2SO_4 = MnSO_4 + Na_2SO_4 + 2H_2O + Cl_2$. On a large scale, the manganous salt formed in this reaction is not thrown away, but is converted back again by oxidation into manganese dioxide by Weldon's process, which was introduced in 1867. (For its detailed description, see Roscoe & Schorlemmer's *Chemistry.*)

Tests.—Iron is almost always present in this oxide, the crystals being the most free from it. If the dioxide be digested in hydrochloric acid until chlorine ceases to be evolved, the addition of ferrocyanide of potassium will color it green or blue if iron be present. The *U. S. P.* directs the following tests: "On intimately mixing 1 part of the dioxide with 1 part of potassium hydrate and 1 part of potassium chlorate, introducing the mass into a crucible, moistening with water, drying, and igniting, a dark fused mass is obtained, which yields, with water, a green solution, changing to purplish-red on being boiled, or on the addition of diluted sulphuric acid. If a portion of the dioxide be strongly heated in a dry test-tube, no combustion should ensue, nor should any carbon dioxide be evolved (absence of organic impurities). If to another portion of the dioxide, contained in a test-tube, a small quantity of diluted hydrochloric acid be added, no odor of hydrogen sulphide should be developed, nor should a strip of paper moistened with lead acetate T.S., and suspended over the mixture, become blackened (absence of metallic sulphides). After the mixture of the dioxide with hydrochloric acid has been raised to boiling and filtered, the filtered liquid should not give, with hydrogen sulphide T.S., an orange-colored precipitate (absence of antimony sulphide). If 1 Gm. of the finely powdered dioxide, contained in a small, long-necked flask, be mixed with 5 Cc. of water, then 4.22 Gm. of ferrous sulphate, in clear crystals, added, and subsequently 5 Cc. of hydrochloric acid, the mixture digested for about 15 minutes at a gentle heat, and finally heated to boiling, the cooled filtrate, when immediately tested with freshly prepared potassium ferricyanide T.S., should not acquire a blue color (presence of at least 66 per cent of pure manganese dioxide)"—(*U. S. P.*). Some other methods for the valuation of manganese dioxide are based on the fact that oxalic acid is quantitatively and readily oxidized to carbonic acid by a mixture of manganese dioxide and sulphuric acid according to the equation: $C_2O_4H_2+MnO_2+H_2SO_4=MnSO_4+2H_2O+2CO_2$.

Action, Medical Uses, and Dosage.—The actions of this oxide upon the system are but imperfectly understood. Dr. Coupar, of Glasgow, considered it to act as a cumulative poison, producing paralysis of the motor nerves, but without causing colic, constipation, or tremors. It has been used internally in many cutaneous diseases, as *herpes*, *scabies*, and in the *scorbutic diathesis*. It has likewise been found efficient in *scrofula*, *chlorosis*, *syphilis*, and in *anemia*. The gastro-intestinal membranes are said to absorb but very little of the salt, but if it be injected into parenchymatous tissues, it is readily taken up and excreted with the feces (Cahn). From 3 to 20 grains may be given, in pill form, every 3 or 4 hours. Externally, 1 drachm mixed with ½ ounce of lard, has been found advantageous as an application to *itch*, *porrigo*, and *old ulcers*. One part of binoxide of manganese, added to 5 or 10 parts of chlorate of potassium, and subjected to a moderate heat in a glass or iron retort, gives out a rapid flow of oxygen gas, which may be collected for various purposes.

Dr. J. Kovascy recommends the following formulæ: Take of binoxide of manganese, 4 grains; extract of savin, extract of aloes, each, 10 grains. Mix, and divide into 6 pills, of which 1 pill may be given 3 times a day. (2) Take of binoxide of manganese, 3 grains; powdered leaves of digitalis, 1 grain; sugar of milk, 8 grains. Mix, and divide into 6 powders, of which 3 are to be taken daily, preferably after meals. These are said to be useful in properly selected cases of *chlorosis* and *amenorrhœa*.

MANGANI SULPHAS (U. S. P.)—MANGANESE SULPHATE.

FORMULA: $MnSO_4+4H_2O$. MOLECULAR WEIGHT: 222.46.

SYNONYMS: *Manganesii sulphas*, *Manganous sulphate*, *Sulfas manganosus*, *Manganum sulfuricum*.

Preparation.—This salt may be formed by adding to carbonate of manganese diluted sulphuric acid, as long as effervescence continues, then filtering and evaporating the solution to crystallization. Another method is to heat a thin, magma-like mixture of manganese dioxide and sulphuric acid. Evaporate to dryness, heat to redness in a crucible to decompose the ferrous sulphate present. Dissolve out the manganese sulphate with water, and heat the solution with a little carbonate of manganese to precipitate the last traces of iron, filter, evaporate, and allow to crystallize.

Description.—"Manganous sulphate varies in properties according to the water of crystallization present. If the salt is crystallized at a lower temperature than 6° C. (48.8° F.), it will have the composition $MnSO_4.7H_2O$; between 7° and 10° C. (44.6° and 50° F.), it is represented by $MnSO_4.5H_2O$; and at from 20° to 30° C. (68° to 86° F.), by $MnSO_4.3H_2O$"—(Lloyd's *Chem. of Med.*, p. 320). The *U. S. P.* describes it as in "colorless, or pale rose-colored, transparent, tetragonal prisms (crystallized at a temperature between 20° and 30° C. [68° and 86° F.], and containing 4 molecules, or 32.29 per cent of water of crystallization), odorless, and having a slightly bitter and astringent taste. Slightly efflorescent in dry air. Soluble in 0.8 part of water at 15° C. (59° F.), and in 1 part of boiling water; insoluble in alcohol. The aqueous solution is neutral, or very slightly acid to litmus paper, and yields, with ammonium sulphide T.S., a flesh-colored precipitate soluble in dilute acids; with potassium ferrocyanide T.S., a reddish-white precipitate; and with potassium ferricyanide T.S., a brown precipitate. With barium chloride T.S., it yields a white precipitate insoluble in hydrochloric acid. If a fragment of the salt be mixed with a little sodium hydrate T.S., and the mixture then dried and fused, it will yield a dark-green mass, dissolving in water with a green color"—(*U. S. P.*). When the water of crystallization is driven off by heat, a white, friable mass is formed. Sulphate of manganese should be preserved in well-stoppered bottles.

Tests.—"A 5 per cent, aqueous solution of the salt, after being heated with a few drops of hydrochloric acid and a little chlorine water, should not be colored red by potassium sulphocyanate T.S. (absence of iron), and should not be affected by hydrogen sulphide T.S. (absence of copper or arsenic). If the manganese be completely precipitated from an aqueous solution of the salt by ammonium carbonate T.S., the filtrate, on evaporation and gentle ignition, should leave no residue (absence of salts of the alkalies, or of magnesium). A solution of 1 Gm., each, of the salt, and of sodium acetate, in 10 Cc. of water, to which a few drops of acetic acid are added, should not be affected by hydrogen sulphide T.S. (absence of zinc). If 1 Gm. of the salt be gently ignited, in a porcelain crucible, it should lose not more than 0.323 Gm. in weight (distinction from manganese sulphate containing a larger amount of water of crystallization)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Sulphate of manganese appears to be a stimulant to the lymphatic system of vessels and glands, and has been found valuable in *anemic conditions* of the system, accompanied with a deficiency of the white corpuscles of the blood. It acts as a powerful cholagogue, causing a profuse secretion of bile, and has been used with efficacy in *scrofula*, *chlorosis*, *jaundice*, *torpid liver*, *diseases of the spleen*, and *cachexia*. Prof. Scudder praised this remedy for its effects in *ascites*, due to hepatic disease and particularly in old topers. He directed from ¼ to 1 grain as the proper dose. In *jaundice*, with *hepatic enlargement*, with sense of weight and fullness in the hypogastrium, he considered it a useful remedy. He believed small doses to be curative in disorders where the chief symptoms were a pallid, dirty, leaden tongue, gastric fullness, sluggish bowels, and lax, pendulous abdomen. Minute doses, as of the first and second decimal trituration, were recommended by him where the tissues were old and feeble, and the cardiac action and circulation weak. A high dilution (6 x trituration) of manganese, has been recommended by Webster in doses of 2 to 3 grains, every 4 hours, in *painful affections of the periosteum*, associated with subacute inflammation. The dose for its gross action is from 2 to 20 grains, 3 times a day; for specific purposes, from $\frac{1}{50}$ to 1 grain. One or 2 drachms dissolved in ½ or 1 pint of water, will act as a prompt purgative, with scarcely any depression of the system. Large doses, or its long-continued use in small doses, injures the tone of the stomach One drachm of the sulphate mixed with 1 ounce of lard, has been used externally, as an ointment, in *buboes*, *chancres*, *indolent ulcers*, and some *diseases of the skin*.

Specific Indications and Uses.—Ascites, with hepatic disease, especially the result of spirituous beverages; lax, pendulous abdomen; pale, dirty, leaden-hued tongue; diarrhœa; small mucous passages, with tormina and tenesmus.

Manganese and Its Compounds.—MANGANESE, *Manganesium*, *Manganum*. Symbol: Mn. Atomic weight: 54.8. Manganese, in the form of dioxide, has long been known and used in the manufacture of glass, and was commonly considered an iron ore until 1775, when Gahn succeeded in extracting a peculiar metal from it. The element is widely distributed in the soil and in the vegetable kingdom. According to Flückiger (*Amer. Jour. Pharm.*, 1886, p. 147), certain species and natural orders—*e. g.*, Zingiberaceæ—are remarkable for their power of assimilating manganese. *Trapa natans*, or *Water-nut*, a marsh plant growing in some parts of Germany, France, and Italy, is another example of these "manganivorous" plants. The element may be obtained by the reduction of pure oxide or carbonate of manganese with charcoal, flux material being added and the whole exposed, in a covered crucible, to a very violent heat for several hours. It will then be reduced to the metallic state and fused into a solid mass. Thus obtained it has a gray color, somewhat whiter than cast iron, finely granular in texture, hard, and so brittle that it can be reduced to powder in a mortar. Manganese is an important factor in the production of white cast iron (see *Ferrum*). Its specific gravity is 8.013 (7.13 to 7.21, Brunner). It has strong affinity for oxygen, quickly absorbing it from the atmosphere, and, in consequence, must be kept like sodium and potassium, under naptha or benzin: but if it contains iron it will be permanent in the air. It decomposes water rapidly at a red heat, hydrogen being disengaged.

Manganese combines with oxygen in several proportions, forming chiefly the following oxides: (1) MnO, *manganese monoxide*, or *manganous oxide;* (2) Mn_2O_3, *manganese sesquioxide*, or *manganic oxide;* (3) Mn_3O_4; (4) MnO_2, *manganese dioxide* (which see); (5) MnO_3, *manganese trioxide;* and (6) Mn_2O_7, *manganese heptoxide*. (1) The oxide MnO is strongly basic, dissolving in acids and forming salts with them, known as *manganous salts*, which are analogous to ferrous salts. Their solutions are of a rose-red or flesh color. The oxide, its hydroxide ($Mn[OH]_2$), and the carbonate, when moist, easily oxidize when exposed to the air. Solutions of manganous salts become turbid upon standing if exposed to air and light (A. Gorgeu, *Amer. Jour. Pharm.*, 1889, p. 522). (2) The oxide Mn_2O_3 remains as residue when manganese dioxide (MnO_2) is heated in oxygen gas. It occurs in nature as the mineral *braunite;* its hydrate ($Mn_2O_2[OH]_2$) as *manganite*. The oxide and its hydrate have weak basic properties; dissolved in acids they yield *manganic salts*, which are analogous to ferric salts, but rather unstable. (3) The red oxide of manganese (Mn_3O_4) occurs in nature as the mineral *hausmannite*. It is the form into which the lower and the higher oxides of manganese are converted upon being heated (the lower, when in contact with air). In some respects it is analogous to *red lead* (*minium*, Pb_3O_4). (4) Manganese dioxide (MnO_2) has weak basic and weak acid properties. It forms several salts of (the hypothetical) *manganous acid* ($Mn_5O_{11}H_2$). (5) Manganese trioxide (MnO_3) (see Watts' *Dictionary*, 1892, Vol. III, p. 184) is the anhydride of *manganic acid* (MnO_4H_2), which is not known in the free state. Its salts (the *manganates*) are green and are stable only when in contact with an excess of caustic alkali. Manganates may be formed from any manganese compound, by fusing it with oxidizers—*e. g.*, saltpeter and soda, or potassium chlorate and caustic potash. The green mass is called *chameleon mineral* (Scheele), because it undergoes a change of color from green to blue, violet, and red upon the addition of an excess of water. When the green, fused mass is treated with diluted acids—*e. g.*, acetic or even carbonic acid—it likewise turns red, being decomposed into insoluble hydrate of manganesium dioxide and soluble permanganate of potassium. This is a delicate reaction for manganese. (6) Manganese heptoxide (Mn_2O_7) is the anhydride of the dark-red liquid and powerfully oxidizing *permanganic acid* (MnO_4H). Its potassium salt is the well-known *potassium permanganate* (which see), used as an oxidizing agent, being especially employed in analytical and organic chemistry. When heated with caustic potash, the solution of permanganate turns green; potassium manganate is formed with evolution of oxygen as follows: $2KMnO_4+2KOH=2K_2MnO_4+O+H_2O$.

Mangani Iodidum, *Manganous iodide* (MnI_2+4H_2O).—This salt may be prepared by adding manganese carbonate (to saturation) to solution of hydriodic acid, thus: $MnCO_3+2HI=MnI_2+H_2O+CO_2$. It forms very deliquescent, unstable crystals. A syrup of this salt is used in medicine.

Syrup of Iodide of Manganese has been used in the same class of diseases as syrup of iodide of iron and manganese. Prof. Procter (*Amer. Jour. Pharm.*, 1850, p. 300) directs it to be made as follows: Take of sulphate of manganese, 16 drachms; iodide of potassium, 19 drachms. Dissolve these salts separately, each, in 3 fluid ounces of water, to which 2 fluid drachms of syrup have been previously added. Mix these two solutions in a glass-stoppered bottle, and when the resultant crystals of sulphate of potassium are all precipitated, filter the supernatant liquor, through a fine muslin strainer, into a vessel containing 12 ounces of pulverized sugar. Add to this sufficient water to make the whole measure 16 fluid ounces. A fluid ounce of this syrup contains about 60 grains of iodide of manganese. Its dose is from 10 drops to ½ fluid drachm, repeated 3 or 4 times a day. Combined with cinchona, it is very efficient in *ague-cake*, or *diseased spleen*, following *intermittent fevers*.

Syrup of Iodide of Iron and Manganese has been recommended in *anemia*, *scrofula*, *cancer*, and *glandular enlargements*. Prof. W. Procter, Jr., gives the following formula for its preparation: Take of iodide of potassium, 1000 grains; sulphate of iron, 630 grains; sulphate of manganese, 210 grains; iron filings (free from rust), 100 grains; coarsely-powdered white sugar, 4800 grains; distilled water, a sufficient quantity. Triturate the sulphates and the iodide separately to powder, mix them with the iron filings, and add ½ fluid ounce of distilled water, triturate, and allow it to rest 15 minutes. A third addition of water should now be made and mixed. The sugar should then be introduced into a bottle capable of holding a little more than 12 fluid ounces, and a small funnel, prepared with a moistened filter, inserted into its mouth. Remove the magma of salts from the mortar to the filter, and when the dense solution has drained through, add carefully, and in small portions, some distilled water, until the solution of the iodides is displaced and washed from the magma of crystals of sulphate of potassium. Finally, finish the measure of 12 ounces by adding sufficient distilled water, and agitate the bottle until the sugar is dissolved. The solution of the sugar may be facilitated, when desirable, by placing the bottle in warm water for a time, then agitating. Each fluid ounce of this syrup contains 50 grains of the mixed anhydrous iodides in the proportion of the 3 parts of iodide of iron to 1 part of iodide of manganese, and the dose is from 10 to 30 drops (*Amer. Jour. Pharm.*, 1853, p. 199). Another formula by Prof. Lloyd is recorded, *ibid.*, 1874, p. 6.

Mangani Chloridum, *Chloride of manganese, Manganese dichloride* ($MnCl_2.4H_2O$).—Formed by dissolving pure dioxide of manganese in hydrochloric acid, evaporating the solution to dryness, and exposing the white salt that remains to a red heat in a glass tube with a very narrow orifice. This compound is also obtained as a by-product in the manufacture of chlorine gas from manganese dioxide and hydrochloric acid. Thus made it is impure, however, and must be deprived of the ferric chloride it contains by proper precipitation with sodium carbonate. From the chloride most of the manganese salts are prepared, the carbonate being made the intermediary product.

Manganous chloride consists of thin, broad, delicate, light-pink plates, which fuse in close vessels without alteration, at a red heat, and, when exposed to the air, deliquesce. Sometimes the salt is granular. They are very soluble in water and alcohol, and have the specific gravity 1.56. They are inodorous, and have a saline, astringent taste. This salt has been recommended in *chronic diseases of the skin*, in *scorbutic affections*, and *syphilitic diseases*, in doses of from 3 to 10 grains in watery or alcoholic solution. A drachm or 2 dissolved in 1 pint of water, has been used as a gargle in *syphilitic ulceration of the mouth and throat*. The alcoholic solution has been used internally to check *epistaxis*, giving 10 or 20 drops every 4 hours, until a feeling of giddiness is perceived.

Mangani Carbonas, *Manganese carbonate* ($MnCO_3$).—This forms a white precipitate when solutions of either chloride or sulphate of manganese are mixed with solution of sodium carbonate. The presence of a little syrup is desirable. Wash with boiling distilled water, and dry quickly at a moderate temperature. It is a tasteless, buff-colored salt, soluble in about 8000 parts of water, and readily soluble in water containing carbonic acid (Roscoe & Schorlemmer). Acids dissolve it readily with formation of salts. By oxidation at ordinary temperature, the carbonate yields no higher oxide than Mn_2O_3; when exposed to a heat of 200° C. (392° F.), 92 per cent of manganese dioxide (MnO_2) is formed.

Various other preparations of manganese have been used and recommended by physicians for nearly similar purposes, as the malate, tartrate, phosphate, lactate, etc., but their therapeutical actions appear to be very nearly alike. Dr. T. S. Speer gives the following formula for a *Saccharine carbonate of iron and manganese*, which has proved very useful in *anemia*. Take of finely powdered sulphate of iron, 25 drachms; carbonate of sodium, 5 ounces; sulphate of manganese, 500 grains; dissolve these, each, in 1½ pints of water (Imperial measure), then add the solutions together and mix them well. Collect the precipitate on a filter of cloth and immediately wash it with cold water, squeeze out as much of the water as is possible, and, without delay, triturate the pulp with sugar, previously reduced to a fine powder. Dry it at a temperature of about 48.8° C. (120° F.). It forms a reddish-brown powder, having only a saccharine taste, and may be given in doses of 5 grains, 3 times a day, gradually increased to 20 grains. It should be given immediately after each meal (*Amer. Jour. Pharm.*, 1854, p. 127). The compounds of iron and manganese have cured cases of anemia in which iron alone failed.

Mangani Phosphas, *Manganese phosphate* ($Mn_3[PO_4]_2+7H_2O$).—Produced when sodium phosphate solution is precipitated with solution of manganese sulphate, or chloride. A white, or faintly reddish, crystalline powder. A syrup may be made by dissolving the salt in diluted phosphoric acid and adding to the cold solution enough sugar to form a syrup.

Mangani Lactas, *Manganese lactate.*—Shining, pale-rose crystals, produced by adding to hot lactic acid manganese carbonate. Soluble in cold water (12 parts) and boiling alcohol, from which the salt crystallizes on cooling.

Mangani Tannas, *Manganese tannate.*—Prepared by adding manganese carbonate (freshly precipitated and wholly free from iron) to a hot solution of tannic acid, in distilled water, until it ceases to be dissolved. Filter and dry by evaporation. Soluble in water. Its solution should not be of an inky color (absence of iron).

Mangani Tartras.—Take of Rochelle salts, 10 parts; dissolve in its weight of boiling water. Likewise dissolve manganese sulphate, 8 parts. Mix the solutions. When cool, wash the salt with cold water. Decomposition results if hot water be employed to wash the product. White or faintly red, small crystals.

MANGIFERA.—MANGIFERA.

The inner bark of the root and tree of *Mangifera indica*, Linné.

Nat. Ord.—Anacardiaceæ.

Common Name: *Mango.*

Illustration: *Botanical Magazine*, Plate 4510.

Botanical Source, History, Description, and Chemical Composition.—A tall tree, native of the East Indies, but cultivated in most parts of the tropics for its edible fruit. It has "become thoroughly naturalized in the West Indies, and is forming large groves in waste places in Jamaica, where negroes, horses, pigs, and fowls feed upon the fruit for nearly four months of the year" (D. Morris, *Amer.*

Jour. Pharm., 1886, p. 444, from *Gard. Chronicle*). The leaves are alternate, lanceolate, entire, from 6 to 8 inches long, and one-quarter as wide. They are petioled, and borne in clusters near the end of the branches. The flowers are small, yellowish, and disposed in large, loose, terminal panicles. The calyx-lobes and petals are 5. The stamens are 5, alternate with the petals, and all but one abortive. The fruit is a reddish-yellow drupe, about the size of a quince, and kidney-shaped; it consists of a hard, fibrous nut, which is surrounded by edible flesh in a manner like the peach, and is known as "mango fruit." It is largely consumed in tropical countries, and forms one of the most highly esteemed fruits. The natives of India use the leaves and leaf-stalks to harden the gums; the wood, together with sandal wood, is used by the Hindus for burning their dead, and an infusion of the bark is employed for various skin diseases. When incisions are made into the bark of the tree, a soft, reddish-brown gum-resin exudes, which hardens by age, and resembles bdellium; this dissolves in spirits and partly in water, forming milky solutions; when chewed, it softens, adheres to the teeth, and gives a pungent and slightly bitter taste (Roxburgh).

Sir J. D. Hooker reports (*Pharm. Jour. Trans.*, 1883, Vol. XIV, p. 501), that the yellow pigment known as *piuri* or *Indian yellow* (compare *purree*) is produced in India by evaporating the urine of cows which are fed exclusively on mango leaves. This is said to increase the secretion of the bile pigment, and to impart to the urine of the animal a bright yellow color; the yield of the pigment is 2 ounces a day, but the animal becomes very unhealthy under this treatment. There is another *piuri*, of mineral origin, but less valued.

In 1877, Dr. M. F. Linquist, New Haven, Conn., introduced the bark of the mango tree to the medical profession, having found it beneficial in a number of diseases. The bark was imported under the name "*mango*," for the purpose of removing incrustations from steam boilers, it having been stated that when a small amount of a strong solution of the bark is added to the water within the boiler, the saline deposit quickly separates. The bark is very astringent, and this property suggested to Dr. Linquist its appropriate application in a therapeutical sense. As found in market it is a coarse powder, of a deep brownish-red color, none of the bark, entire, having come under our observation. The odor is peculiar, being, in a very slight degree, terebintheous. The taste resembles that of rhatany. According to Dragendorff (*Heilpflanzen d. versch. Völker u. Zeiten*, 1898), the bark contains 16.7 per cent of tannic acid and an acrid oil; the fruit contains much sugar, citric acid, mucilage, and yellow coloring matter.

Action, Medical Uses, and Dosage.—Mango bark has been recommended in the treatment of *nasal catarrh*, *diarrhœa*, *dysentery*, *vaginitis*, *metritis*, *diphtheria*, *hemorrhages*, etc. Dr. Linquist, in writing to me concerning its use, makes the following statement: "I have used it for upward of eight years, and have largely experimented with it. It is an astringent of peculiar power upon the mucous membrane. I first employed it in certain uterine diseases, with marked benefit. In *catarrh*, with the spray atomizer, I have used it with better success than any other agent. In *diphtheria*, and other malignant diseases of the throat, its effect has been truly marvelous. During last year I have had several cases of diphtheria, that I have treated exclusively with the fluid extract, penciling the fauces with it, of full strength, and also using it as a gargle in the proportion of 2 fluid drachms of the fluid extract to 4 fluid ounces of water. As an internal remedy in *hemorrhages* from the uterus, bowels, or lungs, or in *muco-purulent discharges* from either the bowels or uterus, I know of no agent equal to it. It appears to have the following advantages: The dose is small, is easily taken, has no disagreeable taste, does not derange the stomach, is rapid in its action, and more certain in its effects than other medicines." Prof. A. J. Howe, M. D., writes me as follows: "During the past year I have prescribed a tincture of Mangifera indica on many occasions; and I find it most useful in lessening *leucorrhœal discharges*, and in diminishing too *profuse menstrual evacuations*. The agent exerts an astringent action, but not to the extent of constipating the bowels. It assuages catamenial pains to an appreciable degree, and corrects menstrual disorders in general. I consider the medicine a valuable adjutant to gynæcological therapeutics. I have also prescribed it in the treatment of *chronic diarrhœa*, and in *obstinate gleet*, and have obtained quite satisfactory results, though not better than from extract of logwood, or from pinus canadensis In a case of albuminuria, the remedy, for a week or two, greatly lessened the amount of albumen discharged; yet it made no decided change for the better. The dose of the fluid extract is from 15 minims to 1 fluid drachm. Dr. Linquist adds from 2 to 4 fluid drachms of the fluid extract to 4 fluid ounces of water, and this mixture he administers in teaspoonful doses, repeated every hour or two (J. King). In Brazil, the flowers of the mango are used either in the form of tea or powder for *catarrh of the bladder* (G. Peckolt, *Amer. Jour. Pharm.*, 1884, p. 622).

Specific Indications and Uses.—Feeble relaxed tissues; mucous profluvia; chronic dysentery with muco-purulent passages.

MANIHOT.—TAPIOCA.

The fecula of the root of *Manihot utilissima*, Pohl (*Jatropha Manihot*, Linné; *Janipha Manihot*, Kunth).

Nat. Ord.—Euphorbiaceæ.

COMMON NAMES: *Tapioca, Tapioca meal, Brazilian arrow-root.*

Botanical Source.—This plant is a native of Brazil, and is cultivated in various parts of South America. It has a large, fleshy, oblong, tuberous root, often weighing 30 pounds, and full of a wheyish, venomous juice. The stems are white, crooked, brittle, jointed, pithy, and usually 6 or 7 feet high, with a smooth, white bark. The branches are crooked, and have on every side, near their tops, leaves irregularly placed on long, terete petioles, broadly cordate in their outline, divided nearly to their base into 5 spreading, lanceolate, entire lobes, attenuated at both extremities. The leaves are dark green above, and pale glaucous beneath; the midrib is strong, prominent, and yellowish-red below with several oblique veins, connected by lesser transverse ones, branching from it. The stipules are small, lanceolate, acuminate, and caducous. The flowers are borne in axillary and terminal racemes, the pedicels having small, subulate bracts at their base. Male flowers smaller than the female. The calyx is campanulate, and divided into 5 spreading segments, purplish externally, fulvous-brown within. The disk is orange-colored, fleshy, annular, 10-rayed; the stamens number 10, alternating with the lobe of the disk. The filaments, which are shorter than the calyx, are white, filiform, and free, the anthers yellow and linear-oblong. The female flowers have the same color as the male, and are deeply 5-parted, the segments being lanceolate-ovate and spreading. The disk has an annular, orange-colored ring, in which the purple ovate, furrowed ovary is imbedded; the style is short. Stigmas 3, reflexed, furrowed and plaited, and white. The capsule is ovate, 3-cornered, and tricoccous; the seeds are elliptical, black, and shining, with a thick, fleshy funiculus (L.—W.).

History.—*Manihot utilissima*, formerly designated by botanists as *Jatropha Manihot*, furnishes a large amount of food to the inhabitants of southern America, under the names of *mandioc*, *tapioca*, or *cassava starch*. The juice, mixed with molasses, and fermented, produces an intoxicating liquor which is much relished by the negroes and Indians of the West Indies. According to Pohl, there are two distinct species, the *bitter* and the *sweet cassara.* The bitter is the more common species, *Manihot utilissima* above described; its root is much larger, knotty, black externally and contains a bitter and poisonous milky juice. The root of sweet cassava (*Manihot palmata*, of J. Mueller; *Manihot Aipi*, Pohl; *Jatropha dulcis*, Gmelin) is fusiform, brown externally, not exceeding 6 ounces in weight, with a sweet, amylaceous taste, and it is stated that it may be eaten with impunity see *Chemical Composition*).

Preparation.—Tapioca is prepared from the bitter cassava. The large, fleshy, and tuberous root is reduced to a pulp, this is washed with cold water in funnel-shaped mat-filters, the starch is allowed to subside in the milky fluid which passes through, and is then elutriated in the usual manner, and finally converted into the granular form by drying it on hot plates. Should any of the volatile poisonous principle remain in the meal previous to drying it, the heat employed for this purpose entirely removes it. *Cassara meal*, which is obtained by pressing out the poisonous juice from the grated root, drying the remaining solid portion, and finally grinding it, is made into *cassava bread* by the natives, who bake it in thin loaves. Large quantities of tapioca are now prepared by steam in Malacca.

Description.—Tapioca is a very pure starch in the form of irregular, warty grains, seldom larger than a pea, white, tasteless, and inodorous. Boiling water dissolves it almost entirely, or, if in small proportion to the tapioca, it forms with it a translucent, tasteless jelly, and firmer than is made with most varieties of starch. Cold water partially dissolves it, forming a liquid which yields a blue precipitate with iodine. Under the microscope it is found to consist of aggregated starch globules, about $\frac{1}{2000}$ of an inch in diameter, partly broken, partly entire, the broken ones only being soluble in cold water, more uniform than the granules of most other varieties of fecula, with a distinct hilum, which is completely surrounded by rings, and bursts in a stellate manner. The rupture observed in some of the granules is owing to the heat employed in drying (C.—P.). (See also an interesting article on *Manioc* or *Cassava*, by Dr. E. Chenery, in *Amer. Jour. Pharm.*, 1890, p. 359.) Tapioca of commerce is frequently prepared from domestic sources, such as potatoes, etc.

Chemical Composition.—The poisonous principle in cassava juice was suspected to be *hydrocyanic acid* as early as 1796, by Dr. Clark, of Dominica, who pronounced the toxic symptoms caused by it in negroes to be similar to those caused by prussic acid. Dr. Fennor, of Cayenne, shortly afterward isolated the poison by distillation. Subsequently, Messrs. Henry and Boutron-Charlard identified the poison in a specimen of cassava juice as hydrocyanic acid by chemical tests. In recent years, Mr. E. Francis (*Amer. Jour. Pharm.*, 1883, p. 35, from *Chem. and Drug.*, 1882), found hydrocyanic acid not only in the bitter but also in the sweet cassava, the latter (15 samples from Trinidad) containing on an average 0.0168 per cent, the former (10 samples), 0.0275 per cent of prussic acid.

Dr. Eberhard, of Blumenau, Brazil (*Amer. Jour. Pharm.*, 1869, p. 301), found the root of *Manihot utilissima* to be composed of starch (13.63 per cent), water (61.7 per cent), lignin (23.49 per cent), and ash (1.18 per cent). The starch flour obtainable from cassava is very pure, being nearly all starch (99.1 per cent), with only about 0.5 per cent of protein substances. Dr. H. W. Wiley (*U. S. Dep. of Agr.*, 1895, Bull. No. 44; also see *Amer. Jour. Pharm.*, 1895, p. 262), found in sweet cassava, growing in southern Florida, about 20 to 25 per cent of starch (referred to fresh root), and recommends the cultivation of this root for the economic production of tapioca, glucose, alcohol, and probably cane sugar.

Action and Uses.—Nutritive and demulcent. Used as a light and agreeable nourishment for the sick. It makes an excellent nourishment for infants about the time of weaning, and is less apt to turn sour on their stomach than any other farinaceous food. For the sick and convalescent, its flavor may be improved by raisins, sugar, prunes, lemon-juice, wine, spices, etc., as may be required.

MANNA (U. S. P.)—MANNA.

The concrete, saccharine exudation of *Fraxinus Ornus*, Linné (*Ornus europaea*. Persoon).

Nat. Ord.—Oleaceæ.

COMMON NAME: *Manna*.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 170.

Botanical Source.—The manna tree, or *Flowering ash*, is a small tree, usually 20 or 30 feet high, with a close, round head; the bark is smooth and grayish. The leaves are opposite, unequally pinnated in 3 or 4 pairs; the petioles furrowed; the leaflets petiolate, oblong, acute, serrated, and very hairy, at the base of the midrib on the under side. The flowers are white, in dense, terminal, nodding panicles, and appear with the leaves. Calyx very small and 4-cleft. Corolla divided to the base into linear, drooping segments. Stamens 2; anthers yellow and incumbent. The pericarp is a winged key, not dehiscing (L.). The leaves on the same tree are said to be variable.

History and Description.—The manna tree is a native of most parts of southern Europe. The official part is the juice of the tree, known in commerce as "*manna*." Manna issues from the tree in part spontaneously from fissures, partly from punctures produced by an insect, but more generally from incisions daily made in the tree (one above another during the warm summer months, from which the viscous, brown, bluish fluorescent, bitterish juice flows out, and speedily hardens, losing thereby its bitterness and becoming white. These incisions are repeated annually, and alternately upon opposite sides of the tree, each season, so long as it yields manna. One tree may yield manna for 20 years. There are several varieties of manna, which chiefly differ from one another in quality according to the season and mode of gathering. The *Sicily manna* (*manna gerari*) is the most esteemed. It is also called *flake manna* (*manna cannulata*)—*large and small flake*—and is procured from the incisions on the upper part of the tree, during the height of the season, when the juice flows vigorously. It is collected on straws or twigs, etc., upon which it concretes in stalactitic masses. Long keeping deepens its color. Its fracture is somewhat crystalline, due to the presence of crystals of mannite. The *U. S. P.* describes good manna as "in flattish, somewhat 3-edged pieces, occasionally 20 Cm. (8 inches) long and 5 Cm. (2 inches) broad, usually smaller; friable; externally yellowish-white; internally white, porous, and crystalline; or in fragments of different sizes, brownish-white and somewhat glutinous on the surface, internally white and crystalline; odor honey-like; taste sweet, slightly bitter and faintly acrid. On heating 5 parts of manna with 100 parts of alcohol to boiling, and filtering, the filtrate should rapidly deposit separate crystals of mannite. Manna consisting of brownish, viscid masses, containing few or no fragments of a crystalline structure, should be rejected"—(*U. S. P.*). The ordinary quality is *common manna*, or *manna in sorts;* this is gathered late in the season when the temperature is diminishing, so that the juice imperfectly concretes, and has to be exposed to the action of the sun to complete its drying. Pieces of manna picked up from the ground form part of this sort of manna. It is in masses of a similar color to, but of less size than the flake manna—joined by a soft, adhesive substance of a dark, yellowish-brown color; its taste is rather unpleasant. A third variety, termed *fat manna*, is gathered in the latter part of autumn, when the season is wet and cool, and, in consequence of which, it does not readily concrete. A fatty manna is also said to be procured from the incision made in the lower part of the tree, during the warmer months. Fat manna is less solid than the preceding varieties, adhesive, not brittle, of a yellowish-red or yellowish-brown color, of a strong honey odor, a mawkish, sweet, unpleasant taste, and mixed with sand, pieces of bark, and other foreign substances. There is not so much mannite present in this grade, but more of sugar, gum, etc. This is the kind of manna rejected by the Pharmacopœia.

Manna softens with the heat of the hand, melts at a temperature somewhat higher, and is inflammable, burning with a blue flame, throwing out yellow sparks. Pure manna is almost entirely dissolved in 3 parts of water at 15.5° C. (60° F.), and 1 part at 100° C. (212° F.). From the latter solution it is deposited, on cooling, in crystalline forms. In consequence of the sugar contained in manna it is capable of undergoing fermentation.

Chemical Composition.—The principal constituent of pure manna is *mannite* ($C_6H_8[OH]_6$), 90 per cent, with 11 per cent of sugar and about 0.75 per cent of impurities (Flückiger, *Pharmacognosie*, 1891, p. 27). Inferior sorts of manna contain mucilage, cane-sugar, lævulose, dextrin (Buignet, 1868; doubted by Flückiger), bitter substances soluble in ether, and *fraxin* ($C_{16}H_{18}O_{10}$), a fluorescent glucosid resembling *æsculin*.

Mannite (*mannitol*) ($C_6H_8[OH]_6$, or $C_6H_{14}O_6$) may be readily prepared from manna by digesting it in hot alcohol; on cooling, the mannite forms in tufts of silky, quadrangular prisms. C. T. Bonsall's method consists in dissolving manna in boiling water (3 parts by weight), precipitation of the gum, etc., by lead subacetate, removal of lead with sulphuric acid or hydrogen sulphide, concentration, and pouring the hot solution in cold alcohol (2 parts), from which the mannite is deposited on cooling. Mannite is sweet, odorless, requiring about 6 parts of water to dissolve it, is readily dissolved in boiling alcohol, much less so in cold, deliquesces in the air, and does not dissolve in ether. Its solution possesses a feebly lævo-rotatory polarization. Mannite combines with bases, dissolves lime, reduces gold from its chloride solution, does not reduce Fehling's solution, forms oxalic and saccharic acids when heated with nitric acid, does not ferment when its solution is mixed with yeast, though it ferments when in contact with old cheese and chalk at 40° C. (104° F.), alcohol, lactic, butyric, acetic, and carbonic acids and hydrogen being produced. Unlike cane-sugar, mannite does not char under the action of sulphuric acid, and does not become, like grape-sugar, brown when heated with alkaline solutions. It fuses at about 165° C. (329° F.), without losing weight, and, on cooling, the colorless solution forms a mass of radiated crystals. At about 200° C. (392° F.), it sublimes partially unchanged, but a large portion of it becomes a sweetish, viscid liquid, *mannitan* ($C_6H_{12}O_5$). It is also changed into fermentable *mannitose* ($C_6H_{12}O_6$) and *mannitic acid* ($C_6H_{12}O_7$) when in contact with moistened platinum black (Gorup-Besanez). Mannite also exists in *Laminaria saccharina*, onions, asparagus tops, celery, unripe olives, certain fungi, etc. It has also been procured from beet root, and the juice exuding from apple and pear trees. One or 2 ounces will, it is stated, act as a gentle laxative.

Action, Medical Uses, and Dosage.—Manna is nutritive in small doses, and mildly laxative in large ones. It operates without causing any local excitement or uneasiness, and is useful as a laxative for young infants, children, females during pregnancy and immediately after, *inflammation of the abdominal viscera*, *disorders of childhood*, *hemorrhoids*, *costiveness*, etc. It is accredited with cholagogue properties, and has a somewhat beneficial action upon the respiratory tract. It is commonly added to other purgatives to improve their flavor, as well as to increase the purgative effect. One or 2 ounces may be taken by an adult; 1, 2, or 3 drachms by a child, according to its age. Two or 3 parts of manna to 1 of senna may be made into a laxative infusion for children. Sometimes manna causes flatulency and griping, which may be obviated by combining it with any grateful warm aromatic.

False Mannas.—Various other trees of the family *Ornus* and *Fraxinus* furnish manna, as the *O. rotundifolia*, *O. parvifolia*, *O. subrufescens*, *O. lentiscifolia*, *F. excelsior*, etc. The *Abies* or *Pinus Larix* (*Larix europæa*) yields a sweet exudation called Briançon Manna, or European False Manna, but which contains no mannite, but a principle called *melezitose* ($C_{18}H_{32}O_{16}.2H_2O$). The *Alhagi Camelorum* (*Hedysarum Alhagi*), of Syria, yields the Manna Mereniabin, an inferior manna. The *Larix Cedrus* produces the Manna of Lebanon; the *Tamarix gallica*, of North Africa, the Manna of Mount Sinai; it also yields tamarisk galls; and the *Eucalyptus mannifera*, a kind of manna called New Holland Manna, containing a saccharine principle, but no mannite. Other species of *Eucalyptus* yield Australian Manna. There are several other mannas, such as Persian Manna, Oak Manna, Oriental Manna, Lerp, etc., for description of which see works specially treating on the subject. The manna of Scripture is now thought possibly to be the lichen *Lecanora esculenta*, which sometimes falls in showers from Persia to the Desert of Sahara. It makes a fairly good bread, and is eaten by the people. It is called *manna*. An American Manna, so called, is the product of an Oregon tree—the *Pinus Lambertiana*. It contains a non-fermentable, very sweet body called *pinite* ($C_6H_{12}O_5$). The California Manna, described, in 1702, by the Jesuit Father Picolo, is most likely an exudation of the reed grass, *Phragmites communis*, caused by insects (see J. U. Lloyd, *Amer. Jour. Pharm.*, 1897, p. 329).

MARANTA.—ARROW-ROOT.

The fecula of the rhizome of *Maranta arundinacea*, Linné.

Nat. Ord.—Marantaceæ.

Common Names: *Arrow-root*, *Bermuda arrow-root*.

Botanical Source.—This plant has a perennial rhizome, which is fibrous, producing numerous fusiform, fleshy, scaly, pendulous tubers from its crown. The stems are 2 or 3 feet high, much branched, slender, finely hairy, and tumid at the joints. The leaves are alternate, with long, leafy, hairy sheaths, ovate-lanceolate, slightly hairy underneath, and pale-green on both sides. The flowers are white, and disposed in a long, lax, spreading, terminal panicle, with long, linear, sheathing bracts, at the ramifications. The calyx is green and smooth; the corolla white, small, unequal, with one of the inner segments in the form of a lip. The ovary is 3-celled and hairy. The fruit is nearly globular, with 3 obsolete angles, and the size of a small currant (L.).

History, Description, and Chemical Composition.—This plant, originally from the West Indies, has been introduced into several parts of the world, in warm latitudes and moist climates, where it is extensively cultivated. It has also been raised in South Carolina and Georgia. The plant is developed by planting portions of the root-stock, which gradually increases in size, and throws out leaves.

which wither when the plant is mature. Arrow-root is prepared from the root when nearly a year old. The tubers are washed, beaten in large, deep vessels to a pulp, this is well stirred in clean water, the fibrous parts being separated by hand and thrown away. The milky liquor, which holds the starch in suspension, is passed through a fine sieve, the starch allowed to subside, the supernatant clear fluid is poured off, the starch is again washed in clean water and drained, and is then dried on sheets in the sun. This constitutes West India arrow-root, of which the finest comes from the Bermudas. The crop of the root on this island in 1891, amounted to 180,000 pounds, yielding 12 per cent of arrow-root. Bermuda arrow-root is now getting very scarce, the attention of the Bermuda planters having turned toward raising early vegetables for the New York market. The island of St. Vincent, in the West Indies, is now the leading district where arrow-root from *Maranta arundinacea* is produced (see J. W. McDonald, *Pharm. Jour. Trans.*, 1887, Vol. XVII, p. 1042). Arrow-root is likewise obtained from other plants, as the *M. nobilis*, *M. Allouia*, *M. indica*, Tussac (regarded merely as a variety of *Maranta arundinacea*) (L.), and *Curcuma angustifolia*, and *C. leucorrhiza*, Roxburgh, the last three furnishing the East India arrow-root.

West India Arrow-root is in the form of a light, opaque, white powder, consisting of irregular, friable grains, varying in size from that of a millet-seed to a pea. It is inodorous, nearly tasteless, and crackles when rubbed between the fingers. Musty arrow-root should never be purchased (see Prof. Wm. Procter, Jr., *Amer. Jour. Pharm.*, 1841, Vol. XIII, p. 188). Examined by the microscope, arrow-root is found to consist of minute, pearly globules, or granules, which are spherical or ovate, and have a diameter varying from 7 to 50 micromillimeters. The rings are said to be distinct, though fine. In polarized light, very distinct crosses are seen, the junction of the arm of the cross indicating the position of the hilum.

Arrow-root presents all the chemical relations of wheat and potato-starch, though it makes a firmer jelly with the same quantity of boiling water, 9 parts in this respect being equivalent to 14 parts of common starch. According to J. W. McDonald, the tuber consists of 27 per cent starch, 63 per cent water, 1.56 per cent albumen, 4.10 per cent sugar, gum, etc., 0.26 per cent fat, 2.82 per cent fiber, and 1.23 per cent ash. Arrow-root starch, according to the same authority, contains 15.87 per cent water and 83.70 per cent starch. West India arrow-root is sometimes adulterated with wheat or potato starch, or with starches from sago and tapioca. The *German Pharmacopœia* of 1872 (see C. L. Lochman's translation, 1873) recommended the test to shake 1 part of arrow-root for 10 minutes with 10 parts of a mixture consisting of 2 parts of hydrochloric acid and 1 part of water; the greater part of the powder should separate unchanged, and should not become mucilaginous nor yield an herbaceous odor similar to that of green, unripe bean-pods. According to Prof. Schaer (see *Amer. Jour. Pharm.*, 1875, p. 503), potato-starch in this process readily yields a thick, almost clear jelly, of a strong, herbaceous, bean-like odor, and may thus be easily recognized. (For the microscopical differentiation of genuine arrow-root from adulterations, see the afore-mentioned pharmacopeial authority; also see literature on this phase of the subject in Flückiger, *Pharmacognosie*, 1891, p. 244.)

East India Arrow-root is chiefly prepared from plants growing throughout India, and particularly on the Malabar coast, the *Curcuma angustifolia* and *Curcuma leucorrhiza*, and to some extent from the *Maranta indica;* it is prepared by a process similar to that followed in the West Indies. It is commonly white, sometimes pale-yellow, less crackling between the fingers than the best West Indian kind, more frequently damaged by impurities, and composed of rather larger globules, unequal in size, egg-shaped, compressed, faintly rugous at their larger end, and with little projections attached to their sides. It is lighter than Maranta arrow-root, does not so quickly make a jelly, and is of inferior value.

Action and Medical Uses.—Arrow-root is nutritive, and is used as an agreeable, non-irritating diet in certain chronic diseases, during *convalescence from fevers*, in *irritations of the alimentary canal*, *pulmonary organs*, or of the *urinary apparatus*, and is well suited for infants to supply the place of breast-milk, or for a short time after having weaned them. It may be given in the form of jelly, variously seasoned with sugar, lemon-juice, fruit jellies, essences, or aromatics. Potato-starch is sometimes substituted for it, but it is more apt to cause acidity. Arrow-root is superior to every other kind of farinaceous food, except tapioca and tous-les-mois. Its jelly has no peculiar taste, and is less liable to become acid in the stomach, and is generally preferred by young infants to all others, except tapioca. *Tous-les-mois* makes a stiffer jelly. Two or 3 drachms of arrow-root may be boiled in a pint of water or milk, and seasoned as may be desired, if allowable.

Other Varieties of Arrow-root.—A product termed ZAMIA ARROW-ROOT, *Florida arrow-root*, *Indian bread root*, or *Koonti*, is prepared in Florida by the Seminole Indians from the rhizome of the *Zamia integrifolia* (see *Amer. Jour. Pharm.*, 1898, p. 213), and a kind of arrow-root that came from Chili under the name *Talcahuana arrow-root*, proved to be the product of *Alstrœmeria ligtu*. Other species of *Alstrœmeria* also yield a starchy material which is used in South America, like arrow-root. *Brazilian arrow-root* is derived from *Manihot utilissima* (which see). *Arrow-root* of *Tahiti* is derived from *Tacca oceanica*; *Australian arrow-root* (of Queensland) is yielded by *Canna edulis* (see *Canna*). The *Colocasia esculenta*, *Dioscorea sativa* (Common yam) and fruit of the bread-fruit tree (*Arctocarpus incisa*), have also yielded a fecula which has been substituted for true arrow-root.

Related Substance.—*Lewisia rediviva*, *Chita*, *Spathum*, *Bitter root*. Northwestern United States. Roots largely used as a food by the American Indians of that locality.

MARMOR ALBUM.—WHITE MARBLE

FORMULA: $CaCO_3$. MOLECULAR WEIGHT: 99.76.

A nearly pure, native, white crystalline, or granular calcium carbonate.

SYNONYMS: *Marble*, *Marmor* (*U. S. P.*, 1870).

History and Description.—White marble is distinguished from most minerals by its pure white color, its crystalline structure, and the effervescence it presents when touched with nitric or hydrochloric acids. It is tasteless, inodorous, friable, easily powdered, and is not dissolved by water or alcohol; but water saturated with carbonic acid gas, dissolves $\frac{1}{1500}$ part of it. From this solution it gradually precipitates, as the acid leaves it, in the form of a white powder. Its specific gravity is 2.717. Heat causes it to decrepitate, and, as the heat is increased, the carbonic acid gas is driven off and caustic lime remains ($CaCO_3 = CaO + CO_2$). Marble dissolves less rapidly in acetic acid than in nitric or hydrochloric. It also dissolves with effervescence in sulphuric acid, and forms nearly insoluble calcium sulphate.

It is sometimes rendered impure by the presence of magnesia. To detect this dissolve the marble in diluted hydrochloric acid, neutralize with ammonia, and precipitate the calcium by adding ammonium carbonate. Boil and filter, and to the cold filtrate add solution of sodium phosphate (PO_4HNa_2). If magnesium is present, a crystalline precipitate of ammonium-magnesium phosphate ($PO_4NH_4Mg + 6H_2O$) will be formed. Marmor album was formerly official in the *U. S. P.* (1870) and the *Br. Pharm.* (1885).

Uses.—Marble is used for several purposes in pharmacy, the principal of which is to furnish carbonic acid gas. It is also used in preparing Liquor Calcii Chloridi. For pharmaceutical purposes, the purest marble is required, but for procuring the acid gas, ordinary marble will answer. The *Dolomitic marble* contains more or less magnesia, and is, therefore, unfit for pharmaceutical use. The finest and best variety of marble is the *Carrara* or *Statuary marble*.

MARRUBIUM (U. S. P.)—MARRUBIUM.

"The leaves and tops of *Marrubium vulgare*, Linné"—(*U. S. P.*).

Nat. Ord.—Labiatæ.

COMMON NAMES: *Horehound*, *Hoarhound*.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 210.

Botanical Source.—Hoarhound has a perennial, fibrous root and numerous, annual, bushy stems, which are erect, quadrangular, leafy, clothed with fine, woolly pubescence, branching from the bottom, from 1 to 2 feet in height. The leaves are roundish-ovate, crenate dentate, rough and veiny above, woolly on the under surface, 1 or 2 inches in diameter, and supported in pairs upon long petioles; upper ones nearly sessile. The flowers are small, white, in sessile, axillary, hairy dense whorls. Calyx tubular, 5 to 10-nerved, nearly equal, with 5 or 10 recurved, acute, spiny teeth, alternate ones shorter; orifice of the tube hairy. The corolla is tubular, upper lip erect, flattish, and notched; lower spreading and trifid; middle lobe broadest. Stamens 4, didynamous, included beneath the upper lip of the corolla; anthers with divaricating, somewhat confluent lobes, all nearly of the same form. Style with short, obtuse lobes. Achenia obtuse. Seeds 4, in the base of the calyx (L.—W.—G.). A synoptical key to various genera belonging to the natural order Labiatæ, based upon the microscopic appearance of the nutlets, by S. E. Jelliffe, is given in the *Druggists' Circular*, 1897, p. 34.

Fig. 167.

Marrubium vulgare.

History and Description.—Hoarhound is indigenous to Europe, but is naturalized in this country, where it is very common. It grows on dry, sandy fields, waste grounds, roadsides, etc., flowering from June to September. The entire plant has a white, hoary appearance. The whole herb is medicinal, and should be gathered before its inflorescence. It has a peculiar, rather agreeable, vinous, balsamic odor, and a very bitter, aromatic, somewhat acrid and persistent taste. Its virtues are imparted to alcohol or water. The *U. S. P.* describes the drug thus: "Leaves about 25 Mm. (1 inch) long, opposite, petiolate, roundish-ovate, obtuse, coarsely-crenate, strongly rugose, downy above, white-hairy beneath; branches quadrangular, white, tomentose; flowers in dense, axillary, woolly whorls, with a stiffly 10-toothed calyx, a whitish, bilabiate corolla, and 4 included stamens; aromatic and bitter"—(*U. S. P.*).

Chemical Composition.—J. A. McMaken, in 1845 (*Amer. Jour. Pharm.*, Vol. XVII, p. 1), isolated from the herb of *M. vulgare* a peculiar crystalline, bitter principle of neutral reaction, insoluble in water, soluble in ether, and more soluble in hot than in cold alcohol. The principle was again discovered, in 1855, by Mein, who named it *marrubiin*. It was subsequently investigated by Harms (1855), Kromayer (1861 and 1863), and more recently by Hertel (*Amer. Jour. Pharm.*, 1890, p. 273), J. W. Morrison (*ibid.*, p. 327), and Harry Matusow (*ibid.*, 1897, p. 201). The latter, by extraction with acetone, obtained a yield of 0.8 per cent, referred to air-dried herb, and gives *marrubiin* the formula $C_{30}H_{43}O_6$. The reactions generally confirm those given by Kromayer, only the melting point he found to be at 154° to 155° C. (309.2° to 311° F.), while Kromayer finds 160° C. (320° F.). The substance is not a glucosid. According to Morrison, several distinct bitter principles appear to exist in the plant. The latter also contains traces of volatile oil.

Action, Medical Uses, and Dosage.—Hoarhound is a stimulant tonic, expectorant, and diuretic. Its stimulant action upon the laryngeal and bronchial mucous membranes is pronounced, and it, undoubtedly, also influences the respiratory function. It is used in the form of syrup, in *coughs, colds, chronic catarrh, asthma*, and all *pulmonary affections*. The warm infusion will produce diaphoresis, and sometimes diuresis, and has been used with benefit in *jaundice, asthma, hoarseness, amenorrhœa*, and *hysteria;* the cold infusion is an excellent tonic in some forms of *dyspepsia*, acts as a vermifuge, and will be found efficient in checking *mercurial ptyalism*. In large doses it purges. It enters into the composition of several syrups and candies. Dose of the powder, 1 drachm; of the infusion, or syrup, from 2 to 4 fluid ounces; specific marrubium, 1 to 30 drops.

MASSÆ PILULARUM.—PILL MASSES.

Three pill masses that may be kept in stock, are recognized by the *U. S. P.*

Massa Hydrargyri (*U. S. P.*), *Mass of mercury, Pilula hydrargyri, Blue mass, Blue pill, Massa cærulea.*—"Mercury, thirty-three grammes (33 Gm.) [1 oz. av., 72 grs.]; glycyrrhiza, in No. 60 powder, five grammes (5 Gm.) [77 grs.]; althæa, in No. 60 powder, twenty-five grammes (25 Gm.) [386 grs.]; glycerin, three grammes (3 Gm.) [46 grs.]; honey of rose, thirty-four grammes (34 Gm.) [1 oz. av., 87 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Triturate the mercury with the honey of rose and glycerin until it is extinguished. Then gradually add the glycyrrhiza and althæa, and continue the trituration until globules of mercury are no longer visible under a lens magnifying at least 10 diameters. If a portion of the mass be triturated, in a mortar, with warm acetic acid, the filtrate should not become more than slightly opalescent on the addition of a few drops of hydrochloric acid (limit of mercurous oxide). If another portion of the mass be digested with warm, diluted hydrochloric acid and a little purified animal charcoal, the filtrate should not be affected by hydrogen sulphide T.S., or by stannous chloride T.S. (absence of mercuric oxide)"— *U. S. P.*).

A powder of blue mass is prepared by using the same ingredients as above, except that sugar of milk and a drop of oil of rose are employed in place of glycerin and honey of rose. By means of alcohol, to give moisture, rub the whole to a uniform mass, and allow the alcohol to evaporate. Reduce to powder. It is known as PULVIS MASSÆ HYDRARGYRI, *Powdered blue mass*, or *Æthiops saccharatus*. PILULÆ HYDRARGYRI, or *Blue pills*, of the *U. S. P.*, 1870, contained 1 grain, each, of mercury. (For uses, see *Hydrargyrum.*) Not employed in Eclectic practice.

MASSA COPAIBÆ (U. S. P.)—MASS OF COPAIBA.

SYNONYMS: *Pilulæ copaibæ, Solidified copaiba.*

Preparation.—"Copaiba, ninety-four grammes (94 Gm.) [3 ozs. av., 138 grs.]; magnesia, six grammes (6 Gm.) [93 grs.]; water, a sufficient quantity. Triturate the magnesia with a little water, in a capsule, until the powder is uniformly dampened throughout. Then gradually incorporate with it the copaiba, so that a uniform mixture may result, place the capsule on a water-bath, and heat during half an hour, frequently stirring. Lastly, transfer the mixture to a suitable vessel, and set this aside until the mass has acquired a pilular consistence"—(*U. S. P.*).

Anhydrous magnesia does not easily combine with the resin of copaiba, hence the direction to sprinkle water upon the magnesia, thus hydrating it, in which state it more readily unites with the resin (*copaivic acid*) to form magnesium copaivate. The volatile oil is simply absorbed. The above proportions will form the proper mass, provided too much volatile oil be not present. If such should be the case, evaporation or exposure will reduce the quantity of oil. For this reason *Para copaiba*, which is thin, has to be prepared in this manner before a good result can be obtained, while, on the other hand, *Maracaibo copaiba*, being much thicker on account of its greater abundance of resin, unites to form a hard compound, a sort of resin-soap. Hence the preference for the latter variety. Fresh calcium hydrate will produce similar results. Wax or spermaceti have been advised in making pills of copaiba, as well as pills of copaiba and cubebs. Vegetable powders, as powdered liquorice root, may be combined with the wax in the mass if desirable. This method has the advantage of producing a pill which remains plastic.

Action and Medical Uses.—Same as for *Copaiba*. It should be made into 5-grain pills, 2 or 3 of which is the ordinary dose.

MASSA FERRI CARBONATIS (U. S. P.)—MASS OF FERROUS CARBONATE.

SYNONYMS: *Vallet's mass, Vallet's pill-mass.*

Preparation.—"Ferrous sulphate, in clear crystals, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; sodium carbonate, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; clarified honey, thirty-eight grammes (38 Gm.) [1 oz. av., 149 grs.]; sugar, in coarse powder, twenty-five grammes (25 Gm.) [386 grs.]; syrup, distilled water, each, a sufficient quantity to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Dissolve the ferrous sulphate and the sodium carbonate, each separately, in two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of boiling distilled water, and, having added twenty cubic centimeters (20 Cc.) [325 ♏] of syrup to the solution of the iron salt, filter both solutions, and allow them to become cold. Introduce the solution of sodium carbonate into a bottle having a capacity of about five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏], and gradually add the solution of the iron salt, rotating the flask constantly or frequently, until carbonic acid gas no longer escapes. Add a sufficient quantity of distilled water to fill the bottle, then cork the bottle and set it aside, so that the ferrous carbonate may subside. Pour off the supernatant liquid, and, having mixed syrup and distilled water in the proportion of 1 volume of syrup to 19 volumes of distilled water, wash the precipitate with the mixture by decantation until the washings no longer have a saline taste. Drain the precipitate on a muslin strainer, and express as much of the water as possible. Lastly, mix the precipitate at once with the honey and sugar, and, by means of a water-bath, evaporate the mixture in a tared capsule, with constant stirring, until it is reduced to one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]"—(*U. S. P.*).

Description.—By this process the iron salt is almost completely prevented from oxidation by the presence of the saccharine matter. The finished product, through some loss by washing, contains but about 35 or 36 per cent of ferrous carbonate. If well made, it will be completely and easily dissolved by acids. When recently prepared, *Mass of ferrous carbonate* (*U. S. P.*) is a greenish-gray, soft mass, of a pilular consistence, which becomes, superficially, greenish-black or blackish on exposure. Its taste is strongly ferruginous.

Medical Uses and Dosage.—(See *Ferrous Carbonate.*) Dose, 3 to 5 grains in pill.

MASTICHE (U. S. P.)—MASTIC.

"A concrete, resinous exudation from *Pistacia Lentiscus*, Linné"—(*U. S. P.*).

Nat. Ord.—Anacardiceæ.

COMMON NAMES: *Mastic, Mastich.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 68.

Botanical Source.—The *Lentisk*, or Mastic-tree, is a mere bush, rarely attaining a height greater than 12 feet, and from 6 to 10 inches in diameter. The leaves are evergreen, and equally pinnate; the leaflets, 8 to 12 in number, usually alternate, with the exception of the two upper, which are opposite, oval, lanceolate, obtuse, often mucronate, entire, and perfectly smooth. The flowers are very small, in axillary panicles, and diœcious; the raceme of the males is amentaceous with 1-flowered bracts; calyx 5-cleft; stamens 5; anthers subsessile and 4-cornered; the females' raceme more lax; calyx 3-cleft; ovary 1 to 3-celled; stigmas 3, and rather thick. The fruit is a very small, pea-shaped drupe, reddish when ripe, with a smooth, somewhat bony nut (L.).

History and Description.—This plant inhabits the south of Europe, north of Africa and the Levant, and abounds particularly on the island of Chios, where it is called "shinia," and from whence the bulk of the drug comes; about 120,000 pounds annually. *Pistacia Lentiscus* also grows in the island of Cyprus, where the leaves are collected and exported for the purposes of tanning and dyeing. They contain from 10 to 12 per cent of tannic acid. The seeds are eaten by goats and pigs, and yield a fatty oil used for burning purposes. When transverse incisions are made into the bark of the male plant, in the month of August, a fluid exudes, which soon concretes into yellowish, translucent, brittle grains.

There are two kinds of mastic in commerce, the picked mastic and mastic in sorts. The former is the finer variety. Good mastic is described by the *U. S. P.* as being in "globular or elongated tears, of about the size of a pea, sometimes covered with a whitish dust, pale-yellow, transparent, having a glass-like luster and an opalescent refraction; brittle; becoming plastic when chewed; of a weak, somewhat balsamic, resinous odor, and a mild, terebinthinate taste. Mastic is completely soluble in ether, and, for the most part, soluble in alcohol"—(*U. S. P.*). It is also soluble in oil of turpentine, or chloroform, insoluble in water. Boiling alcohol dissolves from it a resinous acid to the amount of eight-tenths of its weight, and leaves a white, ductile substance possessing properties similar to caoutchouc, and which is soluble in ether, or boiling absolute alcohol. Carbon disulphide dissolves about 75 per cent of mastic. At a moderate heat (below 120° C. or 248° F.), it melts, and at a higher temperature it burns with a clear flame and balsamic fumes. It has a specific gravity of 1.074. The mastic in sorts is a coarser kind, and is composed of many tears agglutinated together, varying in color from pale-yellow to grayish-brown and black, together with pieces of wood, bark, and sand.

Chemical Composition.—Mastic contains 2 per cent of an essential oil; according to Flückiger, it is dextro-rotatory and chiefly composed of a terpene ($C_{10}H_{16}$), boiling from 155° to 160° C. (311° to 320° F.). The principal constituent of mastic is a resin which was differentiated by Johnston (*Phil. Trans.*, 1839) into alcohol-soluble *alpha-resin* (*mastichic acid*), about 80 per cent, and alcohol-insoluble *beta-resin* (*masticin*), the latter being tough and elastic, soluble in ether and in absolute alcohol, also in alcoholic solution of mastichic acid. According to E. Reichardt (*Archiv der Pharm.*, 1888, p. 158), benzin effects the differentiation of mastic resin more readily and more completely than alcohol. Old mastic yielded to benzin 66 per cent, while new mastic yielded 90 per cent. Analysis showed that the insoluble resin is formed by the gradual oxidation of the soluble portion. Mastic also contains a bitter principle, soluble in boiling water; it is precipitated by solutions of tannic acid.

Action and Medical Uses.—Mastic is seldom employed in medicine, though it was formerly employed in *renal* and *bronchial catarrhs*. The Turks used it as a masticatory to sweeten the breath and strengthen the gums. It is sometimes employed by dentists to fill the *cavities of decayed teeth*. The following preparation is recommended for this purpose: Take of pulverized mastic, 9 parts; sulphuric ether, 4 parts; mix, and digest for several days, strain it through a cloth, and add native alum, in fine powder, a sufficient quantity to form a plastic mass, with which vials holding about 2 drachms are to be filled, having first poured into each about 30 grains of camphorated alcohol, and 15 grains of essence of cloves. This substance, introduced into the cavity of a carious tooth, first well cleansed and dried, is extremely useful on account of the great degree of hardness it acquires, An ounce of mastic, and ½ drachm of caoutchouc, dissolved in 4 fluid ounces of chloroform, and then filtered under cover to prevent the evaporation of the chloroform, forms an elegant microscopic cement. Another formula for dental mastic is as follows: Dissolve 4 parts of mastic and 2.5 parts of balsam of Peru in 7 parts of chloroform (*Amer. Jour. Pharm.*, 1885, p. 241, from *L'Union Pharm.*, 1885). A solution of mastic in alcohol, or oil of turpentine, forms an elegant varnish. Such a solution may be used to arrest slight *hemorrhages from wounds*, *leech bites*, etc.

Related Products.—BOMBAY MASTIC, or *East Indian mastic*. This exudes from the *Pistacia Khinjuk*, Stocks, and the *Pistacia cabulica*, Stocks (*Pistacia Terebinthus*, Linné of Kabul, Beloochistan, and Sind. In the Indian bazaars it is known as *Mustagi-rúmi* or *Roman mastich*. It very much resembles true mastic, but is usually more opaque and not so clean as that product. The same species, *Pistacia Terebinthus*, also grows in the islands of Chios and Cyprus, and yields *Chian turpentine*. The mode of its cultivation, etc., is described in *Proc. Amer. Pharm. Assoc.*, 1897, p. 563. Chian turpentine contains from 9 to 12 per cent of volatile oil (Wigner, 1880). The Arabs of North Africa gather from an Algerian plant, the *Pistacia Terebinthus*, Linné, var. *Atlantica*, Desfontaines, a product similar to mastic.

SANDARACH.—*Sandaraca*, *Sandarac*. A northwest African tree, the *Callitris quadrivalvis*, Ventenat (*Thuja articulata*, Vahl), *Nat. Ord.*—Coniferæ, yields tears of sandarac by spontaneous exudation. They are brittle, elongated, light-yellow, and have a dusty appearance. When masticated they crumble to a powder, are translucent, have a vitreous fracture, and are almost completely dissolved by alcohol. Sandarac is also soluble in ether, amyl alcohol and acetone, partly soluble in chloroform and essential oils, insoluble in low-boiling petroleum benzin, and in benzol, partly soluble in carbon disulphide, also soluble in considerable quantity in hot solution of caustic soda. The freshly exuding resin contains notable quantities of essential oil which evaporates, however, as the tears are exposed (Flückiger, *Pharmacognosie*, 1891, p. 108). Their odor is therefore feeble, unless the product be heated when it becomes balsamic; the taste is resin-like and subacrid. It is inflammable. Sandarac is said to be composed of 3 resins, which may be differentiated by their behavior toward solvents. One of these resins is Giese's *sandaracin*. Like mastic, sandarac resin contains small quantities of a bitter principle.

Australian sandarach is physically very similar to the foregoing. It is obtained in Tasmania and Australia.

PSEUDO-MASTICH.—*Acantho-mastich*. Agglutinated tears of an exudation from the *Atractylis gummifera*. It comes in masses about the size of a small egg. It is employed in Greece.

MATICO (U. S. P.)—MATICO.

"The leaves of *Piper angustifolium*, Ruiz et Pavon"—(*U. S. P.*). (*Piper elongatum*, Vahl; *Stephensia* [*Steffensia*] *elongata*, Kunth; *Artanthe elongata*, Miquel

Nat. Ord.—Piperaceæ.

COMMON NAMES: *Matico*, *Matico-leaves*.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 242.

Botanical Source.—This plant is the *Artanthe elongata* of Miquel, and the *Stephensia elongata* of Kunth; it is described as a tall shrub, presenting a singular appearance from the segmentary character of its stems and branches. The leaves are harsh, short-stalked, oblong-lanceolate, acuminate, pubescent beneath, tessellated or rough on the upper side on account of the sunken veins. The spikes are solitary, cylindrical and opposite the leaves; the bracts lanceolate; the flowers hermaphrodite, yellow, minute, and numerous. The fruit consists of small, almost black seeds.

History and Description.—This is a Peruvian plant, which was brought into notice among the profession of this country by Dr. Ruschenberger, a member of the United States Navy. The dried leaves are the parts used; they have a strong, rather fragrant odor, not unlike that of cubebs, and a warm, aromatic, somewhat feebly astringent taste. They are easily reduced to a powder of a color similar to that of senna leaves. Water takes up their aroma and a slight pungency, but no astringency. Infusion of galls produces a gray precipitate with infusion of matico; iron causes a deep-green one; tartar-emetic, corrosive sublimate, and gelatin scarcely affect it.

The official description of matico is as follows: "From 10 to 15 Cm. (4 to 6 inches) long, short-petiolate, oblong-lanceolate, apex pointed, base unequally heart-shaped, margin very finely crenulate, tessellated above, reticulate beneath, meshes small, and the veins densely-brownish-hairy; aromatic, spicy, and bitterish"—(*U. S. P.*).

Chemical Composition.—Dr. Hodges, in 1844, found in the leaves a bitter principle which he called *maticin*, an aromatic, volatile oil nitrate of potassium, a soft, dark-green resin, etc. T. S. Wiegand (1846) and John J. Stell (1858), and more recently, Prof. Flückiger, doubt the existence of Hodge's maticin; Flückiger (*Pharmacognosie*, 1891, p. 748) was also unable to verify the existence of Marcotte's crystallizable *artanithic acid* (1869). Tannin is present in the leaves. The *volatile oil* of matico is pale yellow and thick, and exists to the extent of 2.7 per cent. Its optical rotation is slightly right-handed. Most of the oil distills between 180° and 200° C. (356° and 392° F.). From the thick residue Prof. Flückiger obtained upon cooling, large crystals of a peculiar camphor; Kügler (1883) ascribes to the purified substance the formula $C_{10}H_{15}(C_2H_5)O$. It melts at 94° C. (201.2° F.), and is devoid of odor and taste.

Action, Medical Uses, and Dosage.—Matico is an aromatic bitter stimulant, whose virtues reside in its resin, volatile oil, and bitter principle. It has been highly reecommended in *bleeding from the lungs*, *stomach*, or *kidneys*, and in *dysentery*, but its use is doubtful in these cases. It has, however, been found advantageous in *leucorrhœa*, *gonorrhœa*, *piles*, and *chronic mucous discharges;* also in *dyspepsia*, owing to chronic mucous affections of the stomach. Externally, the leaves are used for arresting *hemorrhages from wounds*, *leech-bites*, etc.; the downy part of the leaf is said to be the most active part. Also applied to *ulcers*. A tincture is also used, made with 2½ ounces of the leaves to 1 pint of diluted alcohol, of which the dose is from 1 to 3 fluid drachms. The infusion is made by macerating ½ ounce of the leaves in ½ pint of boiling water for 1 hour; dose, from 1 to 2 fluid ounces, 3 or 4 times a day.

Related Species.—*Piper aduncum*, Linné (*Artanthe adunca*, Miquel), abundant in Tropical America, furnishes a leaf which was substituted for matico, and was detected by Prof. Bentley in 1864. It differs but little in odor, shape, or color, from matico, though it does not appear tessellated like the latter. The parallel ascending nerves are more prominent on the under surface, and the spaces are nearly smooth, instead of rugose, and not hairy like the same surface of matico leaves. Chemically, it resembles matico, and therapeutically, it is probably not less effective.

Artanthe lanceæfolium, Miquel (*Piper lanceæfolium*, H. B. K.), yields a *matico* which is employed in New Granada (*Pharmacographia*). The leaves of *Eupatorium glutinosum*, Kunth (the *Chusalonga*) (*Nat. Ord.*—Compositæ), and *Waltheria glomerata*, Presl (*Nat. Ord.*—Sterculiaceæ) of Central and South America, are known also as matico. It appears that the terms *Matico* and *Yerba* (*palo*) *del soldado* (*Soldiers' herb* or *tree*), both Spanish names, are applied to these plants as well as to true matico, on account of their styptic qualities. The *Piper aduncum* is used in Brazil as a stimulant only, styptic properties not being mentioned. The fruit of the same is employed like cubebs. The leaves of the Eupatorium and Waltheria are sufficiently different as not to be confounded with matico.

Piper Carpunya, Ruiz et Pavon. Peru and Chili. Glossy, leathery leaves used in *gastric disorders*.

Piper umbellatum, Linné; *Piper peltatum*, Linné. Tropical America. The *caapeba* or *pariparobo.* Rhizomes, diuretic; leaves employed for *tumors* and *cutaneous diseases*. See also *Areca*, *Piper methysticum*, and *Piper Betle*.

MATRICARIA (U. S. P.)—MATRICARIA.

"The flower-heads of *Matricaria Chamomilla*, Linné"—(*U. S. P.*). (*Chamomilla officinalis*, Koch; *Chrysanthemum Chamomilla*, Bernhardi.)

Nat. Ord.—Compositæ.

COMMON NAME: *German chamomile.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 155.

Botanical Source.—A branching annual, having a stem from 1 to 2 feet high, with alternate, smooth, deep-green, pinnate, or bi- or tri-pinnate leaves, the leaflets of which are small and linear. The numerous small branches bear single, terminal flowers, about ¾ inch in breadth, with spreading rays. The calyx-scales are obtuse, whitish, translucent, and membranaceous near the margins, but green in the center. The white ray-florets are spreading at first, finally becoming reflected. The disc is convex primarily, and later becomes prominently conical and hollow.

History and Description.—This plant is found in wastes and fields in Europe northward to Finland, and is cultivated in this country by our German population. It is likewise found in Asia in the temperate localities, and, through naturalization, has become one of the plants of Australia. All parts of the plant are medicinal, but the flowers are generally employed. When dried they are much smaller than the fresh heads. Matricaria is described by the *U. S. P.* as follows: "About 15 to 20 Mm. (½ to ⅘ inch broad), composed of a flattish, imbricate involucre, a conical, hollow, naked receptacle, which is about 5 Mm. (⅕ inch) high, about 15 white, ligulate, reflexed ray-florets, and numerous yellow, tubular, perfect disk-florets without pappus; strongly aromatic and bitter. The similar flower-heads of *Anthemis arvensis*, Linné, and *Maruta Cotula*, De Candolle (*Nat. Ord.*—Compositæ), have conical, solid, and chaffy receptacles"—(*U. S. P.*). (See *Anthemis*.)

Chemical Composition.—In addition to the ordinary constituents of plants, matricaria contains a small portion of tannin and tannates, malates, bitter extractive, and a volatile oil. The latter, known as *Oleum Chamomillæ Æthereum*, may be obtained, by distillation in a suitable apparatus, in the quantity of 0.45 per cent (Schimmel & Co.). It has an aromatic, warm taste, and a pronounced odor of matricaria. It is thick, somewhat viscid, opaque in bulk, but in layers transparent, and has a rich, dark-blue color which, on exposure to air and light, gradually becomes green, and, lastly, brown. Its density is 0.93; its congealing point, —20° C. (—4° F.). It consists of a colorless oil having the composition $C_{10}H_{18}O$, and a terpene ($C_{10}H_{16}$). *Azulene* (of Piesse), or *cærulein* (of Gladstone), a volatile body said to be present in all blue or green oils, gives to it its blue coloration. It was investigated by Kachler (1871), and occurs only in the highest fractions of the oil. An *Oleum Chamomillæ Citratum*, sometimes met with, is prepared by adding oil of lemon (1 part) to recently gathered matricaria (480 parts), and distilling. It is thinner than the true oil, and its blue color changes more readily. Werner, in 1867, states to have obtained from *Matricaria Chamomilla* the crystallizable, bitter *anthemic acid*, isolated by Pattone (1859) from the flowers of *Anthemis arvensis*, Linné; and a crystallizable alkaloid, which he called *anthemidine*. Flückiger (1891) doubts the correctness of these results.

Action, Medical Uses, and Dosage.—Matricaria is usually listed as having properties similar to anthemis, but of less activity. It has, however, come to be preferred over the latter by Eclectic practitioners, and is now an important remedy with us, particularly in affections of young children. It has two particular specific fields of action—one upon the nervous system, subduing nervous irritability, and the other upon the gastro-intestinal tract, relieving irritation. Upon the nervous system its action is most pronounced, affecting both the sensory and motor nerves. It is peculiarly adapted to the *nervous manifestations of dentition*, and in other affections where there seems to be a *morbid susceptibility to pain. Earache, rheumatic* and *neuralgic pains, abdominal neuroses*, etc., are relieved by it when the nervous apprehension is all out of proportion to the actual amount of pain experienced. A matricaria patient is restless, irritable, discontented, and impatient, and, if a child, is only appeased when continually carried. In *pregnancy*, it relieves nervous twitching, cough, false pains, etc., accompanied by great unrest. It should be borne in mind, however, that it is not the gross dose of matricaria that will overcome these morbid, nervous phenomena, but the small, or almost minute dose. It is one of those agents, and we have many, that exert their peculiar effects only in small doses, yet can be used without harm in large doses, but without the peculiar benefit derived from the smaller amounts. It relieves the erethism producing *hysteria*—a little slowly, perhaps, but its effects are lasting—and for the conditions that threaten *infantile convulsions*, during dentition, it is one of the most certain of drugs. After the spasms have supervened, it is not equal to gelsemium or lobelia.

While it has been said that it has two specific fields of action—upon the mental and nervous, and upon the digestive tract—it must be remembered that the nervous manifestations calling for matricaria, are nearly always present in the disorders of the latter, while, on the other hand, the nervous phenomena may occur without any disturbance of the latter. Hence the references to the nervous symptoms of stomach and bowel disorders, given as specifically calling for the drug. In the *summer diarrhœa* of irritation (not of atony), it becomes an important remedy. The condition will probably not be without call for other specifics, but the indications for matricaria will be distinct. There is marked irritability, the child is peevish and fretful, the stools extremely fetid, and may excoriate around the anus more or less. In appearance they vary—may be watery and green, or slimy, perhaps in yellow and white lumps, or it may be of undigested curds of milk, imbedded in a green mucus—an appearance aptly compared by Prof. Bloyer to "chopped eggs and greens." In *subacute inflammation* and in *congestion of the liver*, small doses of matricaria are very efficient when the bowels are costive, the urine voided with difficulty, the child fretful and peevish, and the right hypochondrium tender. If fever is present, aconite may be associated with it. It corrects the skin eruptions and rashes due to these disorders. Alone, or associated with phytolacca, it relieves *soreness and swelling of the breasts in infants*, and is useful in *suppression of the lacteal secretion*. It is a remedy for *flatulent colic* with distension.

Either small or large doses of matricaria (specific or infusion) are of value in *amenorrhœa*, with sense of weight and heaviness in the womb, and bloating of the abdomen, accompanied with sudden nervous explosions of irascibility. The infusion, given to the extent of producing free diaphoresis, relieves *dysmenorrhœa*, with labor-like pains, and tends to prevent the formation of clots. Various painful conditions, due to contracting *colds*, are relieved by matricaria infusion associated with aconite. Among these may be mentioned *earache*, *rheumatism*, *catarrhal affections of the bowels*, *ears*, *nose*, and *eyes*. Locally, it has been used as a wash for *leucorrhœa*, *mammary abscess*, *ulcerating bubo*, and *catarrhal conjunctivitis*.

For topical application and internal administration, an infusion (℥ss to water Oj) may be used. For its gross action, it may be given freely, but for specific purposes, teaspoonful doses of an infusion of half the above strength will give the best results. Specific matricaria is given in doses of a fraction of a drop to 30 drops.

Specific Indications and Uses.—Nervous irritability, with peevishness, fretfulness, discontent, and impatience; sudden fits of temper during the catamenial period; muscular twitching; morbid sensitiveness to pain; head sweats easily; alvine discharges, fetid, greenish and watery, and of green mucus with curds of milk, or of yellow and white flocculi, associated with flatulence, colic, and excoriation of the anal outlet; a remedy particularly fitted for the disorders of dentition, and to correct the condition threatening to end in dentition convulsions.

Related Species.—*Anthemis arvensis*, Linné. America and Europe. The flowers of this species have no odor, but have a bitter, acrid taste. They are possessed of medicinal qualities similar to anthemis and matricaria, but are regarded less valuable. Pattone ([illegible]) found the flowers to contain bitter and crystallizable *anthemic acid*, and a crystallizable alkaloid, *anthemine*. Flückiger (*Pharmacognosie*, 3d ed., 1891, p. 832) doubts the correctness of these statements.

MEL (U. S. P.)—HONEY.

"A saccharine secretion deposited in the honeycomb by *Apis mellifica*, Linné" (*U. S. P.*).

Class: Insecta. *Order:* Hymenoptera.

Source and History.—The *Apis mellifica*, or honey-bee, belongs to the order *Hymenoptera*, of the class of insects. In the wild state it dwells in the hollows of trees in large communities, consisting of males, females, and neuters. Honey is a saccharine matter secreted by the nectariferous glands of flowers, which is collected by the working bees, and deposited in their *crop* or *honey-bag*, from which it is ejected when the insect reaches its hive. The taste, odor, and quality of honey varies according to the age of the bees and the character of the flowers from which it is gathered. The presence of pollen grains in honey mostly permits the identification of the flowers from which the honey is taken. There is no doubt but the secretions of the crop of the insect, somewhat alter the properties of the honey received into it from the nectaries. It is established, for example, that these secretions contain a ferment which readily converts cane sugar and starch into *invert-sugar*. *Virgin honey* is the best kind, and is procured by dripping honeycomb from a hive of young bees before they have swarmed. Honey of a superior quality is obtained by allowing it to ooze from the honeycomb. After the first honey is thus procured, by subjecting the honeycomb to compression, an inferior variety may be expressed; or it may be obtained by fusion in the vapor-bath. Although a large amount of honey is supplied in our own country, yet a great quantity is also imported from some of the West Indian islands. A plea for California honey was made by J. E. S. Bell, in *Amer. Jour. Pharm.*, 1888, p. 126. The best honey is stated to be produced from linden flowers. On the other hand, certain poisonous plants, especially of the natural order of Ericaceæ, yield poisonous honey, the toxic principle very likely being *andromedotoxin* (see interesting paper by L. F. Kebler, *Proc. Amer. Pharm. Assoc.*, 1896, p. 167).

Description.—The *U. S. P.* describes honey as "a syrupy liquid of a light-yellowish to pale, yellowish-brown color, translucent when fresh, but gradually becoming opaque and crystalline, having a characteristic, aromatic odor, and a sweet, faintly acrid taste"—(*U. S. P.*). (See *Mel Despumatum.*) The specific gravity of good honey, on the average, is 1.425; it should not be lower than 1.375 (*U. S. P.*). In a great measure it is soluble in water, not so readily soluble in alcohol; hot alcohol dissolves it, but on cooling deposits crystals of grape sugar.

Chemical Composition.—According to J. König (*Die Menschlichen Nahrungs- und Genussmittel*, 3d ed., 1893, p. 784), the average composition of 100 parts each, in 183 samples of honey analyzed, was as follows: Water, 20.6; nitrogenous matter, 0.76; *lævulose* (*fruit sugar*), 38.65; *dextrose* (*grape sugar* or *glucose*), 34.48; *cane sugar* (*sucrose*), 1.76; (maximum in one single instance, 12.91; the beehives in this case were situated near a cane sugar manufactory); gum, 0.22; pollen and wax, 0.71; non-sugar substances, 2.82; ash, 0.25; phosphoric acid, 0.028. Thus it is seen that the bulk of the sugar is present as *invert sugar* (equal molecules of dextrose and lævulose) with *lævulose* somewhat preponderating. Most of the genuine honey therefore, is decidedly lævo-rotatory. Still, a possible increase in cane sugar, which is dextro-rotatory, or of dextrin-like bodies (sometimes as much as 4 per cent), in natural honey is liable to change the optical rotation to the right. Pure honey, upon standing becomes semi-crystalline, crystals of *dextrose* ($C_6H_{12}O_6 + H_2O$) being deposited. A peculiar property of invert sugar, which is made use of in analysis by optical methods, consists in the fact that its optical rotation, which is to the left, becomes zero at a temperature of 87.2° C. (189° F.). Honey, diluted with water, is susceptible to the vinous fermentation, without the addition of yeast; if yeast be added, it forms the alcoholic liquor called *mead;* the presence of albuminous bodies in honey facilitates fermentation; if nitric acid be allowed to act on honey, oxalic acid results. Honey also contains *formic acid*, which the bees deposit in the honey in order to preserve it.

Adulterations and Tests.—Honey is occasionally adulterated with flour or starch, especially the inferior kinds, in order to give it a white appearance. If the honey be thin and slow to crystallize, it is probably adulterated with water. Honey is also liable to be adulterated by the addition of solution of cane sugar, or of glucose syrup. The presence and quantity of cane sugar may be established by determining the reducing power of the honey in question upon Fehling's solution before and after inversion with diluted hydrochloric acid. An increased reduction after inversion is due to the presence of cane sugar. The aforenamed adulterants are recognized by the following official tests: "When recent honey is diluted with 2 parts of water, the resulting liquid should be almost clear, not stringy, and should have a specific gravity not lower than 1.100 (corresponding to a specific gravity of 1.375 for the original honey). Honey has a faintly acid reaction toward litmus paper. If 1 part of honey be dissolved in 4 parts of water, a clear or nearly clear solution will result, which should not be rendered more than faintly opalescent by a few drops of silver nitrate T.S. (limit of chlorides), or of barium chloride T.S. (limit of sulphates). If 1 volume of honey be diluted with 1 volume of water, and a portion of this liquid gradually mixed with 5 volumes of absolute alcohol, it should not become more than faintly opalescent (as compared with the reserved portion of the solution), and should neither become opaque, nor deposit a slimy substance on the inner walls and bottom of the test-tube. And when honey is incinerated, in small portions at a time, in a platinum crucible, it should not leave more than 0.2 per cent of ash (absence of glucose and foreign inorganic substances). On boiling 1 part of honey with 5 parts of water, the resulting solution, when cold, should not be rendered blue or green on the addition of iodine T.S. (absence of starch)"—(*U. S. P.*).

Dr. O. Haenle (*Amer. Jour. Pharm.*, 1890, p. 445), employs dialysis and subsequent polarization of the residual liquid to prove the presence of glucose syrup in honey; the residue is optically active if glucose (which always contains dextrin-like bodies) is mixed with the honey in question. Yet, genuine honey, being of variable composition, may contain, as stated before, large quantities of dextrin as a natural constituent. In this connection, see the elaborate researches on the chemistry of honey, by O. Künnmann and A. Hilger, in *Forschungsberichte*, 1896, pp. 211–226.

In testing honey for chlorides, an excess of chlorides present may in some cases be accounted for by the gathering of honey from flowers grown in "salt marshes" (see L. F. Kebler, *Amer. Jour. Pharm.*, 1895, p. 27). The so-called *Eucalyptus honey* of Australia, for which its discoverer, D. Guilmeth, and his followers, claimed the virtue of containing large amounts of eucalyptol, proved to be a misrepresentation. (Compare *Amer. Jour. Pharm.*, 1887, p. 471, and 1891, p. 517.

Action, Medical Uses, and Dosage.—Honey is nutritious, antiseptic, diuretic, and demulcent. Used in *urinary affections*, and as an addition to gargles, lotions, injections, etc. A very excellent preparation for *coughs*, especially during *febrile* or *inflammatory attacks*, is composed of honey, olive-oil, lemon juice, and sweet spirits of niter, each 1 fluid ounce, to be taken several times a day, in half fluid-drachm or fluid-drachm doses. Honey sometimes enters into the formation of cataplasms for *diminishing the lacteal secretion*, and for the treatment of *fissured nipples*, *carbuncles*, and *boils*. Several preparations, as honey of borax, honey of rose, etc., are used as local applications in *aphthous sore throat and mouth*, and to *local disorders of the female genitalia*. It is said that the Indians make an infusion of the honey bee, and give 1 gill of it every half hour, in *strangury*, *suppression of urine*, etc. (see *Apis*), and it is further added, that this infusion has the power of destroying the sexual propensity. The latter statement requires confirmation. A tincture of honey bees is made by collecting a quantity of the living insects in a vial, agitating them roughly so as to irritate them, and while in that condition they are to be covered with alcohol; in a few days it will be ready for use. In small doses, several times a day, this is a highly useful remedy in many *diseases of the bladder* and *kidneys*, as well as in some *uterine affections* (see *Apis*). Some practitioners assert that it will produce abortion in the pregnant female, if its use be too long continued, or when employed too freely. Though extensively used as a food, honey occasionally causes, in susceptible individuals, unpleasant head symptoms, and more often flatulent colic of a peculiar character, and will sometimes produce diarrhœa.

MEL BORACIS.—BORAX HONEY.

SYNONYMS: *Mel sodii boratis*, *Honey of sodium borate*.

Preparation. Mix 60 grains of finely powdered borax with 30 grains of glycerin, and 480 grains of clarified honey. This accords with the *British Pharmacopeia*. The parts used are respectively 2, 1, and 16. This is extemporaneously prepared as needed. (See an interesting article on the chemistry of mel boracis, by W. R. Dunstan, in *Amer. Jour. Pharm.*, 1883, p. 453, from *Pharm. Jour. Trans.*, 1883.)

Action and Medical Uses.—Its uses are practically those of each of the ingredients composing it. It is especially applicable to *aphthous conditions* in young children.

MEL DESPUMATUM (U. S. P.)—CLARIFIED HONEY.

Preparation.—"Honey, a convenient quantity; glycerin, a sufficient quantity. Mix the honey intimately with two (2) per cent of its weight of paper-pulp, which has been previously reduced to shreds, thoroughly washed and soaked in water, and then strongly expressed and again shredded. Then apply the heat of a water-bath, and, as long as any scum rises to the surface, carefully remove this. Finally, add enough distilled water to make up the loss incurred by evaporation, strain, and mix the strained liquid with five (5) per cent of its weight of glycerin"—(*U. S. P.*). Some older processes employed for purification of honey, at boiling heat, the white of eggs, animal charcoal, gelatin, with subsequent addition of tannic acid, etc. (see description of these processes in this *Dispensatory*, preceding editions). "Clarified honey should conform to the tests of purity given under honey (see *Mel*)"—(*U. S. P.*).

Pharmaceutical Uses.—Honey is used in the preparation of pills, confections, oxymels, and medicated honeys.

MELLITA.—*Medicated honeys.* Simple mixtures of drugs with honey, prepared extemporaneously on account of their liability to decompose.

OXYMELLITA.—*Oxymels.* Medicated honeys, containing vinegar, or acetic acid (see *Oxymel*).

MEL ROSÆ (U. S. P.)—HONEY OF ROSE.

Preparation.—"Fluid extract of rose, one hundred and twenty cubic centimeters (120 Cc.) [4 fl℥, 28 ♏]: clarified honey, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Into a tared vessel introduce the fluid extract of rose, then add enough clarified honey to make the contents weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.], and mix them thoroughly"—(*U. S. P.*).

Action and Medical Uses.—Useful and pleasant addition to mouth-washes and gargles. It is slightly stimulant and astringent, and is adapted to *inflammatory ulcerations of mouth and throat.*

MELILOTUS.—MELILOT.

The leaves and flowering tops of *Melilotus officinalis*, Willdenow (*Melilotus vulgaris*, Eaton and Wright; *Trifolium officinale*, Linné).

Nat. Ord.—Leguminosæ.

COMMON NAMES: *Sweet clover*, *Yellow melilot*, *Yellow melilot clover.*

ILLUSTRATION: Johnson, *Med. Bot. of N. A.*, Fig. 120.

Botanical Source, History and Description.—Yellow melilot has an erect, sulcate stem, about 3 (2 to 4) feet high, with spreading branches. The leaves are pinnately trifoliate; the leaflets obovate-oblong, obtuse and smooth, with remote, mucronate teeth. The flowers are yellow, in one-sided, spicate, axillary, loose, paniculate racemes; the calyx half as long as the corolla; the legume ovoid and 2-seeded. The petals in this species are of about equal length. It is an indigenous annual, growing in alluvial meadows, and flowering in June. The whole plant is scented, having nearly the odor of the sweet-scented vernal grass, *Anthoxanthum odoratum*. The taste of the plant, when dried, is somewhat pungent, aromatic, and bitterish. A closely related species, the *Melilotus officinalis* of Desrousseaux (*M. diffusa*, Koch; *M. arvensis*, Walroth) of Europe, is collected also with the foregoing species. It has light-yellow flowers having short carinas, while the fruit is a transversely-rugose, obovate, usually 1-seeded legume. An American species, having white flowers, probably has virtues similar to yellow melilot. It is the *Melilotus alba*, Lamarck (*Melilotus officinalis*, Pursh; *Melilotus officinalis*, var. *alba*, Nuttall; *Melilotus leucantha*, Koch). In this species the standard is longer than the other petals. It is known as *White melilot*, *White melilot clover*, or *Sweet-scented clover*, and is a biennial, with an erect, robust, very branching, sulcate stem, 4 to 6 feet high. The leaflets are variable, oval, ovate, ovate-oblong, truncate, and mucronate at the apex, remotely serrate, and 1 or 2 inches long; stipules setaceous. The flowers are white, numerous, the racemes more loose and longer than in the first species. The petals are unequal, the banner longer than wings or keel, and the calyx shorter than the corolla by more than one-half. This plant grows in similar situations with *M. officinalis*, flowering in July and August, and having a sweet fragrance, which is improved upon being dried—(W.).

Chemical Composition.—The characteristic constituent of melilotus is the aromatic, crystallizable *coumarin* ($C_9H_6O_2$), which is the anhydrid of *ortho-coumaric acid* ($C_6H_4OH.CHCHCOOH$). The latter, and *hydrocoumaric (melilotic) acid* ($C_6H_4OH.CH_2CH_2COOH$) likewise occur in the plant. Cumarin forms with melilotic acid a crystallizable compound (Zwenger and Bodenbender). *Melilotol* of Phipson (1875), is a volatile oil, probably the anhydrid (*lactone*) of melilotic acid. As much as 0.2 per cent has been obtained by distilling the fresh herb with water. *Chenopodin*, a crystallizable principle occurring quite frequently in various plants, was observed by Reinsch (1867) as a deposit from an alcoholic extract of *Melilotus alba;* it is probably identical with *leucin* (*amido-caproic acid*, $C_5H_{10}NH_2COOH$) (Flückiger, *Pharmacognosie*, 1891).

Coumarin is also the odoriferous principle of many other plants, occurring, *e. g.*, in *Tonka beans* where it was first discovered; in *Liatris*, *Asperula odorata*, etc. (see list of coumarin-bearing plants in Husemann and Hilger, *Pflanzenstoffe*, p. 1037). It was found in melilotus only in small quantity (about 0.04 per cent, in combination with melilotic acid). *Coumarin* is now obtained synthetically by the action of acetic anhydrid and sodium acetate upon the sodium compound of salicylic aldehyde (C_6H_4OHCHO). It forms hard, colorless prisms, melting at 67° C. (152.6° F.), and boiling at 291° C. (608° F.). It sublimes, however, at ordinary temperature, in the form of white needles; sometimes it is found in crystals on the herb. Coumarin is soluble in ether, volatile and fatty oils, in acetic and tartaric acids, also soluble in boiling alcohol, and requires 400 parts of cold, and 45 parts of hot water for solution. Hot alkalies convert it into ortho-coumaric acid.

Action, Medical Uses, and Dosage.—Melilotus (species), placed between woolen clothing, is used in Europe to guard against the ravages of the moth. The medicinal properties of melilotus are undoubtedly chiefly due to coumarin. Many observers have found it peculiarly effective in certain *painful disorders*, particularly *neuralgias* of long standing and associated with debility. It is adapted to idiopathic *neuralgic headaches*, and to *neuralgic affections* not depending upon reflex causes, although it has given good results in headaches arising from painful disorders of the stomach. *Recurring neuralgia*, especially from cold or fatigue, have been promptly relieved by small doses of the drug. It relieves *ovarian neuralgia* sometimes as if by magic, and in *dysmenorrhœa* its beneficial effect is observed when lameness and soreness are prominent symptoms, and particularly when the trouble seems to follow the great sciatic nerve. Rheumatic cases, showing marked lameness, are also said to be cases for its exhibition. It is likewise of value in *painful dysuria*, *colic*, *painful diarrhœa*, and *menstrual colic*. *Gastralgia*, *neuralgia of the stomach*, and other *abdominal viscera*, have been promptly relieved by it, and a prominent symptom in these disorders, that has been met by the drug, is the coldness of the extremities. We should remember melilotus in painful states, with coldness, and marked soreness or tenderness to the touch. Dose of specific melilotus, 1 to 10 drops; of a strong tincture, 1 to 20 drops. The leaves and flowers of these two plants (*M. officinalis* and *M. alba*) are boiled in lard, and formed into an ointment, which is found of utility as an application to all kinds of *ulcers*. The *Vanilla*, or *Seneca grass*, used for a stimulant purpose, is the *Hierochloë borealis*.

Specific Indications and Uses.—Idiopathic headaches; long-standing neuralgias; coldness, tenderness, lamenesss or marked soreness of parts; painful menstruation with lameness or sensation of cold; menstrual colic; ovarian neuralgia; colic with diarrhœa and much flatus.

Related Drugs. Tonka Beans. These are derived from the *Dipteryx odorata*, Willdenow (*Coumarouna odorata*, Aublet), a large, papilionaceous tree inhabiting Guiana. The fruit consists of an oblong-ovate, 1-seeded legume. The seed, or part employed, is somewhat 2-edged, appearing compressed, blackish-brown in color, and has a brittle, shining, or fatty-like skin, is deeply rugose, and has an oily, pale-brown kernel. The seeds possess an aromatic, bitterish taste, and a balsamic, agreeable, vanilla-like odor. The chief constituent, and the one upon which its odor depends, is *coumarin* (see *Melilotus*), which is often found between the two halves of the seeds, and upon the surface, as an efflorescence. Coumarin was first observed in Tonka beans, in 1820, by Vogel, who held it to be benzoic acid. Guibourt soon afterward declared it to be a different substance, and gave it its present name. Tonka beans are about 2 inches long. A variety known as *English Tonka beans*, are smoother, smaller, and do not contain as much coumarin as the preceding, 108 grains having been yielded by 1 pound of true Tonka beans. The English Tonka bean is the seed of *Dipteryx oppositifolia*, Willdenow. Tonka depends undoubtedly upon coumarin for its virtues. Pronounced narcotic effects have been observed from coumarin, which is also a cardiac stimulant, and finally paralyzes the heart. Dr. Laurence Johnson attributes the evil effects of cigarette smoking to this principle, for among the substances used in preparing cigarettes are plants containing coumarin, notably *Liatris odoratissima*. A fluid extract of Tonka bean has been used in *pertussis*.

FAHAM LEAVES.—The leaves of *Angræcum fragrans*, belonging to the Orchidaceæ. They have a strong and delicious aroma, and a sharp, aromatic taste. Introduced at one time in France as a substitute for ordinary tea. Fifteen grains are infused in a cup of cold water, brought to a boil for 10 minutes, poured into a closed container, and sweetened when partaken of. It comes from Mauritius and the Isle of Reunion, and contains *coumarin*.

MELISSA (U. S. P.)—MELISSA.

"The leaves and tops of *Melissa officinalis*, Linné"—(*U. S. P.*).

Nat. Ord.—Labiatæ.

COMMON NAMES: *Balm, Lemon balm.*

Botanical Source.—Balm is a perennial herb, with upright, branching, 4-sided stems, 10 to 20 inches high. The leaves are opposite, broadly ovate, acute, coarsely crenate-serrate, rugose, petioled, and more or less hairy. The flowers are pale-yellow, in axillary dimidiate verticils, and subsessile; the bracts are few, ovate-lanceolate, and petiolate. The calyx is slightly gibbous at base, 13-ribbed, flattish above, upper lip 3-toothed, lower one bifid. Corolla with a recurved-ascending tube; upper lip erect, flattish, lower lip spreading, 3-lobed, middle lobe mostly broadest. Stamens ascending (W.—G.).

History and Description.—Balm is a native of southern France, but is naturalized in various parts of Europe and the United States. It grows in fields, along roadsides, and is well-known as a garden plant, flowering from May to August. The whole plant is medicinal, and should be collected previous to its flowering. In the recent state, it has a lemon-like odor, which is nearly lost by drying. Boiling water extracts its virtues. It is officially described as follows: "Leaves about 5 Cm. (2 inches) long, petiolate, ovate, obtuse, rounded or subcordate at the base, crenate, somewhat hairy, glandular; branches quadrangular; flowers in about 4-flowered cymules, with a tubular, bell-shaped, 5-toothed calyx, a whitish or purplish bilabiate corolla, and 4 stamens; fragrant, aromatic; somewhat astringent and bitterish"—(*U. S. P.*).

The *Nepeta Cataria*, Linné, var. *B. citriodora*, a powerful emmenagogue, is sometimes cultivated and employed by mistake for balm. It has the same odor, but may be distinguished by both surfaces of its leaves being hairy.

Chemical Composition.—Balm contains a bitter substance, some tannin, gum, and a peculiar volatile oil, which is yellowish, or reddish-yellow, very limpid, about 0.89 in density, and possessing the fragrance of the plant in a very high degree. A stearopten is present in it (Bizio); the oil is soluble in 5 parts of alcohol. The yield in oil does not exceed 0.1 per cent. The infusion of balm is incompatible with nitrate of silver, acetate of lead, and sulphate of iron.

Action, Medical Uses, and Dosage.—Balm is moderately stimulant, diaphoretic, and antispasmodic. A warm infusion, drank freely, has been serviceable as a diaphoretic in *febrile diseases* and *painful menstruation*, and to assist the operation of other diaphoretic medicines; in combination with ipecacuanha and potassium nitrate, a valuable diaphoretic is formed. It is also occasionally used to assist menstruation. When given in fevers, it may be rendered more agreeable by the addition of lemon juice. The infusion may be taken *ad libitum*.

Related Species.—*Melissa cordifolia*, Persoon, is now accepted as a variety of *Melissa officinalis*. Its leaves are more woolly, larger, and have an unpleasant odor

Cedronella pallida, Lindley, and *Cedronella mexicana*, Bentham, are employed by the Mexican people as substitutes for balm.

Pogostemon Patchouly, Pelletier (*Pogostemon suave*, Tenore).—Eastern India. An aromatic plant, the dried leaves of which yield the volatile *oil of patchouly* (*patchouli*), much employed in giving lasting qualities to other odors in perfumes. The first bale of the leaves was offered in London in 1844, though the plant was known as early as 1826. Oil of patchouly is of two grades—that distilled from the selected fresh stock near the Indian plantations, and that distilled in Europe from the imported leaves. It is of a brownish-yellow color, slightly viscid. According to Gladstone (1864), the bulk of two specimens examined, boiled at 257° C. (495° F.). The residual liquid contained a strongly blue principle (*cœrulein*, or *azulene*)—of much higher boiling point, 302° C. (576° F.). It is also found in the oils of achillea, calamus, absinthium, matricaria, etc. The oil of patchouly, upon standing, deposits crystalline prisms of *patchouly camphor* ($C_{15}H_{26}O$), a stearopten which fuses at 59° C. (138.2° F.) when pure (Montgolfier). The oil has a specific gravity of 0.975 to 0.995, according to Schimmel & Co. (*Report*, April, 1897), and contains *cadinene* and *patchouly alcohol*. The leaves yield from 1.5 to 4 per cent. The oil is said to be occasionally adulterated to the extent of 60 per cent with cubeb and cedar oils (see interesting article on Patchouli, by J. C. Sawer, *Amer. Jour. Pharm.*, 1881, p. 187; also *ibid.*, 1888, p. 184, from *Kew Bulletin*). Prophylactic powers are ascribed to this plant by the Japanese, Chinese, and Arabs.

MENISPERMUM (U. S. P.)—MENISPERMUM.

"The rhizome and roots of *Menispermum canadense*, Linné"—(*U. S. P.*).

Nat. Ord.—Menispermaceæ.

COMMON NAMES: *Yellow parilla, Canadian moonseed, Moonseed sarsaparilla, Texas sarsaparilla, Vine maple.*

Botanical Source.—This plant has a perennial, horizontal, woody, very long root, of a beautiful yellow color externally, and a round, striate, climbing stem, greenish-yellow when young, 8 to 12 feet in length. The leaves are roundish, cordate, peltate, 3 to 7-angled or lobed, smooth, the petiole inserted near the base, 3 to 5 inches long, white lines radiating from the petiole on the upper surface to each angle, glaucous green above, paler below, entire, 4 or 5 inches in diameter. The flowers are small, yellow, and in axillary clusters; sepals, 4 to 8, in a double row; petals 4 to 7, minute, retuse, and shorter than the sepals. Stames 12 to 20 in the sterile flowers; anthers 4-celled. Pistils 2 to 4 in the fertile flowers, raised on a short stalk, 1 or 2 ripening into round drupes. Imperfect stamens are sometimes found in the fertile flowers. The drupes are about 4 lines in diameter, black, with a bloom resembling frost-grapes, and 1-seeded. The seeds are crescent-shaped and compressed (W.—G.).

History.—This is a valuable American remedy, not in extensive use among physicians. It grows in woods and hedges near streams, from Canada to Carolina, and west to the Mississippi, flowering in July. The rhizome, with its roots, is the official part. It has a bitter, persistent, but not unpleasant acrid taste, and yields its virtues to water or alcohol. The root of this plant has been offered in our markets as a *Texas sarsaparilla* (see *Amer. Jour. Pharm.*, Vol. XXVII, page 7).

Description.—The *U. S. P.* describes yellow parilla as follows: "Rhizome several feet long, about 5 Mm. (⅕ inch) thick, brown or yellowish-brown, somewhat knotty, finely wrinkled longitudinally, and beset with numerous thin, rather brittle roots; fracture tough, woody; internally yellowish, the bark rather thick, the wood-rays broad, porous, and longest on the lower side; pith distinct. Nearly inodorous; taste bitter"—(*U. S. P*).

Chemical Composition.—Prof. J. M. Maisch found in it a small amount of berberine, and a large quantity of a white, amorphous, bitter alkaloid, which is soluble in ether, alcohol, and in much water with alkaline reaction (*Amer. Jour. Pharm.*, 1863, p. 303). It does not dissolve in benzene or alkaline solutions, but dissolves in 20 parts of chloroform. H. L. Barber (*Amer. Jour. Pharm.*, 1884, p. 401) has shown it to differ in its properties from *menispermine* (from *Cocculus indicus*) and *oxyacanthine* (from *Berberis vulgaris*). Maisch has named it *menispine*; its taste is a pure bitter, like that of gentian. Tannin, gum, resin, and starch are also present in the drug.

Action, Medical Uses, and Dosage.—Yellow parilla is tonic, laxative, alterative, and diuretic. In small doses, no obvious effects are produced on the general system, but in larger doses, a slight increase of the volume of the pulse may be perceived, as well as increase of the appetite, and the action of the bowels. In excessive doses, purging and vomiting will follow, but no other unpleasant effect. It is a superior laxative bitter. It acts quite prominently upon the glandular structures. It was formerly much esteemed as a remedy in *scrofulous*, *cutaneous*, *arthritic*, *rheumatic*, *syphilitic*, and *mercurial diseases*. Likewise employed in *dyspepsia*, *general debility*, and *chronic inflammation of the viscera*. Externally, the decoction has been used with good effect as an embrocation in *gouty* and *cutaneous affections*. Indications seem to point to its probable value in *leucocythæmia*, especially when the spleen is prominently involved. Dose of the decoction, from 1 to 4 fluid ounces, 3 times a day; of the extract, from 2 to 6 grains, 3 or 4 times a day; or the saturated tincture, from ½ to 1 fluid drachm.

Specific Indications and Uses.—"Skin brown, tongue coated at the base, tip red, irregular appetite, constipation" (Scudder, *List of Specific Indications*).

Related Drug.—*Pangium edule*. East India. Contains an alkaloid which has been compared to *menispermine*. Anthelmintic and narcotic, and, in large doses, toxic.

MENTHA PIPERITA (U. S. P.)—PEPPERMINT.

"The leaves and tops of *Mentha piperita*, Smith"—(*U. S. P.*).

Nat. Ord.—Labiatæ.

COMMON NAME: *Peppermint*.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 203.

Botanical Source.—This herb is a perennial, with procumbent, ascending, branched, reddish stems, quite smooth, or fringed, with a few spreading hairs, furrowed and quadrangular, and 2 or 3 feet in height. The leaves are ovate-oblong, or somewhat lanceolate, rounded at the base, deep-green, smooth or hairy on the under side, serrate, and borne on ciliated petioles. The flowers are in whorls, small, and purplish; upper floral leaves small, lanceolate-subulate, shorter than the flowers. The whorls are few, lax, uppermost in a short, oblong, obtuse, reddish spike; lowermost remote, with the cymes shortly stalked. Bracts subulate, outer ones as long as the calyx. Pedicels quite smooth. Calyx 5-toothed, teeth hispid, subulate, erect. The corolla is 4-cleft, tubular, with the broadest segment emarginate. Stamens 4, awl-shaped, straight, and distant; anthers with 2 parallel cells. Achenia smooth (L.—W.—G.).

Fig. 168.

Mentha piperita.

History, Description, and Chemical Composition.—Peppermint is indigenous to England, and has been extensively cultivated in various parts of Europe and throughout the United States. It grows wild in damp places, and flowers from July to September. In order to preserve the fragrance of this plant, the roots require to be reset triennially, perhaps oftener. Care must also be taken to keep out the weeds, especially *Erigeron canadense*, Linné; *Erechtites hieracifolia*, Rafinesque, and *Ambrosia trifida*, Linné. The entire herb is medicinal; it should be collected as soon as the flowers begin to develop, and be carefully dried in the shade. The whole plant has a peculiar, aromatic, diffusive odor, and an agreeable, warm, burning, bitter taste, followed by a feeling of coolness during inhalation. These properties are more marked in the fresh than in the dried plant. Both the odor and taste are retained when the plant is dried, and may be preserved for a long time. The *U. S. P.* describes it as follows: "Leaves about 5 Cm. (2 inches) long, petiolate, ovate-lanceolate, acute, sharply serrate, glandular, nearly smooth, the few hairs containing crystals of menthol in one or more thin cells; branches quadrangular, often purplish; flowers in terminal, conical spikes, with a tubular, 5-toothed, often purplish calyx, a purplish, 4-lobed corolla, and 4 short stamens; odor aromatic; taste pungent and cooling"—(*U. S. P.*). Its virtues are due to a volatile oil (see *Oleum Menthæ Piperitæ*), which is contained in little vesicles existing throughout the plant, and visible in the leaves; the oil may be obtained by distillation with water. The plant also contains tannic acid, as its infusion becomes dark-green with ferric salts. Its virtues are taken up in infusion by water, and still better by alcohol. As regards the treatment and distillation of peppermint plants, see two interesting papers by W. M. L. Weills, *Proc. Penn. Pharm. Assoc.*, 1887, p. 147, and A. M. Todd, *Amer. Jour. Pharm.*, 1888, p. 328.

Action, Medical Uses, and Dosage.—Peppermint is a powerful diffusive stimulant, antispasmodic, carminative, stomachic, and weak anodyne. It undoubtedly possesses marked antiseptic properties. Used in the treatment of *gastrodynia*, *flatulent colic*, *hysteria*, *spasms* or *cramps of the stomach*, to allay the griping of cathartics, to check *nausea and vomiting*, and to disguise the unpleasant taste of other medicines. Equal parts of the essence and alcohol, used by atomization, relieve the *cough of bronchitis* and *pneumonia*. The fresh herb, bruised and applied over the bowels, will often allay *sick stomach*, and is efficient in *cholera infantum*. The same kind of application sometimes relieves *headache*. The infusion may be drank freely; but the most usual form of administration is the essence, made by dissolving 1 fluid drachm of the oil in 1 fluid ounce of alcohol. Dose, from 10 to 60 drops, in sweetened water.

Specific Indications and Uses.—Gastrodynia, flatulent colic, and difficult digestion

MENTHA VIRIDIS (U. S. P.)—SPEARMINT.

"The leaves and tops of *Mentha viridis*, Linné"—(*U. S. P.*). (*Mentha sylvestris*, var. *glabra*, Koch.)

Nat. Ord.—Labiatæ.

COMMON NAME: *Spearmint*.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 202.

Botanical Source.—Spearmint is a creeping-rooted, herbaceous plant, with erect, branching, quadrangular, smooth stems, 1 or 2 feet high. The leaves are subsessile, ovate-lanceolate, unequally serrated, and smooth; those under the flowers all bract-like, rather longer than the whorls; these last and the calyces hairy or smooth. The flowers are pale purple. Spikes cylindrical and loose. Whorls approximated, or the lowest or all of them distant; peduncles smooth, round, and shining. The calyx is bell-shaped and 5-toothed. Corolla funnel-shaped (L.—W.).

Fig. 169.

Mentha viridis.

History and Chemical Composition.—Spearmint (*Herba menthæ acutæ* [*vel Romanæ*]) is an European herb, but like the preceding species of mint, is extensively cultivated in various moist places in this country on account of its oil, and for domestic use. It flowers in July and August; the whole herb is medicinal, and should be gathered for medicinal use during dry weather and previous to the full development of the flowers. If gathered to procure its oil, it should be done after the flowers have become developed, and before the ripening of the seeds. It has a strong, peculiar, aromatic odor, and an aromatic, faintly bitter taste, followed by coolness in the mouth during inhalation. When the plant is carefully dried, these properties are preserved for a long time. Its virtues are due to a volatile oil (see *Oleum Menthæ Viridis*), which may be obtained by distillation with water. Alcohol extracts its virtues, also water by infusion. It contains a little tannin.

Description.—"Leaves about 5 Cm. (2 inches) long, subsessile, lance-ovate, acute, serrate, glandular, nearly smooth; branches quadrangular, mostly light-green; flowers in terminal, interrupted, narrow, acute spikes, with a tubular, sharply 5-toothed, calyx, a light-purplish 4-lobed corolla, and 4 rather long stamens; odor aromatic; taste pungent"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—The carminative, antispasmodic, and stimulant properties of spearmint are somewhat inferior to those of peppermint;

its principal employment is for its diuretic and febrifuge virtues. As a febrifuge, it is superior to peppermint, and may be used freely in warm infusion. The cold infusion is beneficial in high color, or *scalding of urine*, *difficult micturition*, etc.; it may be used alone or in combination with marsh-mallow root. In fact, it is one of the best of simple diuretics, and acts nicely with potassium acetate. A saturated tincture of the fresh herb with gin has been found serviceable in *gonorrhœa*, *strangury*, *suppressed urine*, *gravel*, and as a local application to *painful hemorrhoids*. The oil is diuretic, stimulant, antispasmodic, and rubefacient, and is used externally in *rheumatic* and *other pains*. Dose, same as peppermint.

Specific Indications and Uses.—Scanty secretion of urine with frequent desire to urinate; simple nausea.

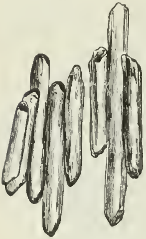
MENTHOL (U. S. P.)—MENTHOL.

Formula: $C_{10}H_{19}OH$. Molecular Weight: 155.66.

"A stearopten (having the character of a secondary alcohol), obtained from the official oil of peppermint (from *Mentha piperita*, Smith), or from Japanese or Chinese oil of peppermint (from *Mentha arvensis*, Linné, var. *piperascens*, Holmes, and *Mentha canadensis*, Linné, var. *glabrata*, Holmes. *Nat. Ord.*—Labiatæ). Menthol should be kept in well-stoppered bottles, in a cool place"—(*U. S. P.*).

Source and Preparation.—Menthol is the solid constituent of oil of peppermint, to which its characteristic odor is due, and was formerly known as peppermint camphor. It occurs in largest quantity in the oils of peppermint known as the Chinese and Japanese oils. Our home-grown peppermint (*Mentha piperita*) yields about 20 per cent of an excellent article of menthol, of a pure mint odor, and known in trade as *pip-menthol*. It forms handsome, dry crystals, and was first prepared in this country by Mr. A. M. Todd, of Nottawa, Michigan. Analysis by the late Prof. Henry Trimble (*Amer. Jour. Pharm.*, 1884, p. 405) shows it to conform to the above formula more closely than Japanese menthol, which still contained traces of liquid hydrocarbons and also showed a slightly reduced melting point on this account. According to Mr. Todd (*Amer. Jour. Pharm.*, 1886, p. 159), menthol is obtained by subjecting the distilled oil of peppermint to a temperature of —22° C. (—7.6° F.), by the aid of a freezing mixture. The menthol crystallizes out in satiny crystals, and the mother liquor is removed while the low temperature is maintained. In rare instances, the distillate congeals at —4.4° C. (24° F.).

Fig. 170.



Crystals of Menthol.

Description.—The *U. S. P.* describes menthol as forming "colorless, acicular or prismatic crystals, having a strong and pure odor of peppermint, and a warm, aromatic taste, followed by a sensation of cold when air is drawn into the mouth. Menthol is only slightly soluble in water, but imparts to the latter its odor and taste. It is freely soluble in alcohol, ether, chloroform, carbon disulphide, or glacial acetic acid. It melts at 43° C. (109.4° F.) to a colorless liquid, boils at 212° C. (413.6° F.), and volatilizes slowly at the ordinary temperature. When it is triturated with about an equal weight of camphor, thymol, or chloral hydrate, the mixture becomes liquid. Its alcoholic solution is neutral to litmus paper, and deviates polarized light to the left"—(*U. S. P.*). Chemically, menthol is a secondary alcohol of the formula $C_6H_3(OH)CH_3C_3H_7.H_6$, or *hexa-hydro-oxy-para-cymene*, yielding, upon oxidation, a mobile, dextro-rotatory fluid (*menthone*, $C_{10}H_{18}O$), which is a ketone, and bears the same relation to menthol as Japan camphor does to *borneol* (see *Camphora*). Reversedly, menthol may be obtained from menthone by reduction with metallic sodium. The hydrocarbon (*menthene*, $C_{10}H_{18}$) is obtained by heating menthol with zinc chloride, or other dehydrating agents.

Tests.—"If a little menthol be heated in an open capsule, on a water-bath, it should gradually volatilize without leaving any residue (absence of wax, paraffin, or inorganic substances). If a few crystals of menthol be dissolved in 1 Cc. of glacial acetic acid, and then 3 drops of sulphuric acid and 1 drop of nitric acid added, no green color should be produced (absence of thymol)"—(*U. S. P.*). Cones or pencils of menthol, which are so extensively sold as a remedy for headache, neuralgia, etc., are usually largely mixed with wax, paraffin, or other foreign admixture, the presence of which is recognized by the above test.

Mr. L. F. Kebler (*Amer. Jour. Pharm.*, 1897, p. 189) recommends the quantitative determination of menthol by a modification of the process given by Prof. Power and Dr. Kleber in *Pharm. Rundschau*, 1894, p. 157. According to this process, the *combined* menthol—*i.e.*, occurring in the form of esters—is first determined by saponification of the oil with a known amount of caustic soda solution. The *total* menthol is then determined by forming an acetyl ester of menthol, and saponifying the product by a known excess of caustic soda. The amount of *free* menthol is then represented by the difference between the total and the combined menthol. (For the details of this process, consult the interesting papers quoted.)

Action, Medical Uses, and Dosage.—Menthol possesses the general properties of peppermint oil somewhat intensified. It undoubtedly has active germicidal and pronounced tonic properties. It exerts considerable anæsthetic power over parts to which it is applied, and is frequently added to ether, chloroform, etc., when they are to be used in spray for the relief of *local pains*. Paralysis of the spinal nerve centers and nerves, involving a loss of both sensation and motion, has resulted from large doses of menthol. When applied in solid form to the skin or mucous tissues, it first produced a sharp, burning sensation, soon followed by a sense of coldness with decreased sensibility of the parts. It forms a good application to *itching surfaces*, and in *pruritis vulvæ* a weak solution in olive oil has given us excellent satisfaction. It is largely used for *itching of the surface*, *cellular inflammations*, and *local pains*—such as occur in *burns*, *scalds*, *insect bites and stings*, *eczema*, *ringworm*, *urticaria*, *toothache*, *earache*, *neuralgia*, *sciatica*, *boils*, *carbuncles*, etc. In *boils of the external auditory canal*, a 20 per cent solution in oil may be applied on cotton, renewing every 24 hours. A petrolatum ointment of menthol (20 per cent) has been recommended as a stimulating agent where there is a lack of secretion of cerumen. *Coryza* and *hay fever* are frequently treated with the vapor or the direct application of a 10 to 20 per cent solution to the nostrils, and a solution of the latter strength has been recommended where thickening of the membranes give rise to *obstruction* or *stenosis of the Eustachian tubes*. *Ozæna*, *catarrhal sore throat*, *and chronic inflammation of the pharynx* are treated with the solution, while it has been used by atomization with success in *pertussis*, *asthma*, and *bronchitis of a chronic type*. Its vapor relieves irritable bronchial *cough*. Extraordinary claims regarding its effects in nebulized spray, have been advanced concerning its retarding influence and even arresting power over both *pulmonary* and *laryngeal phthisis*. These claims, however, require substantiation. Small doses sometimes allay *vomiting*, as of pregnancy, etc. The dose of menthol for internal use is from $\frac{1}{2}$ to 2 grains in pill, capsule, trituration, or olive oil; for local uses, ointments, liniments, and solutions are employed in strength ranging from 5 to 20 per cent.

Specific Indications and Uses.—Topically, to pruritic surfaces.

Related Product.—Menthiodol. Heat carefully in a capsule menthol, 4 parts, and add iodol, in fine powder, 1 part, and triturate until a uniform mass is obtained. Mold into suitable pencils or cones. If too hard, soften by remelting with a small quantity of gum camphor. A local application for *neuralgia*.

MENYANTHES.—BUCKBEAN.

The leaves and rhizome of *Menyanthes trifoliata*, Linné.

Nat. Ord.—Gentianaceæ.

Common Names: *Buckbean*, *Bogbean*, *Marsh-trefoil*, *Water-shamrock*.

Illustration: Bentley and Trimen, *Med. Plants*, 184.

Botanical Source.—This plant is perennial, has a blackish rhizome, about 5 or 6 lines in diameter, penetrating horizontally in the earth to a great distance, regularly intersected with joints at the distance of about half an inch from each other; these joints are formed by the breaking off of the old petioles and their sheaths. The leaves proceed from the end of the rhizome on long stalks furnished with broad, sheathing stipules at the base; are trifoliate, nearly oval, glabrous somewhat fleshy, slightly repand, or furnished with many irregular [illegible] at the edge, which hardly prevent them from being entire. The scape is round, ascending, smooth, about a foot high, bearing a conical raceme of flowers. Peduncles straight, supported by ovate, concave bracts. Calyx erect, somewhat campanulate, 5-parted and persistent. Corolla white; its tube short, border 5-cleft, spreading, at length revolute, and clothed on the upper part with a coating of dense, fleshy, obtuse hairs. Stamens 5, shorter than the corolla, and alternate with its segments; anthers oblong, arrow-shaped. Ovary ovate; stigma bifid and compressed. Capsule ovate, 2-valved, and 1-celled; seeds numerous and minute (L.). Its flowers are flesh color or pale lilac.

History.—Buckbean is indigenous to this country and Europe, growing in spongy, boggy soils, swamps, ditches, etc., flowering from April to August. The whole plant possesses medicinal properties, but the root and leaves are the parts more generally employed. The whole plant is nearly odorless, but has a very bitter, somewhat aromatic taste. Water, or alcohol, takes up its active properties. Infusions of the leaves, saccharated by adding simple syrup, gelatinize through the presence of pectin; if the latter is removed by alcohol, no gelatinization takes place (see *Amer. Jour. Pharm.*, 1881, p. 360).

Chemical Composition.—*Menyanthes trifoliata* contains a bitter, glucosidal principle, first isolated, in 1861, by Ludwig and Kromayer, and called *menyanthin.* Karl Lendrich, in 1892, gave an improved method of obtaining menyanthin (*Archiv der Pharm.*, 1892, p. 38), and found it to have the formula $C_{33}H_{50}O_{14}$. It is a neutral body of bitter taste, and yellow color, soluble in alcohol and hot water; soluble with difficulty in cold water and ether. Although menyanthin contains no nitrogen, it strangely enough responds to alkaloidal reagents, such as Mayer's solution, tannic acid, etc. Diluted alkalies or acids cause it to split into a resinous product, a lævo-rotatory sugar, and a volatile, sweetish, aromatic oil, *menyanthol* $(C_7H_{11}O_2)_n$, which is both an aldehyde and a phenol. Contrary to some statements, it has not the odor of bitter almond oil.

Action, Medical Uses, and Dosage.—Buckbean, when recent, and given in large doses, usually causes emesis. It is, when dried, tonic and astringent, or purgative, according to the dose. It is valuable as a tonic where digestion and blood making are impaired, and particularly when there is an associated *uterine disease* or irregularity, or when following the use of quinine in *malarial disorders* (Scudder). For this purpose, a strong tincture of the fresh leaves may be given in doses of from 1 to 10 minims. It has been given in *dyspepsia*, *intermittent* and *remittent fevers*, with advantage; and has been highly recommended in *chronic rheumatism*, *hepatalgia*, *dropsy*, *worms*, and some *cutaneous diseases*, and as a tonic in *scrofula*, and various *cachectic affections*. As a tonic, the powdered root or herb may be given in doses of from 10 to 25 grains; of the aqueous extract, 5 or 10 grains; of the infusion (made by infusing 2 drachms of the herb or root in 4 fluid ounces of water at 212° F.), a fluid ounce or two; repeating the dose of either every 3 or 4 hours. Sixty grains of the powder, or 4 fluid ounces of the infusion, produce catharsis, and sometimes emesis.

METHYLENI BICHLORIDUM.—METHYLENE BICHLORIDE.

FORMULA: CH_2Cl_2. MOLECULAR WEIGHT: 84.71.

SYNONYMS: *Methene dichloride, Bichloride of methylene, Methylene dichloride, Monochlorinated chloride of methyl, Chlorinated chloride of methyl, Dichloromethane, Dichlormethane, Chloro-methyl, Methene chloride.*

History and Preparation.—This substance may be considered the second substitution product of the action of chlorine upon methane (*marsh gas*), CH_4, the first product being gaseous methyl chloride, or chloromethane, CH_3Cl. It was discovered, in 1840, by Regnault; Dumas and Peligot having prepared chloride of methyl about five years previously. It is difficult to prepare, and is seldom found in commerce. It is formed when chlorine gas is passed into di-iodomethane covered with water, the retort containing it being at the same time heated; iodine separates in crystals, and an oily liquid (*dichloromethane*), with impurities, passes into the cooled receiver. This is purified by prolonged contact with chlorine, then distilling from solution of potash, agitating with calcium chloride, and redistilling to separate water. It may also be made (Regnault's process) by chlorination of methyl chloride (CH_3Cl), bringing the gases together in the sunlight, and afterward separating the methene dichloride by fractional condensation; also by the action of chlorine on methyl iodide, thus: $CH_3I+Cl_2=CH_2Cl_2+HI$. Another process consists in treating chloroform in alcoholic solution with zinc and sulphuric acid as follows: $CHCl_3+H_2=CH_2Cl_2+HCl$.

Description and Adulterations.—*Dichloride of methene* is a colorless liquid, of a sweet, chloroform-like odor, of specific gravity 1.360 at 0° C. (32° F.), and boiling at 40° C. (104° F.) (Butlerow). According to Watts and others, Regnault's preparation boils at 30.5° C. (87° F.), has a specific gravity of 1.344 at 18° C. (64.4° F.), is very volatile, and resembles Dutch Liquid. It is dissolved by alcohol or ether, does not affect test papers, and emits a vapor that is readily combustible.

It is stated that chloroform has been substituted for methene dichloride, but the fraud can be readily detected by the specific gravity, unless the adulterating liquid be reduced to the gravity of methene by the addition of ether. In this case, the odor of ether will be apparent. Should a mixture of chloroform and absolute alcohol be prepared and substituted, agitation with cold distilled water will separate the alcohol, and the difference in bulk will reveal the fraud, while specific gravity of the heavy liquid will be found greater than 1.360.

Action, Medical Uses, and Dosage.—Bichloride of methylene has been proposed by Richardson, Wells, and others, as an anæsthetic. The inhalation of its vapor is rather agreeable, its influence occurs without any unpleasant sensations, and the return to consciousness is rapid and without any feeling of prostration. Vomiting frequently accompanies its administration, and occasionally, a very obstinate period of agitation and struggling. It has been considered less dangerous than chloroform, though Richardson states that it is one of a dangerous family of chemical substances, involving more or less risk, unless used with great care. Spencer Wells, the celebrated ovariotomist, having employed it in nearly one thousand cases, in the course of a surgical practice of ten years, recommends it as more effective and less dangerous than any other known anæsthetic; yet, notwithstanding these commendations, and their confirmation by several other surgeons, the substance has not come into general use in surgical practice. The quantity required for inhalation varies from 20 to 40 minims; and 10 or 20 minims subsequently, if required, whenever symptoms of a return to consciousness begin to manifest themselves. The use of this vapor, undiluted, is unsafe; it should always be inhaled in association with a certain quantity of atmospheric air; and for this purpose, a hollow cone, of metal or pasteboard, perforated with numerous apertures, has been advised. The material upon which the liquid has been poured, is to be placed within the cone, and the vapor be inhaled therefrom. Wells recommends Junker's apparatus for this purpose. Messrs. Regnault and Villejean make the statement (*Amer. Jour. Pharm.*, 1884, p. 646) that the methylene chloride at one time supplied to surgeons, was often nothing but a mixture of chloroform and methylic alcohol. Pure dichloride of methylene prepared by them, differed markedly from chloroform in its physiological action, excepting that both agencies produce unconsciousness. The pure methylene chloride, however, produced constant symptoms of an alarming character.

Related Compounds.—METHYLENE, or ENGLISH METHYLENE CHLORIDE. This is not the above substance, and should not be confounded with it, as it is not a definite chemical compound, but simply a mixture of ether and methylene chloride. It has anæsthetic properties. Richardson declared it a safe anæsthetic in doses of from 1 fluid drachm to ½ fluid ounce. Others, however, regard it as a dangerous agent and one to be altogether avoided. According to Helbing, a second product has been sold as methylene chloride. It is a mixture of methyl chloride and chloroform.

METHYL CHLORIDE, *Monochlormethane* (CH_3Cl), *Chlormethyl.*—This compound is produced by the action, in the presence of a small quantity of zinc chloride, of hydrochloric acid gas upon methylic alcohol. It is also formed by heating the hydrochloride of trimethylamine ($N[CH_3]_3.HCl$) to a temperature of 260° C. (500° F.) It is thus obtained as a colorless gas, with an ethereal smell. Ignited it burns with a green-edged flame. At —23° C. (—9.4° F.) it condenses to a fluid. Likewise a pressure of 5 atmospheres, at common temperature, reduces it to a liquid. It dissolves in ether, alcohol, and chloroform, but less readily in water. By employing the condensed liquid in the form of a spray, it is used as a freezing agent to produce *local anæsthesia*. Reputed success has attended its use in *sciatica* (Debove), the parts over the nerve being treated with its spray.

METHYLI IODIDUM.—METHYL IODIDE

FORMULA: CH_3I. MOLECULAR WEIGHT: 141.50.

Preparation and History.—Equal proportions of anhydrous methylic alcohol and potassium iodide are mixed together in a retort, and a stream of dry hydrochloric acid is passed into the mixture. Upon warming, iodide of methyl distills. It is now chiefly prepared by a modification of the method employed, in 1835, by its discoverers, Dumas and Peligot—namely, by the interaction of pure wood alcohol (35 parts), iodine (100 parts), and *red* (amorphous) phosphorus (10 parts). The reaction which takes place is as follows: $10CH_3OH+I_{10}+P_2=10CH_3I+{}_2PO_4H_3+2H_2O$.

Description.—Methyl iodide is a heavy, colorless liquid, having a sweetish, ethereal odor. Its specific gravity at 0° C. (32° F.) is 2.199; at 15° C. (59° F.), 2.23; its boiling point, 42.8° C. (109° F). At a low temperature it forms, with water, a crystalline hydrate ($CH_3I.H_2O$). It gradually turns brown when exposed to light, and ignites with difficulty, burning with evolution of violet fumes of iodine.

Action, Medical Uses, and Dosage.—This agent was introduced as an anæsthetic by Richardson, in 1868. While a powerful anæsthetic, it is equally a dangerous one. It is very liable to decompose, and, when it does so, it produces the irritant effects of iodine. After anæsthesia under its use, the effects last for many days. It will not come into use for operative purposes. It has more recently (1884) been given internally as a sedative, and to quiet pain and hyperæsthesia in *cancer of the mammæ and womb*. Richardson so employed it, using 1 grain of the iodide in 10 minims of alcohol.

Related Compounds.—METHYLENI IODIDUM (*Methyleni biniodidum*), CH_2I_2. Molecular Weight: 267.03. This compound was first prepared by the interaction of sodium ethylate (C_2H_5ONa) and iodoform (Butlerow). It may conveniently be prepared by heating for some hours, at about 130° C. (266° F.), a mixture of strong hydriodic acid and chloroform. It is a yellow fluid, congealing at about 0° C. (32° F.). Its specific gravity is 3.34; its boiling point, 180° C. (356° F.). Partial decomposition ensues at the boiling point.

METHYL FLUORIDE is asserted by H. Moissan to be anæsthetic.

METHYL SALICYLAS (U. S. P.)—METHYL SALICYLATE.

FORMULA: $CH_3C_7H_5O_3$. MOLECULAR WEIGHT: 151.64.

"Methyl salicylate, produced synthetically. It should be kept in well-stoppered bottles, protected from light"—(*U. S. P*).

SYNONYMS: *Artificial* (or *Synthetic*) *oil of wintergreen*.

Preparation.—G. M. Beringer's (*Amer. Jour. Pharm.*, 1887, p. 8) method is essentially as follows: In 2 fluid ounces of absolute methylic alcohol dissolve ½ ounce of salicylic acid, and add gradually to the solution 1 fluid ounce of sulphuric acid. Heat gently for a day. Distill from a retort into which a jet of steam is injected. Wash the distillate thoroughly and decant the product. The odor of the product is said to improve by time. In the bark of *Betula lenta* methyl salicylate results from the decomposition of *gaultherin*, a bitter, crystallizable glucosid discovered, in 1843, by Prof. Procter, and recently investigated by Schneegans and Gerock. (See review by F. X. Moerk, in *Amer. Jour. Pharm.*, 1895, p. 8; also see an interesting review of the occurrence of methyl salicylate in plants, by Prof. Henry Kraemer, in *Amer. Jour. Pharm.*, 1898, p. 412).

Description and Tests.—It is asserted that artificial oil of wintergreen is more uniform in quality, and gives better results than the natural oils from birch or gaultheria. It is now very extensively used. Methyl salicylate, according to the *U. S. P.*, is "a colorless, or slightly yellowish liquid, having the characteristic, strongly aromatic odor, and the sweetish, warm, and aromatic taste of oil of gaultheria, with the essential constituent of which it is identical. It is wholly identical with volatile oil of betula (see *Oleum Betulæ Volatile*). Specific gravity 1.183 to 1.185 at 15° C. (59° F.). Boiling point 219° to 221° C. (426.2° to 429.8° F.). It is optically inactive. Soluble, in all proportions, in alcohol, glacial acetic acid, or carbon disulphide. The alcoholic solution is neutral or slightly acid to litmus paper. If a drop of methyl salicylate be shaken with a little water, and a drop of ferric chloride T.S., subsequently added, a deep-violet color will be produced. When heated on a water-bath, in a flask provided with a suitable condenser, it should yield no distillate having the characteristics of alcohol or chloroform. If to 1 Cc. of methyl salicylate, contained in a capacious test-tube, 10 Cc. of sodium hydrate T.S., be added, and the mixture agitated, a bulky, white, crystalline precipitate will be produced; then, if the test-tube, loosely corked, be allowed to stand in boiling water for about 5 minutes, with occasional agitation, the precipitate should dissolve, and form a clear, colorless, or faintly yellowish solution, without the separation of any oily drops, either on the surface or at the bottom of the liquid (absence of other volatile oils, or of petroleum). If the alkaline liquid thus obtained be subsequently diluted with about 3 times its volume of water, and a slight excess of hydrochloric acid added, a white, crystalline precipitate will be produced, which, when collected on a filter, washed with a little water, and recrystallized from hot water, should respond to the tests of identity and purity described under *Acidum Salicylicum* (absence of methyl benzoate, etc.)"—(*U. S. P.*).

Action and Uses.—Same as for oil of wintergreen (see *Oleum Gaultheriæ*)

MEZEREUM (U. S. P.)—MEZEREUM.

"The bark of *Daphne Mezereum*, Linne, and other species of *Daphne*"—(*U.S.P.*).

Nat. Ord.—Thymelæaceæ.

COMMON NAME AND SYNONYMS: *Mezereon-bark; Mezerei cortex, Cortex mezerei, Cortex thymeleæ, Cortex coccognidii.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 225, 226, 227.

Botanical Source.—DAPHNE MEZEREUM. *Mezereon*, or *Spurge olive*, is a weather-proof shrub, with a large root and bushy stem, 4 or 5 feet high, with upright alternate, smooth, tough, and pliant branches, leafy when young, and a smooth, dark-gray bark, which is not strongly attached to the wood. The leaves are terminal on the branches, scattered, stalked, lanceolate, smooth, deciduous, 2 inches long, appearing after the flowers, and soon accompanied by flower-buds for the next season. The flowers are highly fragrant, of a pale-rose color, in little clusters on the naked branches, with several brown, smooth, ovate bracteas underneath. Calyx tubular, hairy externally, like a corolla in texture, and crimson all over; limb in 4 deep, ovate, spreading, colored segments. Stamens 8; filaments short, in 2 rows, from about the middle of the tube; anthers roundish-oblong, 2-celled, simple, and inclosed within the tube. Ovary superior, ovate; style short and terminal; stigma capitate, depressed, and entire. The berry is scarlet, pulpy, oval, 1-celled, and 1-sided; the seed suspended, oval, and large, with a thin brittle skin (L.).

DAPHNE GNIDIUM is a small bush, with the leaves linear-lanceolate, clustered, acuminate, cuspidate, and quite smooth. The flowers are numerous, small, white, downy, and fragrant, in terminal, panicled racemes. The fruit is globular, dry, at first green, but ultimately black (L.).

DAPHNE LAUREOLA, or *Spurge-laurel*, is a smooth plant, with a stem 2 or 3 feet high, round, pale, brown, upright, tough, and pliant branches, crowned with tufts of evergreen leaves, elegantly drooping in all directions, about 2 or 3 inches long, lanceolate, glabrous, acute, entire and subsessile. The flowers are deep-green, with orange anthers, 4 of which are just visible in the throat of the calyx, 5 together in each axillary raceme. An oval, concave bract accompanies each short partial stalk, at the base. Berry oval and black (L.).

History and Description.—All species of Daphne possess active properties, but the bark met with in commerce is usually obtained from the three above described, that from the latter being less active than the others. The *D. Mezereum* is a native of the northern parts of Europe, where it is cultivated both as a medicine and as an ornament; it flowers very early in the spring, often before the snow has disappeared. This species is the most active plant of the genus; its bark is generally collected in the spring. It is met with in flat or quilled pieces, a few feet in length, and from 8 to 12 lines in breadth, and put up in packages which are often globular. Alcohol takes up its virtues, also boiling water. Oils or fats boiled with it, likewise take up its active principles and form ointments. The *D. Gnidium* is found in the south of France on hills and barren plains, and its bark is employed equally with that of the other kinds; the root-bark is also used in medicine. The barks of the three species constitute the official drug, which is described as follows: "In long, thin bands, usually folded or rolled into disks: outer surface yellowish or brownish-yellow, with transverse scars, and minute, blackish dots, underneath of a light-greenish color; inner surface whitish, silky; bast in transverse layers, very tough; inodorous; taste very acrid"—(*U. S. P.*). The leaves of *D. salicifolia*, Kunth, of Mexico, are used in that country as an epispastic.

Chemical Composition.—The active principle of the bark of *Daphne Mezereum* is an *acrid resin* soluble in alcohol and ether, insoluble in water Buchheim); it is probably formed by oxidation of *volatile oil* present in the bark. The latter also contains wax, yellow coloring matter, sugar, nitrogenous and gummy matter, malic acid and malates, and *daphnin*, a crystallizable odorless, neutral substance of bitter, somewhat astringent taste, discovered in 1812 by Vauquelin, in the bark of *D. alpina*, and by Gmelin and Bär (1822) in the bark of *D. Mezereum*. Zwenger (1860) found it to be a glucosid, of the formula $C_{15}H_{16}O_9+2H_2O$. It is but little soluble in cold water or alcohol, but readily soluble in hot water or alcohol, insoluble in ether. By boiling with diluted acids, or under the influence of certain ferments, daphnin is decomposed into sugar and *daphnetin*, a crystallizable body having the odor of coumarin; it was found by Stünkel (1879) to be *dioxycoumarin* ($C_6H_2[OH]_2.CHCH.COO$). *Umbelliferon* (see *Galbanum*), an isomer of daphnetin, was obtained by Zwenger (1854) upon dry distillation of mezereum-resin. In the *fruit*, A. Casselmann (*Jahresb. der Pharm.*, 1870, p. 62 determined the presence of 31 per cent of a fatty, drying oil, 5.46 per cent ash, 0.32 per cent of an acrid resin soluble in alcohol, and 0.38 per cent of *coccognin*, a crystallizable substance not identical with daphnin. It is soluble in alcohol and alkalies, soluble with difficulty in hot water, insoluble in cold water and in ether. Upon being heated it sublimes with partial decomposition, the odor of coumarin being developed.

Action, Medical Uses, and Dosage.—In large doses, mezereon is an irritant poison, causing redness and vesication of the skin when left in contact with it, and causing when swallowed, dryness and burning of the throat, vomiting, hypercatharsis, and frequently renal irritation. The berries have proved fatal to children who have eaten them; yet in some countries they are used as a purgative in doses of 8 to 12. In small doses it acts as a stimulant, alterative, diuretic, diaphoretic, in warm decoction, and cathartic. It acts favorably in *syphilis*, *mercurio-syphilis*, *scrofula*, *chronic rheumatism*, and some forms of *obstinate disease of the skin.* Dose of the decoction, from 1 to 3 fluid ounces; of the powder, 10 grains. Homœopathists regard it highly in the treatment of the *periosteal pains* and *nodes* following syphilitic infection, and in *rheumatic*, and even in *syphilitic periostitis*.

Externally, it is used occasionally; sometimes employed by practitioners to produce rubefaction and vesication, and in the form of ointment as an application to *blistered surfaces*, *indolent ulcers*, and *issues*, in order to excite suppuration. When vesication is desired, the bark is soaked in hot vinegar and water to soften it, and then applied to the part by a compress and bandage. The application is to be renewed night and morning, until vesication is produced.

MICA PANIS.—CRUMB OF BREAD.

The soft portion of bread made from wheaten flour was official under the above title in the *British Pharmacopœia* of 1885. Bread crumb is employed as a pill-excipient, and is a constituent of the former British charcoal poultice and of several emollient cataplasms. Corn meal is generally used in this country in making charcoal poultice.

MIMULUS.—HAIRY MONKEY-FLOWER.

The plant *Mimulus pilosus*, Watson.
Nat. Ord.—Scrophulariaceæ.
COMMON NAME: *Hairy monkey-flower*.

Botanical Source.—This is a small annual plant, a native of California, and found growing in damp situations. It has an erect, angular stem, less than a foot high, and much branched from near the base. The entire plant is covered with soft and sticky hairs, whence the specific name. The leaves are opposite, from 1 to 2 inches long, sessile, and entire. The flowers are small, bright-yellow, and are borne on short axillary peduncles; they appear in July and August. The corolla is about ¼ of an inch in length, and 2-lipped; it has a broad tube, a 2-lobed, erect upper lip, and a 3-lobed lower lip, bearing 2 purple spots. The calyx is bell-shaped, slightly shorter than the corolla-tube, and has 5 unequal teeth. The fruit is a dry, 2-celled capsule, containing many seeds. This plant has never been examined chemically.

Action, Medical Uses, and Dosage.—This plant is of rather recent introduction to the profession, and deserves further investigation. A local application of the plant, in the form of a cataplasm, made either by bruising the leaves, or by steeping them in hot water, is reputed very efficient in *local inflammations* and *painful affections*, as in *rheumatism, neuralgia, erysipelas, burns*, etc. A tincture of the plant, in the dose of from 3 to 10 minims, repeated 3 or 4 times a day, will likewise be found beneficial in *rheumatism, neuralgia*, and other painful disorders. In *cardiac affections*, the sequence of rheumatic attacks, it has proved very serviceable, in several cases. In *obstinate bronchial* and *laryngeal affections*, I have derived much benefit from the use of a tincture, made with diluted alcohol, in the form of spray. It is probable that some of the other species of Mimulus possess similar properties (J. King).

MISTURÆ.—MIXTURES.

Mixtures include those liquid preparations containing oleaginous, mucilaginous, albuminous, or saccharine substances, which are used internally, and can not properly be classed with infusions, decoctions, syrups, tinctures, emulsions, etc.; also pharmaceutical compounds in which insoluble substances, whether liquid or solid, are suspended in aqueous fluids by the intervention of viscid substances.

As a rule, those preparations containing oily substances in suspension belong with *emulsions*, although compounds not easily classified, as will be seen below, are included under the elastic term *mixture*. *Saturations* are effervescing draughts prepared by neutralizing with a carbonate solutions of a vegetable acid, like citric and tartaric acids, the container being tightly corked to prevent the escape of carbonic acid gas.

Guttæ are mixtures that are to be administered by drops. If designed to be taken at one or a few doses, a mixture is sometimes called a *Haustus, Potion*, or *Draught*. A sweetened, aromatic mixture, containing a medicated water or an essential oil, is denominated a *Julep* (*Julapium*); a sweet, syrupy mixture, a *Linctus*.

MISTURA ACACIÆ (N. F.)—MIXTURE OF ACACIA.

SYNONYM: *Mixtura gummosa* (*Ger. Pharm.*, I).

Preparation.—"Acacia, in coarse powder, seventy-five grammes (75 Gm.) [2 ozs. av., 282 grs.]; sugar, seventy-five grammes (75 Gm.) [2 ozs. av., 282 grs.], water, eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏]. Dissolve the acacia and sugar in the water. This preparation should be freshly made when wanted for use"—(*Nat. Form*).

Uses.—(See *Acacia*.)

MISTURA ADSTRINGENS ET ESCHAROTICA (N. F.)
ASTRINGENT AND ESCHAROTIC MIXTURE.

SYNONYM: *Villate's solution*.

Preparation.—"Solution of lead subacetate (*U. S. P.*), one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; copper sulphate, sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.]; zinc sulphate, sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.]; diluted acetic acid (*U. S. P.*), eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏]. Dissolve the copper sulphate and zinc sulphate in the diluted acetic acid, add the solution of lead subacetate, and agitate thoroughly. Set the mixture aside so that the precipitate may subside. Then decant, or siphon off, the clear liquid and preserve it for use. *Note.*—In attempting to pass the liquid through a filter, it will usually be found that the finely divided precipitate of lead sulphate will partially pass along with it. This may be prevented (in this and many similar cases) by adding to the mixture a small quantity of starch, thoroughly incorporating this by agitation, and pouring the mixture on the previously wetted filter. The first portions of the filtrate are poured back until it runs through clear"—(*Nat. Form.*).

Action and Medical Uses.—This fluid mixture is designed as an astringent and escharotic.

MISTURA ALTERANTIÆ COMPOSITA.—COMPOUND TONIC MIXTURE.

Preparation.—Take of sulphate of iron, 1 drachm; phosphate of sodium, 6 drachms; sulphate of quinine, 192 grains; strychnine, 6 grains; white sugar, 14 ounces; diluted phosphoric acid, 14 fluid ounces; aqua ammoniæ, diluted sulphuric acid, water, boiling water, each, a sufficient quantity. Dissolve the sulphate of iron in 1 fluid ounce of the boiling water, also dissolve the phosphate of sodium in 2 fluid ounces of the boiling water. Mix these 2 solutions, and wash the precipitate (phosphate of iron) until the washings pass tasteless. Dissolve the sulphate of quinine in 2 fluid ounces of the water, with the aid of a sufficient quantity of the diluted sulphuric acid, and then add the solution of ammonia, a sufficient quantity, to precipitate the quinine, and thoroughly wash this precipitate. Add the phosphate of iron and the quinine thus obtained, together with the strychnine, to the diluted phosphoric acid, and when they are dissolved, add the sugar; dissolve without heat.

Action, Medical Uses, and Dosage.—Of this mixture, which is similar to the syrup of Easton, Prof. J. M. Scudder observes: "A very important object in the treatment of many forms of chronic disease, is to restore the tone of the stomach and bowels, and give better innervation through the ganglionic nerves. The loss of power in the worst cases (as in *secondary syphilis*) is sometimes so great that it requires powerful means to accomplish the object. It is in these cases especially, that this combination will be found most effective. This is one of the most powerful combinations I have ever employed to restore the action of the ganglionic system of nerves, the appetite, and the functions of digestion and nutrition. It may be employed in any *cachectic diseases*, or where the blood is deficient in quantity and quality, with imperfect innervation. It is also an excellent remedy in *periodical diseases*, as well as a prophylactic against them. The dose is from 15 minims to 1 fluid drachm."

MISTURA CAJUPUTI COMPOSITA.—COMPOUND CAJEPUT MIXTURE.

SYNONYM: *Hunn's drops.*

Preparation.—Take of oils of cajeput, cloves, peppermint, and anise, each, 1 fluid ounce; rectified alcohol, 4 fluid ounces. Dissolve the oils in the alcohol.

Action, Medical Uses, and Dosage.—This is a very valuable stimulant and antispasmodic preparation, and has been successfully used in *colic, cramp of the stomach*, or elsewhere, *flatulence, pains in the stomach* or *bowels, painful diarrhœa, cholera morbus, Asiatic cholera*, and in all cases where stimulant and antispasmodic action is desired. During the *cholera* of 1849–51, it was extensively used in Cincinnati for the purpose of overcoming violent spasmodic action, in the doses of 1 or 2 fluid drachms, every 10 or 15 minutes; 1 or 2 doses generally succeeded in relieving the pains and spasms when all other means had failed. The ordinary dose is from 10 drops to ½ fluid drachm. It should be given in simple syrup, mucilage of slippery-elm, or in hot brandy and water sweetened. Care should be taken not to give too much of this preparation, as a large amount would produce inflammation of the stomach. It is a very valuable agent when properly used, and should be kept by every physician and druggist (J. King).

MISTURA CAMPHORÆ COMPOSITA.—COMPOUND MIXTURE OF CAMPHOR.

Preparation.—Take of camphor water, peppermint water, and spearmint water, each, 1 fluid ounce; camphorated tincture of opium, 2 fluid drachms. Mix.

Action, Medical Uses, and Dosage.—This is a very efficient agent in allaying *nausea* and *vomiting*. It was extensively and successfully employed in Cincinnati in the nausea and vomiting attending *Asiatic cholera*. It possesses the virtues of the several articles entering into its composition, without the stimulating influence of the alcohol (which enters into their tinctures), upon already partially-inflamed mucous surfaces. The dose is from a teaspoonful to a tablespoonful, every 5 minutes, if the patient be vomiting, and every 10 minutes if he be only nauseated (J. King). This preparation may be employed in *painful states* due to gaseous distension of the intestines.

Other Camphor and Diarrhœa Mixtures.—Mistura Camphoræ Acida (N. F.), *Acid camphor mixture*, *Mistura antidysenterica*, *Hope's mixture*. "Nitric acid (*U. S. P.*), seventeen and one-half cubic centimeters (17.5 Cc.) [284 ♏]; tincture of opium (*U. S. P.*), twelve cubic centimeters (12 Cc.) [195 ♏]; camphor water (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the nitric acid with about five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of camphor-water, add the tincture of opium, and, lastly, enough camphor water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*Nat. Form.*).

Mistura Contra Diarrhœam (N. F.), *Diarrhœa mixture*, *Cholera mixture*.—1. "Tincture of opium (*U. S. P.*), tincture of capsicum (*U. S. P.*), tincture of rhubarb (*U. S. P.*), spirit of camphor (*U. S. P.*), spirit of peppermint (*U. S. P.*), of each, twenty cubic centimeters (20 Cc.) [325 ♏]. Mix them and filter. *Note.*—The formula above given, which appears to be that in most general use, is also known under the name of 'Sun Mixture.' Of other similar preparations, in more or less general use, the following may be mentioned here:

2. *Loomis' diarrhœa mixture.*—"Tincture of opium (*U. S. P.*), twelve and one-half cubic centimeters (12.5 Cc.) [203 ♏]; tincture of rhubarb (*U. S. P.*), twelve and one-half cubic centimeters (12.5 Cc.) [203 ♏]; compound tincture of catechu (*U. S. P.*), twenty-five cubic centimeters (25 Cc.) [406 ♏]; oil of sassafras, one cubic centimeter (1 Cc.) [16 ♏]; compound tincture of lavender (*U. S. P.*), forty-nine cubic centimeters (49 Cc.) [1 fl℥, 315 ♏].

3. *Squibb's diarrhœa mixture.*—"Tincture of opium (*U. S. P.*), twenty cubic centimeters (20 Cc.) [325 ♏]; tincture of capsicum (*U. S. P.*), twenty cubic centimeters (20 Cc.) [325 ♏]; spirit of camphor (*U. S. P.*), twenty cubic centimeters (20 Cc.) [325 ♏]; chloroform (*U. S. P.*) seven and one-half cubic centimeters (7.5 Cc.) [122 ♏]; alcohol, thirty-two and one-half cubic centimeters (32.5 Cc.) [1 fl℥, 47 ♏].

4. *Thielemann's diarrhœa mixture.*—"Wine of opium (*U.S.P.*), twenty-five cubic centimeters (25 Cc.) [406 ♏]; tincture of valerain (*U. S. P.*), thirty-seven and one-half cubic centimeters (37.5 Cc.) [1 fl℥, 129 ♏]; ether (*U. S. P.*), twelve and one-half cubic centimeters (12.5 Cc.) [203 ♏]; oil of peppermint, three cubic centimeters (3 Cc.) [49 ♏]; fluid extract of ipecac (*U. S. P.*), three-fourths of a cubic centimeter (0.75 Cc.) [12 ♏]; alcohol, twenty-one and one-fourth cubic centimeters (21.25 Cc.) [345 ♏]. This preparation is practically identical with the Mistura Thielemanni of the *Swedish Pharm.*

5. *Velpeau's diarrhœa mixture.*—"Tincture of opium (*U.S.P.*), compound tincture of catechu (*U. S. P.*), spirit of camphor (*U. S. P.*), of each, thirty-three and one-third cubic centimeters (33.33 Cc.) [1 fl℥, 61 ♏]"—(*Nat. Form.*).

MISTURA CHENOPODII COMPOSITA.—COMPOUND WORMSEED MIXTURE.

Synonym: *Worm mixture.*

Preparation.—Take of castor oil, 1 fluid ounce; wormseed oil, anise oil, and tincture of myrrh, of each 1 fluid drachm. Mix (Beach's *Amer. Prac.*).

Action, Medical Uses, and Dosage.—This is an excellent vermifuge, and may be used in doses of one teaspoonful for an adult, to be repeated three or four times a day, and after having been taken for three successive days, to be followed by a cathartic. This somewhat resembles *Fahnestock's Vermifuge*, which is said to be composed of castor oil, 1 fluid ounce, oil of wormseed, 1 fluid ounce; oil of anise, ½ fluid ounce; tincture of myrrh, ½ fluid drachm; oil of turpentine, 10 minims; croton oil, 1 minim. Mix. The dose is a teaspoonful for an adult, every 2 hours, to be continued for 10 or 12 hours.

MISTURA CHLORALI ET POTASSII BROMIDI COMPOSITA (N. F.)

COMPOUND MIXTURE OF CHLORAL AND POTASSIUM BROMIDE.

Preparation.—"Chloral (*U. S. P.*), two hundred and fifty grammes (250 Gm.) [8 ozs. av., 358 grs.]; potassium bromide, two hundred and fifty grammes (250 Gm.) [8 ozs. av., 358 grs.]; extract of Indian cannabis (*U. S. P.*), two grammes (2 Gm.) [31 grs.]; extract of hyoscyamus (*U. S. P.*), two grammes (2 Gm.) [31 grs.]; alcohol, sixty cubic centimeters (60 Cc.) [2 fl℥. 14♏]; tincture of quillaja (*U. S. P.*), sixty-five cubic centimeters (65 Cc.) [2 fl℥. 95 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the chloral and potassium bromide in six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of water, dissolve in this solution the extract of hyoscyamus, and add the tincture of quillaja. Then dissolve the extract of Indian cannabis in the alcohol, and add this solution gradually, and under shaking, to that first prepared. Finally, add enough water to make one thousand cubic centimeters This preparation should be shaken whenever any of it is to be dispensed. Each fluid drachm contains 15 grains each of chloral and potassium bromide, and ⅛ grain each of extract of Indian cannabis and of extract of hyoscyamus. *Note.*—The resinous extract of Indian cannabis, is merely held in suspension by means of the tincture of quillaja, as it is practically insoluble in the liquid. If the mixture is filtered, the resin will remain on the filter"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—(See *Chloral and Potassium Bromide.*) Dose, from ½ to 1 fluid drachm.

MISTURA CHLOROFORMI ET CANNABIS INDICÆ COMPOSITA (N. F.)

COMPOUND MIXTURE OF CHLOROFORM AND CANNABIS INDICA.

SYNONYM: *Chloroform anodyne.*

Preparation.—"Chloroform, one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; ether, thirty-five cubic centimeters (35 Cc.) [1 fl℥, 88 ♏]; tincture of Indian cannabis (*U. S. P.*), one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; tincture of capsicum (*U. S. P.*), sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; morphine sulphate, two and one-half grammes (2.5 Gm.) [39 grs.]; oil of peppermint, two cubic centimeters (2 Cc.) [32 ♏]; glycerin, one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; water, sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the oil of peppermint in five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of alcohol, add the chloroform, ether, and the tinctures. Mix well, and add the morphine sulphate, previously dissolved in the water and glycerin. Finally, add enough alcohol to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents about 7½ minims of chloroform; 7½ minims of tincture of Indian cannabis; 3¾ minims of tincture of capsicum; and ⅐ of a grain of morphine sulphate"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—This mixture is employed for the relief of *painful conditions*, and is similar to the various preparations that have been known as *Chlorodyne*. The average dose is 1 fluid drachm (see also *Mistura Chloroformi et Opii* [N. F.], which is also called *Chloroform anodyne*).

MISTURA COPAIBÆ COMPOSITA.—COMPOUND COPAIBA MIXTURE.

SYNONYM: *Diuretic drops.*

Preparation.—Take of spirit of nitrous ether and oil of almonds, each, 1 fluid ounce; copaiba and oil of turpentine, of each, ½ fluid ounce; camphor, in powder, 10 grains. Mix the liquids, then add the camphor, and agitate briskly (Beach's *Amer. Prac.*).

Action, Medical Uses, and Dosage.—This forms a diuretic mixture, which has been successfully and extensively used in *gonorrhœa*, *gleet*, *scalding of urine*, and *urinary affections*. The dose is 1 fluid drachm three times a day, in some tea or mucilage. It should be well agitated previous to administration.

Other Copaiba Mixtures.—There are various mixtures of copaiba in use for the cure of *gonorrhœa*, and as several of them have been found efficient, I give the formulas for preparing them:

1. Take of copaiba, spirit of nitrous ether, compound spirit of lavender, tincture of chloride of iron, of each, 1 fluid ounce. Mix. The dose is a teaspoonful three times a day.

2. Take of oil of cubebs, oil of anise, copaiba, tincture of opium tincture of chloride of iron, of each, 1 fluid ounce. Mix. The dose is a teaspoonful three times a day. The foregoing preparations are very disagreeable to the taste, but very efficient in *gonorrhœa*, after the active symptoms have subsided. They must be agitated thoroughly previous to taking each dose, and in order to protect the teeth from the injurious action of the acid in the tincture of iron, it is recommended to rinse the mouth immediately after taking each dose, with a solution of bicarbonate of potassium.

3. Take of solidified copaiba, 2 ounces; white wax, 1 ounce; oil of cubebs, oil of spearmint, of each, 1 fluid drachm; niter, finely pulverized, 2 drachms. Melt the wax, add the oils, and then the copaiba; stir all well together, and, finally, add the niter. This forms a paste once used for the cure of *gonorrhœa*. The dose is a quantity about the size of a small chestnut, three times a day.

4. Take of alum, in powder, 1 drachm; precipitated carbonate of iron, ½ ounce; pulverized cubebs, 1 ounce; copaiba, a sufficient quantity to form a kind of paste. The dose is the same as in the preceding preparation (J. King).

MISTURA COPAIBÆ COMPOSITA (N. F.), *Compound copaiba mixture*.—1. *Lafayette mixture:* "Copaiba, one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; spirit of nitrous ether (*U. S. P.*), one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; compound tincture of lavender (*U. S. P.*), one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; solution of potassa (*U. S. P.*), thirty-five cubic centimeters (35 Cc.) [1 fl℥, 88 ♏]; syrup (*U. S. P.*), three hundred and twenty-five cubic centimeters (325 Cc.) [10 fl℥, 475 ♏]; mucilage of dextrin (F. 277), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the copaiba with the solution of potassa and the spirit of nitrous ether. Then add the compound tincture of lavender, and lastly, the syrup and mucilage of dextrin. Mix the whole thoroughly by shaking. This mixture should be well agitated whenever any of it is to be dispensed. Each fluid drachm contains 7½ minims of copaiba. *Note.*—The above mixture has usually been, and may be, prepared with mucilage of acacia; but if mucilage of dextrin be used, it will keep for a longer time without separating. A mixture of somewhat similar composition, in considerable use in some parts of the country, is the following:

2. *Chapman's mixture.*—Copaiba, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; spirit of nitrous ether (*U. S. P.*), two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; compound tincture of lavender (*U. S. P.*), sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; tincture of opium (*U. S. P.*), thirty cubic centimeters (30 Cc.) [1 fl℥, 7 ♏]; mucilage of acacia (*U. S. P.*), one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*Nat. Form.*).

MISTURA CREOSOTI.—CREOSOTE MIXTURE.

Preparation.—To a mixture of 15 minims, each, of glacial acetic acid and creosote, add gradually, 15 fluid ounces (Imp.) of distilled water. Finally, add to this 1 fluid ounce of syrup and ½ fluid drachm of spirit of juniper. This accords with the *British Pharmacopœia*, 1885.

Action, Medical Uses, and Dosage.—(See *Creosota*.) This agent is intended to check *vomiting*. Dose, ½ to 1 fluid ounce.

MISTURA CRETÆ (U. S. P.)—CHALK MIXTURE.

Preparation.—"Compound chalk powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; cinnamon water, four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Rub the compound chalk powder, in a mortar, with the cinnamon water and about two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of water, gradually added, to a uniform mixture; transfer this to a graduated vessel, and rinse the mortar with enough water to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the whole thoroughly. This preparation should be freshly made when wanted"—(*U. S. P.*). As this readily decomposes in hot weather, the addition of a little glycerin is recommended by Kennedy.

Action, Medical Uses, and Dosage.—This preparation is popular with some physicians, chiefly those of the Allopathic school, for the *diarrhœas of children* and *adults* when the dejecta are foamy and greenish, and there is *flatulence* and *gastric acidity*. It is recommended for the watery diarrhœa preceding *cholera*. Astringents and tincture of opium are often added to it. The dose is from 1 to 4 fluid drachms.

MISTURA EXPECTORANS, STOKES (N. F.)—STOKES' EXPECTORANT MIXTURE.

SYNONYM: *Stokes' expectorant.*

Preparation.—Ammonium carbonate, seventeen and one-half grammes (17.5 Gm.) [270 grs.]; fluid extract of senega (*U. S. P.*), thirty-five cubic centimeters (35 Cc.) [1 fl℥, 88 ♏]; fluid extract of squill (*U. S. P.*), thirty-five cubic centimeters (35 Cc.) [1 fl℥, 88 ♏]; camphorated tincture of opium (*U. S. P.*), one hundred and seventy-five cubic centimeters (175 Cc.) [5 fl℥, 440 ♏]; water, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; syrup of tolu (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏). Dissolve the ammonium carbonate in the water, add the fluid extracts and tincture, and lastly, enough syrup of tolu to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏].

Action, Medical Uses, and Dosage.—As its name implies, this preparation is intended as an expectorant mixture. Dose, 1 fluid drachm.

Other Expectorants.—MISTURA AMMONII CHLORIDI (N. F.), *Mixture of ammonium chloride, Mistura* (or *Mixtura*) *solvens simplex:* "Ammonium chloride, twenty-five grammes (25 Gm.) [386 grs.]; purified extract of glycyrrhiza (F. 158), twenty-five grammes [25 Gm.) [386 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the solids in a sufficient quantity of water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. *Note.*—Sometimes a Mistura (or Mixtura) Solvens Stibiata is prescribed. This may be prepared by dissolving thirty centigrammes (0.30 Gm.) of antimony and potassium tartrate in one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of mistura ammonii chloridi"—(*Nat. Form.*).

MISTURA OLEI PICIS (N. F.), *Mixture of oil of tar, Mistura picis liquidæ, Tar mixture.*—"Purified extract of glycyrrhiza (F. 158), sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.]; oil of tar (*U. S. P.*), thirty-five cubic centimeters (35 Cc.) [1 fl℥, 88 ♏]; sugar, two hundred and fifty grammes (250 Gm.) [8 ozs. av., 358 grs.]; chloroform (*U. S. P.*), ten cubic centimeters (10 Cc.) [162 ♏]; oil of peppermint, three cubic centimeters (3 Cc.) [49 ♏]; alcohol, one hundred and sixty cubic centimeters (160 Cc.) [5 fl℥, 197 ♏], water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Add the purified extract of glycyrrhiza and sugar to six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of water, contained in a covered vessel, and heat the mixture to boiling until the extract and sugar are dissolved. Then add the oil of tar, cover the vessel, and allow the contents to cool, stirring occasionally. Next add the chloroform and oil of peppermint, previously dissolved in the alcohol, and lastly, enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. This mixture should be well agitated, whenever any of it is to be dispensed"—(*Nat. Form.*).

MISTURA FERRI AROMATICA.—AROMATIC MIXTURE OF IRON.

Preparation.—Macerate, in a closed vessel, for 3 days, with occasional agitation, 1 ounce of powdered red cinchona bark, ½ ounce of coarsely powdered calumba root, ¼ ounce of bruised cloves, and ½ ounce of fine iron wire, in 12 fluid ounces of peppermint water. Filter, and by pouring upon the filter a sufficient quantity of peppermint water, bring the measure to 12½ fluid ounces. Then add ½ fluid ounce of tincture of orange-peel, and 3 fluid ounces of compound tincture of cardamoms. (Weight, avoirdupois; measure, Imperial.) Preserve in tightly-stoppered bottles. This accords with the formula of the *British Pharmacopœia*, 1885. It is a greenish-black fluid, and is properly a compound infusion.

Action, Medical Uses, and Dosage.—Excellent tonic for *debilitated and anemic individuals*. Dose, 1 to 2 fluid ounces.

MISTURA FERRI COMPOSITA (U. S. P.)—COMPOUND IRON MIXTURE.

SYNONYM: *Griffith's mixture.*

Preparation.—"Ferrous sulphate, in clear crystals, six grammes (6 Gm.) [93 grs.]; myrrh, in small pieces, eighteen grammes (18 Gm.) [278 grs.]; sugar, eighteen grammes (18 Gm.) [278 grs.]; potassium carbonate, eight grammes (8 Gm.) [124 grs.]; spirit of lavender, sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏]; rose water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Rub the myrrh, sugar, and potassium carbonate, in a mortar, with seven hundred cubic centimeters (700 Cc.) [23 fl℥, 321 ♏] of rose water, at first very gradually added, so that a uniform mixture may result. Transfer this to a graduated vessel, add the spirit of lavender, then the ferrous sulphate, previously dissolved in about fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏] of rose water, and, lastly, enough rose water to make the product measure one thousand cubic centimeters (1000 Cc. [33 fl℥, 391 ♏]. Mix the whole thoroughly. This preparation should be freshly made when wanted"—(*U. S. P.*).

By the interaction of the potassium carbonate and ferrous sulphate, potassium sulphate and ferrous carbonate result. The mixture, when freshly made, is of a greenish color, but if allowed to oxidize, as it will do if not tightly corked, the ferrous salt changes to rust-red ferric compounds. Therefore, the mixture should be extemporaneously prepared as needed.

Action, Medical Uses, and Dosage.—This agent was formerly much admired as an antihectic remedy in *purulent chronic bronchitis* with *bronchial dilatation.* The sulphate and the myrrh tend to overcome relaxation while the iron is present to fulfil the common uses of the ferruginous compounds. Dose, ½ to 1½ fluid ounces. Griffith's mixture has also been employed in *menstrual irregularities,* and in anemic and debilitated patients.

MISTURA GLYCYRRHIZÆ COMPOSITA (U. S. P.)—COMPOUND MIXTURE OF GLYCYRRHIZA.

SYNONYM: *Brown mixture.*

Preparation.—"Pure extract of glycyrrhiza, thirty grammes (30 Gm.) [1 oz. av., 25 grs.]; syrup, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; mucilage of acacia, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; camphorated tincture of opium, one hundred and twenty cubic centimeters (120 Cc.) [4 fl℥, 28 ♏]; wine of antimony, sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏]; spirit of nitrous ether, thirty cubic centimeters (30 Cc.) [1 fl℥, 7 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Rub the pure extract of glycyrrhiza, in a mortar, with five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of water until it is dissolved. Transfer the solution to a a graduated vessel containing the other ingredients, and rinse the mortar with enough water to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the whole thoroughly"—(*U. S. P.*).

This forms an unsightly mixture, yet it is very popular with some physicians. The antimonial wine contained in the preceding mixture will render it unpopular with the Eclectic profession, and the following old formula will more nearly meet with the approval of our physicians where a mixture of this kind is desired:

MISTURA GLYCYRRHIZÆ COMPOSITA, *Compound liquorice mixture.*—Take of powdered extract of liquorice, powdered gum Arabic, and white sugar, each, 2 drachms; triturate these with water, 6 fluid ounces, added to them gradually, and when these are dissolved, strain the solution, and add to it camphorated tincture of opium, 1 fluid ounce; tincture of bloodroot, ½ fluid ounce; spirit of nitrous ether, 2 fluid drachms.

Action, Medical Uses, and Dosage.—The latter preparation forms an excellent cough mixture, and may be used in *catarrhal affections* after the subsidence of the more active symptoms, and when expectoration is present. An adult may take ½ fluid ounce for a dose, and a child 3 or 4 years old a fluid drachm.

A very excellent cough remedy may be made as follows: Dissolve ammonium chloride, 2 drachms, in water, 6 fluid ounces; then add extract of liquorice, 2 drachms; extract of hyoscyamus, ½ drachm; when these are dissolved, add syrup of tolu, 1 fluid ounce. The dose is the same as the above, and may be repeated 3 or 4 times a day. A grain or two of the sulphate of sanguinarine may be added to render it more expectorant (J. King).

MISTURA GUAIACI (N. F.)—MIXTURE OF GUAIAC.

Preparation.—"Guaiac (*U. S. P.*), in powder, twenty-five grammes (25 Gm.) [386 grs.]; sugar, twenty-five grammes (25 Gm.) [386 grs.]; acacia, in fine powder, fifteen grammes (15 Gm.) [231 grs.]; cinnamon water (*U. S. P.*), one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the powdered guaiac with the sugar and acacia, then gradually add the cinnamon water, and mix thoroughly. This mixture should be well agitated, whenever any of it is to be dispensed. *Note.*—This preparation is practically identical with the *Mistura Guaiaci* of the *British Pharmacopœia*"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—Same as for *Guaiacum*. Dose, ¼ to 1 fluid ounce, several times a day. Mixture of guaiac was once very popular in the treatment of *constitutional syphilis* and *syphilitic rheumatism*.

MISTURA MAGNESIÆ ET ASAFŒTIDÆ (N. F.)—MIXTURE OF MAGNESIA AND ASAFETIDA.

SYNONYMS: *Dewees' carminative, Mistura Carminativa Deweesi.*

Preparation.—"Magnesium carbonate, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; tincture of asafœtida, seventy-five cubic centimeters (75 Cc.) [2 fl℥, 257 ♏]; tincture of opium, ten cubic centimeters (10 Cc.) [162 ♏]; sugar, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; distilled water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Rub the magnesium carbonate and sugar, in a mortar, with the tincture of asafœtida and the tincture of opium. Then gradually add enough distilled water to make the mixture measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—This agent was formerly much used in *infantile colic*. The average dose is from 10 to 20 minims. This preparation contains $\frac{1}{100}$ part of laudanum.

Related Preparations.—MISTURA CARMINATIVA (N. F.), *Carminative mixture, Dalby's carminative.* "Magnesium carbonate, sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.]; potassium carbonate, three grammes (3 Gm.) [46 grs.]; tincture of opium (*U. S. P.*), twenty-five cubic centimeters (25 Cc.) [406 ♏]; oil of caraway, one-half cubic centimeter (0.5 Cc.) [8 ♏]; oil of fennel, one-half cubic centimeter (0.5 Cc.) [8 ♏]; oil of peppermint, one-half cubic centimeter (0.5 Cc.) [8 ♏]; syrup (*U. S. P.*), one hundred and sixty cubic centimeters (160 Cc.) [5 fl℥, 197 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the oils with about ten grammes (10 Gm.) [154 grs.] of magnesium carbonate, and seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of water gradually added. Then add the remainder of the magnesium carbonate and the other ingredients, and lastly, add enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. This preparation should be freshly made, when wanted for use. Each fluid ounce represents about 1 grain of opium"—(*Nat. Form.*).

MISTURA SASSAFRAS ET OPII (N. F.), *Mixture of sassafras and opium, Mistura opii alkalina, Godfrey's cordial.*—"Oil of sassafras, one cubic centimeter (1 Cc.) [16 ♏]; tincture of opium (*U. S. P.*), thirty-five cubic centimeters (35 Cc.) [1 fl℥, 88 ♏]; alcohol, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; potassium carbonate, eight grammes (8 Gm.) [123 grs.]; molasses, three hundred and twenty-five cubic centimeters (325 Cc.) [10 fl℥, 475 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the tincture of opium with the alcohol in which the oil of sassafras had been previously dissolved. Dissolve the potassium carbonate in about five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of water, mix this with the molasses, then add the mixture first prepared, and lastly, enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Allow the mixture to become clear by standing, then pour off the liquid portion and preserve it for use. Each fluid drachm contains 2 minims of tincture of opium, corresponding to about ⅕ grain of opium"—(*Nat. Form.*).

MISTURA OLEORUM CAMPHORATA.—CAMPHORATED MIXTURE OF OILS.

Preparation.—Take of oils of cloves, cajeput, and amber (rectified), and camphor, each, ½ ounce. Mix the oils together, and dissolve camphor in the mixture.

Action and Medical Uses.—This is intended for the relief of *toothache.* The decayed portion of the tooth is to be cleansed and dried, and then a few drops of the mixture on cotton applied to the part; continue application 2 or 3 times in the same manner, and leave the last in the tooth. This has proved very efficient, and has been extensively sold throughout the country as "*Parisen's Vegetable Specific.*"

It will not be amiss to give at this place, another preparation for *toothache*, which I have found of service. Take of opium and saltpeter, each, 2 ounces; camphor, 1½ ounces; galls, in powder, 4 ounces; alcohol, 1½ pints. Place the articles in the alcohol, macerate for 14 days, and filter. To be applied the same as the preceding mixture. Various other agents, as solution of tannic acid, or gallic acid in alcohol, etc., have also been recommended for relieving toothache (J. King).

MISTURA OLEORUM COMPOSITA.—COMPOUND MIXTURE OF OILS.

SYNONYM: *Vermifuge oil.*

Preparation.—Take of castor oil and wormseed oil, each, 1 ounce; oil of turpentine, and oil of anise, of each, ½ ounce. Mix.

Action, Medical Uses, and Dosage.—This forms an efficient remedy for *worms*, and may be given in teaspoonful doses to an adult, and repeated every 2 hours. After its employment for 2 or 3 days, a purgative must be administered (T. V. Morrow).

MISTURA RHEI ET SODÆ (U. S. P.)—MIXTURE OF RHUBARB AND SODA.

Preparation.—"Sodium bicarbonate, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; fluid extract of rhubarb, fifteen cubic centimeters (15 Cc.) [243 ♏]; fluid extract of ipecac, three cubic centimeters (3 Cc.) [49 ♏]; glycerin, three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏]: spirit of peppermint, thirty-five cubic centimeters (35 Cc.) [1 fl℥, 88 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the sodium bicarbonate in about four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of water. Then add the fluid extracts, the glycerin, and the spirit of peppermint, and, lastly, enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This preparation, in large doses, is purgative and carminative; in smaller amounts, it checks *diarrhœa* and *colic* accompanying *infantile dyspepsia.* Dose, ½ fluid drachms to 2 fluid ounces.

Related Preparation.—MISTURA RHEI COMPOSITA (N. F.), *Compound mixture of rhubarb, Squibb's rhubarb mixture.* "Fluid extract of rhubarb (*U. S. P.*), twelve cubic centimeters (12 Cc.) [195 ♏]; fluid extract of ipecac (*U. S. P.*), two cubic centimeters (2 Cc.) [33 ♏]; sodium bicarbonate, twenty-four grammes (24 Gm.) [370 grs.]; glycerin, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; peppermint water (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the sodium bicarbonate in about five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of peppermint water, then add the fluid extracts and glycerin, and lastly, enough peppermint water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*Nat. Form.*). This preparation must not be confused with the well-known neutralizing cordial, which in some respects it resembles.

MISTURA SANGUINARIÆ COMPOSITA.—COMPOUND MIXTURE OF BLOODROOT.

SYNONYM: *Cough drops.*

Preparation.—Take of syrup of ipecacuanha, syrup of squill, tincture of bloodroot, syrup of balsam tolu, camphorated tincture of opium, each, 1 ounce. Mix (J. King).

Action, Medical Uses, and Dosage.—This is a very efficient preparation in severe *coughs* from *colds*, *catarrhal*, or *bronchial irritations*. The dose is from ½ to 1 fluid drachm whenever the fit of coughing is severe. I have used it for many years in practice, with much benefit. A very pleasant preparation for cough is composed of oil of anise, oil of sweet almonds, tincture of balsam of tolu. Canada balsam, Madeira wine, each, 1 ounce. Mix (Beach's *Amer. Prac.*). The dose is from 10 to 20 drops, 3 or 4 times a day, in a little elm or flaxseed infusion. It assists expectoration, and affords great relief in tickling coughs (J. King).

MISTURA SCAMMONII.—SCAMMONY MIXTURE.

SYNONYMS: *Lac scammonii, Emulsio purgans cum scammonia.*

Preparation.—Make a uniform emulsion by triturating together 6 grains of powdered scammony and 2 fluid ounces of milk. This is really an emulsion, and has a fine appearance, and is not unpleasant to the taste. The formula accords with that of the *British Pharmacopœia*, 1885. It should be made only when needed for immediate use.

Action, Medical Uses, and Dosage.—(See *Scammonia.*) The above mixture is intended for a single dose for an adult; for a child the dose is one-third of this mixture.

MISTURA SENNÆ COMPOSITA.—COMPOUND MIXTURE OF SENNA.

Preparation.—Dissolve, by means of gentle heat, 4 ounces (av.) of magnesium sulphate in 15 fluid ounces (Imp.) of infusion of senna, and add 1 fluid ounce of liquid extract of liquorice, 2½ fluid ounces of tincture of senna, and 1½ fluid ounces of tincture of cardamoms. This is the British form (*Br. Pharm.*, 1885) of compound infusion of senna, or *black draught* (see *Infusum Sennæ Compositum* for American *black draught*).

Action, Medical Uses, and Dosage.—Same as for *Compound Infusion of Senna.* Dose, from 1 to 1½ fluid ounces (Imp.).

MISTURA SODÆ ET MENTHÆ (N. F.)—MIXTURE OF SODA AND SPEARMINT.

SYNONYM: *Soda mint.*

Preparation.—Sodium bicarbonate, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; aromatic spirit of ammonia (*U. S. P.*), ten cubic centimeters (10 Cc.) [162 ♏]; spearmint water (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the sodium bicarbonate in about seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of spearmint water, add the aromatic spirit of ammonia and enough spearmint water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Filter, if necessary"—(*Nat. Form.*).

Action and Medical Uses.—Antacid and carminative.

MISTURA SPIRITUS VINI GALLICI.—MIXTURE OF FRENCH BRANDY.

SYNONYM: *Brandy mixture.*

Preparation.—Take of brandy, cinnamon water, each, 4 fluid ounces; the yolks of two eggs; refined sugar, ½ ounce; oil of cinnamon, 2 minims. Mix—(*Lond.*). This is identical with the present formula of the *British Pharmacopœia* (1898), excepting that the latter does not add the 2 minims of cinnamon oil.

Action and Medical Uses.—This forms a nutritive and stimulating preparation, especially adapted to the stage of prostration in *low forms of fever*, and in cases of much *debility* from various other causes.

MISTURA SULPHURICA ACIDA (N. F.)—SULPHURIC ACID MIXTURE.

SYNONYMS: *Mixtura sulphurica acida* (*Ger. Pharm.*), *Haller's acid elixir.*

Preparation.—"Sulphuric acid (*U. S. P.*), two hundred and fifty grammes 250 (Gm.) [8 ozs. av., 358 grs.]; alcohol, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Add the acid very gradually to seven hundred and fifty grammes (750 Gm.) [1 lb. av., 10 ozs., 199 grs.] of alcohol contained in a flask, agitating after each addition, and taking care that the temperature of the mixture be not allowed to rise above 50° C. (122° F.). When the mixture is cold, add enough alcohol, if necessary, to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. *Note.*—The same product may be obtained, approximately, by carefully and slowly adding 1 volume of sulphuric acid to 7 volumes of alcohol, and this method may be used when small quantities are required for immediate use in a prescription"—(*Nat. Form.*). The sulphuric acid gradually becomes converted into ethylsulphuric acid, of which this mixture is merely an alcoholic solution.

Action, Medical Uses, and Dosage.—(See *Acidum Sulphuricum.*) Dose, 1 to 8 minims, well diluted with water.

MITCHELLA.—PARTRIDGEBERRY.

The whole plant of *Mitchella repens*, Linné.

Nat. Ord.—Rubiaceæ.

COMMON NAMES: *Partridgeberry, Checkerberry, Squaw-vine, Squaw-berry vine, Winter clover, Deerberry,* and *One-berry.*

Botanical Source.—This is an indigenous, evergreen herb, with a perennial root, from which arises a smooth and creeping stem, furnished with roundish ovate, or slightly heart-shaped, petiolate, opposite, flat, coriaceous, dark-green, and shining leaves, usually variegated with whitish lines. The flowers are white, often tinged with red, very fragrant, in pairs, with their ovaries united. Calyx 4-parted. Corolla funnel-form, two on each double ovary, limb 4-parted, spreading, and densely hairy within. Stamens 4, short, and inserted on the corolla. Style slender; stigmas 4. The fruit is a dry, berry-like, double drupe, crowned with the calyx-teeth of the two flowers, each containing 4 small and seed-like, bony nutlets. Some plants bear flowers with exserted stamens and included styles; others, conversely, those with included stamens and exserted styles (W.—G.—T.). According to Mr. Thomas Meehan, this is a diœcious plant, having imperfect rudimentary pistils in the male plant, with the calyx-teeth coarser than in the female, the anthers on filaments projecting considerably beyond the corolla throat; in the female plant, the anthers are sessile, rudimentary, concealed in the coarse down of the corolla tube, and the pistil, with its well-developed stigma, projects beyond the throat of the corolla (*Amer. Jour. Pharm.*, 1868, p. 554).

Fig. 171.

Mitchella repens.

History.—This plant is indigenous to the United States, growing in dry woods, among hemlock-timber, and in swampy places, flowering in June and July. The leaves bear some resemblance to clover, and remain green through the winter. The fruit or berry is bright scarlet, edible, but nearly tasteless, dry, and full of stony seeds, and also remains through the winter. The whole plant is medicinal, and imparts its virtues to boiling water or alcohol.

Chemical Composition.—E. Breneiser found in this plant a saponin-like body, frothing in aqueous solution; the water-soluble part of an ether extract of the plant contained a principle forming a precipitate with tannic acid and with picric acid; but it was neither an alkaloid nor a glucosid. No volatile oil was present (*Amer. Jour. Pharm.*, 1887, p. 229).

Action, Medical Uses, and Dosage.—Partridgeberry is parturient, diuretic, and astringent. Used in *dropsy*, *suppression of urine* and *diarrhœa*, in decoction. It seems to have an especial affinity for the uterus, exerting a powerful tonic and alterative influence upon this organ, and has hence been found highly beneficial in many *uterine derangements*, as in *amenorrhœa*, some forms of *dysmenorrhœa*, *menorrhagia*, *chronic congestion of the uterus*, *enfeebled uterine nervous system*, etc. It is said that the squaws drink a decoction of this plant for several weeks previous to their confinement, for the purpose of rendering parturition safe and easy. Similar virtues have been ascribed to it by competent physicians of our time. The remedy is peculiarly American, not being noticed or used by foreign practitioners. Dose of a strong decoction, from 2 to 4 fluid ounces, 2 or 3 times a day. The berries are a popular remedy for *diarrhœa* and *dysuria*. Used as follows, partridgeberry is highly recommended as a cure for *sore nipples:* Take 2 ounces of the herb, fresh if possible, and make a strong decoction with a pint of water, then strain, and add as much good cream as there is liquid of the decoction. Boil the the whole down to the consistence of a soft salve, and when cool, anoint the nipple with it every time the child is removed from the breast.

MONARDA.—HORSEMINT.

The leaves and flowering tops of *Monarda punctata*, Linné.

Nat. Ord.—Labiatæ.

Common Name: *Horsemint.*

Illustration: Bentley and Trimen, *Med. Plants*, 208.

Botanical Source.—Horsemint is an indigenous perennial or biennial herb, with a fibrous root. The stems are obtusely angled, hoary pubescent, branched, and 2 or 3 feet high. The leaves are oblong-lanceolate to oblong, remotely and obscurely serrate, narrowed at base, punctate, and petioled. The flowers are yellow, with brown or purple spots, in numerous, dense, axillary whorls. The bracts are large, yellow, and red, lanceolate, obtuse at the base, sessile, and longer than the whorls. The corolla is nearly smooth, ringent, tubular, upper lips spotted with purple, lower lip reflexed, 3-lobed. Calyx elongated, cylindric, 15-nerved, subequally 5-toothed, and hairy in the throat; the teeth are short and rigid, awnless. Stamens 2, elongated, ascending, inserted in the throat of the corolla; anthers linear, cells divaricate at base, and connate at apex (G.—W.).

History and Chemical Composition.—This plant is found growing in sandy fields and barrens from New England to the Gulf of Mexico, and westward beyond the Mississippi, flowering during the summer. The entire plant has a rather fragrant odor, and a pleasant, pungent, slightly bitter taste. It contains an abundance of essential oil (*Oleum Monardæ*, *U. S. P.*, 1870) on which its active virtues depend. The oil may be obtained by distillation of the recent herb with water. The plant yields its virtues to alcohol, or boiling water by infusion.

Oleum Monardæ, or *Oil of horsemint*, is of a yellowish, or more often yellowish-red or brownish-red color, and has a sharp taste and an aromatic, pleasant odor. Alcohol readily dissolves it. Below 5° C. (39° F.), it deposits crystals of a stearopten once called *monardin*, but which has subsequently been shown to be *thymol* ($C_{10}H_{13}OH$). H. J. M. Schroeter (*Amer. Jour. Pharm.*, 1888) believes the oil to contain 50 per cent of a hydrocarbon ($C_{10}H_{16}$), 25 per cent of thymol, which he pronounced to be dextro-gyrate, while thymol from oil of thyme is optically inactive, and oxygenated bodies of the composition $C_{10}H_{18}O$. He also found small quantities of formic, acetic, and butyric acids in the form of esters. More recently, Prof. Edward Kremers and W. R. Schumann (*Proc. Amer. Pharm. Assoc.*, 1896, p. 238) distilled the flowering herb of *Monarda punctata* of their own collection, and obtained an amber-colored oil of 0.9307 specific gravity, at 20° C. (68° F.), which yielded to a 10 per cent caustic soda solution, 56 per cent of *thymol*. The residue distilled with water, yielded an oil containing the hydrocarbon *cymene* ($C_{10}H_{14}$), previously shown by Brennan (1895) to occur also in the oil of *Monarda fistulosa*. Another lot of the herb collected by the same authors before flowering yielded upon distillation 3.39 per cent of oil, while more recently, Kremers and W. E. Hendricks (*Pharm. Archives*, 1899, Vol. II, p. 73), obtained only 1 per cent of oil from a flowering specimen of the plant. In the latter case, 60 per cent of phenols were present, mostly thymol. Its isomer, *carvacrol*, may be occasionally present in small quantity. The non-phenol part of the oil contained 10 per cent of an alcohol; furthermore, *cymene*, and a small quantity of dextro-rotatory *limonene*.

Action, Medical Uses, and Dosage.—Horsemint is stimulant, carminative, sudorific, diuretic, and anti-emetic. The infusion or essence is used in *flatulence*, *nausea*, *vomiting*, and as a diuretic in *suppression of the urine*, and other urinary disorders. The warm infusion is a stimulating diaphoretic, and has acquired some celebrity as an emmenagogue; it may be drank freely. The oil is extremely sharp and pungent, and applied to the skin, excites heat and redness, and if too long or too closely applied, will produce a painful blister. It is used like peppermint oil internally, and is employed locally in embrocations to relieve *pain*. The full strength oil may be used upon *neuralgic parts*. The *M. didyma* and *M. fistulosa* may be used as substitutes for the above.

Related Species.—*Monarda didyma*, Linné; *Oswego tea*. This species grows in the Alleghany Mountains, from North Carolina northward to Canada. In the northern states it often grows along streams and in other wet situations. The flower is composed of a showy, large crimson corolla, and crimson-stained bracts. The stamens are much exserted. It is often cultivated in gardens.

Monarda fistulosa, Linné; *Wild bergamot*, also called *Horsemint*. From New England states west and south, growing in thickets. Flowers are in a terminal head, large, and have a greenish, white, light lilac, or blue corolla. It is a variable species. The uses of these two species are similar to those of horsemint. The chemical composition of the oil of this plant is analogous to that of *Monarda punctata*, *carvacrol* taking the place of its isomer, *thymol*, contained in the latter plant. Less than 2 per cent of thymol is present in the oil of *M. fistulosa*. The latter also contains a crystalline red coloring matter resembling alizarin (see E. J. Melzner and Edward Kremers, *Proc. Amer. Pharm. Assoc.*, 1896, p. 242, and *Pharm. Archives*, Vol. II, 1899, p. 76).

MONESIA.—MONESIA-BARK

Extract of the bark of *Chrysophyllum Glyciphlœum*, Casaretti (*Chrysophyllum Buranhem*, Riedel; *Lucuma Glycyphlœa*, Martius et Eichler).

Nat. Ord.—Sapotaceæ.

Common Name: *Monesia*.

Botanical Source.—Chrysophyllum Glyciphlœum is a common Brazilian tree known locally as *buranhem* or *guaranhem*. It is often from 40 to 50 feet in height. The genus *Chrysophyllum* comprises several species, mostly South American trees, with milky juice. The leaves are alternate, entire, and furnished with a golden-yellow pubescence underneath, hence the name. The flowers are small, and in fascicled umbels in the axils of the leaves. The corolla is bell-shaped, and has 5 stamens. The ovary has 10 1-ovuled cells, and bears a peltate 10-lobed stigma.

History and Description.—The bark is in fragments, nearly smooth, and cinnamon-colored internally. The pieces are thin, about ¼ or ½ inch in thickness; at first a sweetish taste is imparted, which subsequently becomes acrid and astringent. It has no odor. The fruit of the *C. Cainito*, and other species are called "star apples," and are eaten by the natives. Chrysophyllum Glyciphlœum is of interest from the fact that an extract from the bark is used in medicine, and known as *Monesia*.

Monesia (*Extractum Monesiæ*), the extract of the foregoing bark, was introduced to notice in 1839, in an article written by Dr. St. Ange, and published in the *Paris Medical Gazette* (*Br. Pharm. Jour.*, Vols. III and IV). The extract appeared in the form of brown, brittle cakes of about 1 pound each, insoluble in ether, partly soluble in alcohol, but more so in water; forming with the latter menstruum, a frothy, soap-suds-like solution. Monesia extract, when prepared in the cold is of a dark-red color, and is considered in Brazil to be superior in quality. T. Peckolt reports (*Pharm. Rundschau*, 1888, p. 30) that the extract is not now exported to any considerable extent.

Chemical Composition.—Shortly after the introduction of monesia bark Derosne and Henry examined it, and found it to contain chlorophyll, wax, *glycyrrhizin*, iron-bluing tannin, and red coloring matter. The supposed active principle, which is acrid, they named *monesin;* although it is probable that the tannin and other substances are of therapeutic value.

Monesin is regarded as identical with saponin ($C_{32}H_{54}O_{18}$). It forms transparent yellow scales, insoluble in ether, but soluble in water and alcohol, and produces in aqueous solution, upon shaking, an abundant froth. It is odorless, but has a bitter, acrid taste. Peckolt's analysis of the bark (*loc. cit.*) shows the presence of *monesia-tannic acid*, 6.2 per cent; red coloring matter, 2.2 per cent; starch, 1.97 per cent; *monesin*, 0.28 per cent; *glycyrrhizin*, 1.5 per cent; crystallizable *hivurahein* (*lucumin*), 0.009 per cent, etc. The latter substance is bitter, insoluble in cold water, soluble in ether and hot alcohol.

Action, Medical Uses, and Dosage.—Monesia appears to possess slightly stimulating and astringent properties. In doses of from 2 to 10 grains, repeated 2 or 3 times a day, it acts as a gentle excitant of the stomach, improving the appetite and the digestive functions. In larger doses, it causes a burning sensation in the epigastric region, gastric uneasiness, and costiveness. It has been found advantageous in certain atonic forms of *dyspepsia*, as a stimulant and tonic; and as a tonic and astringent in *diarrhœa* and *hemorrhages*, as from the lungs, stomach, and kidneys, in *hemorrhoids*, and in *profuse menstruation*. In *chronic bronchitis*, attended with considerable expectoration, and in the *catarrhal affections* and *winter cough* of persons in advanced years, it has proved useful. As an alterative, it has been advised in *scrofulous* and *scorbutic affections*, though it is somewhat doubtful as to its good effect in these cases, although it is stated to have been effectual in the *purpura of scurvy*. It has been advised as a tonic in convalescence from *malarial fevers* and in *incipient consumption*. As a local application, in the form of powder sprinkled upon the parts, in aqueous solution, tincture, or ointment, it has proven valuable in obstinate *indolent ulcers*, in *anal* and *buccal fissures*, in *scorbutic* or other *unhealthy condition of the gums*, in *vaginal leucorrhœa*, and in *nasal hemorrhage;* it may be applied on lint, as a wash, by injection, or by spray.

The dose of monesia is from 2 to 10 or 15 grains; of monesin, from $\frac{1}{4}$ to $\frac{1}{2}$ grain. These may be given in pill, or powder, and in some syrup or other convenient vehicle. The tincture may be made of any desirable strength, from 1 to 4 ounces of monesia extract to a pint of alcohol. The ointment may be made by triturating 1 drachm of the extract with 7 drachms of cerate, or purified lard.

Related Species.—*Lucuma salicifolia*, Kunth. The *Zapote amarillo* or *Z. borracho* of the Mexicans. The fruit produces sleep and the seeds are employed by the natives in *pleuritis*. Several Brazilian species yield food or medicines.

Bassia longifolia, Linné; *Elloopa-tree.*—East India. A nutritious jelly is prepared from the fruit and flowers of this tree, which also furnishes valuable timber. The bark, leaves, and a fixed oil from the seeds have antirheumatic virtues and have been used in *skin disorders*. Elloopa oil is greenish and odorous.

Bassia butyracea, Roxburgh.—The seeds yield a butyraceous substance known as *fulwa-butter*. It is used like the oil of the preceding species. *Bassia parkii* yields *Shea butter*.

Mimusops Elengi, Linné.—India. The sweet fruit of this species is eaten, and the tree furnishes an excellent timber. A pleasant perfume is obtained from the flowers, and the seeds yield a drying fixed oil. Bark and root are reported astringent and tonic, and are employed as such in India. The juice of the unripe fruit and the bark are used to fix colors in silk dyeing (Dymock).

Mimusops hexandra, Roxburgh.—Fruit eaten. Uses same as for preceding.

Mimusops Schimperi and *M. kummel* yield a variety of gutta-percha.

Achras Sapota, Linné (*Sapota Achras*, Miller); *Sapota plum* (*Zapotilla* or *Bully tree.*—West Indies, South America, and naturalized in western India, where the natives eat the quince-flavored fruit called by them *Chikku* or *Kárath*. As a preventive against *febrile* and *bilious attacks*, the inhabitants of the Concan eat the fruit which has been soaked over night in melted butter. The bark is regarded astringent, tonic, and febrifuge; the seeds diuretic and aperient. Bernou (1883) obtained a crystalline alkaloid, *sapotine*, from the bark (*Sapota Bark*); it is insoluble in water, but dissolves in alcohol, chloroform, and ether. He also found two resins, and a large amount of *sapotannic acid*, the last giving the bark its astringency (see Dymock, *Mat. Med. of Western India*). G. Michaud (1891) obtained from the seeds *sapotin* ($C_{29}H_{52}O_{20}$), a crystalline, white, acrid glucosid, insoluble in chloroform, ether, and benzol, but soluble in hot alcohol and water.

Mimusops globosa, Gaertner (*Sapota Muelleri*, Blukrode; *Achras Balata*, Aublet): *Bully tree.*—Guiana. The concrete milky juice of this tree furnishes what is variously known as *balata*, ue, *gum chicle*, *zapota gum*, or *tuno gum*. It is intermediate between gutta-percha and caoutchouc, and is used in America in manufacturing *chewing gum*. Its behavior toward solvents is like that of *gutta-percha* (see *Gutta-percha and its Related Products*; also see *Amer. Jour. Pharm.*, 1883, p. 523, on *Pseudo Gutta-perchas*).

MONOTROPA.—INDIAN PIPE.

The root of *Monotropa uniflora*, Linné.

Nat. Ord.—Ericaceæ.

Common Names: *Indian pipe*, *Ice-plant*, *Bird's nest*, *Fit-plant*, *Ova-ova*, *Pipe-plant*, etc.

Illustration: Dana's *How to Know the Wild Flowers*.

Botanical Source and Description.—This plant has a dark-colored, fibrous, perennial root, matted in masses about as large as a chestnut-burr, from which arise one or more short, ivory-white stems, 4 to 8 inches high, furnished with sessile, lanceolate, white, semi-transparent, approximate leaves or bracts, and bearing a large, white, terminal, solitary flower, which is at first nodding, but becomes upright in fruit. The calyx is represented by two to four scale-like deciduous bracts, the lower rather distant from the corolla. The corolla is permanent, of 5 distinct, erect, fleshy petals, which are narrowed below with a small, nectariferous pit at the base. Stamens 10, sometimes 8; anthers short on the thickened apex of the hairy filament, 2-celled, opening by transverse chinks. Stigma 5-crenate, depressed, and beardless. Pod or capsule 5-celled and 5-valved; the seeds numerous, and invested with an arillus-like membrane (W.—G.—Eaton).

History and Chemical Composition.—This is a singular plant, found in various parts of the Union from Maine to Carolina, and westward to Missouri, growing in shady, solitary woods, in rich, moist soil, or soil composed of decayed wood and leaves, and near the base of trees, on whose roots it is said to be parasitic. The whole plant is ivory-white in all its parts, resembling frozen jelly, and is very succulent and tender, so much so that when handled it dissolves and melts away in the hands like ice. The flowers are inodorous, and appear from June until September; their resemblance to a pipe has given rise to the names *Indian pipe* or *Pipe-plant*. The root is the part used; it should be gathered in September and October, carefully dried, pulverized, and kept in well-stoppered bottles. A. J. M. Lasché (*Pharm. Rundschau*, 1889, p. 208) has found in this plant a crystallizable poisonous principle, which also occurs in several other ericaceous plants; it is named *andromedotoxin* ($C_{31}H_{51}O_{10}$).

Action, Medical Uses, and Dosage.—Ice-plant root is a tonic, sedative, nervine, and antispasmodic. It has also been employed in *febrile diseases*, as a sedative and diaphoretic. The powder has been employed in instances of restlessness, pains, nervous irritability, etc., as a substitute for opium, without any deleterious influences. It is reputed to have cured *remittent* and *intermittent fevers*, and to be an excellent antiperiodic. In *convulsions of children*, *epilepsy*, *chorea*, and other *spasmodic affections*, its administration has been followed with prompt success; hence its common name, *Fit* or *Convulsion root*. The juice of the plant, alone, or combined with rose water, has been found an excellent application to *obstinate ophthalmic inflammation*, to *ulcers*, and as an injection in *gonorrhœa*, and *inflammation and ulceration of the bladder*. Dose of the powdered root, from ½ to 1 drachm, 2 or 3 times a day. It has been used as a substitute for opium.

This plant is undoubtedly one of value, and deserving of more confidence and attention than is at present bestowed upon it. It is, however, seldom or never used at the present day. It is not the *Mesembryanthemum crystallinum* (see *Ficus*, p. 891), or Ice-plant of Europe, which has a creeping stem a foot or more in length, with large, ovate, wavy, frosted leaves, and white flowers; and the whole plant is covered with frost-like, warty protuberances, which give it a singular aspect.

MORUS RUBRA.—RED MULBERRY.

The fruit of *Morus rubra*, Linne.

Nat. Ord.—Urticaceæ.

Common Name: *Red mulberry*.

Botanical Source.—Morus rubra, or the Red mulberry, is but a shrub in the northern and New England states, 15 to 20 feet high, but in the middle and western states it attains an elevation of 50 to 60 feet, with a diameter of 2 feet, and covered with a grayish, furrowed, much-broken bark. The leaves are alternate, rounded or subcordate at base, acuminate, equally serrate, either ovate or 3-lobed, rough above, pubescent beneath, thick, dark-green, 4 to 6 inches long, and about two-thirds as wide. The flowers are small, monœcious, rarely diœcious; sterile ones in loose spikes; calyx 4-parted; fertile ones in dense spikes; styles 2, filiform, stigmatic down the inside. The ovary is 2-celled, one of the cells smaller and disappearing. Achenium ovate, compressed, inclosed within the succulent, berry-like calyx. Fertile spikes cylindric, constituting a dark-red, thickened, oblong and juicy, compound berry or fruit. The sterile spikes are rather slender (W.—G.).

History.—The red mulberry is indigenous to the United States, growing in rich woods, flowering in May, and ripening its fruit in July. The wood of the tree is fine grained, strong, and durable. The fruit is oblong-oval, of a dark-red color, and is compounded of a great number of small berries, which are very juicy, inodorous, and of an agreeable sweetish and acidulous taste; in appearance it very much resembles the fruit of the blackberry. This species is fully equal in value to the *Morus nigra*, Linné, of Europe (figured in Bentley and Trimen, *Med. Plants*, 229), the juice of which was official in the *British Pharmacopœia*, 1885, under the title Mori Succus.

Fig. 172.

Morus nigra.

The *Morus nigra*, Linné, possesses similar properties. It is probably a native of the Levant, though cultivated in Europe, and to some extent in the United States. This species, and that following, is a tree of about 30 feet in height, and has a purplish, black, berry-like fruit. Its leaves furnish food for silk-worms. The *Morus alba*, Linné, a native of China, with white fruit which is more saccharine and less pleasant than the preceding species, is one of the trees upon the foliage of which the silk-worm feeds. This species is naturalized in this country.

Chemical Composition.—Mulberries are said to consist of bitartrate of potassium, pectin, sugar, woody fiber, coloring matter and water. They contain rather more grape-sugar than the ordinary berries, such as strawberries, blackberries, currants, etc., being exceeded only by the cherry and grape. Fresenius found mulberries of the following percentage composition: sugar, 9.19; malic acid with a little tartaric, 1.86; albuminous matter, 0.361; gum, pectin, and fatty matter, 2.31; woody fiber, 0.91; ash, 0.66; water, 84.71. Wright and Patterson (*Pharm. Jour. Trans.*, Vol. VIII, 1878, p. 540) found the solid matter in the juice of the unripe berries to amount to 70.16 Gm. to the liter. A large proportion (26.83 Gm.) of this was citric acid, and a smaller quantity (7.82 Gm.) was malic acid. G. Goldsmith (*Amer. Jour. Pharm.*, 1882, p. 456) observed *succinic acid* in the form of its calcium salt (C_4H_4OCa) in an exudation from the bark of *Morus alba*. It is the *mulberry acid* of Klaproth.

Action, Medical Uses, and Dosage.—Mulberries possess very slightly nutritive qualities; they are refrigerant and laxative, and their juice forms a pleasant and grateful drink for patients suffering under *febrile diseases*, as it checks the thirst, relieves febrile heat, and when taken freely, gently relaxes the bowels. The juice, formed into a syrup and added to water, answers the same purpose, and forms a pleasant adjunct to gargles in *quinsy*. If the berries are eaten to excess they are apt to induce diarrhœa. The bark of the tree is reputed purgative and vermifuge, having expelled *tapeworm*.

MORPHINA (U. S. P.)—MORPHINE.

Formula: $C_{17}H_{19}NO_3+H_2O=302.34$.

"An alkaloid obtained from opium"—(*U. S. P.*).

Synonyms: *Morphinum*, *Morphium*, *Morphia*.

Source and History.—Morphine, the first alkaloid identified, was discovered and its alkaline quality made known in 1816, by Sertürner, a Hanoverian chemist, though Derosne and Seguin, two French chemists, had separated it, as well as narcotine, as far back as 1803 and 1805, without recognizing, however, their differences or establishing their alkaloidal nature. Its only source thus far known, is opium, obtained by inspissation of the milky juice exuding from incisions into the unripe capsules of the poppy (*Papaver somniferum*, Linné) and its varieties. Morphine is also said to occur in the milky sap of the *Papaver orientale*, Linne, and of *Argemone mexicana*, Linné.

Preparation.—Numerous processes have been devised to isolate morphine from opium, the aim being to free it chiefly from contaminating *meconic acid*, *codeine* (methyl morphine) *narcotine*, and the other opium bases, and resinous and coloring matters. In Gregory-Anderson's process, originated by Robertson, an aqueous extract of opium is neutralized with marble dust, the fluid evaporated to a syrup, and the latter boiled for a short time with excess of solution of calcium chloride. Upon dilution with water, resin falls out; the liquid is filtered, again treated with marble dust, and concentrated by evaporation. Calcium meconate falls out, which is removed. Upon evaporation to syrupy consistence, and cooling, a mass of crystals is formed, consisting of the hydrochlorides of morphine and codeine. After removing the black mother liquor, the salts are purified by treatment with animal charcoal, dissolved in water, and treated with aqua ammoniæ which precipitates only morphine, since codeine is much more soluble in water. From the black mother liquor, aforementioned, the other opium bases may be obtained. By Merck's process, an aqueous extract of opium is precipitated by means of sodium carbonate, the morphine thus obtained is purified by washing with water and alcohol, and dissolving in acetic acid which leaves narcotine undissolved, since the latter does not easily combine with acetic acid. Or, narcotine may be dissolved out by ether, in which morphine is nearly insoluble. Mohr's process is that on which is based the assay of opium for morphine, as given in the *U. S. P.*, 1880, and the *Br. Pharm.*, 1898. It depends on the fact that morphine forms with milk of lime, in excess, a soluble compound which is decomposable by the addition of ammonium chloride, morphine being precipitated. The other opium bases are not soluble in milk of lime (see the details of this process in this *Dispensatory*, preceding editions). (For a useful review of the methods employed for abstracting morphine from opium, see Husemann and Hilger, *Pflanzenstoffe*, 1884, p. 666.) The amount of morphine obtainable from opium has been found to vary between the limits 2.7 and 22.8 per cent (Guibourt); the usual average is about 10 per cent.

Description.—As officially described, morphine occurs in "colorless or white, shining, prismatic crystals, or fine needles, or a crystalline powder, odorless, and having a bitter taste; permanent in the air. Soluble, at 15° C. (59° F.), in 4350 parts of water, and in 300 parts of alcohol; in 455 parts of boiling water, and in 36 parts of boiling alcohol; also soluble in 4000 parts of ether. When heated to about 75° C. (167° F.), morphine begins to lose its water of crystallization. Heated for some time at 100° C. (212° F.), it becomes anhydrous. At 254° C. (489.2° F.) it melts, forming a black liquid. Upon ignition, it is consumed without leaving a residue. Morphine has an alkaline reaction upon litmus paper"—(*U. S. P.*). The dry crystals are first tasteless, afterward slightly bitter; in solution the taste is strongly bitter. Morphine is hardly soluble in chloroform if this is absolutely free from alcohol. According to Van der Burg, 1 part of morphine requires for solution 10,000 parts of absolute chloroform; 2000 parts if it contains 1 per cent alcohol; 222 parts if it holds 5 per cent, and 111 parts if it contains 10 per cent of alcohol. One part of morphine furthermore requires 220 parts of glycerin, 400 parts of cold, 90 parts of hot amyl alcohol, and 500 parts of acetic ether. It is nearly insoluble in alcohol-free benzol, and in carbon disulphide. It is also soluble in diluted acetic, hydrochloric, nitric, and sulphuric acids, in the fixed and volatile oils, in solutions of caustic potash and of soda, in solutions of caustic baryta, lime, and strontia, also in small quantity in aqua ammoniæ. It is precipitated from its alkaline solutions, when exposed to the atmosphere, on account of the alkalies combining with the carbonic acid to form carbonates.

In aqueous and in alcoholic solution, morphine is optically lævo-rotatory. Morphine is a tertiary amine also containing two phenol groups. Its formula is $C_{17}H_{19}NO_3+H_2O$ (Laurent), or, $C_{17}H_{17}(OH)_2NO$. Its solubility in excess of alkalies, the blue color-reaction with ferric chloride (see *Tests*), etc., are in accord with this formula. Morphine dissolves in acids, forming a series of salts. In solution it is precipitated by alkaloidal reagents (see enumeration in Charles E. Sohn's *Dictionary of the Active Principles of Plants*, London, 1894). Solutions of alkaline carbonates, like alkalies, precipitate morphine from its solutions, but it is much more slowly soluble in excess of the precipitant. Morphine, both free and in combination, is remarkable for its reducing properties. It reduces gold chloride, silver nitrate, silver oxide, chromic acid, cuprammonium sulphate, potassium ferricyanide, iodic and periodic acids, bismuth subnitrate, and the acids of tungsten, tin, titanium, vanadium, and molybdenum. Morphine, when dissolved in caustic potash solution, is oxidized upon exposure to the air, *oxydimorphine* ($C_{34}H_{36}N_2O_6$) being formed. When a salt of morphine is heated, in a closed tube, to 150° C. (302° F.), in the presence of strong hydrochloric acid, 1 molecule of water is abstracted and *apomorphine* ($C_{17}H_{17}NO_2$) is formed (which see). Morphine also stands in close connection with *codeine* ($C_{17}H_{18}[OCH_3]NO_2$), the latter being methylmorphine (see *Codeina*). Morphine, when heated with strong potassium hydroxide, yields *methylamine*, and upon destructive distillation over zinc dust, various hydrocarbons and bases are yielded, among them *phenanthren* ($C_{14}H_{10}$), *trimethylamine* ($N[CH_3]_3$), *pyrrol* (C_4H_4NH), *pyridine* (C_5H_5N), *quinoline* (C_9H_7N), etc.

Tests.—The *U. S. P.* gives the following tests for morphine: "When crystals of morphine are sprinkled upon nitric acid (specific gravity 1.250 to 1.300) they will assume an orange-red color, and then produce a reddish solution gradually changing to yellow. On shaking a small portion of morphine, in a test-tube, with 10 Cc. of chlorine water, the latter will acquire a yellowish color. On now carefully pouring a small amount of ammonia water on the surface of the liquid, a brown or reddish-brown zone will form at the line of contact of the two liquids. If to a neutral 1 per-cent solution of morphine, made by the careful addition of dilute sulphuric acid, a few drops of ferric chloride T.S. be added, a blue color will be produced which is destroyed by acids, alcohol, or heating. On treating morphine with cold, concentrated sulphuric acid free from nitric acid, the liquid should not at once acquire more than a faintly yellowish tinge (absence of more than traces of narcotine, papaverine, etc.); and the subsequent addition of a small crystal of potassium permanganate should produce only a greenish, but no violet or purple, color (difference from strychnine). On precipitating a solution of any of the salts of morphine by ammonia water, dissolving the washed precipitate in sodium hydrate T.S., shaking the solution with an equal volume of ether, and evaporating the ethereal solution, no appreciable residue should remain (absence of narcotine, codeine, etc.). On adding 4 Cc. of potassium or sodium hydrate T.S. to 0.2 Gm. of morphine, a clear, colorless solution, free from any undissolved residue, should result (absence of, and difference from, various other alkaloids)"—(*U. S. P.*). A delicate test for morphine is that with Fröhde's Reagent (a solution of 0.5 Gm. of sodium molybdate in 100 Cc. of sulphuric acid). Traces of morphine produce, with a thin layer of this solution, a beautiful violet coloration which changes to blue, olive-green, yellow, and in 24 hours to purplish-blue again. Other alkaloids, *e. g.*, codeine, produce a similar change of color with this reagent. According to Flückiger, if a trace of morphine be added to a solution of titanic acid in concentrated sulphuric acid, a brown-red to violet coloration will be produced. A sensitive test for morphine is that based on the liberation of iodine from solution of iodate of potassium, in a slight excess of acetic acid, when a small quantity of morphine is added. The liberated iodine may be recognized by the blue starch reaction. Other alkaloids, however, *e. g.*, codeine, cryptopine, eseridine, laudanine, and narcotine, behave in the same manner (see Flückiger-Nagelvoort, *Reactions*, Detroit, 1893, p. 77). The solution of morphine, in diluted nitric or acetic acid, must give no precipitate with nitrate of silver, or nitrate of barium (absence of hydrochloride or sulphate of morphine). Upon incineration of morphine, upon platinum foil, no residue should remain (absence of inorganic impurities).

Action and Medical Uses.—(See *Morphinæ Sulphas.*)

Salts of Morphine.—In addition to the salts of morphine considered herein under special headings, there are other salts, such as the *nitrate*, *phosphate* and *tartrate*; they are prepared like the acetate, by substituting the respective acids. Doses, same as acetate. The last-named salt occurs in warty, needle crystals, very soluble in alcohol and water, and preferred by some to the sulphate for hypodermatic use, on account of its greater solubility.

MORPHINÆ HYDRIODAS.—*Hydriodate of morphine* ($C_{17}H_{19}NO_3.HI.2H_2O$) may be made by mixing together strong solutions of hydrochlorate of morphine, 2 parts, and of iodide of potassium, rather more than 1 part. Wash the precipitate with a little cold water; press it between folds of blotting paper, redissolve it in hot water, and crystallize. It may also be prepared with morphine and warm hydriodic acid. Long, silky needles, sparingly soluble in water. This salt, according to E. Schmidt, is probably identical with Winckler's *Iodide of morphine* (*Morphinæ Iodas*, see directions for its preparation in this *Dispensatory*, preceding editions, and in *Amer. Jour. Pharm.*, 1853, p. 126). Doses of these, same as the acetate.

MORPHINÆ HYDROBROMAS, *Morphine hydrobromate* ($C_{17}H_{19}NO_3HBr.2H_2O$), *Morphine bromide*.—Prepared by double decomposition between alcoholic solutions of morphine sulphate (19 parts), and potassium bromide (6 parts), or by dissolving pure morphine in warmed hydrobromic acid. It forms long, white needles, soluble in 25 parts of cold water.

MORPHINÆ PHTHALAS, *Morphine phthalate.*—To a hot solution of pure phthalic acid add pure morphine as long as the latter is dissolved. Filter and evaporate. This salt dissolves in 5 parts of water, forming neutral solutions, and is recommended for hypodermatic use.

MORPHINÆ LACTAS ($C_{17}H_{19}NO_3.C_3H_6O_3$).—*Morphine lactate* crystallizes in prisms soluble in water (1 in 8), and alcohol (1 in 93) (see D. B. Dott, *Amer. Jour. Pharm.*, 1886, p. 353).

MORPHINÆ VALERIANAS.—Morphine neutralized with valerianic acid, forms *Valerianate of morphine*, a salt which is used to some extent in *nervous diseases*, restlessness in *fevers*, etc. The dose is the same as for the sulphate of morphine.

MORPHINÆ BIMECONAS, *Morphine bimeconate.*—A preparation called *Solution of Bimeconate of Morphia* was at one time introduced into this country from England, and at a very high price, and was stated to possess all the therapeutic effect of opium without any of its disagreeable influences, as well as to be serviceable in those cases where from idiosyncrasy or other causes the crude drug or its ordinary preparations could not be employed, when these were indicated (see P. Squire, *Amer. Jour. Pharm.*, Vol. XI, 1839, p. 166). In the *London Pharmaceutical Journal*, on page 288, Vol. XV, 1885, the following formula for this solution is given: "Take of bimeconate of morphine, 10 grains; alcohol, 1 fluid drachm; distilled water, 13 fluid drachms. Mix." But there is no formula for the bimeconate itself. If there be such a salt, it may probably be made by the addition of meconic acid to a solution of morphine.

According to Prof. W. Procter, Jr., the morphine bimeconate may be prepared as follows: Macerate opium in powder (or dry enough to powder) 5 troy ounces in distilled water, a pint, with agitation for three days, strain with expression, and again macerate in successive portions of distilled water, a pint each time, for 24 hours, until 4 pints have been used, and the opium is sufficiently exhausted. Evaporate the liquors carefully to the measure of a pint, filter, and add solution of acetate of lead until it ceases to produce a precipitate. Collect this on a filter, thoroughly wash it with water, suspend it in a pint of warm distilled water, pass a current of hydrogen sulphide through the mixture until the lead is entirely precipitated, heat and filter the solution of meconic acid that remains, until deprived of sulphuretted odor. Meanwhile, take the liquid filtered from the lead precipitate (containing the morphine, etc.) together with the washings, evaporate them at a gentle heat to 4 fluid ounces; drop in sufficient diluted sulphuric acid to precipitate the oxide of lead present, and filter; then mix the filtrate with an equal bulk of alcohol, and carefully add water of ammonia, with agitation, until it remains in slight excess; allowing it to rest 24 hours, that the morphine may separate. Collect the impure morphine on a filter, wash it with a little water, and dissolve it in the hot solution of meconic acid (above referred to) and filter if necessary, washing the filter with a little distilled water. Finally, add sufficient distilled water to the filtrate to make it measure 3 pints, and then stronger alcohol, 95 per cent, a pint, and mix them.

This solution is of a light, reddish-brown color, varying however, in different specimens, and which is due to adhering coloring matter, and especially to the oxide of iron with which it comes in contact during the process; its odor is that of alcohol, and its taste decidedly bitter. Its morphine strength is about 3.3 grains per fluid ounce. Prof. Procter does not believe it to possess any merit not embraced in the *Liquor Opii Compositus*, of Dr. Squibb (*Amer. Jour. Pharm.*, 1860, p. 120), and the *Deodorized Tincture of Opium* of the *U. S. P.* (*Amer. Jour. Pharm.*, 1867, p. 104). Mr. D. B. Dott (*Pharm. Jour. Trans.*, Vol. IX, 1879, p. 883, endeavoring to prepare the meconates of morphine, could obtain only one well-defined crystallizable salt, namely, the neutral *dimorphine meconate*, of the formula $(C_{17}H_{19}NO_3)_2.C_7H_4O_7.5H_2O$. It is easily prepared by dissolving the equivalent quantities of morphine and meconic acid in boiling water and allowing the solution to cool. The author was unable, however, to prepare a crystallizable *monomorphine meconate* (*morphine bimeconate*) and, therefore, doubts its existence (*Amer. Jour. Pharm.*, 1887, p. 188).

MORPHINÆ ACETAS (U. S. P.)—MORPHINE ACETATE.

FORMULA: $C_{17}H_{19}NO_3C_2H_4O_2 \cdot 3H_2O$. MOLECULAR WEIGHT: 398.12.

"Morphine acetate should be kept in dark amber-colored, well-stoppered vials"—(*U. S. P.*).

SYNONYMS: *Morphia acetas, Morphium aceticum, Morphinum aceticum, Acetate of morphia, Acetas morphicus, Acetas morphina.*

Preparation.—Wittstein's process is: "Intimately mix 2 parts of pure morphine with 2 parts of water in a mortar, warmed in a sand-bath, and then add concentrated acetic acid to it until the morphine is dissolved; 1 part of acetic acid, sp. gr. 1.045, will be sufficient. Pour the solution on a shallow porcelain plate, dry at a temperature not to exceed 48.8° C. (120° F.), powder, and preserve in a closed vessel in a cool place. The yield will be about one-eighth more than the weight of the morphine employed."

In the British process (*Br. Pharm.*, 1885) the morphine is freshly prepared from the hydrochlorate by precipitation with solution of ammonia. The well-washed morphine is then saturated with diluted acetic acid and evaporated by water-bath, keeping the acid in slight excess, until when cooled it will solidify. The product is dried at a low heat to prevent the dissipation of the acid, rubbed to a powder, and preserved in well-stopped bottles.

Description and Tests.—Morphine acetate is officially described as being "a white or faintly yellowish-white, crystalline or amorphous powder, having a faint, acetous odor, and a bitter taste. It slowly loses acetic acid when exposed to the air. Soluble at 15° C. (59° F.), when freshly prepared in 2.5 parts of water, and in 47.6 parts of alcohol; in 1.5 parts of boiling water, and in 14 parts of boiling alcohol; also soluble in about 1700 parts of ether, 2100 parts of cold chloroform, and 60 parts of boiling chloroform. On protracted exposure to the air. the salt gradually loses some acetic acid, and becomes less soluble. When heated, the salt loses water as well as acetic acid. Upon ignition, it is consumed, leaving no residue. The salt is neutral or faintly alkaline to litmus paper. The addition of potassium or sodium hydrate T.S. to an aqueous solution of the salt causes a white precipitate, which is soluble in an excess of the alkali, and which conforms to the reactions and tests of morphine (see *Morphina*). On adding sulphuric acid to the salt, vapors of acetic acid are evolved"—(*U. S. P.*). If a solution of the acetate is required the addition of a trace of acetic acid will render the solution clear in case the salt has lost some acid by evaporation. Its aqueous solution, moderately concentrated, is affected by nitric acid and ferric chloride in the same manner as morphine; and the alkalies and alkaline earths precipitate morphine from it, but redissolve it if added in excess.

Action, Medical Uses, and Dosage.—Acetate of morphine exerts a similar influence upon the system to the other salts of morphine, and is preferred by some practitioners to them; but I have not found the combination of any acid to appreciably affect the therapeutical influence of morphine (J. King). It may be substituted for opium, as a general rule, or for any of the other salts of morphine. The dose to produce an anodyne or hypnotic effect is from ⅛ to ¼ grain; but under certain excitable conditions of the system, even more may be required. One-sixth of a grain represents about 1 grain of opium. It is sometimes used externally, applied to vesicated surfaces, for the purpose of affecting the system. Internally, it may be given either in the form of pill or solution. A solution (*Liquor Morphinæ Acetatis*) may be formed by adding 4 grains of acetate of morphine to 4 fluid ounces of distilled water. If it does not readily dissolve, 5 minims of diluted acetic acid may be added. The dose of this is from ½ to 2 fluid drachms. A fluid drachm or two of alcohol, mixed with the water forming the solution, will prevent spontaneous decomposition. (See also *Liquor Morphinæ Acetatis* [*Br. Pharm.*], which is four times stronger, containing ½ grain of morphine to the fluid drachm.)

MORPHINÆ HYDROCHLORAS (U. S. P.)—MORPHINE HYDROCHLORATE.

FORMULA: $C_{17}H_{19}NO_3HCl+3H_2O$. MOLECULAR WEIGHT: 374.63.

SYNONYMS: *Morphiæ murias*, *Hydrochloras morphicus*, *Murias morphicus*, *Muriate of morphia*, *Morphiæ hydrochloras*.

Preparation.—"Take of pure morphine, 2 parts; rub in a porcelain dish with water, 5 parts; heat to the boiling point, and add pure hydrochloric acid until the morphine is dissolved (1 part of acid, sp. gr. 1.130, will suffice), and then allow it to cool. After standing a day, the crystals which form are separated from the supernatant liquid, which is evaporated to further crystallization. The salt is spread on filtering paper and dried; about $2\frac{1}{2}$ parts by weight should be obtained" (Wittstein). The hydrochloric acid must be added gradually, and the mixture be constantly stirred. The process of the *U. S. P.* (1870) was essentially the same.

The process of the *British Pharmacopœia* (1885) is based on Dr. Wm. Gregory's method of obtaining the hydrochlorate from opium as the starting point. By this process the meconate of morphine existing in the opium is decomposed by chloride of calcium, which forms, through double decomposition, a precipitate of meconate of calcium, leaving hydrochlorate of morphine in solution, which is obtained in crystals by evaporation; these are purified by repeated solution, concentration, and crystallization, and lastly, decolorization with animal charcoal. (Also compare *Morphina.*)

Description and Tests.—Hydrochlorate of morphine is described by the *U. S. P.* as occurring in "white, feathery needles of a silky luster, or minute, colorless, cubical crystals, odorless, and having a bitter taste; permanent in the air. Soluble at 15° C. (59° F.), in 24 parts of water, and in 62 parts of alcohol; in 0.5 part of boiling water, and in 31 parts of boiling alcohol. Very slightly soluble in ether or chloroform. When heated at 100° C. (212° F.), the salt loses its water of crystallization (14.38 per cent); at 300° C. (572° F.), it coheres slightly, but does not completely melt; and upon ignition it is consumed, leaving no residue. The salt is neutral to litmus paper"—(*U. S. P.*). Hydrochlorate of morphine also dissolves in 20 parts of glycerin and 800 parts of olive oil. This salt contains of crystallized morphine, 80.7 per cent; of anhydrous morphine, 75.9 per cent. Hydrochlorate of morphine is decomposed by diluted sulphuric acid, with disengagement of hydrochloric acid. "The addition of potassium or sodium hydrate T.S. to an aqueous solution of the salt causes a white precipitate, soluble in an excess of the alkali, and conforming to the reactions and tests of morphine (see *Morphina*). The aqueous solution of the salt yields, with silver nitrate T.S., a white precipitate insoluble in nitric acid"—(*U. S. P.*). The *British Pharmacopœia* directs that this salt should dissolve "without coloration in strong sulphuric acid; the addition of a small quantity of sodium arsenate to a portion of this solution causes a bluish-green coloration, and a small quantity of bismuth oxynitrate added to another portion, gives a purplish-brown coloration"—(*Br. Pharm.*, 1898). White sugar is said to have entered sometimes into hydrochlorate of morphine as an adulteration. The fermentation test will serve to discover it. Hydrochlorate of morphine should be entirely soluble in water, giving a colorless solution; its loss of weight at 100° C. (212° F.), should not exceed 14.38 per cent.

Action, Medical Uses, and Dosage.—Hydrochlorate of morphine possesses properties similar to the other salts of morphine, having essentially all the actions of opium. It is much more extensively used in Great Britain than in this country; and may be employed as a substitute for opium, or the acetate or sulphate of morphine. Its dose is from $\frac{1}{8}$ to $\frac{1}{2}$ grain; $\frac{1}{6}$ of a grain represents about 1 grain of opium. A solution of the hydrochlorate of morphine (*Liquor Morphinæ Hydrochloratis*) is made by dissolving 4 grains of hydrochlorate of morphine in distilled water, 4 fluid ounces. If it does not readily dissolve, 5 minims of diluted hydrochloric acid may be added. The dose is from $\frac{1}{2}$ to 2 fluid drachms. Alcohol, 1 or 2 fluid drachms, mixed with the water forming this solution, will prevent spontaneous decomposition (see also *Liquor Morphinæ Hydrochloridi* [*Br. Pharm.*, 1898], which is four times as strong as the foregoing solution.

MORPHINÆ SULPHAS (U. S. P.)—MORPHINE SULPHATE.

FORMULA: $(C_{17}H_{19}NO_3)_2H_2SO_4+5H_2O$. MOLECULAR WEIGHT = 756.38.

SYNONYMS: *Morphiæ sulphas, Sulphas morphicus, Sulphate of morphia.*

Preparation.—"Take of pure morphine, 2 parts; rub it in a porcelain dish with 5 parts of distilled water, then heat to boiling and add sulphuric acid until the morphine is dissolved, and then allow the solution to cool. After standing a day, the crystals which form are treated in the same manner as named for the crystals of hydrochlorate of morphine. The sulphuric acid must be added gradually, an excess of acid is to be tested for with blue litmus paper, and the mixture must be constantly stirred" (Wittstein). The processes of the *U. S. P.* (1870) and of the *Br. Pharm.* (1885) are essentially the same. Morphine is here saturated with sulphuric acid, of which saturation its complete solution in the water is an indication. As in the preparation of the acetate of morphine, the heat must not be too high during evaporation of this salt, else it will be decomposed.

Description and Tests.—Morphine sulphate is officially described as occurring in "white, feathery, acicular crystals of a silky luster, odorless, and having a bitter taste; permanent in the air. Soluble at 15° C. (59° F.), in 21 parts of water, and in 702 parts of alcohol; in 0.75 part of boiling water and 144 parts of boiling alcohol; almost insoluble in ether. When heated for some time at 100° C. (212° F.), the salt loses 3 molecules (7.12 per cent) of water of crystallization; the remaining 2 molecules (4.75 per cent) are gradually expelled by raising the temperature to 130° C. (266° F.). At 255° C. (491° F.) the salt melts, and upon ignition, it is consumed, leaving no residue. The salt is neutral to litmus paper. The addition of potassium or sodium hydrate T.S. to an aqueous solution of the salt causes a white precipitate, which is soluble in an excess of the alkali, and which conforms to the reactions and tests of morphine (see *Morphina*). The aqueous solution yields, with barium chloride T.S., a white precipitate insoluble in hydrochloric acid"—(*U. S. P.*). Morphine sulphate is also soluble in glycerin (1 in 5). It contains of crystallized morphine, 79.94 per cent; of anhydrous morphine, 75.19 per cent. D. B. Dott (1877) found a certain commercial specimen of morphine sulphate to consist of more than one-third of anhydrous sulphate of sodium. Analysis of the mixture thrown on the market in 1898, under the name "Husa," showed that it contained large amounts of morphine sulphate (see J. U. Lloyd, *Amer. Jour. Pharm.*, 1899, p. 210).

Action, Medical Uses, and Dosage.—The effects of morphine and its salts are practically those of *opium*, which see. Being but one of the constituents of that drug, however, slight differences in action have been observed. Much depends also, upon the manner of administering it. The indications are those given under *Opium*. Morphine is not so soluble as its salts, which are usually employed; the principal ones are the sulphate, hydrochlorate, and acetate. Pereira says that in comparing the morphine salts with opium, we observe that they are less stimulant, and less disposed to cause sweating, constipation, headache, and dryness of the tongue; the feelings which they excite are less agreeable, and hence they are not adapted to be substituted for opium by the eaters of this drug; they more readily affect the bladder than opium. Morphine is more likely to provoke nausea and vomiting than opium. If given by mouth for any length of time it induces diarrhæa, while opium does not, but the bowels cease to be costive. Hypodermatically, morphine constipates. Morphine primarily diminishes the frequency of the pulse, while opium increases it. Morphine lowers the temperature, while opium often increases it. Less stimulation of the nervous and circulatory systems are observed under morphine, and itching of the surface is far more readily produced by the alkaloid. Finally, the narcotic action of the morphine is comparatively less profound than that of the parent drug. A weak and oppressed heart is always embarrassed by opium and its alkaloids.

Enormous amounts of morphine are consumed by morphine habitues (see *Opium*). Many cases are reported in which the daily allowances were 14, 16, 18, 40, 50 grains, and even 80 grains have been taken for a few days. A case is reported in which a woman took, hypodermatically, 25 grains at one time, and a case came under our care in which a one-legged habitué attempted suicide by the injection of 24 grains, besides shooting himself through the lower edge of the left lung, the bullet lodging in the skin of the back. Every inspiration forced frothy blood out of the bullet wound. He recovered. His arms, left leg, and side of body presented a tattooed appearance from the habitual injections to which he had been accustomed.

The uses of morphine have been considered mainly under the head of opium (see *Opium*). It may be well, however, to briefly enumerate some of the conditions there mentioned, and to add a few others. It should be borne in mind, however, that unless contraindicated, it is the drug for *sudden, acute pain*, and pain from *wounds*, *burns*, and *scalds*. It is useful, therefore, following the indications given under *Opium* in *puerperal convulsions*, *peritonitis*, *pleuritis*, *angina pectoris*, *ovaritis*, *metritis, appendicitis, asthma, sciatica,* to alleviate severe pain in the various forms of *neuralgia,* as *pleurodynia, gastrodynia,* etc., and in *obstinate vomiting, cholera morbus, renal* and *biliary colic, local spasms, epileptiform convulsions, lead colic,* various severe and acute *abdominal pains,* and *poisoning by belladonna* or *atropine, stramonium* or *strychnine.* In *sunstroke,* with general excitation, jactitation, and convulsions, morphine gives relief. As a stimulant in the prostrating stage of *typhus* and *typhoid fevers,* and to check unhealthy discharges, opium is to be preferred to morphine. Morphine salts are always used to relieve the excessive operation of strychnine.

The dose of morphine and its salts, is from ⅛ to ¼ grain; and ⅙ of a grain represents about 1 grain of ordinary opium. The various salts of morphine, dissolved in water, are used by subcutaneous injection. A dose of from ⅛ to ¼ grain of the selected salt, in solution, is injected at once, repeating the operation in 1 or 2 days, or even every 3 or 4 hours, if the urgency of the case requires. Vomiting, nausea, or uneasiness, sometimes follows the injection, but soon passes away without injury to the patient.

Sulphate of morphine is probably more often employed in this country than any other of the salts of this alkaloid, and is considered to be more uniform in its effects on the system. It possesses the usual properties belonging to morphine and its various salts, and is used in cases where these are indicated. The dose is from ⅛ to ¼ grain, which may be given in pill or solution, or hypodermatically. A solution of sulphate of morphine (*Liquor Morphiæ Sulphatis, U. S. P.,* 1870), is made by dissolving 4 grains of the sulphate of morphine in 4 fluid ounces of distilled water. This forms a convenient solution, in which the morphine may be administered in minute or ordinary doses to suit the occasion; it will keep for a long time unaltered. A fluid drachm of this solution is equal to about ⅛ of a grain of the sulphate (see also *Liquor Morphinæ Sulphatis* [*Br. Pharm.,* 1885], which is four times as strong as the *U. S. P.* [1870] solution.)

MOSCHUS (U. S. P.)—MUSK.

"The dried secretion from the preputial follicles of *Moschus moschiferus,* Linné"—(*U. S. P.*).

Class: Mammalia. *Order:* Ruminantia.

Source and History.—This article is obtained from the male of *Moschus moschiferus* or *Musk deer,* a wild ruminating animal, rather larger than the domestic goat, and approaching the deer in its characters, and which is an inhabitant of Central Asia. At the posterior part of its abdomen, there is a small sac situated immediately under the skin, which opens a little in front of the preputial orifice, and which is filled with a thick fluid, abounding particularly in the rutting season. This fluid, in the dried state, is musk. It is removed from the animal in its containing bag, and dried in this state for exportation. The musk-bag, or pod, is usually plano-convex; and in general the plane surface is a bare membrane, while the convex surface is covered with stiff hairs; but sometimes the hairy and membranous parts are reversed. It weighs along with its contents, between 5 and nearly 10 drachms, and contains on an average 2⅔ drachms of musk, *i. e.,* from 26 to 52 per cent. Two kinds of musk are met with in American commerce. The *Chinese, Thibet,* or *Tonquin musk* is the variety that should always be preferred. It occurs in commerce in lots of about 25 paper-wrapped sacs, shipped in lead-lined boxes (caddies). The yellowish or brownish hairs are cut short. It comes to us partly from Tonquin, but for the greater part, from the Chinese province of Yun-Nan, and is shipped from the Chinese port, Shanghai, hence the name *Chinese musk.* A consular report from Shanghai, in 1885, stated the annual export to be about 3000 caddies, each containing, on an average, 20 pods, thus representing an annual decimation of the animal by about 60,000. *Siberian musk* is also called *Russian musk;* it is exported from St. Petersburgh. It resembles the preceding, yet often is of a much inferior quality, having an ammoniacal, somewhat fetid odor.

Cabardine musk is a variety which comes in flat, ovate sacs, the hairs on which are somewhat paler and thinner, and the odor of which is feebler and far less aromatic than that of good musk, besides having a urinous smell. Two other grades, *Assam* and *Bucharian musk-sacs*, are not found in American markets. Musk is now scarcely ever prescribed, both on account of its high price, and the extreme difficulty of obtaining a pure article, as nearly all the musk in trade at the present day, is an almost uncontrollable drug (see *Adulterations;* also see an interesting article on "Musk," from the *Chemist and Druggist*, 1890, in *Amer. Jour. Pharm.*, 1891, p. 149).

Description.—"In irregular, crumbly, somewhat unctuous grains, dark reddish-brown, having a peculiar penetrating, and persistent odor, and a bitterish taste. It is contained in oval or roundish sacs about 4 to 5 Cm. ($1\frac{1}{2}$ to 2 inches) in diameter, on one side invested with a smoothish membrane, on the other side covered with stiff, appressed, grayish hairs, concentrically arranged around 2 orifices near the center. About 10 per cent of musk is soluble in alcohol, the tincture being light brownish-yellow, and on the addition of water becoming slightly turbid. About 50 per cent of musk is soluble in water, the solution being deep-brown, faintly acid, and strongly odorous. When ignited with free access of air, musk gives off a peculiar, somewhat urinous odor, and leaves behind not more than 8 per cent of a grayish ash"—(*U. S. P.*). It is very inflammable. Musk is very little soluble in ether or chloroform. The powerful odor of musk is destroyed when it is rubbed together with camphor, cinnamon, syrup or oil of bitter almonds, oil of fennel, precipitated sulphur, ergot, quinine sulphate or chloride, etc. Hence, to remove the odor from the hands, it is advised to rub the hands with some quinine, moistened with diluted sulphuric acid. On the other hand, alkalies intensify the odor of musk. The odor is also lost by drying the musk over sulphuric acid; it gradually returns, however, as moisture is reabsorbed. With some persons the odor of musk produces several unpleasant effects, as cephalalgia, fainting, etc.

Chemical Composition.—The chemical nature of the odoriferous principle is not known. Geiger and Reinmann found musk to contain a peculiar volatile substance, ammonia, a peculiar, fixed, uncrystallizable acid, stearin and olein, cholesterin, peculiar bitter resin, osmazome (see foot-note under *Ichthyocolla*), and salts. The *U. S. P.* demands that musk, upon incineration, should yield not more than 8 per cent of ash. In addition to the substances mentioned above, musk is incompatible with bichloride of mercury, sulphate of iron, nitrate of silver, and infusion of cinchona.

Adulterations.—Owing to its high price, musk is very liable to adulterations; indeed it is rare that the pure article can be obtained in commerce. In 1889, a consular report from Shanghai states that the article comes into the Chinese market in simple wood cases of 9 to 14 caddies; every parcel contains a number of adulterated sacs, which must be bought along with the good ones. About 50 per cent seems to be adulteration. The parcels are then, as a rule, broken up by the exporter and sorted for the London market. He divides the lot into three grades, all of which are probably thrown on the market. "The sophistication consists of earth, rasped wood, and small pieces of leather or skin, which are inserted in the pods after the musk has been removed. Less frequently the sophistication is effected with lead, heavy pieces of flesh, or paper inserted between the thin inner and thick outer skin, which can only be discovered upon cutting it. In the last year or two, the adulteration has gone up to 80 per cent, but in the absence of better qualities, even such an article has found buyers" (*Amer. Jour. Pharm.*, 1889, p. 376).

These adulterations are very difficult to detect. Musk which is not readily inflammable, whose odor is weak, which is of a black or pale color, very damp, or gritty to the touch, should be rejected as containing impurities. By incineration, genuine musk leaves behind a grayish-white ash, whereas blood leaves a reddish one. It is probably advisable to insist on buying the musk in its containing bag. False pods may be distinguished from the genuine ones, by their ammoniacal odor, by the absence of any aperture in the middle of the hairy coat, by the hair not being arranged in a circular manner, and by the absence of the remains of the penis, which accompanies every genuine musk-sac. False sacs may often be known by being stitched together, because a genuine sac may be opened to introduce foreign matter; such a sample becomes suspicious, and invites further analysis.

To test a bag for lead inserted through its aperture, exposing the specimen to the action of the Roentgen rays will reveal the fraud without the necessity of cutting open the bag (see interesting shadowgraph of an adulterated musk-bag, by E. Wolff, *Pharm. Centralh.*, 1896, p. 827).

Action, Medical Uses, and Dosage.—Musk is a stimulant to the nervous and vascular systems, acting much after the manner of the alcoholics, and an irritant to the stomach, deranging its functions; also said to possess narcotic properties secondarily. From its influence on the nervous system it is termed a powerful antispasmodic; and has been used with advantage in *typhus* and *low forms of fever*, *obstinate hiccough*, *pertussis*, *epilepsy*, *chorea*, *hysteria*, *asthma*, *palpitation of the heart*, *colic*, *convulsions of infants*, all *spasmodic affections*, etc. (see *Specific Indications* below). United with ammonia, it has been used with success in stopping the progress of *gangrene*. Fifteen grains of musk, combined with extract of valerian, and alcoholic extract of cimicifuga, of each, 15 grains, and divided into 15 pills, will be found beneficial in *pneumonia* accompanied by delirium, and in the involuntary movements observed in *low typhoid fevers*. One pill may be given every 1 or 2 hours, until there is a marked improvement in the symptoms. In small doses musk is hypnotic. If its use is long continued, it imparts its peculiar odor to the secretions. It should always be given in substance, either in the form of pill or emulsion. Dose, from 5 to 20 grains, every 2 or 3 hours. Niter, cochineal, of each, 2 grains; musk, 1 grain; mix and form a powder. This powder, given and repeated every 2 or 3 hours, is said to be very useful in some low forms of fever, and in *febrile* or *inflammatory affections* with spasmodic action or delirium.

Specific Indications and Uses.—Hiccough; muscæ-volitantes, subsultus tendinum, low muttering delirium, and stupor; pulse small, quick, irregular, or tremulous; muscular spasm; insomnia from physical or mental fatigue.

Related Products.—A naturalist found in Central Africa numerous flocks of a small ruminant of the gazelle family, the excrement from which exhaled so decided an odor of musk that be thought it might be advantageously used. M. Stanislas Martin formed a tincture with some of it, using alcohol of 80 per cent. It had a greenish color. This excrement, powdered and macerated with glycerin, lard, or fixed oils, forms a powerful musky odor, answering all the purposes of musk as a perfume, and being decidedly cheaper (*Bull. de Thérap.*, 1868). The species probably referred to is the *Antilope Dorcas*, Linné, or *Algerian gazelle*. The excrements are small and globular. Jacqueme obtained an alcoholic extract (7 per cent) from them, which contained calcium, ammonium, and sodium salts, a resinous body of musky odor, and an acid capable of crystallization.

HYRACEUM.—Probably derived from the *Hyrax capensis*, Cuvier (*Order:* Hyracoidea), or *Badger*, a South African mammal. The drug comes in brittle, resinous, irregular, blackish-brown fragments, of a nauseously bitter taste. When heated it becomes soft and evolves a castor-like odor; further heated it burns, evolving acrid fumes. Water does not wholly dissolve it, and it is still less soluble in alcohol or ether. It is collected on mountain sides in Africa, and is either a fecal or urinous product. Analyses of Wm. H. Greene and A. J. Parker (*Amer. Jour. Pharm.*, 1879, p. 363), show this substance to yield, upon incineration, 34 per cent of ash, chiefly containing chlorides and carbonates of sodium, calcium, potassium, and magnesium. The organic matter constitutes about 52 per cent, containing traces of urea, uric acid, hippuric and benzoic acids. Hyraceum is said to resemble the American castor in physiological action. A similar dried body, renal and fecal, is found in rock-fissures in New Mexico, and is believed to be the product of the *Neotoma* or *Wild rat* (Cope).

CIVETTA, or ZIBETHUM, *Civet*, *Zibeth.*—An unctuous, musky secretion, collected from receptacles between the anus and genitalia of both male and female of the *Viverra Civetta*, Schreber (*Civet cat*), of Africa, and *Viverra Zibetha*, Schreber, of the East Indies. The animals are kept in captivity for the purpose of obtaining the drug. It was formerly employed in medicine, but is now wholly consumed in the perfumer's art. It is semisolid, yellowish, changing to brown, unctuous, not so diffusible nor agreeable as musk, of an unpleasant, subacrid, bitter, greasy taste, soluble in part in hot alcohol and in ether, but not in water. It is fusible, and burns without leaving much residue. It contains salts, resin, coloring bodies, various fats, and a volatile oil.

AMERICAN MUSK.—The musk-sacs of the *Musk-rat* (*Fiber zibethicus*) have been substituted for musk under the name *American musk*. Its odor differs somewhat from that of musk, but it may be advantageously employed in perfumes (see *Amer. Jour. Pharm.*, 1881, p. 397, and 1886, p. 550).

ARTIFICIAL MUSK.—An *artificial musk* is prepared, by carefully adding, drop by drop, 3 parts of fuming nitric acid to 1 of unrectified oil of amber. The acid is decomposed and the oil converted into an acid resin, which must be kneaded under pure water until all excess of acid is removed. The substance which remains is of a yellowish-brown color, viscid, and of an odor similar to musk, for which it may be used as a substitute, in doses of from 15 to 30 grains.

Moschus Factitius, *Artificial musk.*—The artificial musk introduced by Dr. A. Baur, and known commercially as "*Musk Baur,*" is *trinitroso-butyl-toluene* ($C_6H.CH_3.C[CH_3]_3.[NO_2]_3$), prepared by the interaction of tertiary butyl-toluene ($C_6H_4.CH_3.C[CH_3]_3$), and a mixture of sulphuric and nitric acids. It forms yellowish-white needles melting at 96° to 97° C. (204.8° to 206.6° F.), insoluble in water, but soluble in alcohol, chloroform, ether, benzol, and light petroleum ether (see *Amer. Jour. Pharm.*, 1890, p. 489, and 1892, p. 31). The action of this body is similar to, but less energetic, than that of musk. The dose for a small child is from ⅛ to 1 grain, every 2 or 3 hours; for an adult, 10 grains. Of a tincture (ʒj to ℥x of alcohol), the dose is 1 fluid drachm. Hauner, of Munich, praises it in *spasm of the glottis* in children.

Vegetable Musk.—On account of the high price of musk, and its liability to adulteration, Dr. Hannon (*Jour. de Pharm.*, 1854) sought for a vegetable substitute, which he thinks he has found in a Columbian plant, cultivated in Belgium, *Mimulus moschatus*, which plant yields an essential oil by distillation. In doses of 2 or 3 drops, this oil exerts an energetic, excitant action on the intestinal canal, and on the brain. In a state of health it caused vertigo, cephalalgia, dryness in the fauces, epigastric weight, and eructations. He believes it may replace the animal musk, and may be given in *hysteria* and analogous complaints, in doses of from 2 to 4 drops in 24 hours. He calls it *vegetable musk*.

Nearly all of the preceding products are used in the manufacture of perfumes and not, at the present time, in medicine.

MUCILAGINES.—MUCILAGES.

Mucilages are viscid, somewhat tenacious, and generally adhesive liquids, prepared with water as a solvent. As represented by the preparations of the *U. S. P.* they are usually solutions of gums, or closely related bodies. The official mucilages gradually decompose and become acid, thinner, and offensive in smell. Such changes may often be checked or entirely prevented by glycerin, alum, or creosote. The majority of the mucilages should be prepared only as wanted.

MUCILAGO ACACIÆ (U. S. P.)—MUCILAGE OF ACACIA.

Synonym: *Mucilage of gum Arabic.*

Preparation.—"Acacia, in small fragments, three hundred and forty grammes (340 Gm.) [11 ozs. av., 435 grs.]; water, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Wash the acacia with cold water, and let it drain. Then add to it enough water to make the mixture weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.], agitate or stir occasionally until the acacia is dissolved, and strain. Keep the product in well-stoppered, completely filled bottles, in a cool place"—(*U. S. P.*). Clear, white pieces of gum acacia should be selected for this mucilage. By rapid washing of the fragments first with cold water, much of the impurities may be removed. The mucilage becomes thick and dense during preparation, making it somewhat difficult to stir or agitate, and it has been proposed to make the solution by suspending the gum in a loose-textured bag, which should be moved occasionally from place to place in order to bring it into contact with successive portions of water. In our experience, however, no difficulty is experienced in making it by the usual method. It should be at once put into well-filled bottles, and even then it readily sours with the development of acetic acid. Mucilage of acacia should be a colorless, or but faintly yellowish, transparent, nearly tasteless, viscid fluid, with a faint, although not disagreeable odor. Aluminum sulphate (1 to 125 parts) is said to increase its adhesiveness. Heat should not be employed in the preparation of this mucilage as it is said to promote the formation of acetic acid.

Action, Medical Uses, and Dosage.—This flavored and sweetened, diluted mucilage forms an agreeable and soothing drink for *febrile* and *inflammatory conditions*, being particularly applicable in *gastric* and *respiratory inflammations*. It is probably nutritive. In pharmacy it is employed to give adhesiveness in pill masses, and in mixtures to hold in suspension insoluble ingredients. It is sometimes used in making troches. It may be freely given.

MUCILAGO AMYLI.—MUCILAGE OF STARCH.

Preparation.—To 120 grains of starch gradually add 10 fluid ounces (Imp.) of distilled water, with constant trituration. Boil for a few moments, with continual stirring. This accords with the *British Pharmacopœia*, 1885. It should be prepared only when needed. This mucilage is of proper consistence for an enema, being opaline and gelatinous.

Action and Medical Uses.—This is employed for its demulcent effects in *rectal* and other *intestinal inflammations* that can be reached by an enema. It is chiefly employed as a vehicle for anodyne applications (as laudanum) in *dysentery*, and for this purpose but small quantities, 2 or 3 fluid ounces, should be employed so that the patient may be able to retain the medicament until its effects are produced.

MUCILAGO CHONDRI (N. F.)—MUCILAGE OF IRISH MOSS.

Preparation.—"Irish moss, thirty grammes (30 Gm.) [1 oz. av., 25 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Wash the Irish moss with cold water, then place it in a suitable vessel, add one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of water, and heat it, on a boiling water-bath, for 15 minutes, frequently stirring. Then strain it through muslin, and pass enough water through the strainer to make the liquid, when cold, measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mucilage of Irish moss may also be prepared in the following manner: Irish moss gelatin (F. 184), twenty grammes (20 Gm.) [309 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Heat the Irish moss gelatin with one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of water, at a boiling temperature, until it is completely dissolved. Then allow the solution to cool, and add enough water, if necessary, to make up the volume to one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. *Note.*—Mucilage of Irish moss, thus prepared, is well adapted for the preparation of emulsions of fixed oils. If it is, however, required for admixture with clear liquids, it should be diluted, when freshly made, and while still hot, with about 3 volumes of boiling water, filtered, and the filtrate evaporated to the volume corresponding to the proportions above given. The filtration may be greatly facilitated by filling the filter loosely with absorbent cotton, and pouring the liquid upon the latter.

"Mucilage of Irish moss may be preserved for some time by transferring it, while hot, into bottles, which should be filled to the neck, then pouring a layer of olive oil on top, securely stoppering the bottles, and keeping them, in an upright position, in a cool place. When the mucilage is wanted for use, the layer of oil may be removed by means of absorbent cotton"—(*Nat. Form.*).

Medical Uses.—(See *Chondrus.*)

MUCILAGO CYDONII (N. F.)—MUCILAGE OF CYDONIUM.

Synonyms: *Mucilage of quince-seed, Mucilago cydoniæ.*

Preparation.—"Cydonium, two grammes (2 Gms.) [31 grs.]; distilled water, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Macerate the cydonium for half an hour, in a covered vessel, with the distilled water, frequently agitating. Then drain the liquid through muslin without pressure. This preparation should be freshly made, when required for use"—(*Nat. Form.*). An identical preparation was official in the *U. S. P.*, 1880. Rose-water is employed by the *German Pharmacopœia.* The hair-dressing mucilage known as *Bandoline*, is prepared by macerating, in 1 pint of water, 2 drachms of quince-seeds (unbroken), and adding cologne water, 1 ounce. Other perfumes may be substituted, if preferred.

Action, Medical Uses, and Dosage.—Quince-seed mucilage is soothing and protecting, and adapted for *inflammations of mucous surfaces.* It is therefore valuable in *gastro-intestinal inflammations, irritation of broncho-pulmonary tract*, with *cough, cystitis* and other *acute urinary disorders*, and *cutaneous* and *conjunctival inflammations.* It may be freely used.

MUCILAGO DEXTRINI (N. F.)—MUCILAGE OF DEXTRIN.

Preparation.—"Dextrin, three hundred and thirty-five grammes (335 Gm.) [11 ozs. av., 357 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix them in a tared vessel, and heat the mixture, under constant stirring, to near boiling, until the dextrin is dissolved and a limpid liquid results. Then restore any loss of water by evaporation, strain the liquid through muslin, and allow it to cool short of gelatinizing, when it will be ready for immediate use. *Note.*—If the mucilage is not at once to be used for preparing emulsions or other mixtures, transfer it, while hot, to bottles, which should be filled to the neck. Then pour into each bottle a sufficient quantity of olive oil to form a protecting layer, and when the mucilage has gelatinized, securely cork the bottles, and keep them in a cool place, in an upright position. When gelatinized mucilage of dextrin is to be used for the preparation of emulsions and other mixtures, pour off the protecting layer of oil from the surface, remove the remainder of the oil by a pellet of absorbent cotton, and warm the bottle gently, until the mucilage is liquefied. Then allow it to cool short of gelatinizing. The kind of dextrin suitable for this preparation is the commercial, *white* variety, provided it still contains some unaltered or only partially altered starch, and forms a jelly on cooling, when made into a mucilage after the formula above given. The yellow variety, which is completely soluble in about 2 parts of cold water, will not answer the purpose"—(*Nat. Form.*).

MUCILAGO SALEP (N. F.)—MUCILAGE OF SALEP.

Preparation.—"Salep, in fine powder, ten grammes (10 Gm.) [154 grs.]; cold water, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; boiling water, nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏]. Place the powdered salep into a flask containing the cold water, and shake until the powder is divided. Then add the boiling water, and shake the mixture continuously until it has cooled to 25° C. (77° F.), or below this temperature. The cooling may be hastened by frequent and brief immersion of the flask in cold water. Mucilage of salep should be freshly made, when wanted for use. *Note.*—If sugar or syrup is prescribed in the same mixture with mucilage of salep, it is preferable to triturate the required quantity of powdered salep with either of the former, as the case may be, and then to add rapidly the proportionate amount of boiling water"—(*Nat. Form.*).

Action and Medical Uses.—(See *Salep.*)

MUCILAGO SASSAFRAS MEDULLÆ (U. S. P.)—MUCILAGE OF SASSAFRAS PITH.

Preparation.—"Sassafras pith, two grammes (2 Gm.) [31 grs.]; water, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Macerate the sassafras pith in the water during 3 hours, and strain. This preparation should be freshly made, when wanted"—(*U. S. P.*). Sassafras mucilage has a bland taste, is thickish, colorless, and transparent.

Action, Medical Uses, and Dosage.—This is a soothing and refreshing drink for *inflammatory conditions of mucous surfaces* and in *febrile disorders.* It is especially applicable in *dysentery.* Locally, it is applied in *conjunctivitis* (acute), *erythema*, and various *inflammatory skin disorders.* It may be freely used.

MUCILAGO TRAGACANTHÆ (U. S. P.)—MUCILAGE OF TRAGACANTH.

Preparation.—"Tragacanth, six grammes (6 Gm.) [93 grs.]; glycerin, eighteen grammes (18 Gm.) [278 grs.]; water, a sufficient quantity to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Mix the glycerin with seventy-five cubic centimeters (75 Cc.) [2 fl℥, 257 ♏] of water in a tared vessel, heat the mixture to boiling, add the tragacanth, and let it macerate during 24 hours, stirring occasionally. Then add enough water to make the mixture weigh one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.], beat it so as to make it of uniform consistence, and strain it forcibly through muslin"—(*U. S. P.*). Tragacanth is but partly soluble in water. The mucilage is viscid and thick.

Action and Medical Uses.—This has been applied locally to *burns, scalds, ulcers*, etc., for its protective purposes. It is employed as an excipient where a slowly dissolving preparation is desired, as in troches, and in laxatives and non-irritating mixtures. It is also used as a pill excipient.

MUCILAGO ULMI (U. S. P.)—MUCILAGE OF ELM.

Preparation.—"Elm, bruised, six grammes (6 Gm.) [93 grs.]; water, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Digest the elm with the water, on a water-bath, in a covered vessel, during 1 hour, then strain. This preparation should be freshly made, when wanted"—(*U. S. P.*). Though this fulfils the idea of the framers of the Pharmacopœia, inasmuch as it produces what is understood by the term "mucilage," it does not produce the kind of a mucilage most useful and most grateful to the patient. By a mucilage, the *U. S. P.* refers to a kind of opaque semifluid, gelatinous product, having more or less of a viscid or adhesive quality. It is often a solution in water of a gum, or some material closely related to it. The substance wanted in this mucilage is the mucilaginous constituent of the elm-bark, and that is best extracted by means of *very cold water*. Therefore, the best method to pursue in making mucilage of slippery-elm for the patient, is as follows: Take fresh slippery-elm, or, if it can not be obtained direct from the trees, use the dried strips as found in the drug houses. Shred these, longitudinally, so that the individual pieces will be about the width of an ordinary lead pencil. Now, after bundling together the smaller strips, tie them at one end so that the other ends may be left free after the manner of a whisk-broom. In tying the pieces together leave a long piece of cord by which to suspend the bundle of shreds. Prepare a pitcher of ice-cold water, and place a stick across the top of the vessel and from the stick suspend the shredded bark in the water. If particles of ice be floating in the water, so much the better. In a short time the water will be found to have assumed a thick, ropy, mucilaginous consistence. This preparation should be prepared often, and kept in an ice-cold condition. Furthermore, it should be placed in a situation remote from the sick-room, outdoors if necessary, on account of the great facility with which it absorbs gases and noxious emanations of the sick-chamber.

Action, Medical Uses, and Dosage.—Prepared by the second method, a *good* mucilage of slippery-elm is obtained, and will be found a grateful drink for patients undergoing *febrile* and *inflammatory diseases*, as well as those who *cough* much and complain of *dryness of the mouth and fauces*. It is regarded as particularly useful in *catarrhal* and *inflammatory diseases of the stomach* and *genito-urinary tract*. Locally, it is serviceable as a cooling and soothing application to *cutaneous diseases*, especially the various forms of *dermatitis, erysipelas, furuncles*, and *carbuncle*. Besides being a good demulcent, its nutritious value is considerable. It may be freely administered.

MUCUNA.—COWHAGE.

The hairs from the pods of *Mucuna pruriens*, De Candolle (*Mucuna prurita*, Hooker; *Dolichos pruriens*, Linné; *Stizolobium pruriens*, Persoon; *Carpopagon pruriens*, Roxburgh).

Nat. Ord.—Leguminosæ.

Common Names: *Cowhage, Cowage* (*Seta siliquæ hirsutæ*).

Illustration: Bentley and Trimen, *Med. Plants*, 78.

Botanical Source.—This is a perennial plant, with a fibrous root and a twining, herbaceous, much-branched stem, and of considerable length. The leaves are alternate, pinnately trifoliate, distant, and on long petioles; leaflets entire, ovate, acute, smooth above, hairy beneath; lateral ones oblique at the base, middle one slightly rhomboidal. The flowers are rather large, have a disagreeable, alliaceous odor, are disposed in axillary, lax, many-flowered, interrupted racemes, 1 to 1½ feet long. The corolla is papilionaceous; vexillum cordate, incumbent on the wings, much shorter than they and the keel, without callosities, and flesh-colored; wings oblong-linear, connivent, purple, or violet; keel or carina straight below, slightly falcate in the upper part, terminated by a smooth, polished. acute beak, and greenish-white. Stamens diadelphous (9 and 1), alternately longer; anthers alternately longer and ovate. Calyx campanulate, bilabiate, with 2 very caducous bracteoles as long as the tube, hairy, pink, bilabiate, with narrow lanceolate segments; upper lip broad, entire, or emarginate; lower, trifid, middle segment the largest. Style long, slender, and hairy below; stigma small. The legume is about 3 inches long, as thick as the finger, and closely covered with strong, brown, stinging hairs. The seeds are oblong and variegated, with a white hilum (L.).

History, Description, and Chemical Composition.—This plant inhabits the West Indies, and other tropical parts of South America; it is found in woods, along river courses, upon fences, and in waste, neglected places. The medicinal part of the plant is the hair of the pods, which are generally imported into this country attached to the pod, and from which they are carefully removed, so that they do not fasten to the operator's hands. They are straight, about ⅛ of an inch in length, quadrangularly prismatic, with upper half retrorsely serrated, and acutely pointed at the apex. They are brown and glossy, and inclose a granular, brown substance, which but partially fills the hair. Mucuna, according to Martius (1827), contains resin and a small amount of tannin. The shorter, darker-hued spicula of the *Stizolobium urens*, Persoon (*Mucuna urens*, De Candolle; *Dolichos urens*, Linne), is used for the same purposes as cowhage. The seeds of this species are employed in dysuria in the West India Islands. In India the root of the cowhage plant is a reputed remedy for cholera. Mucuna was first introduced to the notice of English physicians by Bancroft, about the year 1769 (see Dymock's *Vegetable Materia Medica of India*, p. 229).

Action, Medical Uses, and Dosage.—Cowhage was formerly regarded as a mechanical anthelmintic, acting by irritating the body of the worms; its decoction or tincture has no anthelmintic properties. It was used in the treatment of *intestinal worms*, which are expelled alive. It is very probable, however, that its setæ did very little mechanical harm to the worm, for when the spiculæ are moistened, they largely lose their irritating properties. It has no effect on tænia, but appears more serviceable in removing the *lumbrici* and *ascarides*. Dose, from 1 drachm to ½ ounce, in syrup or molasses, and followed a few hours afterward by a purgative. The application of oil is the best to allay the heat and itching it produces when rubbed on the skin. Cowhage has been recommended in the form of an ointment, as a cutaneous irritant, in the place of croton-oil and tartar-emetic; also as a good medium for the endermic application of various substances, as hydrochlorate of morphine. The proportions are, 7½ grains of the hairs of cowhage to 1 ounce of lard. This must be rubbed in from 10 to 20 minutes; 7 or 8 grains are usually sufficient. The immediate effect is the production of a sensation resembling stinging with nettles; but the burning sensation, and the itching diminish during the friction, and entirely pass off in less than half an hour. The skin generally becomes covered with white, flat papulæ, which soon disappear, leaving a sensation of heat. It produces no inconvenience, and children bear it easily. It is seldom used.

Related Species.—The following species of Corylus are indigenous to (one cultivated in) the United States, one of which has covering the involucre spiculæ, which are employed like mucuna, as a vermifuge. They belong to the natural order *Cupuliferæ*.

Corylus rostrata, Aiton, *Beaked hazel.*—Canada, northern United States, and along the Appalachian ranges. Shrub 2 to 5 feet high. Fruit inclosed in a long, scaly involucre, which is hirsute, and terminates in a prolonged, tube-like beak. The spiculæ are reputed to act as a mechanical vermifuge.

Corylus americana, Walter.—North American thickets. Fruit wide and long, surrounded by an involucre at least double the length of the fruit.

Corylus avellana, Linné, *Hazel.*—Europe, North Asia, in wood and thickets. Cultivated in the United States. A shrub, from 10 to 15 feet high, flowering in early spring and bearing fruit in the autumn. The fruit is known as the *filbert*, and is a hard nut, with a pale-brown, ligneous shell, surrounding a sweetish, oleaginous, white kernel. It is about an inch long. The seeds yield about 50 per cent of *hazelnut oil*, a light-yellow, fixed oil, without odor, but tasting somewhat like the nuts. It is composed of olein, palmitin, arachin, and stearin, freezing at near the zero point, 0° F. (—17.8° C.).

MYRICA.—BAYBERRY.

The bark and wax of *Myrica cerifera*, Linné.

Nat. Ord.—Myricaceæ.

COMMON NAMES: *Wax-myrtle, Bayberry, Candle berry, Waxberry.*

Botanical Source.—This plant is a branching, half-evergreen shrub, 1 to 12 feet in height, and covered with grayish-bark. The leaves are glabrous, cuneate-lanceolate, rather acute or obtuse, distinctly petiolate, margin entire, but more frequently remotely dentate, particularly toward the end, paler, with distinct veinlets beneath, generally twisted or revolute in their mode of growth, shining, resinous, dotted on both sides, 1½ to 2½ inches in length, and from ½ to ¾ of an inch wide. The flowers appear in May, before the leaves are fully expanded. The males grow in aments, are sessile, erect, 6 to 9 lines in length; originating from the sides of the last year's twigs. Every flower is formed by a concave, rhomboidal scale, containing 3 or 4 pairs of roundish anthers on a branched foot-stalk. Females on a different shrub, less than half the size of the males, consist of narrower scales, with each an ovate ovary, and 2 filiform styles. To these aments succeed clusters or aggregations of small globular fruits, resembling berries, which are at first green, but finally become nearly white, and consist of a hard stone inclosing a dicotyledonous kernel, studded on its outside with small, black grains, resembling fine gunpowder, over which is a crust of dry, greenish-white wax, fitted to the grains, giving the surface of the fruit a granulated appearance. The fruit is persistent for 2 or 3 years (L.—P.—W.—G.).

History and Description.—This plant is found in dry woods, or in open fields, from Canada to Florida. The bark of the root is the preferred part; boiling water extracts its astringent and alcohol its stimulating principles.

BAYBERRY BARK.—As met with in commerce, the bark is in curved or quilled pieces, from 1 to 6 or 7 inches long, covered with a thin, grayish, mottled epidermis, with slight transverse fissures, beneath which the true bark is of a dull reddish-brown color, rugged, darker internally, breaking rapidly with a short fracture, and giving, when pulverized, a light brown powder, of a pungent, peculiar, spicy odor, a bitter taste succeeded by astringency, acridity, and a stinging sensation which gradually extends to the fauces, where it leaves an unpleasant feeling and a sense of constriction; it is powerfully sternutatory, excites cough, and forms a dense froth when briskly agitated with water. Water takes up its active properties; diluted alcohol is its best menstruum. The root should be collected late in the fall, cleansed from dirt and foreign substances, and then, while fresh, pounded with a hammer or club to separate the bark, which should be thoroughly dried without exposure to a wet or moist atmosphere, then pulverized, and kept in darkened and well-closed vessels.

BAYBERRY-TALLOW, or MYRTLE WAX *(Bayberry wax.)*—This substance is yielded by the berries and is obtained by boiling them in water, upon the top of which it floats, and from which it is removed when it has become cold and hardened; it is a concrete oil or fatty substance of a pale-green color, with a tendency to dirty gray, of moderate hardness and consistence, having the tenacity of beeswax, but more brittle and not so unctuous to the touch, of a faintly balsamic and pleasant odor which is increased by burning it, and of an astringent, bitterish taste. It fuses at a temperature of from 47° to 49° C. (116.6° to 120.2° F.) (Moore), burns with a clear, white flame, producing little smoke, and has the specific gravity 1.004 to 1.006. Water does not act upon it; boiling alcohol dissolves about four-fifths of its weight, but deposits it again upon cooling; but ether also dissolves it, and on cooling deposits it in crystalline plates like spermaceti; the ether becomes green, leaving the wax nearly white; oil of turpentine, aided by heat, dissolves it sparingly; alkalies and acids act upon it nearly as upon beeswax. Sulphuric acid, assisted by heat, dissolves about one-twelfth of its weight, and converts it into a thick, dark-brown mass. A bushel of bayberries will yield about 4 pounds of the wax.

Chemical Composition.—According to George M. Hambright (1863), bayberry bark contains albumen, tannic and gallic acids, starch, gum, red coloring matter, traces of oil, an acrid resin soluble in alcohol or ether, an astringent resin soluble in alcohol, insoluble in ether; *myricinic acid*, etc. The latter substance is granular, and when shaken with water, produces a bulky froth, hence is analogous to *saponin*. It is persistently acrid in taste. Ammonia, added to its aqueous solution produces a rapid change of colors from deep green to red, and finally to yellow (*Amer. Jour. Pharm.*, 1863, p. 193). The fruit yielded (Dana) solid fat, 32 per cent; starch, 45 per cent; and resin, 5 per cent. According to G. E. Moore (1852), *bayberry-tallow* is composed of *palmitin*, 1 part, and *palmitic acid*, 4 parts, with a little *lauric acid* (*laurin*). A more recent analysis by G. Schneider (1890) shows this wax to be chiefly composed of palmitin (70 per cent), myristin (8 per cent), and lauric acid (4.7 per cent), mostly in the free state (see G. M. Beringer, *Amer. Jour. Pharm.*, 1894, p. 221).

Action, Medical Uses, and Dosage.—Bayberry bark is astringent and stimulant, and as such is valuable in debilitated conditions of the mucous membranes; in drachm doses, it is apt to occasion emesis. It was largely employed by the followers of Samuel Thomson, in *catarrhal states of the alimentary tract*. The bark has been successfully employed in *scrofula*, *jaundice*, *diarrhœa*, *dysentery*, *aphthæ*, and other diseases where astringent stimulants were indicated. Specific myrica, in small doses (2 to 5 drops) will be found a good stimulant to the vegetative system of nerves, aiding the processes of digestion, blood making, and nutrition. In larger doses (5 to 20 drops) it is a decided gastric stimulant. In small doses it has been found advantageous in *chronic gastritis*, *chronic catarrhal diarrhœa*, *muco-enteritis*, and in *dysentery* having a typhoid character. It is said to restore *arrested lochial discharges*. Cases calling for myrica show feeble venous action, while the pulse is full and oppressed. It is not adapted to acute disorders of the alimentary tract, as a rule. A weak infusion used as an injection, is an admirable remedy in *amenorrhœa* and *atonic leucorrhœa*. Use the specific medicine or tincture internally also. In *scarlatina* in the latter stages, when the tissues are swollen and enfeebled, it may be used both for its antiseptic and stimulating effects (Locke).

The powdered bark, combined with bloodroot, forms an excellent application to *indolent ulcers*, and has likewise been employed as a snuff for the cure of some forms of *nasal polypus*. In the form of poultice, with elm or alone, it is a valuable application to *scrofulous tumors* or *ulcers*. The decoction is beneficial as a gargle in *sore mouth* and *throat*, and is of service in injection, in *leucorrhœa* and *fistula*, and also as a wash for *ulcers*, *tinea capitis*, etc. It also forms an excellent gum wash for *tender*, *spongy*, and *bleeding gums*. The leaves are reputed astringent, and useful in *scurvy* and *spasmodic affections*. Probably the *M. pennsylvanica*, *M. carolinensis*, and *M. Gale*, possess similar properties. Bayberry or myrtle wax, has been used by Dr. Fahnestock in *epidemic dysentery* with typhoid symptoms, with considerable success; it possesses mild astringent, with some narcotic properties. It is also used in the form of plaster, as an application to *scrofulous* and *other ulcers*. Dose of the powdered bark, from 20 to 30 grains; of the wax, 1 drachm; of the decoction of the leaves or bark, from 2 to 4 fluid ounces; specific myrica, 2 to 20 drops. Bayberry bark was a constituent of "*Thomson's Composition Powder* or No. 6."

Specific Indications and Uses.—Profuse mucous flows; catarrhal states of the gastro-intestinal tract; atonic diarrhœa, typhoid dysentery, atony of the cutaneous circulation; full oppressed pulse. Locally and internally—sore mouth; spongy, flabby, bleeding gums; sore throat of scarlet fever when enfeebled and swollen.

Related Species.—*Myrica Gale*, Linné. *Sweet gale*, or *Dutch myrtle*, a smaller plant than the bayberry, is found in swampy places in northern portions of Asia and Europe, and in the United States from the Carolinas to Canada. Its subcoriaceous leaves, pubescent-downy beneath, and its fruit are dotted with a yellow resin. The taste of the leaves and twigs is aromatic, bitterish, and astringent; the odor strongly balsamic. A volatile oil, seven-tenths of which is a stearopten, was obtained in small quantity by Ravenhorst (1836) from sweet-gale leaves. It solidifies at 12° C. (53.6° F.).

Myrica ocuba, a widely distributed shrub, in the Brazilian province of Para, furnishes a fruit whose seeds yield *Ocuba wax*. It has been used in Brazil in the manufacture of cheap candles.

Myrica jalapensis, Kunth.—A solid fat, is obtained from the fruit by boiling it with water, and the bark of the root is astringent and acrid, and in larger doses emetic. The fat is readily saponifiable with alkalies, has probably the same composition as myrtle wax from *Myrica cerifera*, and is given internally in powder for *diarrhœa* and *jaundice* (Prof. J. M. Maisch, *Amer. Jour. Pharm.*, 1885, p. 339).

MYRISTICA (U. S. P.)—NUTMEG.

"The seeds of *Myristica fragrans*, Houttuyn," "deprived of its testa"—*U.S.P.*

Nat. Ord.—Myristicaceæ.

COMMON NAME: *Nutmeg* (*Nux moschata*).

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 218.

Botanical Source.—This is a tree from 20 to 25 feet high, having a grayish-brown, somewhat smooth bark, abounding in a yellow juice; the branches are spreading, in whorls. The leaves are alternate on petioles from ½ to ¾ of an inch long, plane above, or oblong, approaching to elliptical, subbifarious, glabrous, rather obtuse at the base, acuminate, quite entire, aromatic, dark-green and somewhat glossy above, paler beneath, and from 3 to 6 inches long. The flowers are diœcious, small, in axillary, subumbellate racemes, sometimes forked, or compound. The peduncles and pedicels are glabrous, the latter having a quickly deciduous, ovate bract at its summit, often pressed close to the flower. Male flowers, 3 to 5, or more, on a peduncle. Calyx urceolate, thick, fleshy, clothed with a very indistinct, reddish pubescence, dingy pale-yellow, cut into 3 erect, or erecto-patent teeth. The filaments are incorporated into a thickened, whitish cylinder, about as long as the calyx, the upper half covered by about 10 linear-oblong, 2-celled anthers, free at their base, opening longitudinally. The female flowers are scarcely different from the male, except that the pedicel is very frequently solitary. Pistils solitary, shorter than the calyx, broadly-ovate, a little tapering upward into a short style, bearing a 2-lobed, persistent stigma. The fruit is a fleshy pericarp, nearly spherical, of the size, and somewhat of the shape, of a small pear; flesh astringent, yellowish, almost white within, 4 or 5 lines thick, opening into 2, nearly equal, longitudinal valves. The arillus (mace) is thick, between horny and fleshy, much laciniated, folded and anastomosing toward the extremity, almost enveloping the nut, and so tightly as to form inequalities on its surface; when fresh, brilliant scarlet; when dry, much more horny, of a yellowish-brown color, and very brittle. The nut is oval or broadly-ovate, with a hard, rugged, dark-brown, glossy shell, pale, smooth within, about half a line thick. The seed, or nutmeg, is oval, pale-brown, quite smooth when fresh, but soon becomes shriveled, with irregular, vertical lines or furrows on its surface. Its substance or albumen is firm, fleshy, whitish, being traversed by veins of a red brown color, abounding in oil. Near the base of the albumen, imbedded in a cavity in its substance, is the embryo, which is small, fleshy, yellowish-white, rounded below, and where is found the hemispherical radicle; cotyledons of 2, large, somewhat foliaceous, plicate lobes, in the center of which is seen the plumule (L.).

Fig. 173.

Myristica fragrans.

History and Description.—This tree has received several botanical names, as *M. officinalis*, Linné, *M. moschata*, Thunberg, *M. aromatica*, Lamarck, and *M. fragrans*, Houttuyn; this last is the one now generally adopted by botanists. The nutmeg tree is indigenous to the Molucca Isles, and is raised in Sumatra, French Guiana, the Mauritius, and various West Indian Islands. The nutmeg tree is propagated by planting the uninjured seed; when it has attained the age of about 9 years, it commences to blossom, and continues to yield fruit for about three-quarters of a century, requiring hardly any attention from its cultivators. The seeds are frequently spread in the Banda Isles by certain species of pigeons, which thus contribute to the propagation of the tree. In the eighteenth century this was the cause of much disaster to the natives of these islands in their dealings with the Dutch East Indian Company who endeavored to limit and monopolize the plantation of the nutmeg tree, by prohibiting its being planted on certain isles (A. Tschirch, *Indische Heil-und Nutzpflanzen*, Berlin, 1892, p. 104). In the Banda Isles there are three harvests annually, the principal one in July or August, in November, and in March or April. The ripe fruit is gathered by means of a barb attached to a long stick; the mace or arillus separated from the nut, and both separately cured (P.). The kernel of the fruit, or *nutmeg*, and the arillus of the nut, or *mace* (see *Macis*), are the official parts; they are imported from the East Indies, from Europe, and a small portion from the West Indies.

The nutmegs, previous to exportation, undergo a process of curing to preserve them, and protect them from the attacks of insects; the nuts are exposed to the sun for 4 or 6 days, and afterward smoke-dried for several weeks at about 60° C. (140° F.); when thoroughly dried, the kernel rattles in the shell, which is then cracked with a wooden mallet, and the perfect nuts selected; these are then covered with dry lime, or steeped for a time in a thick mixture of lime and water; the former is considered the preferable plan. Nutmegs are officially described as follows: "Oval or roundish-ovate, about 25 Mm. (1 inch) long, light-brown, reticulately furrowed, with a circular scar on the broad end; internally pale-brownish, with dark orange-brown veins, and of a fatty lustre; odor strongly aromatic; taste aromatic, warm, and somewhat bitter"—(*U. S. P.*). From the interior veins mentioned, an oil may be easily expressed with the point of a warm knife. The virtues of nutmegs are extracted by alcohol or ether. The small, round, heavy nutmeg is esteemed superior to those which are larger, longer, lighter, less marbled, and not so oleaginous. It produces a grayish-brown, somewhat fatty powder. Singapore and Penang nutmegs are unlimed; those from the Dutch colonies are limed. (For botanical and anatomical studies of various species of Myristica, see A. Tschirch [*Jahresb. der Pharm.*, 1885, p. 98, and 1887, p. 108, and *Archiv der Pharm.*, 1895, p. 443]; also J. Moeller [*Pharm. Centralhalle*, 1880, pp. 453, 465 and 473], and W. Busse [*Jahresb. der Pharm.*, 1895, p. 113].) An exhaustive and classical monograph, on the history, botany, commercial aspect, etc., of nutmeg, was written quite recently by O. Warburg (1897).

Chemical Composition.—Nutmegs contain 8 to 10 per cent of volatile oil (see *Oleum Myristicæ*), 30 to 40 per cent of fatty oil (see *Oleum Myristicæ Expressum*), from 9 to 13 per cent of water, and about 5 per cent of ash; furthermore, nitrogenous matter, starch, gum, woody fiber, etc. The fatty oil of nutmeg contains as the characteristic constituent, about 12 per cent of *myristin*, the glycerin ester of *myristic acid* ($C_{14}H_{28}O_2$), discovered by Playfair, in 1841. Stearic and oleic acids are likewise present in the fatty oil.

Action, Medical Uses, and Dosage.—Both nutmeg and mace possess aromatic stimulating properties, and are occasionally used to remove *flatulency*, correct the nausea arising from other drugs, and to allay *nausea* and *vomiting*. It may be used in *gastrodynia* and *atonic diarrhœa*. The nutmeg forms a very agreeable addition to various drinks for convalescents, as well as to some articles of diet; it is generally grated over them, or mixed with them. Applied locally, grated nutmeg, mixed with lard, has been found an excellent application in *piles*, and the nutmeg roasted is used internally in some parts of the country, as a domestic remedy for *leucorrhœa*. I have known the following preparation to cure several cases of *intermittent fever*, and have been assured of its almost universal success in this disease. It is also recommended for the cure of other forms of *fever*. Char a nutmeg by holding it to the flame, and permitting it to burn by itself without disturbance; when charred, pulverize it, combine it with an equal quantity of burnt alum, and divide the mixture into three powders. On the commencement of the chill, give a powder—if this does not break it, give the second powder on the approach of the next chill, and if not cured, the third powder must be given as the succeeding chill comes on. Usually the first powder effects a cure, and it is seldom that the three powders are required. The bowels should be acted upon by a purgative previous to the administration of the powders. It is certainly deserving attention, though I do not pretend to account for its action (J. King). Nutmeg occasionally controls passive *uterine hemorrhage*. The powder, dusted upon a larded cloth, is effectual as an application to the chest in *pneumonic complaints* and *colds*, and to the bowels in *cholera infantum*, and over the stomach to allay *vomiting*. Dose of nutmeg or mace, from 5 to 20 grains. Larger doses possess decided narcotic qualities, and in doses of 2 or 3 drachms, dangerous symptoms have been produced. Death followed the eating of two nutmegs by a boy of 4 years. The symptoms produced in various cases of nutmeg poisoning vary. The chief symptoms, however, are headache, coldness and collapse, drowsiness, indisposition to muscular movement, and increased diuresis. In [illegible] cases the urine has been suppressed (see case of *Myristica poisoning*, *Ec. Med. Jour.*, 1891, p. 125; also *Amer. Jour. Pharm.*, 1885, p. 23).

Related Species and False Nutmegs.—*Myristica argentea*, Warburg, grows in New Guinea; its leaves are silvery below, hence the name. The nutmeg is longer and narrower than that of *M. fragrans*, after which it ranks next in commercial importance. Instead of this species *M. fatua*, Houttuyn, growing in the Molucca Islands, has for a long time been erroneously believed to yield the long nutmeg of commerce. The seed of *M. fatua* (*Male nutmeg*, *Mannetjes-noote*) soon loses its already weak aroma.

M. madagascariensis, Lamarck, growing in Madagascar, and cultivated in the French island of Bourbon, is probably identical, according to Warburg (*Ber. d. Deutsch Pharm. Ges.*, 1892, p. 211), with *M. fragrans*.

M. officinalis, Martius, growing in Brazil, yields the solid *Bicuyba oil* of the Brazilians. The seed is but faintly aromatic, and yields 72 per cent of oil (see analysis by A. Stutzer, *Jahresb. der Pharm.*, 1887, p. 108).

M. bicuhyba, Schott, growing in Brazil, produces a seed of an agreeable, cacao-like odor. H. Nördlinger (*Amer. Jour. Pharm.*, 1886, p. 88) found the dried kernels to yield 73.7 per cent of an aromatic fat, chiefly the glycerides of myristic and oleic acids with free myristic acid.

M. surinamensis, Roland.—Reimer and Will found in the seeds 73 per cent of a slightly aromatic fat, melting at 45° C. (113° F.), and consisting of myristin and 6.5 per cent of myristic acid (*Amer. Jour. Pharm.*, 1886, p. 88).

M. malabarica, Lamarck, is believed to yield *Bombay mace* (see *Macis*). Prof. Schaer (1896) found in the inspissated extract of the bark a new kino (see *Kino*).

Calabash Nutmeg, or Jamaica Nutmeg, is the product of *Monodora Myristica*; Plume, or New Holland Nutmeg, from *Atherosperma moschata*; and Clove Nutmeg, from *Agathophyllum aromaticum*. For species yielding oils, see also *Oleum Myristicæ Expressum*.)

California Nutmeg.—The seed of a California conifer, the *Torreya californica*, Torrey (*Torreya Myristica*, Hooker). It has a terebinthinate taste, is oblong, its testa smooth, brown and thin, and the seed upon cross-section is marbled.

MYROBALANUS.—MYROBALAN.

The fruit of *Terminalia Chebula*, Retzius; *Myrobalanus Chebula*, Gaertner.

Nat. Ord.—Combretaceæ.

Common Name: *Myrobalans.*

Botanical Source.—Terminalia Chebula is a tree whose trunk towers from 40 to 70 feet, its verticillate branches giving the tree a symmetrical head. The leaves are short-petioled, alternate, entire, or slightly dentate, arranged on the ends of the branches (hence the name *Terminalia*), coriaceous and spotted. The 10-stamened flowers are white or yellowish, and borne in racemes or spikes. The fruit is a drupe about the size of a large plum.

History.—Several other species yield commercial myrobalans, but the fruit is almost unknown in Western commerce. In India and China, where the spespecies are indigenous, the fruit is highly valued for almost every ill that flesh is heir to. The hard wood takes a fine polish and is useful in cabinet work. The creamy, fragrant juice of the *T. angustifolia*, Wight, when dried, is used in Indian temple worship as an incense. The tree is regarded sacred, and has interesting historical and mythological connections. The celebrated *India Ink* is the product of the bark and leaves of *T. cattapa*, Linné. All the species yield a tanning bark. The leaves, bark, and fruit yield a dye, which with iron gives a rich black, and with alum a fine yellow color.

Description.—*Chebula myrobalans* are ovoid or oblong, about the size of the prune, yellow-brown, marked with 5 or 6 obtuse angles, and ribbed. The light-brown endocarp is resin-dotted. The single seed is white. The *Myrobalani citrina*, or *Yellow myrobalans*, are smaller, orange or yellow-hued, and of a more pronounced bitter taste. They have been sold as *white galls*. The unripe fruit is known as *Myrobalani nigræ*, or *Black myrobalans*. They are blackish, shrivelled and brittle, glossy on fracture, and contain either none or an imperfect seed. They are astringent and somewhat sour.

Chemical Composition.—The fruit, as well as all other parts of the tree, contains tannin. According to E. Mafat (*Pharm. Jour. Trans.*, Vol. XXIII, 1892, p. 145), the amount of tannin in chebulic myrobalans varies from 18.2 to 52 per cent. Stenhouse (1843) found 45 per cent of tannin, gallic acid, mucilage, and a brown-yellow coloring matter. The black variety contains much sugar. Apéry (1888) isolated from black myrobalans a green oleoresin soluble in alcohol, ether, petroleum spirit, and oil of turpentine. He named it *myrobalanin*. A. Campbell Stark (*Pharm. Jour. Trans.*, 1892, Vol. XXIII, p. 253) making a complete analysis of myrobalans, observed the same oil and obtained only 20.6 per cent of tannin. Dr. G. Zölffel (*Archiv der Pharm.*, 1891, p. 123) found the tannin matter of myrobalans to be identical with that of *algarobilla*, the astringent fruit of *Cæsalpinia brevifolia*, Bentham, a Chilenian plant. It consists of two principles which differ in both plants only with regard to their relative proportions. Accordingly, the tannin matter of myrobalans is a mixture of predominating *ellaggen-tannic acid* ($C_{14}H_{10}O_{10}$, Loewe, 1875, or $C_6H_2.COOH.[OH]_2 O.O.CO.C_6H_2.[OH]_3$, Zölffel), and a smaller quantity of *gallic acid glucosid*, yielding, upon hydrolysis, gallic acid and dextrose. Gallic acid also preexists in part in myrobalans. *Ellaggen-tannic acid*, isolated by Loewe (1875) from the fruits of *Cæsalpinia Coriaria*, Willdenow (*Divi-divi*), as well as from myrobalans, decomposes, upon hydrolysis, into water and *ellagic acid* ($C_{14}H_6O_8+2H_2O$). Fridolin's crystallizable *chebulinic acid* (1884), upon hydrolysis, splits into 2 molecules of gallic, and 1 molecule of tannic acid. It is no doubt closely related to the tannic principles aforenamed.

Action, Medical Uses, and Dosage.—Myrobalans were known to the ancients who appear to have valued them highly in innumerable complaints for which they are never now employed. They impart a green color to the saliva, and have an astringent, sourish taste. Like rhubarb, they have been found to possess both cathartic and astringent properties (Apéry), and are reputed of some value in the chronic forms of *diarrhœa*, *dysentery*, and *catarrhal diseases of the bowels*. The dose is from 2 to 5 grains, in pill or capsule, every 2 to 4 hours.

Other Myrobalans.—Belleric Myrobalans. Subglobular, smaller than the chebulic myrobalans, short-stalked, tomentose, and of a red-brown color. The putamen is light-brown, 5-sided, odorless, bitter, and astringent. The fleshy part of the fruit is resinous. It is the product of *Terminalia bellerica*, Roxburgh (see its analysis in *Pharmacographia Indica*, Vol. II, 1890, p. 7). Several other species of *Terminalia* yield astringent barks and are employed in tanneries.

Emblic Myrobalans.—This is furnished by an entirely different plant from the Terminalia, the *Phyllanthus Emblica*, Linné (*Emblica officinalis*, Gaertner); *Nat. Ord.*—Euphorbiaceæ. India. Subglobular, drupaceous fruit, having 6 grooves, deeply furrowed between grooves, 3-celled, each cell enclosing 2 glossy, brownish-red seeds. The taste of this fruit is astringent and sour.

MYRRHA (U. S. P.)—MYRRH.

"A gum-resin obtained from *Commiphora Myrrha* (Nees), Engler"—(*U. S. P.*). (*Balsamodendron Myrrha*, Nees.)

Nat. Ord.—Burseraceæ.

Common Name: *Myrrh* (*Gummi-resina myrrha*).

Illustration: Bentley and Trimen, *Med. Plants*, 60.

Botanical Source.—The *Commiphora Myrrha* (*Balsamodendron Myrrha*), has a shrubby, arborescent stem, with squarrose, spinescent branches, a very pale-gray bark, and a yellowish-white wood. Its leaves are ternate, on short petioles; leaflets obovate, obtuse, somewhat tooth-letted at the apex, the lateral smooth. The flowers are unknown. The fruit is ovate, smooth, brown, somewhat larger than a pea, surrounded at base by a 4-toothed calyx, and supported on a very short stalk (Nees—De Candolle).

Fig. 174.

Commiphora Myrrha.

History.—Until recent years much doubt was entertained as to the true botanical source of myrrh. Nees von Esenbeck examined specimens of the supposed myrrh tree brought from Ghizan (Arabia), in 1826, by Ehrenberg, and named it *Balsamodendron Myrrha*. D. Hanbury, in 1873 (see his *Science Papers*, p. 378), described four districts, all situated around the Gulf of Aden and the Red Sea, which have been mentioned by various travelers as being the home of the myrrh tree. Still the species from which the bulk of commercial, especially Somali, myrrh is derived, is not as yet known with exactness. Authorities, including the *U. S. P.*, however, accept that the drug is derived from *Commiphora Myrrha* (Nees), Engler. Mr. E. M. Holmes (see *Amer. Jour. Pharm.*, 1897, p. 110) believes that Arabian myrrh at least is derived from *Balsamodendron Myrrha*, Nees, and that in tracing the botanical origin of other commercial varieties, the taste and peculiar odor of myrrh may reasonably serve as a guide, since these qualities undoubtedly exist in the plants themselves. An exceedingly useful description of the plants possibly yielding myrrh and bdellium, by Mr. E. M. Holmes, is recorded in *Pharm. Jour. Trans.*, 1898, Vol. VII, p. 547, and 1899, Vol. VIII, pp. 26 and 77.

The region south of the gulf of Aden, the country of the Somalis, furnishes almost the entire commercial drug. Formerly, myrrh was known in commerce as *Turkey myrrh*, as it formerly entered commerce from Egypt and the Mediterranean ports; but now it goes first to Berbera (ancient Mosylon) and Aden, and from thence to Bombay, where the bags are opened and sorted; the best grades going into European and American commerce, while the inferior sorts are sent to China to be used as incense. What was formerly known as *India myrrh* is the *bissa bol* of the Somalis (see *Other Myrrhs*). True myrrh is known in its native country as *Mur* (Arab). *Mulmul* (Somali), *Heerabole* (Indian), names also applied to an Arabian product from the tree known as *Didthin*, a tree identical with that furnishing African myrrh. (Also see commercial classification and description of the drug, by Mr. E. M. Holmes, in *Pharm. Jour. Trans.*, 1898, Vol. VII, p. 547.) The juice flows naturally from the myrrh tree, like cherry-tree gum upon the bark; at first it is soft and pale-yellow, but by drying becomes hard, darker and redder, and forms the medicinal gum myrrh. Myrrh varies in size from that of a pea to that of a large walnut, and may be even larger.

Description.—Myrrh is "in roundish or irregular tears or masses, dusty, brownish-yellow or reddish-brown; fracture waxy, somewhat splintery, translucent on the edges, sometimes marked with whitish veins; odor balsamic; taste aromatic, bitter and acrid. When triturated with water, myrrh yields a brownish-yellow emulsion; with alcohol it yields a brownish-yellow tincture which acquires a purple tint on the addition of nitric acid. Dark-colored pieces, the alcoholic solution of which is not rendered purple by nitric acid, and pieces of gum which dissolve completely, as well as those which merely swell in water, should be rejected"—(*U. S. P.*). Myrrh is friable and readily powdered in cold weather, but in a warm atmosphere it is difficultly pulverized, unless some of its oil and water have been extracted from it. When heated it softens, then froths up and at length ignites and burns with difficulty. Its proper solvent is rectified spirit. It is not wholly dissolved by water, ether, or proof spirit; water dissolves its gum, and the mucilage retains the oil and part of the resin in the state of emulsion; proof-spirit dissolves some of its resin. The tincture is transparent, and when poured into water forms a yellow opaque fluid, but does not form a precipitate, while the watery solution is always yellow and opaque. Alkaline solutions are good solvents for myrrh.

Chemical Composition.—Myrrh is composed of *gum*, 40 to 60 per cent, insoluble in alcohol; *resin*, about 27 to 40 per cent, soluble in alcohol, and *volatile oil*, 2.18 per cent, Ruickholdt; 7 to 8 per cent, O. Köhler, 1890. Upon incineration, myrrh leaves about 3.5 per cent of ash, principally calcium carbonate. O. Köhler (*Archiv der Pharm.*, 1890, p. 291) found 57 to 59 per cent of gum which was ascertained to be a carbohydrate of the formula $C_6H_{10}O_5$. The resins (*myrrhin* and *myrrhic acid*, of Ruickholdt) were separated by Köhler into an indifferent resin ($C_{26}H_{34}O_5$) soluble in alcohol and ether, and having three replaceable hydroxyl groups, and two dibasic resin-acids. The essential oil (*myrrhol*, or *myrrhin* of older observers) contains a volatile compound ($C_{10}H_{14}O$) not identical with thymol or carvol. The volatile oil of myrrh is lævo-rotatory. When exposed to air and light, it resinifies by oxidation and acquires the appearance and consistence of myrrh. Formic acid is said to be developed in this process.

Myrrhol, dissolved in carbon disulphide and subsequently treated with bromine or nitric acid, gradually assumes a permanent violet-blue coloration. The resin gives the same reaction due to the presence of some volatile oil. Fluckiger also abstracted, by means of water, a *bitter glucosid* from the resin as obtained by alcohol. It is amorphous, brittle, and brown, and sparingly soluble in water, producing an exceedingly bitter, yellowish solution (*Pharmacographia*). Small amounts of pyrocatechuic acid and pyrocatechin are formed when myrrh is fused with potassium hydroxide. The gum makes a good non-decomposing adhesive paste, which is still more adhesive if molasses be added to it (Shuttleworth, 1871).

Action, Medical Uses, and Dosage.—Myrrh is stimulant, especially to mucous tissues. It also exerts an antiseptic influence, and is used to promote expectoration, as well as menstruation. It has also been used as a vermifuge. Internally, the smaller doses promote digestion. Large doses accelerate the pulse, augment the heat of the body, cause gastric heat and burning, great sweating and marked prostration; occasionally it causes nausea, vomiting, and purgation. It is not antispasmodic, and is contraindicated in internal inflammations. It is generally used in enfeebled conditions of the body, and has been found useful in cases of *excessive mucous secretion*, as in *gleet*, *chronic gonorrhœa*, and *chronic catarrh*; also in *laryngitis*, *bronchitis*, *humoral asthma*, and other diseases of the air-tubes accompanied with profuse secretion, but expelled with difficulty. Its property of restraining the mucous discharges is observed to be most pronounced upon the renal and bronchial tract. As an expectorant, it acts best by combining it with such agents as squill, giving to both an increased force possessed by neither alone. *Chronic respiratory disorders* are the cases for its exhibition, it being indicated in *chronic bronchitis* with unhealthy and exhausting secretions, relaxed mucous tissues, and difficulty in raising the sputa. It is contraindicated by arterial excitement or fever. For use in the above condition, the following combination, an excellent alterative expectorant and stimulating tonic, is recommended by Prof. Locke: ℞ Syr. prunus virg., syr. senega, āā fl℥ij; Comp. tinct. of myrrh and capsicum fl℥ij. Mix. Sig. Teaspoonful every 3 hours. The same may also be used in the *asthma* of the aged. Cough and expectoration are lessened, the secretions reduced in quantity, and the consequent exhaustion incident to profuse expectoration prevented. Besides, it acts kindly on the stomach, and otherwise sustains the strength of the patient.

Myrrh has some reputation as an emmenagogue. It is adapted to female disorders accompanied with weight, dragging, and *leucorrhœa*. It is reputed useful in *suppressed menses*, and in some cases of *anemia*. In either instance, however, it is not efficient unless exhibited with some form of iron, aloes, etc. Locke recommends for *amenorrhœa*, and particularly if the uterine torpor be associated with constipation, the following prescription: ℞ Pulv. myrrh, grs. xxx; aloes, grs. x; macrotin, grs. x. Mix. Make 20 pills. Sig. Dose, 1 or 2 pills three times a day.

Myrrh is of value in *chronic gastritis* and *atonic dyspepsia* with full, pallid tongue and mucous tissues, and with frequent, mucous alvine discharges accompanied with flatulence. Here myrrh and gentian act well, and if nervous symptoms are prominent, an equal quantity of valerian may be used with them. The dose of the combination of equal parts of these tinctures is from 5 to 20 drops. *Chronic mucous fluxes*, from the bowels or urinary tract, are benefited by myrrh.

Myrrh was formerly used as a dressing for *indolent ulcers* to promote granulation and alter the character of the discharges. It was at the same time given internally also. Topically, it is a very useful application to *indolent sores*, *gangrenous ulcers*, and *aphthous* or *sloughy sore throat*, *spongy* or *ulcerated conditions of the gums*, *caries of the teeth*, etc. In *chronic pharyngitis*, with tumid, pallid membranes, elongated uvula, and spongy, enlarged tonsils, it is an exceedingly useful topical agent. It overcomes the *bad breath of dyspeptics* and *scorbutics*. It is sometimes combined with hydrastis and capsicum, in *aphthæ*. The dose of myrrh, in powder or pill, is from 5 grains to ½ drachm; of the tincture, from 20 drops to 2 fluid drachms.

Specific Indications and Uses.—Chronic bronchitis, with profuse secretion of mucus or muco-pus, with difficult expectoration; membranes lax and pallid, tonsils enlarged and spongy, throat pale and tumid; soreness and sponginess of the gums; reproductive disorders of women, with weight and dragging in the parts, and leucorrhœa.

Other Myrrhs.—BISSA BOL (*Bysabole, Bhesabol*), *Hebbakhade, Habaghadi*. This species of myrrh was formerly known as *East Indian myrrh*, and is regarded in eastern commerce as a very inferior quality of myrrh. The plant yielding it is now known as *Balsamea erythræa*, Engler (see Flückiger, *Pharmacognosie*, 3d ed., 1891, p. 43). This product resembles *Herabol* or true myrrh, but has a somewhat different odor, recalling that of the mushroom. Its taste is almost acrid, and its resin is paler than that of myrrh. Carbon disulphide but sparingly dissolves it; it is almost insoluble in petroleum ether. Besides it differs from myrrh in being unaffected by bromine, the latter producing an intense violet hue with myrrh in carbon disulphide solution. W. Tucholka (*Archiv der Pharm.*, 1897, p. 290) proposes the following characteristic test for Bisabol myrrh: 6 drops of a petroleum ether extract (its concentration not to exceed 1:15) are mixed in a test-tube with 3 Cc. of glacial acetic acid, and 3 Cc. of concentrated sulphuric acid are cautiously added so as to form a lower layer. A beautiful rose-red color becomes apparent at the zone of contact; shortly afterward the whole acetic layer will be of a permanent rose-red. If the petroleum ether extract is more concentrated, the resultant color is brown. True myrrh, under the same conditions, produces merely a faint rose-red coloration of the acetic layer, and a green coloration at the zone of contact, turning brown with green fluorescence upon standing. Analysis of bisabol showed the following percentage composition: Gum, soluble in water, 22.1; gum, soluble in soda solution, 29.85; resin, 21.5; bitter principle (crude), 1.5; ethereal oil, giving the above reaction plainly, 7.8; water, 3.17; vegetable and inorganic matter, 13.4.

ARABIAN MYRRH.—This product occurs in irregular pieces very much resembling common myrrh, though it lacks the whitish markings on fracture, is less unctuous, and has a gummy appearance externally. With bromine it reacts like myrrh. It comes from Aden, being collected in Arabia by the Somalis.

Related Drugs.—BDELLIUM. Chiefly two varieties of this product are known in commerce, *Indian* and *African*. *Indian bdellium*, or *East Indian bdellium*, is believed to be the product of *Balsamodendron Mukul*, Hooker (*Balsamea Mukul*, Engler), of India, and possibly Arabia. It forms large, rounded, dusty fragments; has a flattish shell-like fracture; in thin section translucent, but in mass dark, even deep-brown, and possesses the odor and taste of myrrh in a lesser degree. Nitric acid does not impart a purplish color to the tincture of this or the next variety.

African bdellium is the product of *Balsamodendron africanum*, Arnott (*Commiphora africana*, Engler), of western Africa. It occurs in oval, or roundish, irregular translucent tears, breaking with a wax-like fracture, and ranging in color from yellowish to brownish-red. It also has a cedar-like odor and a slightly bitter taste. Bdellium is infusible, but inflammable. It consists of resin, 59 per cent; bassorin, 30.6 per cent; gum, 9.2 per cent; and volatile oil, 1.2 (Pelletier). The French use the African variety in plasters. Bdellium was once used for purposes similar to myrrh.

BALSAMUM GILEADENSE, *Balsam of Gilead*, *Balm of Gilead*, *Opobalsamum*, *Mecca balsam*.—This product is referred to a small, evergreen, non-thorny tree, the *Balsamodendron Opobalsamum*, Kunth (*Commiphora Opobalsamum*, Engler). The dried fruit of this species formerly went by the name *carpobalsamum*; the dried branchlets *xylobalsamum*; and the exudation, as *opobalsamum*. As it spontaneously exudes from the tree it is a whitish or yellowish opaque, viscid fluid, having considerable fragrance. By exposure, it solidifies. Bonastre found in it volatile oil, 10 per cent (Trommsdorff, 30 per cent); adhesive resin, 70 per cent, and hard resin, 12 per cent. Trommsdorff obtained of hard resin, 64 per cent. It is seldom found in commerce.

Balsamodendron Berryi.—An Indian thorn-tree, *Mulu Kilirary*, yielding a gum-resin in abundance, which contains 84 per cent of gum, soluble in water. This gum-resin is devoid of fragrancy and bitterness (see D. Hooper, *Amer. Jour. Pharm.*, 1889, p. 508, from *Pharm. Jour. Trans.*, 1889).

MYRTUS.—MYRTLE.

Myrtus communis, Linné.

Nat. Ord.—Myrtaceæ.

COMMON NAMES: *Myrtle*, *Common myrtle*, *European myrtle*.

Botanical Source.—The myrtle is an evergreen shrub, whose stem is from 6 to 8 feet in height and covered with a deep-grayish, fissured bark. The stem is branched, and bears opposite, ovate, lanceolate leaves of variable width, short-petioled, closely pellucid-punctate, smooth, glossy, and evergreen. The flowers are solitary, axillary, and white, or pale-pinkish, and have many stamens. The fruit is a 2 or 3-celled bluish-black, fleshy berry, subglobular, each cell containing 4 or 5 reniform, whitish seeds. The flowers, leaves, and berry are all very fragrant. The bark is astringent.

Fig. 175.

Myrtus communis.

History.—The myrtle grows in tropical and subtropical climes, often being cultivated. It is thought to be a native of the south-eastern portion of Italy, and now grows abundantly throughout the borders of the Mediterranean. Florists consider five varieties of this species. The myrtle has been held as the emblem of honor and authority, and was worn by the Athenian judges in the exercise of their functions. It constituted the wreaths of the Grecian and Roman victors, in the Olympian and other festivities. Scriptural allusions to it are abundant,, and to the Jews it was a token of peace, and entered into bridal decorations. It is a Mohammedan tradition that it was among the pure things carried by Adam from out the Garden of Eden. The leaves, berries, and twigs have been employed in flavoring food and wines, and the leaves are said to furnish a good tea (see Willis, *Practical Flora*).

The French distill an aromatic water from the leaves and flowers which they call *eau d'ange.* Myrtle was one of the medicinal plants of the ancients, and was practically obsolete in modern therapeutics until revived, in 1876, by Delioux de Savignac. In Mexico the *Myrtus Arroya*, Kunth, is substituted for myrtle. Its leaves contain a volatile oil and tannin.

Chemical Composition.—The ripe fruit of myrtle yielded Riegel (1849) resin, sugar, citric and malic acids, tannin, and volatile oil. P. Bartolotti obtained by distillation of the leaves and twigs 0.56 per cent of an emerald-green volatile oil (*Jahresb. der Pharm.*, 1891, p. 452). It is dextro-rotatory, and has a specific gravity of 0.895 to 0.915. *Myrtol* was at one time supposed to be its chief constituent; however, it is not a simple body, and consists of a mixture of pinene, cineol, and dipentene, boiling between 160° and 180° C. (320° and 356° F.) (*Amer. Jour. Pharm.*, 1891, p. 48).

Action, Medical Uses, and Dosage.—Myrtle has recently been revived as a remedy for relaxation of parts with mucous and other profluvia. The oil and the alcoholic solution of the same possess anodyne properties, less in degree, however, than that of menthol and peppermint oil. The powder, sprinkled upon cotton first impregnated with glycerin, has been applied with marked advantage to *uterine ulcerations*. *Suppurative wounds* and *ulcers*, *intertrigo*, and *eczema* have been treated in the same manner, omitting the glycerin, while in cases with *offensive discharges* and *threatened gangrene*, a wine of myrtle has been employed with the result of correcting the fetor and inducing granulation. An infusion of the leaves or the tincture, diluted, may be used for the above-named purposes, and has given excellent results when used as an injection in *uterine prolapse*, *lax vaginal walls*, and *leucorrhœa*. An infusion is likewise valuable as a topical agent in *catarrhal conjunctivitis*, *pharyngitis*, and *bronchitis*. Made into a bolus with Venice turpentine, it has some reputation as a curative agent in *hemorrhoids*. An infusion injected is said to relieve *dysentery*, while the powder in doses of 15 to 40 grains is asserted useful in *renal* and *cystic catarrh*, and *colliquative sweating of phthisis*, and in doses of 10 to 30 grains, to check the wasting in *menorrhagia*. The oil stimulates the gastric, renal, and pulmonic membranes, increasing their functions, and is reputed to possess decided antiseptic and deodorant powers. In doses of 2 minims, the oil (in capsules) every 2 or 3 hours, is asserted prompt and curative in *fetid bronchitis* and *pulmonary gangrene*. The chief advocates of the use of myrtle are Delioux de Savignac and Eichhorst. Infusion (leaves or berries, ʒii to ʒiv to water Oj) locally; for internal use should be diluted, and even then it is very unpleasant to take. A much stronger infusion of the bark may be prepared (℥i to ℥ii to water Oss). Dose, of the fine powder, 5 to 40 grains; of the oil (in capsules), 1 to 5 minims.

Related Species.—*Myrtus Chekan*, Sprengel (*Eugenia Chekan*, Molina). This Chilian shrub is known in its native land as *cheken*, *chequen*, or *chekan*. The rough brownish bark is astringent, and the leaves almost sessile, nearly an inch long, elliptic or ovate-lanceolate, smooth, pale-green, with slightly revolute margins, and beset with oil-glands, are gathered with the branchlets, for medicinal use. The leaves have a feeble, aromatic fragrance, and a bitter, pungent, aromatic taste. The leaves contain volatile oil (2 per cent, J. W. England, *Amer. Jour. Pharm.*, 1883, p. 248), soluble in alcohol, ether, chloroform, and amylic alcohol; insoluble in water. It burns with a brilliant white flame, and becomes oxidized when exposed to the air. Fritz Weiss (*Jahresb. der Pharm.*, 1888, p. 80) found it to consist of about 75 per cent of *pinene* ($C_{10}H_{16}$), 15 per cent of *cineol* ($C_{10}H_{18}O$), and 10 per cent of undetermined higher boiling fractions. The leaves, freed from the essential oil, yielded to the author the following substances: Crystallizable *chekenon* ($C_{40}H_{44}O_8$), insoluble in water, soluble in hot alcohol; amorphous, non-poisonous *cheken bitter*, soluble in all ordinary solvents except water and petroleum-ether; *chekenin* ($C_{12}H_{11}O_3$), crystallizing in yellowish plates, and probably being a di-phenol, and *chekenetin* ($C_{11}H_7O_6+H_2O$), forming yellowish, olive-colored crystals, probably related to quercetin. The mother liquor finally contained large amounts of sugar and a small amount of *choline*, which tends to explain the formation of the volatile base *chekenine*, observed by Mr. England (*loc. cit.*) upon distillation of the leaves with alkali after they were deprived of their essential oil. The leaves were also found to contain about 4 per cent of tannin (J. W. England, *loc. cit.*, and J. Hoehn, *ibid.*, p. 253). Cheken was brought forward as an efficient remedy for *catarrhal disorders of the broncho-pulmonic tract*, and similar conditions of the urinary organs. It is claimed to be a good remedy for *winter cough* and oppressed breathing. The dose of the fluid extract is a fluid drachm, 3 times a day.

Jambosa vulgaris, De Candolle (*Eugenia Jambos*, Linné; *Jambosa malaccensis*, De Candolle).—India. The flowers, leaves, and bark are used medicinally by the natives. The bark of jambosa root is astringent, and is used in India in *leucorrhœa*, *diarrhœa*, and *dysentery*. A minute portion of alkaloid (Lyons), a crystalline, non-glucosidal body *jambosin* ($C_{10}H_{15}NO_3$), and an oleoresin have been found in it (A. W. Gerrard, *Pharm. Jour. Trans.*, 1884 Vol. XIV, p. 717). The fruit is rose-flavored and pleasantly acid, and is known as *rose-apple*.

Psidium Guajava, Linné (*Psidium pomiferum*, Linne, and *Psidium pyriferum*, Linné).—West Indies and the tropics. The acidulous fruit of these species is the *guava*, much employed by the natives in jellies, etc. The aromatic leaves and astringent bark are reputed febrifuge. They contain 12 per cent of tannin, and a resinous substance *guavin* (Bertherand, 1888); the latter is believed to be the active principle.

Eugenia Jambolana, Lamarck (*Syzygium Jambolanum*, De Candolle; *Calyptranthes Jambolana*, Willdenow). *Nat. Ord.*—Myrtaceæ. *Jambul*, *Jambu*, *Java plum*.—The seeds of this plant are reputed a remedy for *diabetes*. The subacid fruit is largely eaten by the natives, and a vinegar prepared from it is regarded as carminative, stomachic, and diuretic. The whole plant is astringent, the bark being employed where astringents are indicated. The bark externally is fissured and gray: internally fibrous and red. It has a very astringent taste and the odor of oak-bark (Dymock). The fruit is purple, of the shape and size of an olive, and excessively astringent unless altered by cultivation. The fruit is employed in India in *bilious diarrhœas*, *sore throat*, and *ringworm*. The seeds have been highly lauded as a remedy for *diabetes*, the amount of sugar being appreciably reduced in a marvelously brief space of time, the patients at the same time being able to partake of amylaceous food without ill effects. It appears, however, that the opinions as to the efficacy of this remedy are divided (see *Chemist and Druggist*, 1892, Vol. XLI, p. 319). The seeds are nearly ½ inch long, and ⅓ inch wide, gray-black in color, cylindrical in shape, with one truncated and one dome-shaped extremity, very hard and nearly tasteless. Analysis by Mr. W. Elborne (1888) showed the presence of a trace of essential oil, fat, chlorophyll, gallic acid (1.65 per cent), colored extractive soluble in water, albumen, and resin soluble in ether and alcohol, all in small amounts, together with a large proportion of insoluble matter (*Pharm. Jour. Trans.*, Vol. XVIII, p. 921). The fluid extract of the seeds is administered in doses of from 30 minims to 1 fluid drachm a day, beginning with 10-drop doses 3 times a day at first, and gradually increasing each day.

NABALUS.—LION'S FOOT.

The plant *Nabalus albus*, Hooker (*Prenanthes alba*, Linné).

Nat. Ord.—Compositæ.

COMMON NAMES: *Lion's foot*, *Rattlesnake root*, *White lettuce*, *Gall of the earth*, *Cancer weed*.

Botanical Source.—This plant is an indigenous, perennial herb, with a smooth, somewhat glaucous stem, corymbose-paniculate at the summit, stout purplish, often deeply so in spots, from 2 to 4 feet in height. The radical leaves are angular-hastate, often more or less deeply 3 to 5-lobed; the uppermost cauline ones lanceolate; between these the intermediate forms hastate and ovate, petiolate, and all irregularly dentate. The heads are pendulous and glabrous; the involucre of 8 linear scales, and from 9 to 12-flowered; the scales purplish, and the corollas whitish. Pappus brown (W.—G.).

There is a variety of the above plant *Nabalus Serpentaria* (or *Prenanthes Serpentaria*), with rough, dentate leaves, of which the radical are palmate, the cauline with long foot-stalks, sinuate-pinnatifid, disposed to be 3-lobed, with the middle lobe 3-parted, the upper lanceolate. The racemes are terminal, somewhat panicled, short, nodding, with an 8-cleft calyx, and 12 florets; it is about 2 feet high, with purple flowers (W.—G.).

History and Chemical Composition.—This plant is found in moist woods and shades, in rich soils, from New England to Iowa, and from Canada to Carolina, flowering in August. The variety *N. Serpentaria* is common to the mountainous districts of Virginia, North Carolina, and other sections of the United States, and is considered more active than the *N. albus*. The root, leaves, and juice of the plant are employed. According to N. B. Williams (*Amer. Jour. Pharm.*, 1887, p. 117), the rhizome contains tannin, gum, resins, etc., and the leaves 12 per cent of ash.

Action, Medical Uses, and Dosage.—Nabalus is said to be an antidote to the *bite of the rattlesnake*, and other *poisonous serpents*. The milky juice of the plant is taken internally, while the leaves steeped in water are to be applied to the wound, and frequently changed. A decoction of the root, which is bitter, has been successfully used in the bite of the rattlesnake, also in *dysentery*. This plant is deserving further and more accurate investigation, possessing undoubted power over the nervous system. A strong tincture of the green plant (℥viii to alcohol, 76 per cent, Oj) should be employed in doses of from 1 to 20 drops in experimenting for its effects in nervous disorders.

NAPHTALINUM (U. S. P.)—NAPHTALIN.

FORMULA: $C_{10}H_8$. MOLECULAR WEIGHT: 127.7.

"A hydrocarbon obtained from coal-tar. It should be kept in well-stoppered bottles"—(*U. S. P.*).

SYNONYMS: *Naphtalene, Naphtaline.*

History and Preparation.—Naphtalin was first observed, in 1819, in the products of the distillation of coal, by A. Garden, and believed by him to be a camphor. J. Kidd (1821) gave it its present name. T. Thomson showed that it was a hydrocarbon, and M. Faraday ascertained its correct percentage composition. The view of Dumas that naphtalin exists ready-formed in coal was refuted by Reichenbach. E. Erlenmeyer established its graphic formula, the correctness of which was experimentally proved by Gräbe and others (Roscoe and Schorlemmer's *Chemistry*, Vol. III, 1892).

Naphtalin is formed by the dry distillation of wood and coal, and is obtained by fractional distillation of the resulting wood- or coal-tar, the latter containing from 5 to 10 per cent of naphtalin. It is also formed when certain organic substances, *e. g.*, oil of turpentine, camphor, even alcohol, acetic acid, etc., are allowed to pass in vapor form through red-hot metallic tubes. Naphtalin may also be obtained from the Baku and Burmese petroleum. Naphtalin is contained in that fraction of the distillation of coal-tar which distills over between 180° and 250° C. (356° and 482° F.). The condensing pipes must be kept warm in order to prevent the naphtalin from crystallizing. Upon cooling the distillate, dark-colored crude naphtalin crystallizes and is separated by straining. It is then deprived of its mother liquor (containing phenols) by pressure, and is purified by treatment with solution of caustic soda, which removes phenol; then washed with water and treated with sulphuric acid, whereby some bases (*aniline*, etc.) are removed. After washing out the acid, and drying, naphtalin is finally obtained almost pure by sublimation. Still, owing to the presence of certain phenols, it has a tendency, when exposed to light and air, to become darker in color. A mixture of manganese dioxide and sulphuric acid is then made to act upon it for about a quarter of an hour, at the heat of a water-bath; this oxidizes and removes the phenols, after which the product is washed with water and caustic soda solution, and lastly sublimed. For pharmaceutical purposes this product should then be recrystallized from alcoholic solution.

Description.—Naphtalin is officially described as occurring in "colorless, shining, transparent laminæ, having a strong, characteristic odor resembling that of coal-tar, and a burning, aromatic taste; slowly volatilized on exposure to air. Insoluble in water, but when boiled with the latter imparting to it a faint odor and taste. Soluble in 15 parts of alcohol at 15° C. (59° F.), and very soluble in boiling alcohol; also very soluble in ether, chloroform, carbon disulphide, and fixed or volatile oils. Naphtalin volatilizes slowly at ordinary temperatures; rapidly when heated. It also volatilizes with the vapors of water or alcohol. At 80° C. (176° F.) it melts, and at 218° C. (424.4° F.) it boils. Its vapor is inflammable, burning with a luminous and smoky flame. When ignited, it is consumed, leaving no residue. Naphtalin is neutral to litmus paper moistened with alcohol. On shaking a small portion of naphtalin with concentrated sulphuric acid, the acid should remain colorless; nor should it acquire more than a pale reddish tint if the mixture be heated, for 5 minutes, on a water-bath (absence of contaminations derived from coal-tar)"—(*U. S. P.*). Naphtalin is heavier than water, its specific gravity at 4° C. (39.2° F.) being 1.145.

The graphic formula for naphtalin, as given by Erlenmeyer, suggests the possibility of a number of substitution products, which are considered in detail in every text-book of organic chemistry. Diluted nitric acid converts naphtalin into phtalic acid; with concentrated nitric acid it yields *nitronaphtalenes* ($C_{10}H_7.NO_2$); these in turn are converted by reduction into crystallizable *naphtylamines* ($C_{10}H_7.NH_2$). With sulphuric acid it yields sulpho-acids. By substituting naphtalin hydrogen by one or more phenol groups (OH), the various *naphtols* are obtained (see *Naphtol*).

Action, Medical Uses, and Dosage.—Naphtalin destroys vegetable and animal parasites. It forms a popular material for protecting woolens from the moth, sometimes being called "tar camphor," "moth balls," etc. It also finds extensive application in the preparation of a great number of organic dye-stuffs (see *Aniline Colors*). Applied to the sound integument it exerts no action upon it, but if the skin be broken it causes heat and smarting, and if the raw surfaces are secreting, decomposition of the discharges is prevented. Some contend that as high as 75 grains may be taken day after day for a long time without any untoward results, owing to its limited absorption into the system. On the other hand it is claimed that even 5 grains have produced unpleasant urinary symptoms and positive suffering, with frequent, burning, painful micturition, tenesmic pain in the bladder, and a reddening of the meatus urinarius has been induced by 15-grain doses. Collapse with facial pallor has been observed in its employment for the *diarrhœa* of infants. To the taste it is sharp, acrid, and burning, and occasions an abundant secretion of froth-like or ropy sputa, on which account Dupasquier, a half century ago, brought the drug forward as an expectorant in *chronic bronchitis*. It is now used in vapor form in the *bronchorrhœa* and *chronic bronchial inflammations* of the aged, and in *pertussis*. Naphtalin possesses decided antiseptic properties. It is for this action that it has been valued in *diarrhœas* caused by fermentative changes and catarrhal states, and by the ulcerations of Peyer's patches in *enteric fever*. *Intestinal worms* have been expelled under its influence. Externally and to mucous tracts the drug has been applied for the purpose of preventing putrescency. In this manner *wounds* and *foul ulcers* have been treated with it. An ointment of lard, green soap, chalk, and naphtalin is used in *scabies*, and a 5 per cent ointment has been lauded in *prurigo* and other skin affections, while *sprains, bruises*, etc., have been treated with its alcoholic solution. A watery emulsion of naphtalin is occasionally employed in *purulent ophthalmia*, reducing the redness and swelling of the eyelids, without however, materially lessening the discharge. For local use, an ointment containing from 15 to 25 grains to the ounce of lard or other base may be used; for internal use the powder should be given in capsules in doses ranging from 3 to 30 grains. It has been very little used in Eclectic medicine.

Related Product.—DIOXY-NAPHTALENE ($C_{10}H_8O_2$). Several isomers of this body are known, all being di-phenols. The chief are *alpha-* and *beta-dioxy-naphtalenes*. Lepine found it to be active in the lower animals, producing severe convulsions. Three grains of it a day are said by Lepine to increase power in asthenic individuals.

NAPHTOL (U. S. P.)—NAPHTOL.

FORMULA: $C_{10}H_7OH$. MOLECULAR WEIGHT: 143.66.

"A phenol occurring in coal-tar, but usually prepared artificially from naphtalin. Naphtol should be kept in dark, amber-colored, well-stoppered bottles"—(*U. S. P.*).

SYNONYMS: *Beta-naphtol, B-naphtol, Iso-naphtol, Naphtol.*

Preparation.—Schäffer first prepared naphtol in 1869. By acting upon naphtalene at 200° C. (392° F.) with strong sulphuric acid, beta-naphtalene sulphonic acid ($C_{10}H_7.HSO_3$) is formed. This high temperature insures the conversion into the beta variety. At a low temperature, near 80° C. (176° F.), the *alpha* acid is chiefly produced, and is converted into the *beta* acid by elevation of the temperature. The product is dissolved in water, milk of lime added to saturation, and the calcium compound crystallized out and redissolved, this aqueous solution being then acted upon by sodium carbonate, yielding sodium naphtalene sulphonate ($C_{10}H_7SO_3Na$). The sodium compound is then added to melted caustic soda, sodium naphtol ($C_{10}H_7ONa$) and sodium sulphite (Na_2SO_3) resulting. To the sodium naphtol hydrochloric acid is added, resulting in the production of sodium chloride and naphtol. To purify the beta-naphtol it is sublimed and recrystallized from hot water or petroleum ether (benzin).

Description and Tests.—"Colorless, or pale buff-colored, shining, crystalline laminæ, or a white or yellowish-white, crystalline powder, having a faint phenol-like odor, and a sharp and pungent, but not persistent taste. Permanent in the air. Soluble at 15° C. (59° F.), in about 1000 parts of water, and in 0.75 part of alcohol; in about 75 parts of boiling water, and very soluble in boiling alcohol. Also very soluble in ether, chloroform, or solutions of caustic alkalies. When heated, naphtol sublimes easily. It is also volatilized with the vapors of alcohol or water. It melts at 122° C. (251.6° F.), and boils at 286° C. (546.8° F.). On ignition, it is consumed, leaving no residue. It is neutral to litmus paper moistened with alcohol. A cold, saturated, aqueous solution of naphtol, when mixed with ammonia water, exhibits a faint bluish fluorescence. Chlorine or bromine water, added to the aqueous solution, produces a white turbidity, which disappears on adding ammonia water in excess. On adding about 0.1 Gm. of naphtol to about 5 Cc. of an aqueous solution (1 in 4) of potassium hydrate, then about 1 Cc. of chloroform, and gently warming, the aqueous layer will acquire a blue tint, changing after a while to green and brown. Ferric chloride T.S. colors the aqueous solution of naphtol greenish, and after some time, causes the separation of white flakes, which turn brown upon the application of heat. A piece of pine wood, dipped into an aqueous solution of naphtol, and afterward moistened with diluted hydrochloric acid, becomes green on exposure to daylight. Naphtol should dissolve in 50 parts of ammonia water without leaving a residue (absence of naphtalin), and the solution should not have a deeper tint than pale yellow (absence of various other organic impurities). If 0.1 Gm. of naphtol be mixed, in a test-tube with 1 drop of syrup and 5 Cc. of water, and about 3 Cc. of concentrated sulphuric acid be then poured into the tube held in a slanting position, so that the liquids may form separate layers, a yellowish-brown color will appear at the zone of contact, which becomes darker on standing (absence of, and distinction from, alpha-naphtol, which produces at once a crimson color, turning deep blue in the upper part of the zone on standing)"—(*U. S. P.*). By E. Leger's test, the presence of *alpha-naphtol* in *beta-naphtol* may be ascertained by the following delicate reaction: Rub the naphtol in a mortar with water, until a saturated solution is obtained; then add to 10 Cc. of this solution 2 drops of a solution of *sodium hypobromite* prepared by adding 30 Cc. of soda solution, 36° B., to 100 Cc. of water, and adding 5 Cc. of bromine. The *alpha-naphtol* produces a violet color and precipitate which is still noticeable in dilution, while *beta-naphtol* merely turns yellow, then greenish, and finally yellow again (*Amer. Jour. Pharm.*, 1897, p. 369).

Action, Medical Uses, and Dosage.—Beta-naphtol is deodorant, antiseptic, antifermentative, and stimulant. Unless in strong solution, it does not stain the integument nor hair, and may be readily washed from garments. Strong solutions in water and alcohol fissure the skin, slightly staining the epidermis brown-yellow. By absorption when applied in skin affections, it has produced a sort of intoxication. A 10 to 15 per cent ointment is efficient in *itch*, *pruritis*, *prurigo*, *acne*, *morbus pediculosis*, *ichthyosis*, *herpes*, and *lupus erythematosus*, when not actively inflamed, but has proved irritating in *eczema* (Kaposi). A soapy solution has been applied in *ozœna*, *otitis*, *conjunctivitis*, etc., and the drug is given internally in *typhoid fever*, *diarrhœa*, *dysentery*, *dyspepsia*, and *cardiac dilatation*, all with fermentative changes. The dose is from 3 to 5 grains.

Beta-naphtol (5 per cent solution) has been beneficially employed once a day in *trachoma*, both acute and chronic. For a few minutes considerable irritation is produced, but this may be subdued by the application of cold water. A solution (1 in 2500) has been found efficient in *purulent ophthalmia*, but the drug is contraindicated when the cornea is ulcerated (Foltz).

Related Products.—Camphorated Naphtol. Beta-naphtol, 1 part; camphor, 2 parts. Mix. A transparent, brownish, syrup-like fluid. *Coryza*, *furunculous inflammations*, etc., are painted with this preparation which causes considerable pain.

Alpha-naphtol.—This body, as has been stated above, is produced in the same manner as *beta-naphtol*, except that a lower temperature, 80° to 90° C. (176° to 194° F.), is employed (see *Naphtol*). It is isomeric with beta-naphtol, but is more toxic, dissolves more easily in water, fuses at 94° C. (201.2° F.), and boils near 280° C. (536° F). A collyrium (1 to 5000) is employed in *purulent ophthalmias*.

Hydronaphtol.—A derivative of beta-naphtol, produced by acting upon the latter with reducing substances. It is stated to crystallize in silver-white laminæ of a slight, aromatic odor, dissolving readily in alcohol, ether, chloroform, glycerin, benzol, and fixed oils, less soluble in water (1 in 1000). It melts at about 117° C. (242.6° F.). The hydronaphtol of commerce is said to be merely impure beta-naphtol (see *Amer. Jour. Pharm.*, 1886, pp. 93 and 158). This agent was recommended as a substitute for carbolic acid, having much greater antiseptic power, is non-corrosive, non-toxic, and not destructive to garments. Organic matter is said not to decompose it. The usual antiseptic wash consists of an aqueous solution of 1 part in 1000 of water. It is said to destroy the parasite producing *tinea tonsurans*.

Benzo-naphtol, or B-naphtol Benzoate ($C_{10}H_7.O.COC_6H_5$).—This compound of benzoic acid and beta-naphtol is produced by acting upon beta-naphtol with benzoyl chloride ($C_6H_5CO.Cl$). A crystalline white powder or long, acicular, tasteless and odorless crystals, insoluble in cold water, soluble in chloroform and hot alcohol, little soluble in ether. It melts at 110° C. (230° F.). This agent slows the action of the heart and lungs, reduces temperature, and increases the renal secretions. It is used as an antiseptic and diuretic. The dose has been variously given as from 4 to 8 grains, suspended in water or syrup, while others give, as the daily dose, 30 to 70 grains. Care should be exercised in its use, as it is somewhat toxic.

B-naphtol Salicylate ($C_6H_4OH.COO.C_{10}H_7$), *Betol*, *Naphtalol*, *Salinaphtol*, *Naphtosalol*. This body is analogous to salol, splitting up in the intestines by action of the alkaline pancreatic fluid into beta-naphtol and salicylic acid. Comparing molecular weights, betol contains about 10 per cent less of salicylic acid than salol. It has a higher fusing point, 95° C. (203° F.), salol at 43° C. (109.4° F.), and is prepared like salol (which see), excepting that sodium naphtol is substituted for sodium phenol. An odorless and nearly tasteless, lustrous, crystalline powder, soluble in ether, boiling alcohol, benzol, and warm linseed oil, soluble with difficulty in cold alcohol and turpentine; not at all soluble in hot or cold water and glycerin. Cold concentrated acids or diluted alkalies scarcely affect it, but when heated with concentrated alkaline solutions, it is saponified into beta-naphtol and salicylic acid. Concentrated sulphuric acid, when pure, produces with betol a lemon-yellow solution. This, upon the addition of a minute quantity of nitric acid, becomes an olive- or brownish-green. No such changes take place with salol under like treatment. This agent is pleasant to the taste, and is not considered toxic. In doses of 4 to 8 grains, in syrup or mucilage, it is administered in *rheumatism of the joints*, *cystic catarrh*, *gonorrhœal cystitis* when the urine is ammoniacal, and in *intestinal disorders*, chiefly of children. It is eliminated by the urine, which, when treated with ferric chloride, exhibits a violet color.

Diiodo Beta-naphtol (Naphtol-aristol).—A solution of iodine and potassium iodide (2.4 parts each) is mixed with a solution containing beta-naphtol (11 parts), and sodium carbonate (4 parts). A solution of sodium hypochlorite precipitates the naphtol-aristol from the mixture. A greenish-yellow, tasteless, and odorless compound, evolving violet vapors when heated. Chloroform dissolves it freely; alcohol, acetic acid, and ether sparingly; it is insoluble in water.

Microcidin. A non-caustic, antiseptic compound, varying somewhat in composition, but containing most largely sodium-naphtol. By melting together 1 part of beta-naphtol and ½ part of caustic soda, it is obtained as a white powder. Antiseptic; said to be twenty-fold more active than boric acid, and ten-fold more prompt than phenol. A solution (1 to 5 parts in 1000 of water) is used upon *gangrenous* and *other ulcers*, and *discharging wounds*.

Alpha-oxynaphtoic acid ($C_{10}H_6OH.COOH$).—Prepared by acting upon sodium alpha-naphtol with carbonic acid gas. Crystallizes in colorless needles, in odor resembling that of naphtol; they melt at 185° C. (365° F.). Quite readily soluble in hot water; sparingly in cold water, glycerin, alcohol, and ether. It unites with alkalies to form soluble compounds. Antiseptic and disinfectant. Used in *scabies* and *other skin affections*, employed as an ointment containing 10 per cent of the acid.

Alumnol.—*Aluminum naphtolsulphonate*. Probably obtained by the double decomposition of barium naphtolsulphonate and aluminum sulphate. A non-hygroscopic, white powder, easily soluble in glycerin and cold water, less soluble in alcohol, and insoluble in ether. Its solutions in alcohol and water are acid and exhibit blue fluorescence. A solution prepared with hot water will remain clear if not containing more than 40 per cent of alumnol. It precipitates albumen and gelatin, but excess of the latter redissolves the precipitate. Ferric chloride strikes blue with the aqueous solution. Introduced in 1892 as an astringent antiseptic by Heinz and Liebrecht.

Asaprol, *Calcium beta-naphtol-alpha-monosulphonate* ($[C_{10}H_6.OH.SO_3]_2Ca+3H_2O$).—This is prepared by neutralizing its component acid with chalk, evaporating, and crystallizing the product. A neutral, crystalline, colorless powder soluble in water (1 in 1½), and alcohol (1 in 3). Introduced, in 1892, as an antiseptic by Stackler and Dubief. Used in *enteric fever*, *la grippe*, and *acute rheumatism*. Doses, increasing gradually daily, amounting to 30, 40, 50 grains a day, being given in divided quantities with plenty of water,

Cresol-naphtol.—A viscid tarry-brown liquid recommended by Guinard as an active germicide. Water produces with it an emulsion, but does not dissolve it. Though toxic poisoning is said to be seldom produced in animals, when given by mouth, from the fact that speedy emesis occurs to eject the poison. When mixed with water and applied surgically, it is apt to be deposited in the wounds, making it an undesirable remedy.

NARCISSUS.—DAFFODIL.

The bulb of *Narcissus Pseudo-Narcissus*, Linné.

Nat. Ord.—Amaryllidaceæ.

Common Name: *Daffodil.*

Botanical Source and History. This is a perennial, bulbous plant, native of the central and northern parts of Europe, and a common plant in moist woods in England. It is often cultivated in this country, especially the form with double flowers, and is among the first of spring flowers. The bulb is globular, white internally, and has a blackish coat. The leaves are all radical, linear, and about a foot long. The scape, which is a little longer than the leaves, is erect, and bears a large, terminal, nearly nodding flower of a yellow color. The flower is inclosed in bud in a membranous spathe, which splits lengthwise when the flower expands, and remains persistent at the base. The perianth has a funnel-form tube and six acute segments, about an inch long; near the mouth of the tube is borne a large bell-shape cup, about the length of the perianth segments, and with a crisped, 6-lobed margin. The stamens are 6, attached to the perianth tube, and included in the flower. The pistil consists of a 3-celled, inferior ovary, a slender style, and a 3-lobed stigma. The seeds are numerous.

Narcissus poeticus, Linné, *Poet's narcissus*, is an allied species, native of central Europe, and naturalized in many places in England; it is one of the most common of spring flowers in cultivation in this country. The ovate bulb has a brown skin, and possesses medicinal properties similar to the bulbs of *N. Pseudo-Narcissus*. The perianth segments are spreading, and of a pure white color. The cup is very short, and has a crenate, crimson margin.

Narcissus Jonquilla, Linné.—Jonquil has a scape bearing from 2 to 5 fragrant, yellow flowers.

Chemical Composition.—M. Jourdan has described a white, deliquescent, active principle, possessing emetic properties, which he named "*narcitine*," and M. Caventou obtained from the flowers an odorous, yellow coloring matter, which he termed "*narcissine*." From the bulbs, Mr. A. W. Gerrard (*Pharm. Jour. Trans.*, 1877, Vol. VIII, p. 214) obtained a small amount of a neutral crystalline body, and a non-crystalline alkaloid, somewhat analogous to atropine, to which the name *pseudo-narcissine* has been given. The flowers of the jonquil yielded Robiquet, by extraction with ether, a volatile, butyraceous, yellow oil, very fragrant, from which *jonquil camphor* crystallized out, upon cooling, in the form of yellowish, warty crystals, volatile by heat. Louis Robechek found the bulbs of *Narcissus orientalis* (Chinese lily) to contain 0.02 per cent of an alkaloid, and 0.2 per cent of a glucosid; furthermore, resin, pectin, sugar (3 per cent), mucilage (9.5 per cent), ash (3 per cent), etc. (*Amer. Jour. Pharm.*, 1893, p. 369).

Action, Medical Uses, and Dosage.—The flowers and bulbs of this plant are the parts that have been employed, and the recent, wild plant appears to possess more active properties than the cultivated. Internally, in large doses, it is an active and even dangerous article, occasioning severe emeto-catharsis and gastro-intestinal inflammations, and its local application to the surface of ulcers and wounds is stated to occasion similar results, and, in addition thereto, serious depressing effects upon the nerve centers. The alkaloid from the bulb is a mydriatic, and, in many respects, resembles atropine in action. As a medicine, narcissus is rarely employed in this country, but is said to possess emetic, cathartic, antispasmodic, and narcotic properties. It has been used in *epilepsy*, in *hysteria*, and other *spasmodic affections*. Laennec employed it with success in *pertussis*, and other European practitioners have accorded to it an efficient action in *intermittent fever*, *diarrhœa*, *dysentery*, *worms*, etc. It has likewise been found of prompt benefit in severe *catarrh*. The cases for narcissus are those exhibiting epileptoid movements of the muscles, in *chorea*, in *rheumatism*, showing muscular contractions, and in *cerebral diseases*, with dull eyes and dilated pupils. A tincture of the bulbs by maceration in 98 per cent alcohol, may be given in doses of ½ drop to 10 drops. Dose of dried flowers or bulbs, in powder, from 10 to 60 grains; from 1 to 3 grains of the aqueous extract provokes vomiting. A syrup, ethereal oil, and acetous tincture have also been employed.

Specific Indications and Uses.—Epileptiform movements and muscular contractions; eyes dull, pupils dilated.

NECTANDRA.—BEBEERU-BARK.

The bark of *Nectandra Rodiæi*, Schomburgk.

Nat. Ord.—Lauraceæ.

Common Names: *Bebeeru*, *Bebeeru-bark*, *Greenheart-bark*, *Bibiru*, *Sipiri*, (*Cortex beberu*, or *bibiru*, *Nectandra cortex* [*Br.*]).

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 219.

Botanical Source.—This is a magnificent forest tree, growing from 60 to 80 feet in height, branching near the summit, and covered with a smooth, ash gray bark. The leaves are nearly opposite, smooth, shining, coriaceous, 5 or 6 inches long, and 2 or 3 broad. The flowers are obscure, whitish-yellow, cordate, and disposed in axillary panicles. The fruit is a globular berry, about 6 inches in circumference, having a woody, grayish-brown, speckled pericarp, and a seed with 2 large, plano-convex cotyledons, which is yellow when freshly cut, and possesses an acid reaction and an intensely bitter taste. The fruit abounds in bitter starch (Schomburgk).

History and Description.—This tree is a native of British Guiana. Its bark was introduced by Dr. Rodie as an energetic tonic and febrifuge. It is in flat pieces of 1 or 2 feet in length, from 2 to 6 inches broad, and about 4 lines in thickness, dark, heavy, brittle, with a rough, fibrous fracture, dark cinnamon-brown, and rather smooth internally, and covered externally with a brittle, grayish-brown epidermis. It has little or no odor, but a strong, persistent, bitter taste, with considerable astringency. The fruit is about the size of a small peach, somewhat heart-shaped, or inversely ovate, slightly flattened, the outside coat being frangible, and the kernel pulpy. It is exceedingly bitter. The sulphate of beberine is obtained from the bark and seeds.

Chemical Composition.—The bark of nectandra contains starch, iron-greening tannin, deliquescent *bebiric acid*, melting at 150° C. (302° F.), subliming at 200° C. (392° F.), and has two alkaloids—*bebeerine* (*bibirine* or *beberine*) and *nectandrine* (*sipeerine* or *sipirine* of Maclagan, 1845). The *British Pharmacopœias* of 1867 and 1885, indicate an elaborate process for the preparation of beberine sulphate from nectandra bark. The product is probably a mixture of sulphates of *beberine* ($C_{36}H_{42}N_2O_6$), *nectandrine* ($C_{40}H_{46}N_2O_8$), and other alkaloids (Maclagan and Gamgee, *Pharm. Jour. Trans.*, 1869, Vol. XI, p. 19).

BEBERINE ($C_{18}H_{21}NO_3$, von Planta, Flückiger) is identical with the alkaloids *buxine* and *pelosine* (see *Buxus* and *Pareira brava*). It is an amorphous substance, very soluble in alcohol, soluble in ether, sparingly soluble in water.

NECTANDRINE ($C_{20}H_{23}NO_4$, Maclagan and Gamgee) is a white, amorphous powder of an intensely bitter taste, fuses in boiling water, is very soluble in chloroform, but is much less soluble in ether than beberine. One part beberine requires 104.2, 1 part nectandrine, 2500 parts of ether. When heated with strong sulphuric acid and manganese dioxide, a magnificent green color is developed, which changes to violet (similar to the analogous strychnine reaction).

Action, Medical Uses, and Dosage.—The sulphuric acid salt of the alkaloid *beberine* is employed as a substitute for quinine, in preference to the bark itself (see *Beberinæ Sulphas*).

Related Species.—*Ocotea opifera*, Aublet (*Oreodaphne opifera*, Nees). Brazil. Source of *canella de cheiro*. The fruit yields a volatile, aromatic oil, used as a liniment.

Ocotea guianensis, Aublet. Bark employed in decoction for *abscesses*.

Cryptocarya australis, Bentham, *Laurel, Moreton bay laurel, Gray sassafras.*—Australia. Insects dislike the wood on account of its odor. Bark persistently bitter through the presence of an alkaloid, which crystallizes from solution in stellate masses. It is toxic, producing in warm-blooded animals difficult respiration, ending in asphyxia and death (Bancroft, 1887; see *Useful Native Plants of Australia*, by Maiden).

Mespilodaphne pretiosa, Nees (*Cryptocaria pretiosa*, Martius).—Brazil. Source of *casca pretiosa*. A warty, cinnamon-colored bark, having a combined cinnamon-sassafras odor, and a warm, aromatic, sweetish taste.

Nectandra puchury major, Nees, and *Nectandra puchury minor*, Nees, *Pichury beans*, *Pichurim bean*, *Sassafras nuts.*—Brazil. The halves, or cotyledons, of the two sizes (one about 1½ inches long by ½ inch thick, the other about one-half that size) are oblong or round-ovate, convex on one side, flat-concave on the other, having a depressed radicle scar at one end, deep-brown or chocolate-colored externally, pale-brown internally, interspersed with oil cells, and yellow in color. The small seed are darkest in color. Both taste and odor are aromatic, recalling the combined characteristics of sassafras and nutmeg. Starch, gum, butyraceous fat (*pichurim fat*) containing laurostearin, solid fat, and volatile oil, possibly containing safrol. The "native oil of sassafras or laurel," from Venezuela, an oleoresin, described by Procter (1851) as having a pale-amber color, a penetrating, peculiar odor, and a pungent, bitter, aromatic, camphoraceous taste, and thought to be the substance employed to adulterate Maracaibo copaiva, is referred, by Prof. Carson, to this species (*Amer. Jour. Pharm.*, 1855, p. 387). Used for same purposes as the ordinary aromatics. In doses of from 10 to 20 grains, in powder or infusion, pichurim beans are given as a stimulant tonic in [illegible], as [illegible] *diarrhœa* and *dysentery* of a subacute or chronic character, and in *intestinal weakness with flatulence.* The bark, in doses of from 20 to 40 grains, has been employed in *typhoid disorders, chronic vomiting, dyspepsia, intermittents,* and *atonic menstrual derangements.*

NICCOLI SULPHAS.—NICKEL SULPHATE.

FORMULA: $NiSO_4.7H_2O$. MOLECULAR WEIGHT: 280.14.

Preparation and Description.—This salt is easily formed by dissolving metallic nickel or carbonate of nickel in diluted sulphuric acid, and concentrating the solution. When the solution contains an excess of acid, the crystals are bluish-green, quadratic pyramids of the composition $NiSO_4+6H_2O$. When it is neutral, the crystals are rhombic prisms, isomorphous with Epsom salts, sulphate of zinc, ferrous sulphate, etc., and having the composition $NiSO_4+7H_2O$. The color of the salt is a fine, deep emerald-green, its taste is sweetish, styptic, slightly acrid and persistent. At 15.5° C. (60° F.), 100 parts of water dissolve 75.6 parts of these crystals. Neither alcohol nor ether dissolves them. Exposed to the air, the rhombic prisms lose a little water, but the square prisms do not. When heated, they swell up but do not melt. At 100° C. (212° F.) a salt of the composition $NiSO_4+H_2O$ remains. The last molecule of water can not be expelled under temperatures above 280° C. (536° F.).

Nickel-ammonium sulphate ($[NH_4]_2Ni[SO_4]_2.6H_2O$) is precipitated when nickel sulphate solution is mixed with an excess of saturated ammonium sulphate solution. It is a blue-green compound, chiefly employed in the electroplater's art.

Action, Medical Uses, and Dosage.—Nickel sulphate has been asserted to act much like iron and manganese compounds, and to be less apt to nauseate than the corresponding salts of copper and zinc. However, in doses of 5 grains, both nausea and giddiness were produced by it. It appears to be a mild tonic, and pain-relieving agent, though soporific properties are not attributed to it. Sulphate of nickel was recommended by Prof. Simpson, of Edinburgh, as a tonic, in doses of from ½ grain to 1 grain, repeated every 4 or 5 hours, and given in pill form. He found it quite efficient in *periodical cephalalgia* (Braithwaite's *Retrospect*, Vol. XXVII, p. 446). *Chronic catarrh of the stomach, irregular heart action* due to valvular lesions, *diarrhœa,* and *rheumatic pains,* are other conditions in which it has been thought useful. The dose should not exceed 3 grains.

Nickel and Its Compounds.—NICCOLUM, *Nickel.* Symbol: Ni. Atomic Weight: 58.6. Nickel was first prepared from *niccolite* (*kupfer-nickel,* NiAs), a mineral known since 1694. The metal was discovered in 1751, by Cronstadt, and the discovery confirmed in 1774, by Bergmann. Nickel occurs to a slight extent in the waters of certain mineral springs, and in combination with sulphur, iron, cobalt, antimony, and arsenic, in various ores in several parts of Europe, as well as in the United States and Canada. The ore from New Caledonia is free from cobalt. It is a silicate of nickel and magnesium, and is called *garnierite.* Nickel is prepared from its ores by converting them into oxides by roasting and calcinating, and subsequently reducing the oxide formed by strongly heating with charcoal. A purer product is obtained when proceeding in the wet way (see Roscoe and Schorlemmer's *Chemistry,* Vol. II, p. 144). A remarkable method for obtaining pure nickel is that recently devised by Ludwig Mond, of England. "When nickel is heated to 80° C. (176° F.) in the presence of carbon monoxide, it is combined with the latter to nickel-carbonyl, and the latter is again decomposed into its constituent parts at 150° C. (302° F.). Mond has turned this knowledge to practical account to separate nickel from cobalt in the ore. Passing carbon dioxide over the warmed nickel (previously obtained from the ore by calcination and reduction as stated above) gaseous nickel-carbonyl is formed, while cobalt remains behind. On heating the gas, pure nickel separates, while the reformed carbon monoxide is used over and over again. A curious fact about this metallic compound is that it forms a colorless fluid which boils at a temperature lower than chloroform, 43° C. (109.4° F.)." (Adapted from *Western Druggist,* 1896, p. 120; also see *Pharm. Jour. Trans.,* 1898, Vol. VII, p. 525.) Nickel is also a constituent of meteoric masses.

When pure, nickel is white, resembling silver, is softer than iron, has the specific gravity 8.27 to 8.93, is malleable, attracted by the magnet, is not altered by the action of the air or of water, is soon tarnished when moderately heated, and forms two oxides, the *monoxide* (NiO), and *per-oxide* (*sesquioxide*) (Ni_2O_3). Only the monoxide forms salts. Nickel is used in electroplating, and forms an essential part in certain alloys, *e. g., German silver* (copper, nickel, and zinc, in the proportion of about 5:3:2), and the lower coins in some countries, including the United States. Our 5-cent coin consists of 25 parts of nickel and 75 parts of copper. Nickel is also used in the manufacture of *nickel-steel.* Its preparations are said to be poisonous. The sulphate, chloride, and bromide have been recommended for medicinal use.

NICCOLI BROMIDUM, *Nickel bromide* ($NiBr_2.3H_2O$).—Molecular Weight: 272. Prepared by digesting nickel with an aqueous solution of bromine, or by the interaction of hydrobromi acid and nickel carbonate. It forms deliquescent, green prismatic, or acicular crystals, soluble in water, alcohol, and ether. Its aqueous solution decomposes on exposure, with the deposition of nickel hydroxide. It has a sharp, hot taste. It has favorably influenced the seizures of *epilepsy*, in several instances having been effective as a nerve sedative when the alkali bromides failed, and may be used in only a third as large a dose. The dose is about 10 grains.

NICCOLI CHLORIDUM, *Nickel chloride*. This salt is prepared by dissolving the oxide or carbonate of nickel in diluted hydrochloric acid, and evaporating to dryness. The anhydrous salt is yellow; when hydrated (with $6H_2O$), it forms deliquescent, green crystals. Heated in the presence of air, it evolves chlorine, leaving nickel oxide as residue; if the air is excluded, the salt can be sublimed without decomposition. Two-grain doses have been successfully given in *anemia* and *amenorrhœa*.

NICCOLI CARBONAS, *Nickel carbonate*.—Prepared by precipitating with sodium or potassium carbonate an aqueous solution of salts of nickel. It forms a compound of uncertain basic composition, having a light or very dark-green color.

NICKEL-CARBONYL, *Carbonic oxide of nickel* ($Ni[CO]_4$).—This compound is not employed in medicine, and is extremely toxic, vapors of it producing very violent headache. It reduces bodily temperature, and is thought to act upon the blood, destroying the hæmoglobin.

NITROBENZENUM.—NITROBENZENE.

FORMULA: $C_6H_5NO_2$. MOLECULAR WEIGHT: 122.75.

SYNONYMS: *Nitrobenzol, Oil of mirbane*, etc. (see below).

Preparation and History.—This article is prepared (impure) in quantities for the purpose of manufacturing aniline colors, by acting upon benzene with a mixture of nitric and sulphuric acids, at a temperature not exceeding 50° C. (122° F.); or, by decomposing nitrate of sodium in contact with benzene, by means of sulphuric acid. In the former case, the sulphuric acid seems to concentrate the nitric acid, by abstracting water from it; and, in the latter case, it liberates nitric acid from its combination with sodium. It was discovered by Mitscherlich (1834), and was originally made by slowly adding benzene to warm, fuming nitric acid. An oily liquid separates on cooling, which is washed with water, then with caustic soda, and then distilled from chloride of calcium.

Description and Tests.—Nitrobenzene is a yellowish, oily liquid, having the odor of bitter almond oil, and a sweet but burning taste. Its specific gravity is 1.208 at 15° C. (59° F.), and its boiling point is 206° to 207° C. (402.8° to 404.6° F.) (Prof. S. P. Sadtler, *Handbook Indust. Org. Chem.*, 1895, p. 391). It is insoluble in water, but dissolves in all proportions in ether and alcohol. It forms acicular crystals at 3° C. (37.4° F.); dissolves in fuming nitric acid and in concentrated sulphuric acid, and, upon heating, is then converted into *dinitrobenzene* ($C_6H_4[NO_2]_2$).

Nitrobenzene is used in the arts for preparing aniline, and by soap manufacturers for scenting soap, under the name, oil or essence of mirbane. It is called artificial oil of bitter almonds, and has been used to adulterate the genuine bitter almond oil. Various methods have been proposed to detect the presence of nitrobenzene in oil of bitter almonds; one of these is as follows: "2 Cc. of the suspected oil are well shaken with 34 Cc. of 45 per cent alcohol. Pure oil of bitter almond will dissolve completely; but nitrobenzol or mirbane oil will gradually subside from the liquid in the course of 24 hours" (*Amer. Jour. Pharm.*, 1887, p. 557). Another process is as follows: "Warm with a little sodium hydrate, and add ferrous sulphate to destroy odor of hydrocyanic acid; an addition of considerable excess of potassium permanganate will now remove the odor of oil of bitter almond by oxidizing this compound to benzoic acid, while the treatment does not affect the nitrobenzol, which can now be easily detected by its odor" (Dr. K. List, *Chem. Ztg.*, 1888, p. 1727; also see *Amer. Jour. Pharm.*, 1889, p. 77).

Action and Medical Uses.—Nitrobenzol is a very poisonous agent, causing death in very small doses (Letheby, *Lond. Pharm. Jour.*, Sept., 1863), and whether its toxical effects be due to internal or external employment, occasioning vertigo, nervous and muscular prostrations, spasms, convulsions, dilatation of the pupils, dyspnœa, irregular action of the heart, and eventually death; consciousness being retained the most of the time. These symptoms vary in severity and in rapidity of appearance, according to the amount of the dose employed, and are supposed to be owing to the conversion of the nitrobenzol in the system into aniline. The pathological conditions after death are, congestion of the lungs, heart, and brain, and a dark, tarry appearance of the venous blood. It should never be employed in therapeutics, though it has been advised as a local remedy in the treatment of *itch* and *parasitic cutaneous maladies;* but even in these affections dangerous symptoms have followed its employment. The best means to employ in cases of poisoning by this agent, are stimulants internally, as carbonate of ammonium, etc., and externally, electro-magnetism, frictions, and baths as hot as can be used without impairing the integrity of the skin, together with the application, at the same time, of cold douches to the head and along the vertebral column.

NITROGENII MONOXIDUM.—NITROUS OXIDE.

FORMULA: N_2O. MOLECULAR WEIGHT: 43.98.

SYNONYM: *Laughing gas.*

Source, History, and Preparation.—Nitrous oxide was discovered by Priestley, in 1776. It remained of interest to the experimental chemist only until some time after Davy, in 1800 (*Elements of Chemistry*, by Lavoisier, 1802, Vol. II), discovered its wonderful action when inhaled. Then it became a curiosity, and under the name of *laughing gas*, remained such until a recent period. At present it is in extensive use throughout civilized countries for the purpose of producing temporary insensibility in dental operations. It is best to prepare it from fused nitrate of ammonium. At a certain temperature this substance splits up into water and nitrous oxide gas ($NH_4NO_3=N_2O+2H_2O$). If the nitrate of ammonium be free from chloride, no special precautions are necessary further than washing the gas with warm water; but if, as is often the case, the ammonium nitrate is impure, precautions must be taken to separate the impurities. For this purpose the following process is recommended:

Into a spacious retort introduce fused nitrate of ammonium to one-third its capacity. Connect it by means of glass tubes, with two consecutive wash bottles. The first bottle should be half filled with solution of sulphate of iron, the second with solution of caustic potash. Connect the latter bottle with the gas bag, or with a pneumatic trough containing warm water. Apply heat to the retort, and, when the temperature approaches 200° C. (392° F.), nitrous oxide gas will be abundantly disengaged. As the reaction progresses the temperature may be cautiously increased. The traces of nitric oxide will be retained by the solution of ferrous sulphate, and the free chlorine (if present) by the solution of caustic potash.

Description.—Nitrogen monoxide, or nitrous oxide, is a colorless gas, having a sweet taste and a pleasant odor. Its specific gravity is 1.52 (Colin), 1.6 (Dalton). It is somewhat soluble in cold water, and more so in alcohol. When the gas is compressed by 30 atmospheres, at 0° C. (32° F.), it liquefies to a colorless liquid. Wills has solidified it to a snow-like formation (*Jour. Chem. Soc.*, 1874). The gas supports combustion, in consequence of its ready decomposition at higher temperatures, with liberation of oxygen, which, in reality, is the combining agent. It derived the name *laughing gas*, from the curious effect it produced upon the system when mixed with oxygen and inhaled. At present, nitrous oxide gas may be obtained in our cities compressed into cylinders, and ready for use, and for dental purposes it is extensively employed in this form, and the dentist is thus saved the trouble of its preparation. *Oxygenous aerated water* is a solution of this gas in water, prepared under a 5-atmosphere pressure.

Action, Medical Uses, and Dosage.—Sir Humphrey Davy (1800) discovered that nitrous oxide possessed anæsthetic properties, and Dr. Horace Wells (1844), of Hartford, Conn., first used it to annul pain during the *extraction of teeth.* Among anæsthetics it stands remarkable for its quickness and brevity in action, and its comparative safety. The death rate from this agent is estimated at 1 in 100,000. Though seldom fatal, occasionally untoward results follow its administration, among them being convulsions, coma lasting several days, paralysis, hysteria, and albuminuria, though these effects are exceedingly rare. The first effect of the inhalation is a general stimulation of the body with accelerated, strong pulse, quick, shallow breathing, a tingling sensation throughout the system, uncommon mental activity, and a pale countenance. After inhaling the gas for a period les-than 2 minutes in duration, stertorous breathing ensues, the face becomes cyanotic, and loss of consciousness and sensation follows. If the inhalation be withdrawn before the latter effects are produced, a stage of intoxication is produced. Muscular rigidity or twitchings are sometimes observed under this agent, and occasionally hysterical manifestations and even erotic actions are observed. The high state of excitement produced, causing the individual to sing, make speeches, or to laugh immoderately, has given to this agent the popular appellative of "laughing gas." Occasionally one becomes violent under its influence. Its effects are quickly over as soon as the agent is withdrawn.

Nitrous oxide is obviously employed only where transient or quick *operations* are to be performed. It may be safely administered to young or old, and scarcely any condition contraindicates its use. The operative stage may be known by the loss of sensation when the conjunctiva is touched, and by the stertorous breathing. It is best inhaled by a mouth-piece having a valve to permit expiration, the apparatus being connected by tubing to the container, which is generally a rubber bag, or wrought-iron cylinder. The nostrils should be held closed. The chief use to which it has been put is in dentistry to allay the pangs of teeth extraction. Opening of *abscesses*, operations for *cataract*, and other operations requiring not more than 20 minutes' time, may be performed under its influence. It has been used to mitigate the sufferings of *labor*, to relieve *neuralgia* and other *painful affections*, but is now seldom employed outside of operative dentistry.

NUX VOMICA (U. S. P.)—NUX VOMICA.

"The seed of *Strychnos Nux vomica*, Linné"—(*U. S. P.*).

Nat. Ord.—Loganiaceæ.

COMMON NAMES: *Nux vomica, Nux vomica seed, Quaker buttons, Poison nut (Semen nucis vomicæ)*.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 178.

Botanical Source.—This is a moderate-sized tree, with a short, pretty thick, often crooked trunk. The branches are irregular, covered with smooth, ash-colored bark; the young shoots deep-green and highly polished. The wood is white, hard, close-grained, and bitter. The leaves are opposite, short-stalked, oval, shining, smooth on both sides, 3 to 5-nerved, or rather between that and triple, or quintuple, differing in size from 1½ to 4 inches long, and from 1 to 3 broad. The flowers are small, greenish-white, funnel-shaped, in small, terminal cymes, with a disagreeable odor. Calyx 5-toothed; corolla also 5-parted. Filaments scarcely any, or exceedingly short, inserted over the bottom of the divisions of the corolla; anthers oblong, half within the tube, and half without. Ovary superior, roundish, 2-celled, with many ovules in each cell, attached to the thickened center of the partition. Style as long as the tube of the corolla; stigma capitate. The fruit is a berry, round, about the size of a large apple, covered with a smooth, hard rind, of a rich-orange color when ripe, and filled with a white, soft, gelatinous pulp. The seeds are 5, nidulant, discoidal, with a central prominence, covered with a fine woolly substance but whitish and hard like horn internally (L.).

Fig. 176.

Strychnos Nux vomica.

History and Description.—The nux vomica tree inhabits India, along the Coromandel coast, Ceylon, and other parts of the East Indies. The wood is exceedingly bitter, especially that of the root, which is said to cure intermittent fevers and bites of venomous snakes. The pulp of the fruit is greedily eaten by various birds. The *Lignum colubrinum*, or *Snake-wood*, which is generally referred to the *Strychnos colubrina*, is also derived from the nux vomica wood. The bark contains a large proportion of brucine and some strychnine, and is said to be identical with the false angustura bark, which at one time appeared on the market. The characteristic seeds are the parts used in medicine, the Bombay variety being considered the best commercial sort. As described by the *U. S. P.*, nux vomica is "about 25 Mm. (1 inch) in diameter, orbicular, grayish or greenish-gray; soft-hairy, of a silky lustre, with a slight ridge extending from the center of one side to the edge; internally horny, somewhat translucent, very tough, with a large circular cavity, into which the heart-shaped, nerved cotyledons project. It is inodorous and persistently bitter"—(*U. S. P.*). The seeds are with difficulty reduced to a powder. An efficient method is that of the former *Edinburgh Pharmacopœia*, which directs them to be softened well with steam, and then sliced, dried, and ground. By another process the seeds may be dried whole for a few days in a drying oven, and, after breaking them into fragments, dried again by the action of warm air, and lastly powdered. The powder has a fallow-gray color, a bitter taste, and a peculiar odor, similar to that of liquorice. Concentrated sulphuric acid blackens it; nitric acid renders it a deep, orange-yellow color. Hot water and diluted alcohol dissolve the bitter, active ingredients; the last solvent acts most energetically. Ether takes up a concrete oil and some wax. The aqueous decoction is of a pale, grayish-yellow color, and intensely bitter, and becomes orange-yellow on the addition of nitric acid, and emerald-green by sesquioxide of iron, the color disappearing on the addition of hydrochloric acid. Tannic acid, or infusion of nutgalls, produces in the aqueous decoction a copious precipitate.

Fig. 177.

Seed of Strychnos Nux vomica.

Chemical Composition.—The chief constituents of nux vomica are *strychnine* (see *Strychnina*) and *brucine*, both existing in combination with *igasuric acid* (Pelletier and Caventou), a tannic principle identical with *caffeo-tannic acid* (G. Sander, 1897). A crystallizable glucosid (*loganin*, $C_{25}H_{34}O_{14}$) was discovered by Dunstan and Short (*Pharm. Jour. Trans.*, 1884, Vol. XIV, p. 1025), in the pulp surrounding the seeds, the dried pulp containing between 4 and 5 per cent. Loganin was also found in the seeds in small amounts. When gently heated with a few drops of strong sulphuric acid, a handsome red color is developed, changing to purple on standing. When boiled with diluted acids, it splits into glucose and *loganetin*. Loganin is readily dissolved by alcohol or water, but is less soluble in ether, chloroform, and benzene. A supposed third alkaloid, *igasurin* (Desnoix, *Amer. Jour. Pharm.*, 1854, p. 31), according to Shenstone (*ibid.*, 1881, p. 610) is probably nothing but impure brucine. The seeds also contain a fatty substance (3 to 4 per cent), yellow coloring matter, nitrogenous matter (11 per cent), gum, sugar, and about 1.5 per cent of ash. The amount of total alkaloids in the seeds, usually containing strychnine and brucine in about equal proportions, has been found to vary from about 2 to 5 per cent. Dunstan and Short (*Pharm. Jour. Trans.*, 1884, Vol. XV, p. 6) found specimens of Ceylon nux vomica especially rich in alkaloids, the latter amounting on an average to 1.7 per cent of strychnine and 3.2 per cent of brucine; the total amount in one instance was 5.34 per cent.

BRUCINE ($C_{23}H_{26}N_2O_4+4H_2O$) was discovered by Pelletier and Caventou in 1819. It exists in the bark and seeds of nux vomica, and in St. Ignatius' bean (see *Ignatia*). It was obtained by its discoverers from false angustura bark (formerly thought to be the bark of *Brucea antidysenterica*, Miller—hence the term *brucine*), but is now obtained as a by-product in the preparation of strychnine from nux vomica (see *Strychnina*). Shenstone (*loc. cit.*) prepared it pure by converting the base (contaminated with small amounts of strychnine) into the hydriodide, and recrystallizing the latter from alcohol repeatedly. *Brucine* slowly crystallizes in colorless, transparent, oblique, 4-sided prisms, or by rapid evaporation in pearly scales. It is odorless, intensely and persistently bitter, slightly efflorescing in the air, and fusible a little above 100° C. (212° F.). When anhydrous, it is soluble in alcohol (1.5 parts), chloroform (7 parts), and glycerin (70 parts), in 850 parts of cold water, and 500 parts of boiling water; the hydrous alkaloid ($4H_2O$) is soluble in 320 parts of cold and 150 parts of hot water and in aqua ammonia; sparingly soluble in fixed and volatile oils, and insoluble in ether. Brucine forms crystallizable salts with acids. In chlorine water brucine entirely dissolves, assuming a rose color, which ammonia converts to a dirty yellow. Nitric acid dissolves it, also with decomposition, forming a deep rose-scarlet or blood-red color, which, on warming, becomes yellow; if stannous chloride is now added a purple-violet color and precipitate is formed. This behavior toward stannous chloride distinguishes brucine from morphine. Strychnine can be quantitatively separated from brucine by Gerock's process, which consists in converting the mixture of strychnine and brucine into picrates, and warming with nitric acid of specific gravity 1.056, which destroys the picrate of brucine only. Brucine may likewise be destroyed in its mixture with strychnine by merely warming it for half an hour with nitric acid of the strength mentioned (see J. B. Nagelvoort-Flückiger, *Reactions*, Detroit, 1893, p. 137; and *Proc. Amer. Pharm. Assoc.*, 1893, p. 165).

Action, Medical Uses, and Dosage.—Nux vomica is an energetic poison, exerting its influence chiefly upon the cerebro-spinal system; it affects the spinal cord principally because the division of this cord does not prevent its poisonous influence, and, again, because when the cord is destroyed by the introduction of a piece of whalebone into the spinal canal, the convulsions immediately cease. In poisonous doses, nux vomica produces violent tetanic convulsions, without impairing the functions of the brain, with asphyxia and death. When given in doses sufficiently large to influence the system, a sensation of debility and heaviness is experienced, the spirits become depressed, the limbs tremble, and a slight rigidity or stiffness comes on when it is attempted to move. Frequently, the person can not stand erect; he staggers, and if at this time he be suddenly tapped on the ham while standing, a slight convulsive attack will often ensue, with an inability to stand. In the most severe paroxysms caused by this medicine, the patient retains his mental faculties, and the slightest motion, noise, or even a breath of wind passing over him, will excite convulsions anew, every time these occur. Sometimes, even with small doses, there will be sudden starts resembling shocks of electricity, which will be more or less severe, occasioning him to jerk the muscles acted on in this manner. It frequently occasions priapism. Of course, these symptoms vary with different persons, in proportion to their susceptibility to the influence of the medicine, and to the quantity swallowed. The usual effects of nux vomica are about as follows: in poisonous doses, stiffness, weariness, pain or rending in the limbs, violent tetanic convulsions, with short intervals of repose, acute sensibility, dreadful alarm, and finally death; in small doses, twitching of the muscles, restlessness, anxiety, and increase of urine, perspiration, etc.; when the doses are rather large, there will be more active spasm of the muscles, a tendency to lockjaw, with the preceding symptoms more or less severe. Heat in the epigastric region, constriction of the throat, headache, dizziness, and impairment of vision with closely contracted pupils, are often caused by small doses; and more especially with the corpulent and apoplectic, there will be painful sensations in the skin compared to an electric shock, or to the creeping of insects over the surface, with more or less perspiration, slight involuntary spasms of the muscles, and a very disagreeable, dreamy or vague condition of the brain. The pulse may or may not be increased in frequency. Chloroform is beneficial in poisoning by nux vomica. (For other effects, and treatment of poisoning by nux vomica and strychnine, see also *Strychninæ Sulphas*.)

In medicinal doses, nux vomica is tonic, and increases the action of the various excretory organs; it should always be given, as well as its alkaloids, in doses to fall short of any immediate sensible effects upon the system. The key-note to its use is *atony*. It was formerly employed in cases where there is a want of nervous energy, as in the treatment of *paralysis*, especially when this has been of some standing, and not occasioned by hemorrhage in the nervous centers, or inflammatory conditions of them. Strychnine is now generally used in its stead. It must not be used in recent cases, or while reaction prevails, or when signs exist either of local irritation in the brain or spinal cord, or of determination of blood toward the head.. Congestion or inflammation must always be removed before employing it. It is said to be more beneficial in *general paralysis* and *paraplegia* than in *hemiplegia*, and also in *local paralyses*, as of the *bladder*, in *amaurosis*, *impotence*, *spermatorrhœa*, *tremor of the muscles* produced by habitual intoxication, etc. It has also been beneficially employed in *neuralgia*, *chorea*, *prolapsus of the rectum*, *borborygmi of females*, *colica pictonum*, etc. A small quantity added to cathartics frequently increases their energy. *Rheumatism*, *hysteria*, *mania*, and *worms* have been successfully treated by the use of this agent.

As a remedy for *atony of the gastro-intestinal tract*, few agents equal, and none exceed nux vomica in value. The condition must not be one of irritation or inflammation, though it may be one of irritability due to atony. Often there is an enfeebled spinal innervation. The tongue is pallid and expressionless, there is *nausea* or *vomiting*, a yellow or sallow circle is about the mouth, and there is evidence of a disordered liver. There may be a yellow, pasty coating upon the tongue, yellowness of the conjunctiva, pain or fullness in the hepatic region, pain in shoulder, and colicky pains pointing to the umbilicus. With any or all of these symptoms it becomes a remedy of first importance, both for the ailments of adults and children. When nausea is due to irritating material in the stomach, nux will not be apt to relieve, but if due to simple atony, it is a positive agent. Used as above indicated, it is very valuable in *cholera infantum*, *cholera morbus*, *Asiatic cholera*, *constipation*, *chronic dysentery*, *diarrhœa of atony*, *nervous debility of the stomach*, the *gastric irritability of the dipsomaniac* (with good food and capsicum), and in *chronic non-inflammatory infantile diarrhœa*. It is especially used in *obstinate* and *habitual constipation* due to atony. A drop of nux vomica should be taken in a glass of cold water upon rising in the morning, and a regular habit of going to stool be encouraged. Nux relieves constipation due to spasmodic conditions of the bowels, and to some extent, that arising from the effects of lead. Nux is a remedy for *heartburn*, *flatulent colic*, *colic of atony* in infants, in all of which the pain centers near the umbilicus. It relieves the *vomiting of pregnancy*, of *hysteria*, and of *phthisis pulmonalis*. In *chronic dyspepsia* of an atonic character, or associated with dilatation, or flatulent distension, it is one of our best remedies. Drop doses are of great benefit in the *dyspepsia of inebriates*. Though usually contraindicated by congestion, it is nevertheless a remedy for *hepatic* and *splenic congestion*, or other parts supplied by the cœliac axis. It stimulates the sluggish portal circulation and thereby relieves the congestion dependent thereon. It is the remedy for "*biliousness*," for *hepatic colic*, when not due to calculi, and for *chronic jaundice* due to atony.

In *stomach* and *liver disorders* requiring nux, there is always a feeble and sluggish circulation, and enfeebled spinal and sympathetic innervation. These conditions are overcome by nux vomica more quickly than by any other agent. Nux vomica is more largely used in disorders of the gastro-hepatic tract than strychnine, while strychnine is generally preferred in nervous, sexual, and bladder disorders. Nux vomica frequently acts as a sedative and antiperiodic. This it does when the conditions above referred to are present. Thus it has proved exceedingly useful when nerve force was low, as in *typhoid fever*, and in *asthmatic seizures*, in both of which there was impaired spinal innervation and difficulty in breathing. It is adapted to cases where the patient awakens suddenly from sleep, with a sense of suffocation; where breathing seems to depend largely on the will power. Here strychnine is valuable. When respiration flags in *pneumonia*, nux or strychnine is demanded.

Nux and strychnine are of great value in the *urinal incontinence* of children, when not due to irritation, and the same in the aged when due to a relaxed or paralyzed sphincter with feeble circulation. It is also a remedy for *paralytic retention of urine*. It is often of value in *catarrh of the bladder*. It is a remedy for *uterine inertia*, and is said to lessen the liability to *post partum hemorrhage*. Nux has long been used in *sexual atony*, as a remedy for *impotence*, *spermatorrhœa*, *sexual frigidity* in the female, etc. In *amenorrhœa* it serves well with iron if there is weakness, constipation, anemia, and torpor. When in *dysmenorrhœa*, the discharges are premature and associated with cramps and chilliness, or in *menstrual colic* with sharp, cramp-like pain and marked atony, nux vomica is the remedy to be used. Small doses benefit *leucorrhœa* with a heavy, yellow discharge, and great torpor of the system.

Nux vomica has been praised in *amblyopia* when due to excessive use of tobacco or alcoholics, in *nervous affections of the lids*, and in *muscular asthenopia*

Foltz). Where atony of the general system contributes toward the aggravation of eye and ear disorders nux should be administered. It often aids in the cure of *conjunctivitis* and *phlyctenular keratitis*. It is of some value in *choroiditis*. In *purulent otitis media* with general lack of tone, nux is the best remedy (Foltz).

Nux vomica and its alkaloids should always be given with great care, the physician closely observing its effects. The dose of powdered nux vomica is from ½ grain to 5 grains, three or four times a day, and gradually increased to 10, or until a slight influence is observed as indicated. Specific nux vomica, tincture, or alcoholic extract, are the best forms of administration. The extract may be given in doses of from $\frac{1}{12}$ to $\frac{1}{10}$ of a grain as a tonic; and in paralytic affections from ½ grain to 2 grains in the form of a pill, and, as with the powder, gradually increased. The saturated tincture may be given in doses of from 5 to 30 drops, likewise gradually increased. For specific uses, the usual prescription is: ℞ Specific nux vomica, gtt. v to xv; aqua, fl℥iv. Mix. Sig. One teaspoonful every 1 to 3 hours, as indicated. (For further consideration, see *Strychninæ Sulphas*.)

Specific Indications and Uses.—Atonic states; tongue pallid and expressionless, uncoated, or coated with a pasty-yellowish coat; yellowness of the conjunctiva; yellow or sallow countenance, and yellowish or sallow line around the mouth; fullness and dull pain in the right hypochondrium; pain in shoulder, colicky pains pointing to the umbilicus; menstrual colic; constipation; diarrhœa of atony; functional forms of paralysis.

Related Species.—*Strychnos malaccensis*, Bentham (*Strychnos Gaultheriana*, Pierre), *Hoàng-Nàn*, *Tropical bindweed*. A climber of Malacca and neighboring isles, also of China. Its bark contains *brucine* and *strychnine*, the former preponderating. The drug closely resembles the latter alkaloid in action, producing in the inferior animals violent tetanic convulsions. In doses of 3 grains of the powdered bark, it has been employed in cases in which nux vomica is applicable.

Strychnos colubrina, Linné, yields true *lignum colubrinum*, often substituted in India for nux vomica branches. It contains strychnine and brucine.

Strychnos potatorum, Linné, *Clearing nuts*, *Indian gum nuts*, *Chilbinz*.—India. The seeds of this species are subglobular, and of a brown-gray color. They are insipid in taste, and do not contain any alkaloid (*Proc. Amer. Pharm. Assoc.*, 1893, p. 865), but an abundance of an albuminous body upon the presence of which their properties most likely depend. They are used in India to clear muddy water, and as an emetic, and in *dysenteric* disorders.

Strychnos Tieute, Leschenault.—A climbing plant of Java. A decoction of the root-bark, mixed with onions, garlic, pepper, and other substances, constitutes the arrow poison *upas tieute*. Strychnine (about 1.5 per cent) and very little brucine are the toxic principles contained in it. The seeds are lighter in color, and smaller than those of nux vomica. The seeds and the leaves, according to Boorsma, also contain 1.4 per cent of strychnine.

Akazga, *Ikaja*, *M'Boundou*, *Quai*, *Ikaju*, *Icaja*, *Boundou*.—According to Pecholier and Saint-Pierre, of France, this is believed to be a shrub of the family of Apocynaceæ, which, as with some other plants of the same family (*Nerium Oleander*, *Inee*, etc.), is used in the preparation of a violent arrow poison. More recently, however, it was ascertained to be a Strychnos species, and the poison is now accepted to be derived from *Strychnos Icaja*, Baillon (1879). The root-bark is employed. It is intensely bitter, and feebly aromatic, and contains, according to Prof. T. R. Fraser, of Edinburgh, a crystallizable alkaloid which he has named *akazgine*. Heckel and Schlagdenhauffen, in 1881, established the absence of brucine and the presence of strychnine, in Icaja poison. This is confirmed by the more recent researches of Gautret and Lautier (*Jour. Pharm. Chim.*, 1896, p. 418), who also found that the active principle is chiefly contained in the bark of the root, and is also found in much smaller quantity in the leaves and the stems.

According to Pecholier and Saint-Pierre, the bark of this shrub (*Strychnos Icaja*) is employed in infusion among the Africans on the Gabon as an ordeal liquid under the name of *M'Boundou*. The bark is macerated and the infusion given to the accused to drink, followed by certain proceedings; and if the accused can successfully pass the ordeal, he is deemed innocent of the charge against him. Its effect is to determine tetanic convulsions with rapid death. Sometimes profuse urination occurs, and the person gradually returns to health and life. From experiments on frogs, a dog, and rabbits, these gentlemen have concluded that the boundou contains a poisonous principle, soluble in water and in alcohol, which exerts an action upon the sensitive nervous system analogous to that caused by nux vomica. Administered by the stomach, or used endermically, this poison increases the number of inspirations and cardiac pulsations, succeeded by a great diminution of these movements; at the same time it causes an exaggeration of sensibility, followed by tetanic convulsions, and, finally, insensibility, paralysis, and death. Its action on the motor nervous system is only secondary, and it does not affect the contractility of the muscular system. It is not a poison to the heart, which, on the contrary, continues to pulsate for a long time after death (*Montpellier Médical*).

Ipoh. At one time believed to be derived from [illegible] or *Tuba root*. The arrow-poison of the Malays and fish poison of Java. Its active constituent, an acid resin, *derrid*, is reputed intensely poisonous, gold-fish being stupefied by [illegible] part, death following in 30 minutes. Recently (1892) Ipoh has been ascertained to be identical with [illegible], from

Antiaris toxicaria (see Wray, *Pharm. Jour. Trans.*, 1892, p. 613). The pygmies of Central Africa use an arrow-poison containing both *strychnine* and *erythrophlœine* (also see *Arrow-poisons* under *Strophanthus*).

Hedwigia balsamifera.—Habitat, the Antilles. Contains a resin and an alkaloid. The extract from root and stems acts powerfully upon the nervous system. The alkaloid acts upon the spinal cord, inducing convulsions; the resin is a paralyzer.

Hyænanche globosa (*Toxicodendron capense*).—South Africa. Contains a powerfully poisonous, bitter, neutral principle *hyænanchine*, acting much like strychnine, except that it markedly affects the cerebrum, the convulsions being of centric origin (see Engelhardt, *Jahresb. der Pharm.*, 1892, p. 55).

NYMPHÆA.—WATER LILY.

The rhizome of *Nymphæa odorata* (Dryander), Aiton (*Castalia odorata*, Dryander).

Nat. Ord.—Nymphæaceæ.

Common Names: *Water lily*, *Pond-lily*, *White pond-lily*, *Sweet-scented water lily*, *Water nymph*, *Water cabbage*.

Botanical Source.—White pond-lily has a blackish, large, fleshy, perennial rhizome, growing in mud, where the water is from 3 to 10 feet in depth. It is often as thick as a man's arm, sending up leaves and flowers to the surface. The petioles are long, somewhat semi-circular, perforated throughout by long tubes or air-vessels which serve to float them. The leaves are floating, orbicular, sometimes almost kidney-shaped, peltate, cordate-cleft at the base quite to the insertion of the petiole, lobes on each side prolonged into an acute point, entire, reddish, with prominent veins beneath, dark shining-green above, 5 or 6 inches in diameter. The flowers are large, white or rose-colored, beautiful, and fragrant. Sepals 4, lanceolate, green without, white within. Petals numerous, lanceolate, 1 to 2½ inches long, of the most delicate texture, white, sometimes tinged with purple on the outside. Stamens numerous and yellow, in several rows; filaments dilated gradually from the inner to the outer series so as to pass insensibly into petals. Anthers in 2 longitudinal cells growing to the filaments, and opening inwardly. Stigma with 12 to 24 rays, very much resembling abortive anthers, at first incurved, afterward spreading. The pericarp is berry-like, many-celled, and many-seeded (L.—W.—G.).

Fig. 178.

Nymphæa odorata.

History and Chemical Composition.—This plant grows in ponds, marshes, and sluggish streams, in most parts of the United States, flowering from June to September; the flowers shut at night and open about sunrise, and the seeds ripen under water. It is one of the most beautiful of flowers, and commands a ready sale among flower-lovers. The root is the medicinal part, and becomes light, spongy, and friable on drying. It has an astringent and mucilaginous, bitter taste, and readily imparts its virtues to water. The root should be collected in the fall, freed from dirt, cut into slices and carefully dried. Nymphæa is said to contain tannic and gallic acids, with starch, mucilage, resin, sugar, tartaric acid, etc. It probably contains several non-toxic alkaloids (see *Related Species*).

Action, Medical Uses, and Dosage.—The root is astringent, demulcent, anodyne, and antiscrofulous. Used in *dysentery*, *diarrhœa*, *gonorrhœa*, *leucorrhœa*, and *scrofula*, and combined with wild cherry in *bronchial affections*. Externally, the leaves and roots have been used in form of poultice to *boils*, *tumors*, *scrofulous ulcers*, and *inflamed skin*. In infusion, used as a gargle in *ulcers of mouth* and *throat*, and as an injection in *leucorrhœa*. I recollect a lady, who, several years since, was pronounced by several physicians to have *uterine cancer*, which resisted all their treatment; she was permanently cured by a squaw, who gave her to drink freely of the decoction of a root, which proved to be that of the white pond-lily, as well as to inject it in the vagina (J. King). It should be especially experimented with for its alterative effects and its influence on mucous tissues. A tincture may be prepared from the root (℥viii), and alcohol, 76 per cent (Oj), the dose of which ranges from 1 to 10 drops. The dose of the powdered root is ½ drachm in milk or sweetened water; but one of its best forms of administration is the infusion made by macerating for 30 minutes 1 ounce of the coarsely powdered root in a pint of boiling water, of which from 2 to 4 fluid ounces may be given 3 or 4 times a day.

Related Species.—*Nuphar advena* (R. Brown), Aiton (*Nymphæa advena*, Solander). The *Yellow pond-lily*, called also *Spatterdock*, *Frog-lily*, *Cow-lily*, etc., possesses similar properties, and may be used as a substitute for the preceding. It has a large and extensively creeping rhizome, with large, erect leaves, or floating on half-cylindrical petioles, oval, rounded at apex, with rounded, diverging lobes at base, dark shining green above, and when floating, pale and slimy beneath. Flowers rather large, globular, erect, yellow, on a thick rigid stalk. Sepals 6, the 3 outer yellow inside, the 3 inner entirely yellow. Petals numerous, small, yellow, furrowed externally, inserted with the stamens on the torus. Stamens numerous, truncated, linear. Stigma sessile, discoid, with prominent rays. Fruit an ovoid, naked pericarp, many-celled, many-seeded. It is a very common plant in ponds, ditches, muddy lakes, and mostly in shallow water (W.—G.).

Nymphæa alba, Linné, *European water lily*. The flowers of this species are official in the *French Codex* as *Nénuphar blanc*. Dragendorff (1879), and W. Grüning (*Archiv der Pharm.*, 1882, p. 604) found in the rhizome an amorphous alkaloid probably closely related to, but not identical with, *nupharin*. The rhizome, according to Grüning, also contains several tannic principles, viz., ether-soluble *tanno-nymphæin* ($C_{56}H_{52}O_{36}$), *nymphæo-phlobaphene* ($C_{56}H_{48}O_{36}$), and *nymphæa-tannic acid* proper ($C_{56}H_{58}O_{38}$). (See *Amer. Jour. Pharm.*, 1883, p. 96.) This drug was formerly employed as an aphrodisiac.

Nuphar luteum, of Smith, contains a non-toxic alkaloid, *nupharine*, a white, amorphous body, soluble in alcohol, ether, chloroform, acetone, amylic alcohol, and diluted acids. The seeds contain a tannin, *nuphar-tannic acid* ($C_{56}H_{36}O_{37}$), associated with *nuphar-phlobaphene* ($C_{56}H$[illegible]O[illegible]) (Grüning, *Amer. Jour. Pharm.*, 1883, p. 96). This agent has been employed in *spermatorrhœa*, and to arrest *nocturnal emissions*, as well as to give tone and increased power to the sexual organs. Its best effects are probably obtained in *digestive disorders* with morning diarrhœa, and in *chronic diarrhœa*. Dr. Zell Baldwin praises the fluid extract of *Nuphar luteum*, employed full strength locally, as a valuable agent in many chronic forms of *uterine disease* (*Ec. Annual of Med. and Surg.*). The dose, of a strong tincture of the fresh root, is a fraction of a drop every 3 or 4 hours.

ŒNOTHERA.—EVENING PRIMROSE.

The root, bark, leaves, and twigs of *Œnothera biennis*, Linné.

Nat. Ord.—Onagraceæ.

COMMON NAMES: *Evening primrose*, *Tree primrose*.

Botanical Source.—This is an indigenous, biennial plant, with an erect, rough, hirsute, and branching stem, from 2 to 5 feet high. The leaves are ovate-lanceolate, alternate, acute, obscurely toothed, roughly pubescent, 3 to 6 inches long, ½ to 1½ inches broad, those on the stem sessile, the radicles tapering into a petiole. The flowers are numerous, pale-yellow, sessile, odorous, in a terminal, somewhat leafy spike; they are nocturnal, open but once by night, and continue only a single day. The calyx tube is 2 or 3 times longer than the ovary, deciduous, 4-lobed, and reflexed. Petals 4, equal, obcordate, or obovate, inserted into the top of the tube. Stamens 8, a little shorter than the petals. Anthers mostly linear. Capsule oblong, somewhat tapering above, 3-celled, and 4-valved. Seeds numerous, naked, and in 2 rows in each cell (G.—W.).

Fig. 179.

Œnothera biennis.

History. Tree primrose grows throughout the country in fields and waste places, flowering in July and August. There are several varieties of it, as *Œ. muricata*, *Œ. grandiflora*, *Œ. parviflora*, *Œ. cruciata*, and *Œ. canescens*. When growing in retired, isolated places, a white substance appears on the leaves, rendering them apparently very downy. By cultivating the plant, its flowers improve, growing much larger, and acquiring a darker hue. Each flower opens at the dusk of evening, and does not close till about 9 or 10 o'clock the next morning, after which they do not open again. Pursh remarks that he has "frequently observed a singularity in this plant, and it might be interesting to make further inquiry into its cause; it is that in a dark night, when no objects can be distinguished at an inconsiderable distance, this plant, when in full flower, can be seen at a great distance, having a bright white appearance, which probably may arise from some phosphoric properties of the flowers." The bark, leaves, and twigs are the parts used. Their taste is very viscid, with a subsequent slight acrimony, which last is diminished by desiccation. Water takes up the properties of the plant.

Chemical Composition.—The stem of this plant contains tannin (Braconnot). Mucilage is abundant. The *œnotherin* of Chicoisneau (1834) is composed of several substances, and has not been well studied. The alcoholic extract of *Œ. biennis* sometimes deposits crystals of potassium nitrate (*Amer. Jour. Pharm.*, 1884, p. 365).

Action, Medical Uses, and Dosage.—An ointment made by boiling the twigs, leaves, and bark, in lard or tallow—or a strong decoction of these—has been found very efficient in curing *tetter*, *milk-scall*, and other cutaneous affections of infants. Collect the material when the plant is in flower. In fomentation, or when recent, the bruised leaves form an excellent application to *ulcers*. Internally, œnothera has been used for a number of purposes, and its specific field of action seems none too well established. It has, however, been accorded a place in the treatment of *gastro-intestinal disorders* of a functional character. Dr. Scudder points out as the indications for it, a sallow, dirty skin, with full and expressionless tissues, an expressionless face, an unnatural and large tongue, having the sallow, dirty hue of the skin, and the patient's mentality is of a gloomy and despondent character. Under these conditions he has employed it with success in *dyspepsia*, *hepatic torpor*, *splenic and mesenteric glandular enlargements*, and in *female disorders*, with torpor and pelvic fullness. The dyspepsia met by it is that form associated with vomiting, distressing sensations after taking food, restlessness at night, and frequent desire to pass urine. When *cholera infantum* and *watery diarrhœas* assume a choleraic form, it has been asserted to act well, as it does in *dysentery*, with marked tenesmus and bloody stools. The intestinal irritation and consequent liability to destructive inflammation of Peyer's patches, in *enteric fever*, is said to be lessened by the timely administration of œnothera (Webster). It relieves difficult respiration and *chronic asthma*, with gastric complication. The dose of the fluid extract ranges from 5 to 30 drops; of a strong tincture of the recent plant (98 per cent alcohol), from 1 to 15 drops.

Specific Indications and Uses.—Sallow, dirty skin, tissues full and expressionless, tongue unnatural in size and color, being large and of the dirty color of the skin, face dull and apathetic; dyspepsia, with vomiting of food, and gastric distress, with desire to urinate frequently; choleraic and dysenteric discharges; nocturnal restlessness; innervation feeble; patient gloomy and despondent; atonic reproductive wrongs of the female, with pelvic fullness.

OLEA.—OILS.

The term *Oil* applies to a number of unctuous bodies not miscible with water, from both the vegetable and animal kingdoms, which are fluid at ordinary or slightly elevated temperature. When placed upon paper they render it translucent, or impart to it a greasy stain. Oils may be conveniently divided, with reference to their volatility, into two great classes: *Fixed* or *fatty oils* and *fats*, to which also belong the *waxes* (see *Cera*), and *volatile* or *essential oils*. Intermediate between the two, although chemically unlike either, stand the *mineral oils* and *mineral waxes*, or *paraffins* (see *Petrolatum*).

Olea Fixa.—FIXED OR FATTY OILS (*Olea pinguia*). Fixed oils derive their name from not being volatilized by the vapors of boiling water. The difference between fatty oils and fats is merely one of consistency, the former being liquid, the latter solid or semisolid at ordinary temperatures. In the vegetable kingdom, fixed oils are mostly derived from the seeds of dicotyledonous plants, although monocotyledonous plants, such as the palm trees, furnish several of the technically important fixed oils. The oil often constitutes a large proportion of the seeds, *e. g.*, not less than 25 per cent in linseed, 50 per cent in walnuts, about as much in almonds, as against about 2 per cent in cereals. It is obtained from the crushed oil-bearing material, either by cold or warm pressure, in hydraulic presses, or by extracting with such solvents as carbon disulphide, or by boiling the crushed material with water, whereby the oil floats on top and may be conveniently collected. The residual press-cakes, obtained in the first process (*oil cakes*), are valuable feed material for cattle, since they contain much nitrogenous and fatty matter (see table in Prof. S. P. Sadtler's *Handbook of Indust. Org. Chem.*, 2d ed., 1895, p. 70).

The oils and fats derived from the animal kingdom, are obtained from various organs of the animal; thus, bone-oil from bones, by boiling with water, or extraction with solvents; neat's-foot oil from the feet of oxen by boiling with water; cod-liver oil and shark oil, from the respective livers, by spontaneous exudation and gentle expression; tallow and lard from the internal abdominal fat of sheep and hogs (see *Sevum* and *Adeps*), etc. The crude oils and fats as obtained in the manner alluded to, are mostly of a yellow, brown or even black color, and frequently require more or less purification. This is often effected by mechanical treatment, such as filtration with or without charcoal, etc., but more frequently, by chemical processes, especially treatment with 1 or 2 per cent of strong sulphuric acid (applicable, for example, to linseed oil), or with zinc chloride, or alkalies, tanning materials and oxidizers, such as potassium bichromate, hydrogen peroxide, etc.

The fatty oils of marine animals, and those from most vegetable sources, are fluid at ordinary temperature: palm oil, cacao-butter, nutmeg butter, cocoanut oil, and others, are semisolid like butter. When exposed to cold, fixed oils solidify at temperatures varying with the oil. Fatty oils are insoluble in water, rendering that fluid milky when agitated with it, but the oil finally rises upon the surface; if a mucilaginous substance, or alkaline carbonate be added, the oil is prevented from rising, and a permanent milky mixture called an *emulsion* is formed. With the exception of castor oil and croton oil, fatty oils are nearly insoluble in cold alcohol. They dissolve readily, however, in ether, carbon disulphide, chloroform, benzol, petroleum benzin, amyl alcohol, acetone, and oil of turpentine, and freely mix with one another, as well as with resins and volatile oils. They are all lighter than water, their specific gravities ranging from 0.879 to 0.968. Fatty oils are not volatile as such, but can be heated to boiling (at about 315° C., or 600° F.) whereby decomposition takes place, acrid fumes of *acrolein* (see *Glycerin*) being evolved, together with carbonic acid gas, some volatile organic acids and inflammable hydrocarbons. Upon condensing the vapors, an empyreumatic oil is obtained. When in the state of vapor, fixed oils take fire upon the approach of an ignited body; the products of combustion are water and carbonic acid gas.

As to their chemical nature, most fatty oils are mixtures of salts of the trivalent alcohol *glycerin* ($C_3H_5[OH]_3$), with the saturated *palmitic* ($C_{16}H_{32}O_2$) and *stearic acids* ($C_{16}H_{36}O_2$), both higher homologues of acetic acid, of the general formula $C_nH_{2n}O_2$, and the unsaturated *oleic acid* ($C_{18}H_{34}O_2$), which represents the series $C_nH_{2n-2}O_2$. The salts are called *glycerin esters*, or *glycerides*, and are known respectively as *palmitin*, *stearin*, and *olein*. The former two are solid and preponderate in solid fats—*e. g.*, lard—while olein is liquid and predominates in liquid fats—*e. g.*, olive oil and almond oil. The solid and liquid constituents of a fatty oil are frequently separated by subjecting the oil to hydraulic pressure at about the temperature of melting ice. Olive oil, for example, is differentiated into a purified olive oil and solid olive oil stearin, lard into lard oil and lard stearin, sperm oil (from the head of *Physeter macrocephalus*) into purified sperm oil and solid *spermaceti* (see *Cetaceum*), etc. In some fats—*e. g.*, butter—part of the fatty acid is replaced by lower fatty acids—*e. g.*, butyric, or in porpoise oil, by valerianic acid—both occurring as glycerin esters, *butyrin*, *valerin*, respectively (see also *Glycerin* and *Adeps*). In drying oils (see below), oleic acid is in part replaced by the still more unsaturated *linoleic acid* ($C_{16}H_{28}O_2$) of the type $C_nH_{2n-4}O_2$), the chief constituent of linseed oil, which is the type of drying oils. The waxes have an analogous, yet different composition (see *Cera* and *Cetaceum*). The presence of certain albuminous matters in fatty oils, and other causes as well, often induce the liberation of free fatty acid, especially the ill-smelling lower volatile acids. Thus butyric acid is formed in old butter, causing what is known as *rancidity.* Olive oil, palm oil, etc., are also liable to become rancid with age. Oils which have a tendency to liberate free fatty acids are undesirable for lubricating purposes. Neat's-foot oil hardly possesses this tendency. Mineral oils (see *Petrolatum*) are now frequently employed as lubricants, owing to their indifferent chemical nature.

When fatty oils and fats are treated with caustic alkalies, they are decomposed (*saponified*) into glycerin and the alkali salts of the fatty acids that were combined with glycerin. These alkali salts are called *soaps*, and the process is that of *saponification*. Analogous decomposition may also be effected by means of caustic lime, or oxides of heavy metals (see *Emplastrum Plumbi*), or by superheated steam (see *Glycerinum* and *Sapo*). For analytical purposes, this reaction is likewise of great importance. Since each ester requires a definite amount of caustic potash solution for saponification, values expressing the number of grammes of the fat or oil which are saponifiable by one gramme-equivalent of the caustic alkali employed, have been obtained for all fatty oils and waxes (Koettstorfer's *Saponification Equivalent*). The values obtained present some striking differences in various classes of oils, and may serve as useful guides in the detection of adulterations by certain oils. Thus, paraffin oils, on account of being hydrocarbons, are unaffected by caustic alkali, and, if mixed with fatty oils, will raise the saponification equivalent of the latter upon saponification of the oil. Washing out the soap with water will allow of the recovery of the admixed paraffin oil (see table and comment, by A. H. Allen, *Commercial Organic Analysis*, Vol. II, Part I, 3d ed., Philadelphia, 1899, pp. 53–58, and p. 111). An additional important analytical method is based upon the absorption of bromine (Mills) or iodine (Hübl) by the different oils when they are in contact with solutions of these elements. Oils in which the glycerides of saturated acids (carbon atoms united by single bonds) dominate, as, for example, cocoanut oil, absorb much smaller quantities of halogens than those oils containing a highly unsaturated fatty acid (with two pairs of carbon atoms united by double bonds)—*e. g.*, the glyceride of linoleic acid, the chief constituent of linseed oil. (For details, see A. H. Allen, *loc. cit.*, pp. 62–66; and S. P. Sadtler, *loc. cit.*. 2d ed., 1895, pp. 78 and 79.)

Parallel with their capacity for absorbing halogens, runs the well-known quality of fatty oils to absorb oxygen by prolonged exposure to the air, and to become more or less dry and solid. Accordingly, fatty oils are differentiated into *drying oils* and *non-drying oils.* The type of drying oils is linseed oil, and of the non-drying, olive oil (see enumeration of both classes of oils in the table subjoined).

Drying oils are also characterized by not yielding solid *elaïdin* when treated with nitrous acid in form of gas or in solution, while non-drying oils by virtue of their olein contents, when treated with nitrous acid gradually become a hard mass of *elaïdin*, an isomer of olein (compare *Acidum Oleicum*). (For a special description of the more important oils, see the authorities quoted; the pharmacopœial oils are described under their respective headings.)

The following general classification of the fatty oils and waxes is adapted from A. H. Allen (*Commercial Organic Analysis*, 3d ed., Philadelphia, 1899, Vol. II, Part I, p. 88; and S. P. Sadtler, *Handbook of Indust. Org. Chem*, 2d ed., 1895, p. 51):

Classification of Fatty Oils and Waxes.—I. Olive-oil Group. *Vegetable oleins, Vegetable non-drying oils.* Lighter than Groups III, IV, and V. Specific gravity, 0.914 to 0.920. Yields solid elaidins with nitrous acid. Moderate saponification equivalents and iodine absorptions. Includes olive, almond, peach, and earthnut oils.

II. Rape-oil Group.—All oils from *Cruciferæ.* Less perfectly *non-drying oils.* Yield pasty elaïdins; have higher iodine absorptions and high saponification equivalents. Includes oils of rape-seed (colza), cabbage seed, black and white mustard.

III. Cotton-seed Oil Group.—Specific gravity, 0.920 to 0.926. Intermediate between drying and non-drying oils. Undergo more or less drying on exposure. Yield little or no elaïdin. Includes oils of cotton-seed, grape-seed, maize, sesame, sunflower, hazelnut, and beechnut.

IV. Linseed-oil Group.—*Drying oils.* Specific gravity, 0.924 to 0.937. Yield no elaïdin. Less viscous than the preceding groups. Includes oils of linseed, hemp-seed, poppy seed, tobacco seed, niger seed, Scotch fir-seed, and walnut.

V. Castor-oil Group.—*Medicinal oils.* Very viscous and of high specific gravity 0.937 to 0.985. Includes castor and croton oils, both distinguished by their solubility in alcohol and glacial acetic acid.

VI. Palm-oil Group.—Solid vegetable fats. Do not contain notable quantities of esters of lower fatty acids. Includes palm-oil, cacao butter, nutmeg butter, bayberry tallow, and shea or galam butter.

VII. Cocoanut-oil Group. Solid vegetable fats, of high specific gravity and low saponification equivalents. Members of sub-group A (cocoanut, palm-kernel, laurel, and macassar oils contain notable proportions of esters of lower fatty acids, distilling over in a current of steam. Sub-group B are wax-like and of peculiar composition. (Japan wax, myrtle wax.)

VIII. Lard-oil Group.—*Animal oleins.* Do not dry notably on exposure, and give solid elaidins with nitrous acid. Not turned brown by boiling with caustic alkalies (difference from marine animal oils). Includes neat's-foot oil, bone oil, lard oil, and tallow oil.

IX. Tallow Group.—*Solid animal fats.* Predominantly glycerides of palmitic and stearic acids, although butter contains glycerides of lower acids, notably butyric acid. Includes tallow (suet), lard, bone fat, wool fat (suint), butter fat, oleomargarine, and manufactured stearin.

X. Whale-oil Group.—*Marine animal oils.* Offensive fishy odor, especially on warming. Reddish-brown color upon warming with caustic alkali. Dries more or less upon exposure and yields but little elaïdin. Includes whale, porpoise, seal, menhaden, cod-liver, and shark-liver oils.

XI. Sperm-oil Group.—*Liquid waxes.* Are not glycerides, but are esters of higher monatomic alcohols of the methane series. Yield solid elaïdins. Includes sperm oil, bottle-nose oil (dœgling oil), and dolphin oil.

XII. Spermaceti Group.—*Waxes proper.* Are esters (organic salts) of higher monatomic alcohols with higher fatty acids in free state. Includes spermaceti, beeswax, Chinese wax, and carnauba wax.

In the early days of Eclecticism a few plant preparations in which the natural oil of the drug was intimately associated with other proximate constituents, were introduced under the name oil, and as such are still employed. Among these may be named oil of stillingia, oil of capsicum, and oil of lobelia. These preparations are made by exhausting the thoroughly dried drug (stillingia root, capsicum, and lobelia seed) with official alcohol, and then distilling the alcohol until the residue is syrupy. This product in each case is a mixture that carries the therapeutical qualities of the drug in a marked degree of concentration, but consists largely of foreign substances. The "oil of stillingia" is prone to gelatinize, but the others keep fairly well. (Compare *Oleoresinæ.*)

Olea Volatilia.—Volatile Oils (*Essential oils*). Volatile oils (essential oils) are aromatic liquids of vegetable origin, practically insoluble, or but slightly soluble in water, and capable of being distilled with more or less facility in the vapors of boiling water, even though their own boiling points lie considerably higher. Like fatty oils, they render paper translucent, but the oily stain produced gradually disappears upon exposure. With one exception (*Oil of Aspidium*) essential oils have been obtained from phanerogamous plants only, in which, as a rule, they occur ready-formed. Some oils, *e. g.*, of bitter almond, black mustard, or sweet birch, originate in definite compounds contained in the plants (*amygdalin*, *sinigrin*, *gaultherin* respectively), and are evolved therefrom in the presence of water by the action of certain ferments or enzymes (*emulsin*, *myrosin*, *betulase*) that are likewise present.

All parts of a plant, leaves, flowers, fruits, stems, and roots may yield essential oils, although the oil is in most cases derived only from one or two of these organs. In a few cases, such as Chinese cinnamon (Cassia cinnamon), oil of uniform quality may be obtained in fair quantities from various parts of the plant, while reversedly, in Ceylon cinnamon (*Cinnamomum zeylanicum*) the oils yielded by the bark, the leaves, and the root differ materially in their chemical composition.

Some essential oils, *e. g.*, of bitter orange, oil of lemon, etc. (which see), are prepared by expressing the rind of the fruit containing the oil. Certain oils used in perfumery, which are sensitive to heat, *e. g.*, the odoriferous principles of hyacinth, jasmine, etc., are obtained by maceration, especially by abstracting the aroma by means of liquid fats or semisolid paraffins (*enfleurage*). Again, synthetic oils, such as artificial methyl salicylate, are obtained by laboratory processes which are briefly described under their respective headings. All other oils are obtained by distillation with the vapors of boiling water. Directions for the pharmaceutical preparation of essential oils were given by the older pharmacopœias, for example, the *Edinburgh* and the *Dublin Pharmacopœias* (see this *Dispensatory*, preceding editions).

The technical preparation of essential oils in the different countries producing them is carried out by distilling the oil from the oil-bearing material, mixed with water, by means of steam, which either runs into the material direct, or is applied to the vessel externally by means of a steam-jacket. In some cases (*e. g.*, eucalyptus oils) the oil-bearing material is deprived of its oil by direct steam without previous maceration. Rectification of the crude oils thus obtained is effected by fractional distillation either at atmospheric pressure, or, if decomposition is to be feared, at reduced pressure, whereby the boiling point is lowered.

The advances made within comparatively recent years in the theoretical study of essential oils has been the cause of a simultaneous development of this branch of chemical industry. By operating upon the basis of exact physical and chemical investigation, the manufacture of essential oils has been carried to a degree of refinement well illustrated by the classical work now before us, *Die Ætherischen Oele*, by E. Gildemeister and Frederick Hoffmann, published within recent months by Messrs. Schimmel & Co., of Leipzig. We are greatly indebted to this invaluable work, which we freely consulted in the preparation of this paper, but which, in its complete form, should be in the hands of every pharmacist.

Most essential oils are colorless or yellowish, although some are greenish or bluish-green, while others, like oil of thyme, soon acquire a dark red-brown color. Some oils deposit a crystalline body upon standing, often called a *stearopten* or *camphor;* the fluid portion being termed an *elæopten*. Such deposits are formed, for example, in the oils of neroli, chamomile, matico leaves (Flückiger's *matico camphor*), elecampane (*alant camphor*), etc. Other oils produce crystalline deposits at low temperatures, *e. g.*, anise oil deposits *anethol*, American peppermint oil *menthol;* Japanese peppermint oil is a semisolid mixture of menthol and liquid oil.

The specific gravities of essential oils vary more than those of fatty oils. While all of the latter class are lighter than water, a number of essential oils, such as those of bitter almond, cassia, cinnamon, cloves, sassafras, mustard, and wintergreen, are heavier than water. The specific gravities vary from 0.800 for oil of heracleum and 0.833 for oil of rue, to 1.187 for oil of wintergreen. All essential oils are soluble in absolute alcohol, ether, chloroform, benzene, benzol, carbon disulphide, etc.; most of them also form clear solutions with weaker alcohol, of even as low strength as 70 per cent by volume. This property assists us in recognizing many adulterations, *e. g.*, mineral oils and most fatty oils. An important agency in the identification of an essential oil consists in its behavior toward a ray of polarized light, which is determined by means of *polarimeters* (*polariscopes*). (See article on "The Polarimeter and Its Use in Pharmacy," by Dr. Charles Symes, in *Amer. Jour. Pharm.*, 1880, p. 44, where there is also appended a list of specific gravities and optical rotations for a number of essential oils.)

Most essential oils readily undergo a change in color, consistency, and composition if exposed to air and light, and gradually change in odor; hence the necessity of keeping them in well-stoppered bottles, preferably of amber color, protected from air and light. The constituents of essential oils are of a far greater variety than those of fatty oils, and may be conveniently classed as follows (adapted from the work above quoted):

I. HYDROCARBONS.—*Paraffins* (C_nH_{2n+2}), and *olefines* (unsaturated paraffins C_nH_{2n-4}) are sometimes found in essential oils, such as arnica flowers, matricaria (*matricaria-camphor*), oil of bay (*myrcen*, $C_{10}H_{16}$), etc. Other hydrocarbons of occasional occurrence are *para cymol* ($C_{10}H_{14}$) in oil of thyme, etc., and *styrol* ($C_6H_5.CH:CH_2$) in oil of storax. By far the most important essential oil hydrocarbons are those known as the TERPENES. They are isomers of the formula $C_{10}H_{16}$, unsaturated, boiling between 150° and 180° C. (302° and 356° F.). They are optically dextro- or lævo-rotatory, or inactive, and comprise the following: (1) *Pinene;* (2) *camphene*, solid, melting at 50° C. (122° F.); (3) *fenchene;* (4) *limonene;* (5) [illegible]; (6) *sylvestrene;* (7) *terpinene;* (8) *phellandrene.*

SESQUITERPENES are hydrocarbons of the formula $C_{15}H_{24}$; they boil between 250° and 280° C. (482° and 536° F.); their specific gravity is above 0.90; they comprise: (1) *cadinene;* (2) *caryophyllene;* (3) *humulene;* (4) *cedrene*, etc.

POLYTERPENES.—Diterpenes and triterpenes, boiling above 300° C. (572° F.). They have been little investigated.

The following classes comprise substances which constitute the characteristic odoriferous principles of the oils in which they occur:

II. ALCOHOLS.—(1) *hexyl-* ($C_6H_{13}OH$) and *octyl-alcohol* ($C_8H_{17}OH$) in heracleum oils; (2) *linalool* (*coriandrol*) ($C_{10}H_{18}O$) in oils of bergamot, coriander, etc.; (3) *geraniol* (*rhodinol*, $C_{10}H_{18}O$) in oils of rose and lemon grass; (4) *citronellol* ($C_{10}H_{20}O$), in oils of geranium and rose; (5) *terpineol* ($C_{10}H_{18}O$), in oils of cajeput and camphor; (6) *borneol* ($C_{10}H_{18}O$) in Borneo camphor; (7) *menthol* ($C_{10}H_{20}O$).

III. ALDEHYDES.—(1) *Citral* (*Geranial*) ($C_{10}H_{16}O$), the aldehyde of geraniol; in lemon-grass oil; (2) *Citronellal* ($C_{10}H_{18}O$), in citronella oil; (3) *furfurol* (C_4H_4O), in oil of cloves; (4) *benzaldehyde* ($C_6H_5.CHO$), in oils of bitter almond and cherry laurel; (5) *salicylic aldehyde* ($C_6H_4OH.CHO$), in spiræa oil; (6) *anis-aldehyde* ($C_6H_4.OCH_3.CHO$), in old anise oil; (7) *cumin aldehyde* ($C_6H_4.C_3H_7.CHO$), in oil of Roman chamomile; (8) *vanillin* ($C_6H_3.OH.OCH_3.CHO$), (9) *heliotropin*, in spiræa oil; (10) *cinnamic aldehyde* ($C_6H_5CH:CH.CHO$), in cassia and cinnamon oils; (11) *ortho-cumar-aldehyde methyl-ether* ($C_6H_4.OCH_3.CH:CH.CHO$), in oil of cassia.

IV. KETONES.—(1) *Methyl-amyl-ketone* ($CH_3.CO.C_5H_{11}$), in oil of cloves; (2) *methyl-heptenone* ($C_8H_{14}O$), allied to linalool; (3) *carvone* ($C_{10}H_{14}O$), in oil of caraway; (4) *anis-ketone* ($C_6H_4.OCH_3.CH_2.CO.CH_3$); (5) *Japan camphor* ($C_{10}H_{16}O$) (see *Camphora*); (6) *fenchone* ($C_{10}H_{16}O$), liquid, in oil of fennel; (7) *thujone* (*tanacetone*) ($C_{10}H_{16}O$), in oil of thuja; (8) *pulegone* ($C_{10}H_{16}O$), in oil of pennyroyal; (9) *menthone* ($C_{10}H_{18}O$), in oil of peppermint; (10) *irone* ($C_{13}H_{20}O$), in oil of orris root.

V. ACIDS.—*Acetic, propionic, butyric, valerianic, tiglinic acids*, seldom free, mostly as esters, combined with higher alcohols. Furthermore, *benzoic, salicylic*, and *cinnamic acids*. LACTONES.—*coumarin* and *hydrocoumarin*, *alanto-lactone* (*helenin*) in oil of elecampane; OXIDES.—*Cineol* (*eucalyptol* $C_{10}H_{18}O$), occuring in many oils, especially from *Artemisia cina*, cajeput and eucalyptus.

VI. PHENOLS and PHENOL-ETHERS.—(1) *Vanillin*; (2) *anethol*; (3) *para-cresol methyl-ether* ($C_6H_4.CH_3.OCH_3$), in ylang-ylang oil; (4) *carvacrol* (*iso-propyl ortho-cresol*), in oil of *Monarda fistulosa*, etc.; (5) *thymol* (*iso-propyl meta-cresol*), in oil of thyme, etc.; (6) *chavicol* (*para-allyl-phenol*), in Java betel-leaf oil, and oil of bay; (7) *methyl-chavicol*, in anise oil; (8) *eugenol* (*allyl-guaiacol*) ($C_6H_3.C_3H_5.OCH_3OH$), in oil of cloves; (9) *safrol* ($C_{10}H_{10}O_2$), in sassafras and camphor oils; (10) *asarone* ($C_{12}H_{16}O_3$), in oil of *Asarum europæum*; (11) *apiol* ($C_{12}H_{14}O_4$), from oil of parsley.

VII. MUSTARD OILS.—Contain sulphur compounds.

The more important of these constituents will be briefly described under the oils wherein they chiefly occur. Since the chemical nature of essential oils is in many cases well-defined, it often permits of a more or less exact quantitative determination of their characteristic constituents. Thus, *esters, e. g.*, linaloyl acetate in oil of bergamot, may be determined by their saponification value (compare *Fatty Oils;* also see *Cera*); certain *aldehydes, e. g.*, cinnamic aldehyde in oil of cassia, by means of the crystalline compounds they form with sodium bisulphite; *phenols, e. g.*, eugenol in Ceylon cinnamon oil, by the loss of volume which the oil incurs by being shaken with solution of caustic potash. An interesting analytical method, applicable to oils containing an *alkyl-oxy-group* (*e. g., methoxy*, OCH_3) as anethol in anise oil (which see), consists in determining the *methyl-number, i. e.*, the number of milligrammes of methyl that is split off when 1 gramme of oil is boiled with hydriodic acid (measured by the amount of silver iodide that is precipitated when the vapors of the methyl iodide formed are conducted into an alcoholic solution of silver nitrate). Since alcohol also gives a methyl-number when subjected to this reaction, the latter may serve as a good test for alcohol in such oils as do not contain a methoxy-group, and consequently do not yield a methyl number, as bitter almond, bergamot, caraway, lemon, cubeb, eucalyptus, lavender, peppermint oils, etc.

Owing to their high price, essential oils are frequently subject to adulteration. If a few drops of the oil in question be placed on filtering paper, the odor will sometimes indicate impurities. An addition of *alcohol* reduces the specific gravity of the oil. Larger quantities may be recognized by shaking out with water, distilling the aqueous liquid and testing the distillate for alcohol by the iodoform test, viz., by warming with sodium carbonate and iodine, whereby iodoform is precipitated. Or, shaking the oil with dry chloride of calcium (Borsarelli), or acetate of potassium (J. J. Bernoulli), will separate the alcohol from the essential oil. *Oil of turpentine* is the adulterant most frequently used. It may often be recognized by its odor. Its presence affects the specific gravity and the solubility of the oil in 70 per cent alcohol. Its chief constituent being *pinene*, the presence of this body in oils not naturally containing it, proves the presence of turpentine. Addition of *fatty oils* to essential oils may be recognized by a permanent greasy stain they leave on paper, upon prolonged exposure. Their presence may also be detected by distilling the essential oil with the vapors of boiling water, and heating a portion of the residue on platinum foil, or in a dry test-tube with acid potassium sulphate, whereby the irritant vapors of acrolein are evolved. Treatment with 70 per cent alcohol, in which all fatty oils, including castor oil, are insoluble, will also reveal their presence in many oils. *Mineral oils* (petroleum) are easily separated and recognized by reason of their insolubility in alcohol, their low specific gravity, and their inability to saponify with alkalies.

Some essential oils as stated above, contain small quantities of paraffins as regular constituents. *Oils of cedar*, *copaiba*, and *gurjun balsam*, are also used as adulterants of essential oils, and are detected with difficulty. They dissolve with difficulty in alcohol of 70 to 90 per cent, are strongly lævo-rotatory, and boil at temperatures above 250° C. (482° F.).

OLEA INFUSA (N. F.)—INFUSED OILS.

Preparation.—"The dry herb, in moderately coarse (No. 40) powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; alcohol, one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]; water of ammonia (*U. S. P.*), four grammes (4 Gm.) [62 grs.]; lard oil, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]; cotton seed oil, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]. Moisten the powdered herb with a sufficient quantity of the alcohol and water of ammonia previously mixed, then pack it tightly into a stone or enamelled iron vessel of suitable capacity, pour on the remainder of the ammoniated alcohol, cover it well, and allow the mixture to macerate for 24 hours. Then add one hundred and twenty grammes (120 Gm.) [4 ozs. av., 102 grs.] of the mixed oils, digest, under frequent agitation, during 12 hours, at a temperature between 50° and 60° C. (122° and 140° F.), transfer the mixture to a strainer, and express strongly. To the residue, returned to the vessel, add the remainder of the oils, digest and express in the same manner, and unite the expressed portions. *Note.*—This process is a modification of that prescribed by the *German Pharmacopœia*. The alcohol and free ammonia are dissipated during the digestion. Infused oils are usually prepared only from so-called narcotic plants, but it is known that only a portion of their active constituents is taken up by the oil. The above process is to be used for the preparation of *Oleum Hyoscyami* of the *German Pharmacopœia*, and similar infused oils"—(*Nat. Form.*).

The uses of the infused oils will be those of the ingredients which enter into their composition.

OLEANDER.—OLEANDER.

The leaves of *Nerium Oleander*, Linné.

Nat. Ord.—Apocynaceæ.

COMMON NAMES: *Oleander*, *Laurier rose.*

Botanical Source.—The oleander bush is an arborescent shrub, having branches ternately divided, and coated with an almost smooth bark of a grayish or greenish-gray color. The smooth, coriaceous, deep-green, almost sessile leaves, are in whorls of three; above, they are glossy; beneath, grayish or pale-green. They are linear-lanceolate, acuminate, entire, marked with delicate, feather veins, and about 4 to 6 inches long. The flowers are beautiful, and of a rose or white color, and waxy appearance.

Fig. 180.

Nerium Oleander.

History and Chemical Composition.—The leaves of this ornamental shrub, grow wild in northern Africa, western Asia, and the south of Europe. They have been used in the treatment of epilepsy, but without apparent benefit. All parts of the shrub are cardiac poisons. The acrid and bitter leaves of Nerium Oleander contain, according to Schmiedeberg (1882), three glucosids, namely: non-basic, amorphous, poisonous *oleandrin*, discovered by Leukowsky (1864), who believed it to be an alkaloid; *nerein* (*neriin*), considered by Schmiedeberg to be identical with *digitalein* (see *Digitalis*), and crystallizable *nerianthin*, free from nitrogen. (For details regarding the study of Oleander, see Husemann and Hilger, *Pflanzenstoffe*, 1884, p. 1331.)

From the bark of Nerium Oleander, E. Pieszczek (*Archiv der Pharm.*, 1890, p. 352) isolated a new, poisonous, nitrogen-free glucosid, *rosaginin*, in the form of warty crystals, melting at 171° C. (339.8° F.), soluble in strong alcohol with neutral reaction, nearly insoluble in water, petroleum ether, chloroform and ether if free from alcohol. In addition were obtained, bitter, amorphous *neriin*, of

Schmiedeberg, nitrogen-free, lemon-yellow, soluble in water and absolute alcohol with neutral reaction, insoluble in ether and petroleum ether, and producing a purple-violet coloration when dissolved in concentrated sulphuric acid and brought into contact with bromine vapor; a *volatile oil* of an unpleasant odor, and a crystallizable, fluorescent body occurring more pronouncedly in older bark, probably identical with *umbelliferon*. The oleander of Algeria, upon incision of the twigs, yields a poisonous exudate which is said to contain *strophanthin* (*Amer. Jour. Pharm.*, 1899, p. 281). The flowers of the oleander are reputed to yield a poisonous honey. The exhalation of the flowers of oleander in bedrooms is said to have caused death (see Pieszczek, *loc. cit.*).

Action, Medical Uses, and Dosage.—According to Orfila, Kurzak, and others, all parts of the oleander plant are poisonous. From experiments upon birds and the lower animals, it was determined that both the voluntary and involuntary muscles were paralyzed by it, and the voluntary muscles were somewhat convulsed. When death ensues, respiration is first arrested and then the heart's action stops. The action of the active constituents has been compared to that of digitalis. Water in which oleander leaves have lain, is said to have caused the death of animals, and the flesh of fowls has been rendered sufficiently toxic to be fatal to man. Rats are said to be poisoned by the bark, and *pediculi* destroyed by a decoction of the leaves. In fatal cases, the heart has been found flaccid, and the larger venous trunks filled with a dark-colored blood. The chief therapeutic use that has been made of oleander, is in *epilepsy*, and it has been abandoned in that malady as useless. From its decidedly toxic power over the heart, it seems worthy of an investigation as a cardiac remedy. In fact it has been found to act well in *valvular affections*, rapidly slowing the heart's action, reducing the œdema, and relieving the dyspnœa. Some have preferred it to digitalis in *atheromatous states*. It is actively diuretic, and occasionally purges. The dose, in infusion or tincture, represents from 1 to 3 grains of fresh bark or dried fruit.

Related Species.—*Nerium odorum*, Aiton (*Nerium odoratum*, Lamarck). India. Wild and cultivated. Closely resembles the preceding plant, but its flowers are fragrant, its leaves longer, and has a paracorolla which is fringed. Greenish, in 1881, isolated two toxic, bitter glucosids, and a fixed oil. *Nerodorin* is a yellow, tenacious, transparent varnish, soluble in chloroform, somewhat less in alcohol, and little soluble in water. According to Schmiedeberg, it is analogous to oleandrin, while *neriodoriin* is a lemon-yellow powder, insoluble in chloroform, but soluble in water and alcohol, and resembling neriin. Neither are dissolved by carbon disulphide, benzin or benzol.

Geissospermum læve, Baillon.—A Brazilian tree known in its habitat as *pao pereira*. The bark is very bitter, and contains three alkaloids. *Geissospermine* ($C_{19}H_{24}N_2O_2 + H_2O$, O. Hesse, 1877), crystallizable, melting at 160° C. (320° F.), is insoluble in water and ether, not easily soluble in cold, but readily soluble in warm alcohol; soluble in concentrated sulphuric acid to a colorless liquid which soon turns blue; it is poisonous, and causes death by paralysis. *Pereirine* ($C_{19}H_{24}N_2O$, O. Hesse), an amorphous alkaloid, soluble in alcohol, ether, chloroform, nearly insoluble in water. Nitric acid dissolves it with blood-red color which does not turn violet with stannous chloride (difference from *brucine*, see *Nux Vomica*). Large doses cause paralysis, fever, and death. *Villosine* ($C_{23}H_{26}N_2O_4$, M. Freund and Fauvet, *Jahresb. der Pharm.*, 1893, p. 513, and 1895, p. 449) is a well-crystallizable alkaloid, insoluble in water, soluble in chloroform, alcohol, warm benzol and petroleum benzin, partly soluble in ether. According to analysis by T. Peckolt (*ibid.*, 1896, p. 40), the air-dried bark contains *pereirine*, 2.72 per cent; *geissospermine*, 0.125 per cent; wax, starch, resin, etc. The leaves, but not the bark, contained tannic acid. The bark is an antiperiodic also.

Parameria vulneraria, Radlkofer.—Philippine Islands. A climbing plant, the bark and leaves of which, when boiled in cocoanut oil, yield a peculiarly odorous, yellow substance known as *Cebu balsam* (*Balsamo de Tagulaway*). An aromatic resin, 3 per cent, and caoutchouc, 8.5 per cent, are yielded by the bark of the root (Zipperer, *Archiv der Pharm.*, 1885, p. 81). The oily, yellow-white liquid is applied to *wounds* and *cutaneous affections*.

Thevetia yccotli, De Candolle (*Cerbera thevetioides*, Kunth). The tree known in the Mexican Cordilleras as the *joyote*. It inhabits the damp, hot sections of the mountains. The fruit is applied to *hemorrhoids*. The seeds, which are known as joyote seeds are very acrid and poisonous. A. Herrera (*Amer. Jour. Pharm.*, 1877, p. 145) obtained, by pressure, 40 per cent, of a fixed oil, and a crystallizable, acrid glucosid which he called *thevetosin*. Merck (1894) isolated another glucosid which he named *cerberid*. It is a cardiac poison.

Thevetia neriifolia, De Candolle (*Cerbera Thevetia*, Linné). West Indies. Bark of this shrub used as an antiperiodic. It yields the crystallizable glucosid *thevetin*, discovered by De Vrij. By treatment with diluted acids, it splits into sugar and a resinoid body, *the* [illegible]. *Thevetin* ($C_{54}H_{84}O_{24}$) is bitter, odorless, soluble to some extent in cold water, more soluble in alcohol and acetic acid. *Thereresin* ($C_{48}H_{70}O_{17}$) is a white powder, and is but slightly dissolved by hot water. Both principles are toxic. Thevetin is a cardiac, and to some extent a respiratory paralyzer. Its effects are practically identical with those of digitalin. Its identity with *cerberin* and *tanghine* has been questioned. The latter is the active constituent of the "Madagascar ordeal bean," from the *Tanghinia venenifera*; the former, the active constituent of *Cerbera odallum*. Gaertner. *Thevetia ovata*, De Candolle, and *Thevetia cuneifolia*, De Candolle, have properties similar to *yccotli*, and are known as *narcisos amarillos* and also as *joyote*. This bark is a drastic cathartic, and the fruit causes emesis.

OLEATA.—OLEATES.

M. L'hermite (1854) proposed solutions of alkaloids in *oleic acid* as substitutes for the oleaginous and glycerinic solutions of these bases. He objected to the oils from their incapability of dissolving the alkaloids, and to the glycerin from its not possessing unctuous properties. His suggestions passed largely unnoticed until the matter was revived, in 1872, by Prof. John Marshall. Oleic acid triturated with the alkaloids dissolves these and their salts perfectly, and the solutions, if desired, may be perfumed. When either alkaloids or metallic oxides are treated with oleic acid, a salt known as an *oleate*, is produced. The *oleates*, as employed medicinally, are solutions of these normal salts (true oleates) in an excess of oleic acid. Heat should be avoided where possible, though in many instances a moderate degree of heat is permissible.

Oleates, especially of the metallic oxides, are also prepared by double decomposition between a salt of the base selected and a sodium or potassium oleate or castile soap (sodium oleo-palmitate), with the last-named soap yielding an impure oleate. Prof. J. M. Good (*Proc. Mo. Pharm. Assoc.*, 1891) suggests dissolving the alkaloids in just sufficient oleic acid to effect solution, and then diluting with almond oil or other bland oil.

The oleates possess the properties of their bases, and are employed like the ointments of the same bodies, being, however, more cleanly and finer in appearance, and, on the other hand, more irritating, unless diluted with some bland oil. They should not be applied with friction, but should be gently applied with the finger or brush. (For a short treatise on the oleates, see G. M. Beringer, *Amer. Jour Pharm.*, 1889, pp. 593–600; also see John V. Shoemaker, *The Oleates*, Phila., 1885.)

OLEATUM VERATRINÆ (U. S. P.)—OLEATE OF VERATRINE.

Preparation.—"Veratrine, two grammes (2 Gm.) [31 grs.]; oleic acid, ninety-eight grammes (98 Gm.) [3 ozs. av., 200 grs.]. To make one hundred grammes (100 Gm.) [3 ozs., 231 grs.]. Rub the veratrine with a small quantity of oleic acid, in a warm mortar, to a smooth paste. Then add the remainder of the oleic acid, previously warmed, and stir frequently until the veratrine is dissolved"—(*U.S.P.*).

This preparation contains 2 per cent of veratrine. The other alkaloidal oleates may be made after this formula, when a 2 per cent strength is desired; should a 5 per cent preparation be wanted, as is usually the case with cocaine and morphine, use 5 parts of the alkaloid and 95 parts of oleic acid. Quinine oleate is usually 25 per cent in strength; for making this use 25 parts of the alkaloid and 75 parts of oleic acid.

Action and Medical Uses.—This oleate is just half the strength of *veratrine ointment*. It is employed in localized *neuralgia*, and well adapted for inunction purposes. Where it is desired that the alkaloid shall not be absorbed the ointment is preferable.

Other Oleates.—Oleatum Aconitinæ (N. F.), *Oleate of aconitine*. "Aconitine, alkaloid, two grammes (2 Gm.) [31 grs.]; oleic acid, ninety-eight grammes (98 Gm.) [3 ozs. av., 200 grs.]. Triturate the aconitine with a small portion of the oleic acid in a mortar, then incorporate the remainder of the oleic acid, and stir the mixture frequently until the alkaloid is dissolved. *Note.*—The market affords a variety of aconitines made by different processes, by different manufacturers, and of greatly different potency. Only the pure crystallized or crystallizable alkaloid, prepared by Duquesnel's method, or at least one equal to it in strength, should be used for this preparation"—(*Nat. Form.*). This agent, in very small amounts, is employed as a topical application for *local neuralgias* (see article by E. R. Squibb, in *Amer. Jour. Pharm.*, 1882, p. 572). This preparation is a dangerous remedy, and is seldom employed by Eclectic physicians.

Oleatum Bismuthi, *Oleate of bismuth*.—Rub to a fine powder, 480 grains (1 troy ounce) of bismuth oxide, dried at 100° C. (212° F.) until it no longer loses weight, and mix thoroughly with 175 grains of purified oleic acid. Add water, 2 parts, and boil until complete saponification takes place, adding water to replace that lost by evaporation. When the process has so far proceeded that a portion of the oleate, when dropped into water, assumes an ointment-like consistence, without separating any free oleic acid, the operation may be considered finished. This method was proposed by G. M. Beringer (*Amer. Jour. Pharm.*, 1889, p. 599). The uses of the oleate are those of bismuth oxide.

Oleatum Hydrargyri (*U. S. P.*), *Oleate of mercury, Mercuric oleate.*—"Yellow mercuric oxide, thoroughly dried, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; oleic acid, eight hundred grammes (800 Gm.) [1 lb. av., 12 ozs., 96 grs.], to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Introduce the oleic acid into a capacious mortar, and gradually add to it the yellow mercuric oxide by sifting it upon the surface of the acid, and incorporate it by continuous stirring. Then set the mixture aside in a warm place, at a temperature not exceeding 40° C. (104° F.), and stir frequently, until the oxide is dissolved"—(*U. S. P.*). Contact with metals must be avoided in its preparation. The above oleate is of a yellow color, and firm, butyraceous consistence. It contains 20 per cent of the yellow oxide, and is rather an unstable compound. It is employed like mercurial ointment. The *British Pharmacopœia* (1898) prepares it by the interaction of mercuric chloride with oleic acid and hard soap.

Oleatum Plumbi (N. F.), *Lead oleate.*—"Lead acetate, seventy-five grammes (75 Gm.) [2 ozs. av., 282 grs.]; solution of sodium oleate (N. F. 246), two thousand cubic centimeters (2000 Cc.) [67 fl℥, 301 ♏]; acetic acid (*U. S. P.*), water, each, a sufficient quantity. Dissolve the lead acetate in four thousand cubic centimeters (4000 Cc.) [135 fl℥, 122 ♏] of water. Should the solution be turbid or opalescent, add to it acetic acid, in drops, until it has become clear. Then filter, if necessary, through a pellet of absorbent cotton placed in the neck of a funnel, and mix it slowly, and under constant stirring, with the solution of sodium oleate. Heat the mixture to boiling, transfer it to a strainer, and when the liquid has drained off, wash the residue with four thousand cubic centimenters (4000 Cc.) [135 fl℥, 122 ♏] of boiling water. Lastly, take the mass from the strainer, remove any occluded water by pressure, and transfer it, while warm and soft, to suitable vessels. This product contains an amount of lead corresponding to about 28 per cent of lead oxide. *Note.*—The theoretical yield of lead oleate obtainable from 75 grammes of lead acetate is 143 grammes; in practice, about 125 grammes will be obtained. Lead oleate prepared by the above process is of about the consistence of lead plaster, and may be converted into an ointment by mixing with it such a proportion of oleic acid as may be required"—(*Nat. Form.*). Its uses are practically those of lead acetate, locally applied.

Oleatum Quininæ (N. F.), *Oleate of quinine.*—"Quinine (*U. S. P.*), dried at 100° C. (212° F.), until it ceases to lose weight, twenty-five grammes (25 Gm.) [386 grs.]; oleic acid, seventy-five grammes (75 Gm.) [2 ozs. av., 282 grs.]. Triturate the quinine with the oleic acid, gradually added, then apply a gentle heat, and stir frequently, until the quinine is dissolved. The product contains 25 per cent of dry quinine. *Note.*—When the official quinine ($C_{20}H_{24}N_2O_2.3H_2O$) is not available, the quantity corresponding to 25 grammes of dry quinine may be prepared as follows: Take 34 grammes of official quinine sulphate, dissolve it in 200 grammes of water with the aid of a sufficient quantity of diluted sulphuric acid, then precipitate the quinine by means of water of ammonia, added, under constant stirring, until it is in slight excess. Transfer the magma to a close muslin strainer, previously wetted, allow the liquid to drain off, and wash the precipitate with ice-cold water, until the washings are practically tasteless, but using not more than about 200 grammes of water. Lastly, dry the precipitate. The theoretical quantity of dry quinine obtainable from 34 grammes of the sulphate is 25.27 grammes. In practice, approximately 25 grammes will be obtained"—(*Nat. Form.*). Its uses are those of quinine by inunction.

OLEATUM ZINCI (U. S. P.)—OLEATE OF ZINC.

Preparation.—"Zinc oxide, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; oleic acid, nine hundred and fifty grammes (950 Gm.) [2 lbs. av., 1 oz., 223 grs.]. To make one thousand grammes (1000 Gm.) [2 lbs., 3 ozs., 120 grs.]. Introduce the oleic acid into a capacious capsule, and gradually add to it the zinc oxide by sifting it upon the surface of the acid, and incorporate it by continuous stirring. Set the mixture aside for a few hours, and then heat it on a water-bath, frequently stirring, until the oxide is dissolved"—(*U. S. P.*).

This oleate is of soft, ointment consistence, and contains 5 per cent of zinc oxide. That of the *British Pharmacopœia* (1885) contains 10 per cent of oxide of zinc, and is a much firmer preparation. Uses, those of zinc oxide, locally applied.

Oleatum Zinci (N. F.), *Zinc oleate.*—"Zinc acetate, crystallized, one hundred and fifteen grammes (115 Gm.) [4 ozs. av., 25 grs.]; solution of sodium oleate, five thousand cubic centimeters (5000 Cc.) [169 fl℥, 33 ♏]; water, a sufficient quantity. Dissolve the zinc acetate in ten thousand cubic centimeters (10,000 Cc.) [338 fl℥, 66 ♏] of cold water, filter the solution, if necessary, through a pellet of absorbent cotton placed in the neck of a funnel, and then mix it slowly, and under constant stirring, with the solution of sodium oleate. Transfer the mixture to a wetted muslin strainer, and when the liquid has drained off, wash the precipitate with water, until the washings are practically tasteless. Lastly dry the precipitate, spread on paper, by exposure to dust-free air, without heat. The product contains an amount of zinc corresponding to about 13 per cent of zinc oxide. *Note.*—The theoretical yield of zinc oleate obtainable from 115 grammes of zinc acetate is 287.5 grammes; in practice, about 265 grammes will be obtained. Zinc oleate, prepared by the above process is in the form of a soft, white powder, and may be converted into a plaster or ointment by mixing it with such a proportion of oleic acid as may be required"—(*Nat. Form.*).

Powdered Zinc Oleate.—Dissolve castile soap, 1 ounce, in water, 2 pints; also dissolve zinc acetate, 360 grains, in water, 4 pints. Both solutions being cold, add the soap solution slowly to the zinc solution, with constant stirring. The precipitate should now be collected, washed well with cold water, and dried without heat. This is the method of Parsons.

OLEORESINÆ.—OLEORESINS.

Oleoresins are those substances obtained from vegetable medicines by means of ether (sometimes alcohol, etc.), which consist principally of a fixed or volatile oil and a resin. In some cases the resin will be held in solution in the oil, while in others it will be deposited upon standing, and will require agitation to again diffuse and suspend it in the oil. A third case occurs in which the oil and resin form a more or less permanent mixture, having the consistence of a very soft extract. The resins in these preparations, like the essential oils, are generally mixtures of two or more resins, but which on account of their unequal solubility in different menstrua, may frequently be isolated from each other. Often the resins are formed by the oxidation of the essential oils contained in the plants, or of a certain portion of these oils. In many instances, especially with the oleoresins obtained from alcoholic tinctures, it will be better not to distill off the remaining third of the alcohol from the water, until the oleoresin has spontaneously precipitated and been separated from the liquid, because an elevated or too prolonged heat will injure the preparation. All these oleoresins should be kept in well-stopped vessels.

Mr. N. H. Rittenhouse, in the process for obtaining oleoresins, recommends the use of 1½ ounces of ether for each ounce of drug treated, followed by sufficient benzin to make the amount of percolate equal to the amount of ether employed, as both economical and satisfactory (*Proc. Amer. Pharm. Assoc.*, 1866, p. 208). The expense may be considerably reduced by recovering a part of the ether distilled for employment in future operations. The suggestion of Mr. George M. Beringer (*Amer. Jour. Pharm.*, 1892, p. 145), to use acetone in place of ether can not but be regarded favorably. It is equally as efficient, has a higher boiling point than ether, and is much less expensive.

OLEORESINA ASPIDII (U. S. P.)—OLEORESIN OF ASPIDIUM.

Synonyms: *Oleoresin of male fern*, *Liquid extract of male fern*, *Oleum filicis maris*, *Oleoresina filicis*, *Extractum filicis liquidum*, *Oleoresin of fern*, *Ethereal extract of fern.*

Preparation.—"Aspidium, recently reduced to No. 60 powder, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]; ether, a sufficient quantity. Put the aspidium into a cylindrical glass percolator, provided with a stop-cock, and arranged with cover and receptacle suitable for volatile liquids. Press the drug firmly, and percolate slowly with ether, added in successive portions until the drug is exhausted. Recover the greater part of the ether from the percolate by distillation on a water-bath, and, having transferred the residue to a capsule, allow the remaining ether to evaporate spontaneously. Keep the oleoresin in a well-stoppered bottle. *Note.*—Oleoresin of aspidium usually deposits on standing, a granular-crystalline substance. This should be thoroughly mixed with the liquid portion before use"—(*U. S. P.*).

Or, by percolation, exhaust coarsely powdered root of male fern, any quantity, with ether, a sufficient quantity. Distill off three-fourths of the ether, and, having placed the remainder of the solution in an evaporating dish, allow it to evaporate spontaneously.

Description.—A thick, deep-green or brownish-green liquid, having a bitterish, nauseous, subacrid taste, and the odor of male fern. On standing it deposits *filicic acid* in granules, hence the above pharmacopœial direction to shake the oleoresin before use. Only such parts of the rhizomes as are greenish in color should be employed in making this oleoresin; the rhizome with the stipes gives a brown product.

Action, Medical Uses, and Dosage.—This may be used in all cases where male fern is indicated, for which see *Aspidium*. Six grains in capsule, with or without a like quantity of ether, may be given every quarter hour until 1½ or 2 drachms have been taken.

OLEORESINA CAPSICI (U. S. P.)—OLEORESIN OF CAPSICUM.

SYNONYM: *Ethereal extract of capsicum.*

Preparation.—"Capsicum, in No. 60 powder, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]; ether, a sufficient quantity. Put the capsicum into a cylindrical glass percolator, provided with a stop-cock, and arranged with cover and receptacle suitable for volatile liquids. Press the drug firmly, and percolate slowly with ether, added in successive portions, until the drug is exhausted. Recover the greater part of the ether from the percolate by distillation on a water-bath, and, having transferred the residue to a capsule, allow the remaining ether to evaporate spontaneously. Then pour off the liquid portion, transfer the remainder to a strainer, and, when the separated fatty matter (which is to be rejected) has been completely drained, mix the liquid portions together. Keep the oleoresin in a well-stoppered bottle"—(*U. S. P.*).

Or, exhaust finely powdered capsicum, any quantity, in a percolating apparatus, by ether, a sufficient quantity. Distill off three-fourths of the ether, and, having placed the remainder of the solution in an evaporating dish, allow it evaporate spontaneously.

Description.—This oleoresin consists of a thick oily liquid holding the active principle *capsaicin* (see *Capsicum*), and a fatty substance which gradually separates when the fluid is allowed to rest, and which may be separated by decantation or straining. The oleoresin forms a thick, dark-brownish fluid possessing in a high degree the acrid, burning taste of the capsicum, which is slightly soluble in water or vinegar, but very soluble in alcohol, ether, oil of turpentine, and the caustic alkalies, forming reddish-brown solutions. Benzin is an excellent solvent of capsicum, and may be employed in the above process instead of ether.

Action, Medical Uses, and Dosage.—As this oleoresin is a very powerful stimulant, it may be added to liniments, poultices, etc., whenever excessive stimulation or rubefaction is desired. It is entirely too active to employ as an internal remedy, except in very small doses, not exceeding 1 drop, which should be greatly diluted with syrup, glycerin, mucilage, or olive oil. Thus used it may prove useful in *delirium tremens*, and *torpid conditions of the stomach.*

OLEORESINA CUBEBÆ (U. S. P.)—OLEORESIN OF CUBEB.

Preparation.—"Take of cubeb, in No. 30 powder, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]; ether, a sufficient quantity. Put the cubeb into a cylindrical glass percolator, provided with a stop-cock, and arranged with cover and receptacle suitable for volatile liquids. Press the drug firmly, and percolate slowly with ether, added in successive portions, until the drug is exhausted. Recover the greater part of the ether from the percolate by distillation on a water-bath, and, having transferred the residue to a capsule, allow the remaining ether to evaporate spontaneously. Keep the product in a well-stoppered bottle. *Note.*—Oleoresin of cubeb deposits after standing for some time, a waxy and crystalline matter, which should be rejected, only the liquid portion being used"—(*U. S. P.*).

Description.—This oleoresin is of a deep brownish-green, or bright green color, according to the amount of chlorophyll present in the cubebs. It contains active resins (*cubeb resin* and *cubebic acid;* see *Cubeba*) and volatile and fixed oils, its relative fluidity depending on the quantity of the oil present. *Cubebin* and waxy matter are also present, and will deposit on standing. These should be separated by decantation, as their presence adds nothing of special value to the preparation.

Action, Medical Uses, and Dosage.—(See *Cubeba.*) Dose, 1 to 30 minims, in capsule or on sugar.

OLEORESINA CYPRIPEDII.—OLEORESIN OF CYPRIPEDIUM.

Synonym: *Cypripedin.*

Preparation.—By percolation, exhaust coarsely powdered root of yellow ladies' slipper any quantity, with alcohol a sufficient quantity. Distill off about two-thirds of the alcohol, and add the residue to two or three times its volume of water; by distilling off the remaining alcohol, or by allowing the mixture to stand, the oleoresin precipitates. Collect it, wash it in clear water, allow it to subside, and then separate it from the water by decantation and filtration. The result is a dark substance of the consistence of a soft extract.

Action, Medical Uses, and Dosage.—This oleoresin may be used in all cases where cypripedium is indicated, in doses of from 1 to 5 grains, 2 or 3 times a day; it is best given in pill form with some inert or active (as may be desired) excipient. A dry *Cypripedin* has been presented to the profession, consisting of the oleoresin and a sufficient quantity of magnesia or other absorbent powder; in other instances, it has been simply a dried aqueous extract. Either of these dried preparations are nearly worthless.

OLEORESINA IRIDIS.—OLEORESIN OF IRIS.

Synonyms: *Oleoresin of blue flag, Iridin.*

Preparation.—By percolation, exhaust moderately fine powder of the root of blue flag any quantity, with alcohol a sufficient quantity. Distill off about two-thirds of the alcohol, and add the residue to two or three times its volume of water. By distilling off the remaining alcohol, or by allowing the mixture to stand, the oleoresin precipitates, collect it, wash it in clear water, allow it to subside, and then separate it from the water by decantation and filtration.

History.—I had the pleasure of calling the attention of the profession to this article in 1844, about the same time I introduced podophyllin (to remarks on which I refer the reader), and again in 1846. I have used it extensively and find it to be an invaluable medicine. It is soluble in alcohol, but insoluble in water (J. King). *Iridin*, or *Irisin*, in powder, is prepared by adding to the oleoresin about 10 per cent of magnesia or other absorbent; sometimes the extract of the root deprived of its oleoresin, has been dried, powdered, and sold under one of the above names.

Action, Medical Uses, and Dosage.—This oleoresin is cathartic, alterative, sialagogue, diuretic and anthelmintic. I have used it more or less extensively for several years in combination with the resin of podophyllum, and in the form of pill, for *dropsy*, *primary* and *secondary syphilis*, *chronic visceral affections*, *rheumatism*, *gonorrhœa*, and many *female affections*. It is not as nauseating, when given alone, as the resin of podophyllum, and requires rather larger doses. One grain, triturated with 10 grains of sugar, may be given in 3-grain doses, every hour or two, until a cathartic effect is produced. I have long used the following as a sialagogue in those cases of *glandular diseases* which seemed to resist the action of other means, viz.: equal parts of oleoresins of iris, podophyllum, and xanthoxylum, given in grain doses every hour or two until ptyalism was produced. By trituration with sugar or lactin, this combination becomes more active. Oleoresin of iris is not as prompt in its effects as resin of podophyllum, although it may be substituted for this in all instances; and its alterative influence, though slowly developed and without any immediate appreciable effect, is yet positive and certain. For several years I used it in preference to the resin of podophyllum, conjoined with resin of cimicifuga, in *uterine diseases*. The usual dose of oleoresin of iris ranges from $\frac{1}{2}$ grain to 5 grains. Physicians will occasionally meet with patients upon whom resin of podophyllum, even in small doses, exerts a powerful and long-continued influence, sometimes not readily obviated; in such cases, oleoresin of iris seems to me to be more especially indicated. The addition of capsicum or resin of caulophyllum to oleoresin of iris, mitigates any harshness of action it may produce. A combination of oleoresins of iris and xanthoxylum, with resin of podophyllum, or extract of corydalis, is a most powerful and certain remedy for *syphilis*, either primary or secondary, and will be found very useful in *scrofula*. Oleoresin of iris, 3 grains, extract of leptandra, 6 grains, and bitartrate of potassium, 20 grains, made into one powder, forms a hydragogue cathartic of much value in some forms of *dropsy*. Oleoresin of iris may be used in all cases where iris is indicated (J. King).

OLEORESINA LUPULINI (U. S. P.)—OLEORESIN OF LUPULIN.

SYNONYMS: *Oleoresina lupulinæ* (*U. S. P.*, 1870), *Extractum lupulini æthereum*, *Ethereal extract of lupulin.*

Preparation.—"Lupulin, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; ether, a sufficient quantity. Put the lupulin into a cylindrical glass percolator, provided with a stop-cock, and arranged with cover and receptacle suitable for volatile liquids. Press the drug very lightly, and percolate slowly with ether, added in successive portions, until the drug is exhausted. Recover the greater part of the ether from the percolate by distillation on a water-bath, and, having transferred the residue to a capsule, allow the remaining ether to evaporate spontaneously. Keep the oleoresin in a well-stoppered bottle"—(*U. S. P.*).

Description.—This forms a thick, dark red-brown oleoresin, of the consistence of a very soft extract, and possessing the taste and smell peculiar to lupulin. It is soluble in ether, alcohol, and water of ammonia.

Action, Medical Uses, and Dosage.—Similar to those of lupulin (see *Lupulinum*). The dose of this oleoresin is from 1 to 6 grains, 2, 3, or 4 times a day, given in pill form with some inert, or active if desired, excipient. It may also be rubbed up with syrup, glycerin, mucilage, etc., by the aid of a little ether or other solvent.

OLEORESINA PIPERIS (U. S. P.)—OLEORESIN OF PEPPER.

SYNONYMS: *Oleoresin of black pepper*, *Ethereal extract* (or *Oil*) *of black pepper.*

Preparation.—"Pepper, in No. 60 powder, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]; ether, a sufficient quantity. Put the pepper into a cylindrical glass percolator, provided with a stop-cock, and arranged with a cover and receptacle for volatile liquids. Press the drug firmly, and percolate slowly with ether, added in successive portions, until the drug is exhausted. Recover the greater part of the ether from the percolate by distillation on a water-bath, and, having transferred the residue to a capsule, set this aside until the remaining ether has evaporated, and the deposition of crystals of piperin has ceased. Lastly, separate the oleoresin from the piperin by expression through a muslin strainer. Keep the oleoresin in a well-stoppered bottle"—(*U. S. P.*).

Description.—Oleoresin of pepper forms a dark, greenish, rather thick liquid, containing volatile and fixed oil, and the pepper-resin, and possessing all the active properties of the pepper. About one-sixteenth part of the oleoresin is thus obtained, mixed with *piperin*, which is removed by the expression. This is not so dark in color, and contains more of the volatile oil than *oil of black pepper*, once employed and for which this oleoresin is a substitute. Oil of black pepper is a dark, almost black-green body, and is obtained as a by-product in the preparation of piperin.

Action, Medical Uses, and Dosage.—Oleoresin of black pepper may be used in cases where the fruit itself is indicated, in doses of from 1 to 3 or 4 drops, rubbed up with mucilage, glycerin, syrup, or with pill mass.

OLEORESINA PTELEÆ.—OLEORESIN OF PTELEA.

SYNONYMS: *Oleoresin of wafer ash*, *Ptelein.*

Preparation.—By percolation exhaust moderately fine powder of the bark of wafer ash, any quantity, with alcohol, a sufficient quantity. Distill off two-thirds of the alcohol, and add the residue to two or three times its volume of water. By distilling off the remaining alcohol, or by allowing the mixture to stand, the oleoresin precipitates. Collect it, wash it in clear water, allow it to subside, and then separate it from the water by decantation and filtration.

History and Description.—The oleoresin of ptelea, improperly named *ptelein*, was, I believe, first prepared by Mr. Wm. S. Merrell, and is obtained from the tincture of the bark by precipitation with water, in the same manner by which the oleoresins of Eupatorium purpureum, iris, xanthoxylum, etc., are obtained. It is of the consistence of thick syrup or molasses, dark-brown in mass, much lighter when in thin layers, and has a peculiar odor, somewhat similar to that ot the extract of liquorice, and an oily, bitterish, acrid, persistent taste, peculiar and rather disagreeable, and acting powerfully on the fauces. It is soluble in alcohol, ether, oil of turpentine, and rather imperfectly in alkaline solutions; insoluble in acids and water. It imparts a slight milky color to water, and separates into two portions, one of which floats on the water while the other sinks. Acetic acid added to its alcoholic or ethereal solution does not disturb them, unless added in excess. Water added to the alcoholic solution produces a milky color, precipitating the resin; added to the ethereal solution it separates the oil which floats on the surface. The same remarks apply to "*ptelein*" in powder, as are given concerning "*irisin*" in powder (J. King).

Action, Medical Uses, and Dosage.—Oleoresin of ptelea is a tonic, and possesses other properties, not yet satisfactorily understood. It is a valuable medicinal agent. I have used it extensively and successfully, combined with equal parts of oleoresin of xanthoxylum, and given in doses of 1 or 2 grains, repeated 3 times a day, in cases of *dyspepsia;* if *constipation* be present, I have found the following an admirable combination: Take of oleoresin of ptelea, 19 grains; alcoholic extract of nux vomica, 1 grain; white sugar, or lactin, 2 drachms. Mix thoroughly together. The dose is 6 grains, to be repeated 3 or 4 times a day. I have found the following a valuable pill in *chronic erysipelas*, *hepatic torpor*, *enlarged spleen*, *habitual constipation*, *chronic dysentery*, and some forms of *dyspepsia:* Take of resin of podophyllum and extract of leptandra, each, 1 grain; sulphate of quinine, 4 grains; oleoresin of ptelea, 8 grains; mix these together, and divide into 8 pills. The dose is 1 pill, to be repeated 2 or 3 times a day, and the alkaline bath to be used daily (J. King).

OLEORESINA SENECII.—OLEORESIN OF SENECIO.

SYNONYMS: *Oleoresin of life root*, *Senecin*.

Preparation.—By percolation, exhaust moderately fine powder of the root and herb of life root, any quantity, with alcohol, a sufficient quantity. Distill off about two-thirds of the alcohol, and add the residue to two or three times its volume of water. By distilling off the remaining alcohol, or by allowing the mixture to stand, the oleoresin precipitates. Collect it, wash it in clear water, allow it to subside, and then separate it from the water by decantation and filtration. Any other of the Senecios referred to in this work may be used in the preparation of this oleoresin.

Description.—Oleoresin of senecio thus prepared, is of thick consistence, a very dark green color, appearing quite black in mass, having a peculiar, herbaceous odor, and a bitter, slightly pungent, persistent, and rather unpleasant taste. A portion of it, probably the oil, is soluble in alcohol, imparting a green color to the solution; on the addition of liquor potassæ to the alcoholic solution, the oleoresin is rendered wholly soluble, and if hydrochloric acid be added in small quantity, it changes the green solution to greenish-white, without precipitation. It is entirely soluble in ether, forming a greenish solution, which is not precipitated by water nor acetic acid. It is insoluble in water, but becomes soluble on the addition of strong alkaline solutions.

Action, Medical Uses, and Dosage.—Oleoresin of senecio possesses the virtues of the plant from which it is obtained in a high degree. It is, however, more especially employed in the treatment of female diseases, as *amenorrhœa*, *dysmenorrhœa*, and other *uterine derangements*. Combined with alcoholic extract of aletris, resin of caulophyllum, or resin of cimicifuga, it will be found especially useful in these complaints. In *menorrhagia* it may be combined with extract of geranium advantageously; or its ethereal tincture may be administered in some astringent infusion. A pill of oleoresin of senecio, alcoholic extract of aletris, and sulphate of iron, will be found of benefit in *chlorosis* accompanied with *amenorrhœa*. In *dysmenorrhœa* it may be combined with extract of belladonna and sulphate of quinine. It is one of those agents which exert a tonic influence upon the uterus, thereby restoring its various functional derangements to a normal condition. Dose of the oleoresin, from 3 to 5 grains, 3 times a day (J. King).

Related Preparation.—SENECIONINE is the incorrect name given to a concentrated powdered preparation formerly made by our manufacturers. Dr. H. H. Hill prepared it as follows: Make a tincture of the coarsely powdered leaves and roots of *Senecio*, with alcohol of 76 per cent. Distill off the alcohol until the liquid is of the consistence of a fluid extract, add to it several times its weight of water, and precipitate with a solution of alum. Wash the precipitate to free it from the alum, and dry it in the open air without heat. It forms a dark-green powder, having a peculiar, herbaceous, strong, unpleasant, somewhat resinous and senna-like taste and odor, is soluble in water, partially soluble in alcohol, and more so in ether. It is said to possess the virtues of the plant, and may be given in doses of from 1 to 5 grains, 3 or 4 times a day (J. King).

OLEORESINA XANTHOXYLI.—OLEORESIN OF XANTHOXYLUM.

SYNONYMS: *Oleoresin of prickly ash*, *Xanthoxylin*.

Preparation.—By percolation exhaust finely powdered prickly ash bark, any quantity, with alcohol, a sufficient quantity. Distill off two-thirds of the alcohol, and add the residue to two or three times its volume of water. By distilling off the remaining alcohol, or by allowing the mixture to stand, the oleoresin precipitates. Collect it, wash it in clear water, allow it to subside, and then separate it from the water by decantation and filtration.

History and Description.—The profession is indebted to Mr. Wm. S. Merrell for the preparation of this valuable agent, which appears to possess all the medicinal properties of the bark in a concentrated form. When in mass it is blackish, but of a reddish-brown color in thin layers; it has a peculiar odor, somewhat similar to that of most oleoresins, and a peculiar bitterish taste, quickly succeeded by a persistent pungency in the mouth and fauces. It is insoluble in water, partially soluble in aqua ammoniæ and liquor potassæ, forming a solution with a soapy feeling; soluble in ether, from which aqua ammoniæ removes a portion without much change of color; soluble in oil of turpentine, and to a greater or less extent in oil of savin, and some other essential oils; soluble in alcohol, from which water precipitates it, forming a dirty-white solution. Acetic, nitric, sulphuric, and hydrochloric acids, when added to the alcoholic solution, occasion no precipitate.

"*Xanthoxylin*" in powder is prepared somewhat similar to the process named for "*irisin*" in powder; as a rule all these so-called dry oleoresins (?) are nearly inert, and not as active as the powdered crude article from which they are made.

Action, Medical Uses, and Dosage.—Oleoresin of prickly ash bark is stimulant, tonic, alterative, and sialagogue, and may be used in all cases where it is desired to stimulate and strengthen mucous tissues. It forms an excellent remedy for *rheumatism* unaccompanied with inflammation, or where there is an asthenic condition of the system, and I have often used it for this purpose with resin of black cohosh, in doses of 1 grain of each, every 1, 2, or 3 hours, with much advantage. Combined with quinine, it will be found very beneficial in cases where quinine alone appears to exert no influence, and will prove a valuable agent in *dyspepsia*, accompanied with loss of appetite, flatulence, and distress after eating, given in conjunction with oleoresin of ptelea. In *low typhoid fever*, oleoresin of prickly ash bark will be found a valuable and permanent stimulating tonic, and may, when necessary, be added to laxatives in that disease, to prevent too much prostration —it must, however, be employed only during the stage of prostration. It may be used alone as a stimulating tonic and alterative. When a stimulating tonic is required for children after *diarrhœa*, *dysentery*, or other *debilitating diseases*, a combination of hydrochlorate of berberine with oleoresin of prickly ash bark will admirably fulfil the indication. In *chronic rheumatism* I have found the following preparation highly beneficial: Take of resin of cimicifuga, oleoresin of prickly ash bark, and extract of apocynum, each, 1 drachm; proof-spirits or whiskey, 1 pint. Mix. Of this, the dose is a tablespoonful 3 times a day, or sufficient to slightly affect the head, at the same time attending to the surface and the excretory functions. Sometimes I add 2 drachms of guaiacum to the above. The dose of the oleoresin of prickly ash bark is from 1 to 3 grains, 3 or 4 times a day (J. King).

OLEORESINA ZINGIBERIS (U. S. P.)—OLEORESIN OF GINGER.

SYNONYMS: *Extractum zingiberis æthereum*, *Ethereal extract of ginger.*

Preparation.—"Ginger, in No. 60 powder, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]; ether, a sufficient quantity. Put the ginger into a cylindrical glass percolator, provided with a stop-cock, and arranged with cover and receptacle suitable for volatile liquids. Press the drug firmly and percolate slowly with ether, added in successive portions until the drug is exhausted. Recover the greater part of the ether from the percolate by distillation on a water-bath, and, having transferred the residue to a capsule, allow the remaining ether to evaporate spontaneously. Keep the oleoresin in a well-stoppered bottle"—(*U. S. P.*).

Description and History.—This substance is the *piperoid of ginger* of Beral. It is a clear, thickish, deep-brown liquid, having the sharp pungency and the flavor of ginger root. Less oleoresin is obtained from the uncoated Jamaica ginger, but it has a more pleasant flavor, a lighter color, and greater fluidity when obtained from the latter. Acetone extracts the full amount of it.

Action, Medical Uses, and Dosage.—Same as for ginger. Dose, 1 minim, well diluted.

OLEOSACCHARA (N. F.)—OIL-SUGARS.

SYNONYM: *Elæosacchara (Ger. Pharm.).*

Preparation.—"Any volatile oil, one drop (1 drop); sugar, two grammes (2 Gm.) [31 grs.]. Triturate the sugar with the volatile oil to a fine powder. This preparation should be freshly made when wanted for use. *Note.*—When *Elæosaccharum Anisi*, *E. Fœniculi*, *E. Menthæ piperitæ*, etc., are prescribed, these are to be prepared from the corresponding essential oils, according to the above formula"—(*Nat. Form.*).

OLEUM ADIPIS (U. S. P.)—LARD OIL.

A fixed oil expressed from lard at a low temperature.

Preparation.—If lard be enclosed in stout bags and exposed to a very low temperature, about that of freezing, and then subjected to a gradually increased, yet powerful pressure, the olein separates from the stearin and yields a little over 60 per cent of lard oil. The residual stearin is utilized in the manufacture of soap. Lard oil chiefly contains olein, with some palmitin and stearin. Its composition is similar to that of olive oil.

Description and Tests.—Lard oil, according to the *U. S. P.*, is "a colorless or pale-yellow, oily liquid, having a peculiar odor, and a bland taste. Specific gravity, 0.910 to 0.920 at 15° C. (59° F.). At a temperature a little below 10° C. (50° F.) it usually commences to deposit a white, granular fat, and at or near 0° C. (32° F.) it forms a semisolid, white mass. When it is brought in contact with concentrated sulphuric acid, a dark reddish-brown color is instantly produced. If 5 Cc. of the oil be thoroughly shaken in a test-tube, with 5 Cc. of an alcoholic solution of silver nitrate (made by dissolving 0.1 Gm. of silver nitrate in 10 Cc. of deodorized alcohol, and adding 2 drops of nitric acid), and the mixture heated for about five minutes in a water-bath, the oil should remain nearly or quite colorless, not acquiring a reddish or brown color, nor should any dark color be produced at the line of contact of the two liquids (absence of more than about 5 per cent of cotton-seed oil). If 5 Cc. of the oil, contained in a small flask, be mixed with a solution of 2 Gm. of potassium hydrate in 2 Cc. of water, then 5 Cc. of alcohol added, and the mixture heated for about 5 minutes on a water-bath, with occasional agitation, a perfectly clear and complete solution should be formed, which, on dilution with water to the volume of 50 Cc., should form a transparent, light-yellow liquid, without the separation of an oily layer (absence of appreciable quantities of paraffin oils)"—(*U. S. P.*).

Medical Uses.—Lard oil is used chiefly in pharmacy. In the absence of other fats it might be employed in *poisoning by the caustic alkalies.*

OLEUM ÆTHEREUM (U. S. P.)—ETHEREAL OIL.

"A volatile liquid consisting of equal volumes of heavy oil of wine and ether"—(*U. S. P.*).

Preparation.—"Alcohol, one thousand cubic centimeters (1000 Cc. [33 fl℥, 391 ♏]; sulphuric acid, one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], distilled water, twenty-five cubic centimeter (25 Cc. [406 ♏]; ether, a sufficient quantity. Add the acid slowly to the alcohol, mix them thoroughly, and allow the mixture to stand, in a closed flask, for 24 hours, or until the liquid is clear; then pour the clear liquid into a tubulated retort of such capacity that the mixture shall nearly fill it. Insert a thermometer through the tubulure, so that the bulb shall be deeply immersed in the liquid, and, having connected the retort with a well-cooled condenser, and also having connected with the receiver a bent glass tube for conducting the uncondensed gases into water, distill, by means of a sand-bath, at a temperature between 150° and 160° C. (302° and 320° F.), until oily drops cease to come over, or until a black froth, which forms on the surface, begins to rise in the retort. Separate the yellow ethereal liquid from the distillate, and expose it to the air for 24 hours, in a shallow capsule. Then transfer it to a wet filter, and when the watery portion has drained off, wash the oil which is left on the filter with the distilled water, which should be as cold as possible. When this also has drained off, transfer the oil to a graduated measure, and add to it an equal volume of ether. Keep the product in small, glass-stoppered vials, in a cool place"—(*U. S. P.*).

Description and Chemical Composition.—Ethereal oil is officially described as "a transparent, nearly colorless, volatile liquid, of a peculiar, aromatic, ethereal odor, a pungent, refreshing, bitterish taste, and neutral to dry litmus paper. Specific gravity, 0.910 at 15° C. (59° F.)"—(*U. S. P.*).

The chemical composition of this oil is tersely stated by Bruno Hirsch (*Universal Pharmacopœia*, 1890, No. 2109) as follows: "The heavy oil of wine which constitutes one-half of the finished product, is to be considered a solution of solid *ætherin* and liquid *ætherol*, both of the empirical formula C_2H_4, in *diethyl-sulphurous acid* ($[C_2H_5]_2SO_3$) and *diethyl-sulphuric acid* ($[C_2H_5]_2SO_4$) in variable quantities, the proportions of which are not yet determined." (Also see Prof. J. M. Maisch, *Amer. Jour. Pharm.*, 1865, p. 100; and Charles L. Diehl, *ibid.*, p. 126.)

Uses.—This oil is used only for pharmaceutical purposes. It is a constituent of compound spirit of ether. In moderate doses ethereal oil stimulates the vasomotor centers, and if the dose be sufficiently large, this is followed by paralysis of the tunics of the blood vessels.

OLEUM AMYGDALÆ AMARÆ (U. S. P.)—OIL OF BITTER ALMOND.

"A volatile oil obtained from bitter almond by maceration with water, and subsequent distillation. It should be kept in small, well-stoppered bottles, protected from light"—(*U. S. P.*).

SYNONYM: *Oleum amygdalarum (amararum) æthereum.*

Preparation and Chemical Composition.—The greater quantity of commercial oil of bitter almond is prepared from the seeds of apricots, which yield an oil identical with that from bitter almond (Gildemeister and Hoffmann, *Die Ætherischen Oele*, Leipzig, 1899, p. 572). The seeds are first deprived of their fixed oil by subjecting them, ground, to a hydraulic pressure of 350 atmospheres. Bitter almonds yield 50 per cent, apricots 35 to 38 per cent of fatty oil. The powdered press-cake is then mixed with about 6 parts, by weight, of water, the mixture allowed to digest at about 50° C. (122° F.) for some 12 hours; the oil is then distilled off with steam. Oil of bitter almond does not preexist in the kernels, but is produced in the presence of water by the action of the ferment *emulsin* upon the glucosid *amygdalin*, whereby dextrose, oil of bitter almond, and hydrocyanic acid are formed, thus: $C_{20}H_{27}NO_{11}$ (*amygdalin*) + $2H_2O$ (*water*) = $2C_6H_{12}O_6$ (*glucose*) + C_7H_6O (*oil of bitter almond*) + HCN (*hydrocyanic acid*). Time must be allowed this chemical decomposition to take place, and the temperature must not be too high, or else the fermentative power of emulsin will be destroyed (compare *Amygdala Amara* and *Laurocerasus*).

The yield of the oil from bitter almonds is 0.5 to 0.7 per cent; from apricots, 0.6 to 1 per cent. It consists of *benzaldehyde* (C_6H_5CHO) and *hydrocyanic acid*, the former being easily convertible by oxidation into benzoic acid. This change is favored by removal of hydrocyanic acid. The quantity of the latter may normally vary from 1.5 to 4 per cent (F. B. Power, *Essential Oils*, published by Fritzsche Brothers, 1894). A third body may occur in the oil, namely the *nitril of mandelic acid* ($C_6H_5.CHOH.CN$), which is merely an addition product of equal molecules of benzaldehyde and hydrocyanic acid. It forms when both substances are in prolonged contact with each other, and is decomposed into its constituents by steam heat. It is therefore not present in the fresh oil. It has the specific gravity 1.124, while the normal oil has the specific gravity of 1.045 to 1.060. Thus a high specific gravity of the oil (exceeding 1.070) indicates the presence of dangerous proportions of hydrocyanic acid. As to the method of valuation of hydrocyanic acid in bitter almond oil, see paper by Prof. Edward Kremers and O. Schreiner, in *Pharm. Review*, 1896, p. 196. The oil may be completely deprived of its hydrocyanic acid by shaking with milk of lime and ferrous sulphate, whereby insoluble calcium ferrocyanide is formed (Gildemeister and Hoffmann, *loc. cit.*). The crude oil may also contain *benzoin* ($C_{14}H_{12}O_2$), a solid, crystallizable substance formed by polymerization of benzaldehyde.

Description.—Oil of bitter almond is officially described as "a clear, colorless or yellowish, thin, and strongly refractive liquid, having a peculiar, aromatic odor, and a bitter and burning taste. Specific gravity, 1.060 to 1.070 at 15° C. (59° F.). Boiling point, about 180° C. (356° F.). Optically inactive. Soluble in 300 parts of water at 15° C. (59° F.), and in alcohol or ether in all proportions; also soluble in nitric acid at ordinary temperatures without the evolution of nitrous vapors. In the fresh state the oil is neutral to litmus, but when kept for some time it assumes an acid reaction, due to the formation of benzoic acid"—(*U. S. P.*). *Warm* nitric, or fuming nitric acid converts it into nitrobenzaldehyde and benzoic acid.

Tests.—The *U. S. P.* gives the following tests: "If 10 drops of the oil, dissolved in a little alcohol, be shaken with a few drops of a strong solution of sodium hydrate, then with a little ferrous sulphate T.S., and finally mixed with a slight excess of hydrochloric acid, a blue precipitate will be produced (presence of hydrocyanic acid). The presence of artificial oil containing chlorinated products may be detected in the following manner. Fold a small strip of filter paper in the form of a taper, saturate it with the oil, and lay it in a small porcelain capsule. Set this capsule into a larger one, and provide a large beaker to be inverted over the capsule containing the taper. Then, having moistened the inner surface of the beaker with distilled water, ignite the taper, immediately invert the beaker over the capsule, and allow the products of combustion to be absorbed by the water in the beaker. If the beaker be now rinsed with a little distilled water, and the liquid filtered, the filtrate should yield no turbidity with silver nitrate T.S. If 5 Cc. of the oil be vigorously shaken, in a flask, with 50 Cc. of a cold, saturated solution of sodium bisulphite, and the mixture heated for a few minutes on a water-bath, the odor of the oil should disappear, and a nearly clear solution be formed, without the separation of any oily drops on the surface of the liquid (absence of most other volatile oils and of nitrobenzol)"—(*U. S. P.*). The latter test depends on the property of aldehydes to enter into crystallizable, inodorous addition-compounds with sodium bisulphite. Thus: $C_6H_5.CHO + NaHSO_3 = C_6H_5.CHOH.SO_3Na$ (also see test under *Nitrobenzenum*). Another rapid and simple test for artificial oil containing chlorine compounds depends upon the distinct, but evanescent, green-flame coloration imparted to the flame of a Bunsen burner by a clean, copper wire when moistened with the oil in question, the coloration being due to the vapors of copper chloride (F. B. Power, *loc. cit.*).

Artificial Oil of Bitter Almond, or *pure benzaldehyde* (*benzoic aldehyde*) C_7H_6O. or $C_6H_5.COH$, is now extensively prepared, in Europe, from certain chlorine substitution products, *e. g.*, *benzalchloride* ($C_6H_5.CHCl_2$), of the fluid coal-tar hydrocarbon *toluene* ($C_6H_5.CH_3$). This artificial product is now frequently used; it is naturally free from hydrocyanic acid, but has a slightly peculiar smell owing to the presence of traces of chlorine compounds, which are difficult to remove (see *Tests*).

Action, Medical Uses, and Dosage.—The medicinal uses of this agent are those named under diluted hydrocyanic acid, which see. It is used in the arts to give flavor and odor to candies, and in pharmacy to flavor castor and cod-liver oils. It is extremely poisonous, 1 drop having proved fatal to small animals, and 15 drops to an adult. Locally (oil, 1 drop, to water, 1 fl℥) it allays itching. The maximum dose internally should not exceed one-half minim, given in emulsion with sugar, water, and acacia.

OLEUM AMYGDALÆ EXPRESSUM (U. S. P.)—EXPRESSED OIL OF ALMOND.

"A fixed oil expressed from the bitter or sweet almond. It should be kept in well-stoppered bottles, in a cool place"—(*U. S. P.*).

Synonyms: *Oleum amygdalæ* (*Br.*), *Oleum amygdalæ dulcis*, *Oleum amygdalarum*, *Expressed oil of almond*, *Sweet oil of almond*.

Preparation.—Both bitter and sweet almonds deprived of the adherent brownish dust by means of rubbing or sifting, and freed from inferior pieces, are bruised or ground, put into a bag, and strongly pressed between perfectly smooth and slightly warmed steel plates. The heat should not be greater than 30° C. (86° F.). The margins of the press-cake, if again powdered and expressed, yield an additional quantity of oil. At first the oil is turbid. It is allowed to stand, and the clear oil is then decanted. The yield is from 40 to 55 per cent for sweet almonds; about 30 to 50 per cent for bitter almonds. The highest yields are obtained only by strong hydraulic pressure. If almonds be immersed in hot water, deprived of their cuticular covering, oven-dried and then expressed, a colorless oil is obtained, but it is more liable to become rancid than if prepared as above directed, and to develop a prussic acid odor.

Description and Chemical Composition.—"A clear, pale straw-colored or colorless, oily liquid, almost inodorous, and having a mild, nutty taste. Specific gravity, 0.915 to 0.920 at 15° C. (59° F.). Only slightly soluble in alcohol, soluble in ether and in chloroform in all proportions. It remains clear at —10° C. (14° F.), and does not congeal until cooled to near —20° C. (—4° F.)"—(*U. S. P.*). Almond oil is non-drying and when exposed to the atmosphere is liable to become rancid and acrid. Benzin and the fixed oils readily dissolve it in all proportions. The coloring matter, together with a small portion only of the oil, is dissolved by alcohol. According to G. M. Beringer (*Amer. Jour. Pharm.*, 1889, p. 232), 1 part of oil of almond is completely dissolved in 4 parts of boiling absolute alcohol, and in 34 parts of the same solvent at ordinary temperature, while 42 parts of boiling alcohol of the specific gravity 0.820, are required for complete solution. Expressed oil of almond consists principally of the glyceride of oleic acid with appreciable amounts of the glyceride of linoleic acid (see A. Hazura, in *Amer. Jour. Pharm.*, 1889, p. 471).

Tests.—"If 2 Cc. of the oil be vigorously shaken with 1 Cc. of fuming nitric acid and 1 Cc. of water, a whitish, not red or brownish, mixture, should be formed, which, after standing for some hours at about 10° C. (50° F.), should separate into a solid, white mass, and a scarcely colored liquid (distinction from the fixed oils of apricot and peach kernels, and from sesamum, cotton-seed and poppy-seed oils). If 10 Cc. of the oil be mixed with 15 Cc. of a 15 per cent solution of sodium hydrate and 10 Cc. of alcohol, and the mixture allowed to stand at a temperature of 35° to 40° C. (95° to 104° F.), with occasional agitation, until it becomes clear, and then diluted with 100 Cc. of water, the clear solution thus obtained, upon the subsequent addition of an excess of hydrochloric acid, will set free a layer of oleic acid. This, when separated from the aqueous liquid, washed with warm water, and clarified in a water-bath, will remain liquid at 15° C. (59° F.), although sometimes depositing particles of solid matter and becoming turbid. One part of this oleic acid, when mixed with 1 volume of alcohol, should give a clear solution, which, at 15° C. (59° F.) should not deposit any fatty acids, nor become turbid on the further addition of 1 volume of alcohol (distinction from olive, arachis, cottonseed, sesamum, and other fixed oils)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—A non-poisonous, bland oil of agreeable taste, which may be given like olive oil, in dose of 1 to 8 drachms in mucilage or egg emulsion for the relief of *chronic coughs.*

OLEUM ANETHI.—OIL OF DILL.

The volatile oil distilled from the fruit of *Anethum graveolens*, Linné.

Nat. Ord.—Umbelliferæ.

Preparation and Description.—The yield of the oil, obtained by distillation with water, is from 2.5 per cent (East Indian) to 4 per cent (Russian) (Schimmel & Co.). The residual herb is rich in nitrogenous and fatty matter, and in dried form is used as feed for cattle. The oil is pale yellow, having a sweetish, sharp, burning taste, and a penetrating odor resembling that of the fruit. It gradually becomes darker in color. The odor of East Indian dill oil differs markedly from that of the German product. The density is 0.905 to 0.915 (as high as 0.970 for East Indian) (Schimmel & Co.). Optical rotation, +70° to +80°; East Indian, +41° 30′.

Chemical Composition.—Oil of dill contains from 40 to 60 per cent of *carvone* (*carvol*), identical in optical rotation and other physical and chemical properties with that from oil of caraway (see A. Beyer, *Amer. Jour. Pharm.*, 1884, p. 324). Furthermore, the terpene hydrocarbons, *dextro-limonene*, and sometimes *phellandrene* are present. The East Indian dill oil contains a peculiar heavy constituent, ascertained by Ciamician and Silber (1896) to be an isomer of apiol from parsley oil and named by these chemists *dill-apiol* ($C_{12}H_{14}O_4$) (Gildemeister and Hoffmann, *Die Ætherischen Oele*, 1899).

Action, Medical Uses, and Dosage.—Carminative and local anodyne. Useful in *flatulent colic*. Dose, 5 to 10 drops in sweetened hot water.

OLEUM ANIMALE ÆTHEREUM.—ANIMAL OIL.

SYNONYMS: *Oleum animale Dippelii, Dippel's animal oil, Oleum cornu cervi rectificatum.*

History and Preparation.—J. C. Dippel, in 1711, first obtained this oil by the destructive distillation of dried blood. It is now produced by the rectification of *Crude* (or *fetid*) *animal oil* (*Oleum Cornu Cervi*, or *Bone oil*). When animal substances, such as bones (previously freed from fat), hoofs, horns, blood, hide, etc., are subjected to dry distillation, the following substances are chiefly produced: Carbonic acid gas and combustible gaseous products, a sublimate of carbonate of ammonium (*salt of hartshorn, sal cornu cervi*); an aqueous liquid (*Spiritus Cornu Cervi*), containing ammonium salts of carbonic and hydrocyanic acids, ammonium sulphide, and empyreumatic oils; furthermore, a black-brown, fetid tar (*Oleum Cornu Cervi*), and a residue of charcoal containing nitrogen. The tar chiefly consists of pyridine bases, such as *pyridine* (C_5H_5N), *picoline* (C_6H_7N), *lutidine* (C_7H_9N), *collidine* ($C_8H_{11}N$), etc., and yields upon repeated rectification Dippel's ethereal oil. According to Hager (*Handbuch der Pharm. Praxis*, Vol. II, 1886, p. 568), the crude oil is first distilled from a glass retort by the heat of a sand-bath, as long as a thin oil passes over. The distillate is mixed with four times its bulk of distilled water, and this mixture distilled from a metallic retort. The distillate separates into an aqueous and an oily layer; the latter is drawn off and run into small bottles, securely sealed and put into a dark and cool place. The yield is about 15 to 20 per cent.

Description.—Medicinal, or rectified animal oil is a thin, colorless, or but faintly yellow, oily body, the average specific gravity of which is 0.80. Its odor is ethereal, not fetid, and powerfully penetrating; its taste acrid and sharp, with a cooling, bitter after-taste. Water (80 parts), volatile and fixed oils, alcohol, and ether, dissolve it. When exposed to the atmosphere and light its color deepens rapidly, and the oil assumes a denser consistence. Its reaction is feebly alkaline.

Chemical Composition.—This oil is a mixture of many substances which are but partly known. Besides several hydrocarbons, methyl-, propyl- and butylamine, aniline, *pyrrol* (C_4H_5N), *pyridine* (C_5H_5N), *lutidine* (C_7H_9N), *picoline* (C_5H_7O), and *collidine* ($C_8H_{11}N$), etc., are present (Anderson).

Action, Medical Uses, and Dosage.—Animal oil is not now employed to any extent in therapy. Formerly it was employed, alone or combined, by friction, for the same purposes as liniments. From 5 to 30 drops were formerly used internally, combined with sugar, ether, and Hoffmann's anodyne, for the expulsion of *tapeworms*, and in *chorea, epilepsy, paralysis, hysteria, sciatic neuralgia, chronic rheumatism*, and in *typhoid states*. It has much to condemn it and nothing to commend it. It is extremely poisonous, 3 drachms having quickly killed an adult.

Derivatives of Crude Animal Oil.—PYRIDINE (not *pyrodine*) (C_5H_5N) is a colorless fluid base obtained from Dippel's animal oil, and is found also in tobacco smoke, coal-naphtha, shale-oil, peat-tar, etc. It is obtained by treating the oil with sulphuric acid, afterward with caustic soda, subjecting the decomposed mixture to fractional distillation, treating with oxidizers to remove aniline, and fractionating a second time. It is also synthetically prepared. Its specific gravity is 0.980; its boiling point, 116° C. (240.8° F.); it has a sharp, peculiar, empyreumatic, and persistent taste. With acids it unites to form salts. Water dissolves it, but caustic potash or soda in excess precipitates it. Fixed oils, ether, alcohol, benzol, and chloroform mix with it in all proportions. Large doses of it act as a powerful poison, inducing cyanosis, general muscular paralysis, and death from respiratory failure. Small doses are reputed stimulant, and are said to have been employed successfully in *angina pectoris*. Dose, 6 to 12 drops, once a day; or better, 2 to 4 drops, 3 times a day. It has been more generally recommended as a palliative inhalant in *asthmatic affections*. An aqueous solution (1 in 300) has been employed locally in *gonorrhœa*.

PYRIDINE TRICARBOXYLIC ACID ($C_5H_2[COOH]_3N$).—A derivative of pyridine, and also obtained from certain of the cinchona alkaloids. It forms prismatic crystals which fuse at 244° C. (471.2° F.). Reputed antipyretic, antiasthmatic, and antiseptic. Ten-grain doses are said to have been more effective than quinine in *malarial fever*, given after the paroxysm. Asserted useful in *typhoid fever, asthma* (1 to 2-grain doses), and to have a specific effect on *gonorrhœa* (locally applied).

PYRODINE.—(See *Related Compounds and Derivatives of Phenacetinum.*)

OLEUM ANISI (U. S. P.)—OIL OF ANISE.

"A volatile oil distilled from anise. It should be kept in well-stoppered bottles protected from light, and, if it has separated into a liquid and a solid portion, it should be completely liquefied by warming before being dispensed"—(*U. S. P.*).

Source and Chemical Composition.—This oil is prepared by distilling anise seed, from *Pimpinella anisum*, Linné, with water. The Russian seeds are now mostly used; they yield, according to Schimmel & Co. (*Reports*, April, 1897), from 2.4 to 3.2 per cent of oil; Italian fruit (Bolognese) yielded as high as 3.5 per cent. Over 90 per cent of the oil consists of *anethol* (*para-methoxy-propenyl-benzol*, $C_{10}H_{12}O$, or $C_6H_4[OCH_3].CH:CH.CH_3$), which is the essential aromatic constituent of the oil. It was obtained synthetically, in 1877, by Perkin. It is a snow-white, crystallizable body, of sweet taste, melts at 21.5° C. (69.8° F.), and is optically inactive. The liquid constituent of anise oil is *methyl-chavicol*, an isomer of anethol. Both anethol and methyl-chavicol also occur in the oil of star-anise (*Illicium verum*) (Schimmel's *Report*, Oct., 1895); anethol is also found in fennel oil (Cahours, 1841). In oil of star-anise, *dextro-pinene* and *lævo-phellandrene* were also found.

Description and Tests.—The *U. S. P.* describes the oil as follows: "A colorless or pale-yellow, thin, and strongly refractive liquid, having the characteristic odor of anise, and a sweetish, mildly aromatic taste. Specific gravity, about 0.980 to 0.990 at 17° C. (62.6° F.), increasing with age. At a low temperature, usually between 10° and 15° C. (50° and 59° F.), it solidifies to a white, crystalline mass. Soluble in an equal volume of alcohol to a clear solution (absence of most fixed oils and oil of turpentine). This solution is neutral to litmus paper, and should not assume a blue or brownish color on the addition of a drop of ferric chloride T.S. (absence of some volatile oils containing phenols). When the oil is dropped into water, without agitation, it should not produce a milky turbidity (absence of alcohol)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Both oil of anise and oil of star-anise, are carminative and antispasmodic, and especially adapted to *flatulency* and *colic of infants.* They likewise, in connection with aqua ammoniæ, ammonium chloride, or ammonium carbonate, afford relief in *spasmodic cough.* The dose is from 5 to 10 drops. Ruschenberger states that the offensive odor of the tersulphides in solutions or ointments is removed or completely covered by the presence of oil of anise. Oil of anise is an ingredient of paregoric and other well-known preparations.

Related Oil.—OIL OF ANISE BARK. From Madagascar; botanical source unknown, but the bark closely resembles the Massoi bark, and yields 3.5 per cent of essential oil. The oil is pale-yellow, spicy and feebly sweet to the taste, and has an odor suggestive of *safrol.* Density, 0.969. It contains chiefly Eykman's *methyl-chavicol* ($CH_3O.C_6H_4.CH_2.CH.CH_2$), the fluid anethol isomeric with ordinary anethol, of which it also contains a small proportion (Schimmel & Co.'s *Report*, April, 1892, p. 53).

OLEUM ANTHEMIDIS.—OIL OF CHAMOMILE.

The essential oil distilled from the flowers of *Anthemis nobilis*, Linné.

Nat. Ord.—Compositæ.

SYNONYMS: *Oleum chamomillæ Romanæ, Oil of Roman chamomile.*

Source and Description.—Oil of chamomile is obtained by distillation of chamomile flowers (*Anthemis nobilis*) with water, the yield being 0.8 to 1 per cent (Schimmel & Co.'s *Report*, April, 1897). When first obtained it is bluish, afterward greenish, but finally becomes yellowish-brown; its specific gravity is about 0.9083 (0.905 to 0.915). It has the odor of chamomile flowers, and an aromatic, somewhat pungent taste. It dissolves in 6 parts of 70 per cent alcohol.

Chemical Composition.—The constituents of this oil, according to Schimmel & Co., are chiefly the *isobutylester* of *isobutyric* and *angelic acids*, the *amyl-* and *hexyl-ester* of *angelic* and *tiglic acids.* The highest boiling fractions yield upon saponification and distillation, principally two alcohols, viz., *methyl-ethyl-propyl alcohol* ($C_2H_5.CH_3:CH.CH_2.CH_2OH$), and *anthemol* ($C_{10}H_{16}O$) an isomer of camphor. A paraffin-like body, *anthemen* ($C_{18}H_{36}$) (Naudin, 1884) is probably also present in the highest fractions. (For interesting details regarding the chemistry of this oil, see Gildemeister and Hoffmann, *loc. cit.*) Angelic and tiglic acids are isomers, their composition being $C_5H_8O_2$. Heat converts the former into the latter acid.

Action, Medical Uses, and Dosage.—Oil of chamomile is tonic and antispasmodic; and has been found very serviceable in *spasm of the stomach, painful dysmenorrhœa, hiccough, pertussis,* to allay *nausea* and *vomiting,* and to prevent or lessen the griping influence of some cathartics. The dose is from 5 to 10 drops. The *Matricaria Chamomilla* furnishes a thick, deep-blue oil, becoming brown by age, and which is frequently substituted for the oil of chamomile. It is less antispasmodic than the true chamomile oil. It is an ingredient of some liniments for *painful affections.*

OLEUM AURANTII CORTICIS (U. S. P.)—OIL OF ORANGE PEEL.

"A volatile oil obtained by expression from the fresh peel of either the bitter orange, *Citrus vulgaris*, Risso, or the sweet orange, *Citrus Aurantium*, Linné (*Nat. Ord.*—Rutaceæ). It should be kept in well-stoppered bottles, in a cool place" (*U. S. P.*).

SYNONYM: *Essential oil of orange peel.*

Source and Preparation.—There are in commerce two oils of orange peel, viz.: OLEUM AURANTII DULCIS, *Oil of sweet orange peel*, and OLEUM AURANTII AMARI, *Oil of bitter orange peel.* Both are included in the official oil. They are prepared in southern Europe by at least five different methods: (1) by rupturing the superficial portion of the rind, thus liberating the oil from the glands; (2) by forcibly twisting the fresh rind and collecting the oil upon sponges, and afterward squeezing the contents of the saturated sponges into a suitable vessel; (3) by grating the exterior of the rind and expressing; (4) by putting the scrapings into hot water and skimming off the oil; (5) by distillation of the residues after expression, which yields an inferior product.

Chemical Composition.—Both oils are composed chiefly (to 90 per cent) of *dextro-limonene* (Wallach, 1884). In addition the oil of sweet orange peel contains, according to Semmler (1891), a small quantity of *geranial* (*citral*), and an aldehyde of lower boiling point (Power, *Essential Oils*). The oil of orange peel is under further chemical investigation. Ninety per cent of the oil distills between 175° and 180° C. (347° and 354° F.).

Dextro-limonene occurs chiefly in orange and lemon oils; also found in oils of caraway, dill and elsewhere; *lævo-limonene* in American oil of peppermint and a few other oils. Both modifications are identical in every respect except their optical antagonism. Combined in equi-molecular quantities, they form a terpene nearly identical with *dipentene* which is inactive. *Limonene* is a colorless liquid of a pleasant lemon odor; its specific gravity at 15° C. (59° F.) is 0.846; boiling point 175° to 176° C. (347° to 348.4° F.). Being an unsaturated terpene, 1 molecule absorbs 4 atoms of bromine, forming therewith a characteristic addition product which melts at 104.5° C. (220° F.) (Wallach, 1887).

Description and Tests.—Chemically, and in most other particulars, these two oils are similar. Their flavor differs somewhat, and that from the bitter oranges undergoes change more quickly on exposure. Oil of sweet orange peel is generally preferred in making elixir of orange. The best is the Sicilian oil, though not all is made in Sicily. That from Bigarade orange is known in France as *Essence de Bigarade*, and regarded the most valuable; that from the Portugal or Sweet orange is called *Essence de Portugal*. Oil of orange peel is officially described as "a pale yellowish liquid, having the characteristic, aromatic odor of orange, and an aromatic and, when obtained from the bitter orange, somewhat bitter taste. Specific gravity, about 0.850 at 15° C. (59° F.). Its optical rotation should not be less than 95° to the right in a 100 Mm. tube, and at a temperature of about 15° to 20° C. (59° to 68° F.). Soluble in about four times its volume of alcohol, this solution being neutral to litmus paper; also soluble in all proportions, in absolute alcohol or in carbon disulphide, and in an equal volume of glacial acetic acid. When kept for some time the oil should not develop a terebinthinate odor or taste (absence of oil of turpentine or of other oils containing pinene)"—(*U. S. P.*). Both oils have the same specific gravity (0.848 to 0.854, Schimmel & Co.).

Action and Uses.—This agent is employed for perfuming or flavoring medicines. Its properties are those of an irritant, and it is somewhat narcotic. Those who prepare the oil are subject to mental confusion, muscular debility, neuralgia, headaches, disordered digestion, and erythema, papules, and vesicles upon the skin.

OLEUM AURANTII FLORUM (U. S. P.)—OIL OF ORANGE FLOWERS.

"A volatile oil distilled from the fresh flowers of the bitter orange, *Citrus vulgaris*, Risso (*Nat. Ord.*—Rutaceæ). It should be kept in well-stoppered bottles, in a cool place, protected from light"—(*U. S. P.*).

Synonyms: *Oil of neroli*, *Essence of neroli*.

Preparation and History.—This oil is obtained in the making of orange-flower water, the oil floating upon the surface of the fluid in small amounts. It is best when prepared from the petals rather than from the whole flower. As found in commerce it is usually adulterated with *oil* or *essence of petit grain*. The latter is the volatile oil of the leaves, shoots, and the young fruits of the Bigarade orange. The term *oil* or *essence of petit grain*, was at one time applied to the oil obtained by distillation from small, immature oranges, but is now referred to the oil produced as above stated.

Description.—"A yellowish or brownish, thin liquid, having a very fragrant odor of orange flowers, and an aromatic, somewhat bitter taste. Specific gravity, 0.875 to 0.890 at 15° C. (59° F.). Soluble in an equal volume of alcohol, the solution being neutral to litmus paper. If a little alcohol be poured on the surface of the oil, and the mixture gently undulated, a bright, violet fluorescence will usually be observed. In contact with a saturated solution of sodium bisulphite it assumes a handsome and permanent purplish-red color"—(*U. S. P.*). The oil has a slight right-handed optical rotation.

Chemical Composition.—Orange-flower oil contains an odorless stearoptene formerly called *neroli camphor;* it is a paraffin, melting at 55° (131° F., *Pharmacographia*). Tiemann and Semmler, in 1893, obtained by fractional distillation of the oil *limonene*, *lævo-linalool*, *linaloyl acetate*, and *geraniol.* Schimmel & Co., in 1894, discovered in the oil small quantities of *anthranilic acid methyl-ester* ($NH_2.C_6H_4.COOCH_3$), melting at 25° C. (77° F.), to the presence of which the fragrance and the fluorescence of the oil are due (see *Report*, April, 1899, p. 32). An artificial body, many times stronger than oil of neroli, and used quite extensively by soap-makers and perfumers, is on the market under the name *nerolin.* It is a white powder, soluble in fixed oil and alcohol, but not in water.

Uses.—Oil of orange flowers is used chiefly in manufacturing perfumes, and has been suggested for perfuming local applications.

OLEUM BERGAMOTTÆ (U. S. P.)—OIL OF BERGAMOT.

"A volatile oil obtained by expression from the rind of the fresh fruit of *Citrus Bergamia*, Risso et Poiteau (*Nat. Ord.*—Rutaceæ). It should be kept in well-stoppered bottles, in a cool place, protected from light"—(*U. S. P.*).

SYNONYM: *Oleum bergamii* (*Pharm.*, 1880).

Botanical Source, Preparation, and History.—Oil of bergamot exists in the rind of the ripe fruit of *Citrus Bergamia*, from which it may be obtained by expression in the same manner as for procuring the oil of lemon. It may also be obtained by distillation, but the product is not so agreeable as by expression. According to Wight and Arnott, the leaves of the bergamot tree are oblong, more or less elongated, acute, or obtuse, underside somewhat pale; the petiole more or less winged or margined; the flowers usually small and white; the fruit pale-yellow, pyriform or depressed; the rind with concave receptacles of oil; the pulp more or less acid. About 2½ ounces of oil may be obtained by expression from 100 bergamots. The plant is cultivated in the south of Europe from whence the oil is imported.

Description and Tests.—Bergamot oil is sometimes erroneously called *essence of bergamot.* The *U. S. P.* describes it as "a greenish or greenish-yellow, thin liquid, having a peculiar, very fragrant odor, and an aromatic, bitter taste. Specific gravity, 0.880 to 0.885 at 15° C. (59° F.). Its optical rotation should not be more than 20° to the right in a 100 Mm. tube, and at a temperature of about 15° to 20° C. (59° to 68° F.). Two volumes of the oil, when mixed with 1 volume of alcohol, should give a clear solution of a slightly acid reaction, and this solution should not become turbid on the further addition of alcohol (distinction from oil of orange or oil of lemon). The oil should also be soluble at 20° C. (68° F.), without the separation of oily drops, in 1.5 to 2 volumes of alcohol of 80° per cent by volume. It is soluble, in all proportions, in glacial acetic acid. If about 2 Gm. of the oil be evaporated in a small, tared capsule, on a water-bath, until the odor has completely disappeared, a soft, green, homogeneous residue should be left, amounting to not more than about 6 per cent of the oil (absence of fatty oils)"—(*U.S.P.*).

Chemical Composition.—The fragrance of oil of bergamot is due to the *acetic ester* of *lævo-linalool*, its quantity varying in the oil from 36 to sometimes 40 per cent. The fully matured fruits yield most of this ester. Furthermore, free *linalool*, *dextro-limonene*, perhaps *dipentene*, and 5 per cent of inodorous *bergamot camphor* or *bergapten* ($C_{12}H_8O_4$) are present. According to Pomeranz (1891), it is the *mono-methyl-ether* of *dioxy-coumarin*, derived from *phloroglucin* (Gildemeister and Hoffmann, *loc. cit.*).

Action and Medical Uses.—Gently excitant, but is used almost wholly in perfumery, soaps, and for scenting toilet preparations and ointments.

Related Oils.—OIL OF LEMON GRASS, *Oleum andropogon citrati*. An essential oil, sometimes called *oil of verbena*, derived from several species of *Andropogon*, particularly *Andropogon citratus*, cultivated in India, Ceylon, Malayan peninsula, and near Singapore. It is yellowish-brown with a sharp taste and peculiar odor, used only in perfumes in this country, but as a stimulant and carminative in the East. When treated with a saturated solution of sodium bisulphite, it yields a crystalline compound. The known constituents of this oil are the aldehyde *citral* ($C_{10}H_{16}O$), an unsaturated ketone *methyl-heptenone* ($C_8H_{14}O$), and in the highest boiling fractions the alcohol *geraniol* ($C_{10}H_{18}O$).

Oil of Citronella, *Oleum andropogon nardi.*—The volatile oil distilled from a plant in cultivation in Ceylon, in the Straits Settlement, and coast of Malabar. The natives of Ceylon are engaged in the treatment of the plant, which is distilled by steam in suitable apparatus. It is a yellowish-green oil, slightly lævo-rotatory, of the specific gravity 0.886 to 0.900, has a sharp taste and characteristic odor. With alcohol, it mixes in all proportions. Two or two and one-half volumes of alcohol (80 per cent) should mix perfectly transparent with 1 volume of the oil, at a temperature not lower than 20° C. (68° F.). If the mixture be cloudy it indicates the presence of fixed oils. If oily drops form upon standing, when 5 to 10 volumes of 80 per cent alcohol are added, the presence of petroleum is indicated. Citronella oil contains about 50 per cent of *geraniol*, *citronellal*, an aldehyde ($C_{10}H_{18}O$) which Semmler (1891) succeeded in converting into *citronellic acid* ($C_{10}H_{18}O_2$); furthermore *borneol* (1 to 2 per cent), *methyl-heptenone*, *acetic* and *valerianic acids* in the form of esters. The higher specific gravity observed in *Lana batu oil* is due to the presence of *methyl-eugenol* (*allyl-veratrol* $C_6H_3.C_3H_5.OCH_3.OCH_3$) (Gildemeister and Hoffmann, *loc. cit.*). The oil is employed in perfuming soaps.

Ylang-Ylang Oil, *Cananga oil*, *Oleum unonæ*, *Oleum anonæ*.—The flowers of a south Asiatic tree, growing in Java and Manila, yield this essential oil which is used only in perfumes. A reputed solution of it, in the oil of the cocoanut, is known as *Macassar Hair Oil.* Ylang-Ylang oil contains *lævo-linalool*, *geraniol*, *benzoic* and *acetic acids* (in the form of esters), *methyl-ether* of *para-kresol* ($CH_3.C_6H_4.OCH_3$), traces of a phenol, *cadinene*, etc.

OLEUM BETULÆ VOLATILE (U. S. P.)—VOLATILE OIL OF BETULA.

"A volatile oil obtained by distillation from the bark of *Betula lenta*, Linné, *Sweet birch* (*Nat. Ord.*—Betulaceæ). It is identical with *methyl salicylate* ($CH_3C_7H_5O_3$), and nearly identical with oil of gaultheria. It should be kept in well-stoppered bottles, protected from light"—(*U. S. P.*).

Synonym: *Oil of sweet birch.*

History and Chemical Composition.—This oil is formed in the bark by the action of the ferment *betulase* (Schneegans, 1896) upon the glucosid *gaultherin* ($C_{14}H_{18}O_8 + H_2O$) (Procter, 1843; Schneegans and Gerock, 1894). Upon saponification, it yields salicylic acid and methyl alcohol. The oil was first distilled from sweet birch, in 1865, in Luzerne county, Pennsylvania, and although the yield is only 0.23 per cent, against 0.80 per cent from gaultheria, distillation of the former material is less expensive. (See, in this connection, two interesting papers by Mr. Geo. W. Kennedy, in *Amer. Jour. Pharm.*, 1882, p. 49, and W. H. Breisch, *ibid.*, 1891, p. 579.) The oil is frequently sold for *Natural oil of wintergreen*. Dr. F. B. Power and Dr. C. Kleber (*Pharm. Rundschau*, 1895, p. 228) summarize the differences between oil of wintergreen and oil of sweet birch as follows: (1) "*Oil of wintergreen* (*Gaultheria*) contains about 99 per cent of methyl salicylate, together with a small amount of a paraffin, which is probably *triacontan* ($C_{30}H_{62}$), an aldehyde or ketone, an apparently secondary alcohol ($C_8H_{16}O$), and an ester ($C_{14}H_{24}O_2$). A pure, fresh oil of gaultheria deviates a ray of polarized light to the left, and the extent of this rotation should not be less than —0° 25′ in a tube of 100 Mm. (2) *Oil of sweet birch* (*Betula*), in its unrectified state, contains about 99.8 per cent of methyl salicylate, together with a very small amount of the above-mentioned paraffin ($C_{30}H_{62}$), an aldehyde or ketone, and the ester ($C_{14}H_{24}O_2$), but does not contain the alcohol ($C_8H_{16}O$), which is found in gaultheria oil. The oil of sweet birch is always optically inactive. (3) Both of these oils have a specific gravity varying from 1.180 to 1.187 at 15° C. (59° F.). Both of them, as well as synthetic methyl salicylate, form a clear solution with five times their volume of 70 per cent alcohol, at 20° to 25° C. (68° to 77° F.). Neither the oil of gaultheria nor the oil of sweet birch contains any trace of benzoic acid or its esters, nor do they contain any terpene or sesquiterpene."

Volatile oil of betula "has the same properties and conforms to the same reactions and tests as methyl salicylate"—(*U. S. P.*). (See *Methyl Salicylas;* also *Oleum Gaultheriæ.*)

Action, Medical Uses, and Dosage.—Same as *Oleum Gaultheriæ* (which see).

OLEUM BUBULUM.—NEAT'S-FOOT OIL.

The oil obtained from the feet of the *Bos domesticus*.

Synonyms: *Oleum pedum tauri*, *Axungia pedum tauri*.

Preparation.—Having removed the skin and hoof from ox feet, subject them to the long-continued action of water at 100° C. (212° F.); the fatty matters which rise and float upon the surface must be skimmed off from time to time, placed into another portion of clear water, and the whole be heated to about 90.6° or 93.3° C. (195° or 200° F.). The oil again floats upon the surface, and may be taken therefrom. The oil may be still further purified, if necessary, by placing it in clean water, and subjecting it, for 20 or 25 hours, to a temperature which will be just sufficient to isolate the oil from its fat; upon the cooling of the water, and after the solidification of the fat, the thin oil which remains should be passed through a coarse charcoal filter.

Description.—Good neat's-foot oil has no smell, a mild taste, an oily feel, and is of a white or pale-yellowish color. According to Hager (*Handbuch*, 1886), it does not become rancid, even after a lapse of one year; its use for hair pomades is therefore suggested. Its specific gravity at 15° C. (59° F.) is 0.915. It does not readily solidify remaining fluid at very low temperatures, and is used for lubricating purposes, likewise by saddlers and shoemakers, to soften and preserve leather and prevent its cracking. Glycerin, oleic acid, and a small portion of stearic acid, are yielded upon saponification.

Action, Medical Uses, and Dosage.—This oil is emollient and relaxant, and may be applied with advantage to the breast and throat, in *croup* or *cough*, rubbing it on with brisk friction. It likewise enters into various extemporaneous liniments and poultices. Dr. C. R. Hall stated in the *London Journal of Medicine*, that he has used this oil in the place of cod-liver oil, in *tuberculous diseases* with much efficacy; the dose is the same as that of the cod-liver oil, and occasionally proves laxative. He found it especially useful among those patients with whom the fish oil occasioned nausea. The oil used was merely freed from foreign particles; it was of a yellowish-brown color, and thick and opaque with stearin, like honey not over clear. It does not, however, find favor at the present day, on account of its taste and odor, and its tendency to purge. It is now largely used for rendering leather soft and pliable.

OLEUM CADINUM (U. S. P.)—OIL OF CADE.

"A product of the dry distillation of the wood of *Juniperus Oxycedrus*, Linné (*Nat. Ord.*—Coniferæ)"—(*U. S. P.*).

SYNONYM: *Oleum juniperi empyreumaticum.*

Description and Chemical Composition.—"A brownish or dark-brown, clear, thick liquid, having a tarry odor, and an empyreumatic, burning, somewhat bitter taste. Specific gravity, about 0.990 at 15° C. (59° F.). It is almost insoluble in water, but imparts to it an acid reaction. It is only partially soluble in alcohol, but is completely soluble in ether, chloroform, or carbon disulphide"—(*U. S. P.*).

It is inflammable, and is prepared in France in a manner similar to that for making tar. Common juniper-wood oil is often substituted for it. Oil of cade contains phenols and large quantities of the sesquiterpene *cadinene* ($C_{15}H_{24}$) (Wallach, 1887).

Action, Medical Uses, and Dosage.—Oil of cade has been much used in France as a remedy in many *cutaneous affections*, as *prurigo*, *chronic eczema*, particularly of the moist variety, *psoriasis*, *pityriasis rubra*, and *favus*, and for the removal of *worms* (3 to 5 drops, several times a day). Probably our common tar will, as a substitute, prove fully as effectual. It is largely used upon animals. It may be used pure, or in ointment, liniments, soaps, or glycerites.

OLEUM CARBOLATUM (N. F.)—CARBOLIZED OIL.

Preparation.—"Carbolic acid, five grammes (5 Gm.) [77 grs.]; cotton-seed oil, ninety-five grammes (95 Gm.) [3 ozs. av., 154 grs.]. Melt the carbolic acid with a gentle heat, and mix it with the cotton-seed oil"—(*Nat. Form.*).

Action and Medical Uses.—(See *Acidum Carbolicum.*)

OLEUM CAJUPUTI (U. S. P.)—OIL OF CAJUPUT.

"A volatile oil distilled from the leaves of *Melaleuca Leucadendron*, Linne (*Nat. Ord.*—Myrtaceæ). It should be kept in well-stoppered bottles, in a cool place"—(*U. S. P.*).

SYNONYMS: *Oleum cajeputi, Oil of cajeput, Oleum Wittnebianum.*

Botanical Source and History.—This oil is distilled from the leaves of *Melaleuca Leucadendron*, a tree growing in the Moluccas and adjacent islands. It is variously known as *White tea-tree, Broad-leaved tea-tree, Paper-barked tea-tree, Swamp tea-tree*, and *White-wood*. It is a small tree, with a tolerably erect but crooked trunk; a soft, thick, spongy, whitish, ash-colored bark; and scattered branches, with the slender twigs often drooping as completely as in the weeping willow (*Salix Babylonica*). The leaves are alternate, most frequently vertical, short-stalked, narrow-lanceolate, while young, sericeous, sometimes slightly falcate, entire, from 3 to 5 inches long, and from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch broad; and very aromatic when bruised. The flowers are ternate, sessile, small, white, scentless, in terminal and axillary, downy spikes; the bracts are solitary, lanceolate, silky, and caducous. Calyx urceolate. Corolla white and orbicular; filaments 30 to 40, much longer than the petals; anthers ovate-cordate, with a yellow gland on the apex. The style is somewhat longer than the stamens; the stigma obscurely 3-lobed. The capsules are 3-celled and 3-valved; the seeds numerous, and angularly wedge-shaped (L.). This tree is the *Melaleuca Cajuputi* of Roxburgh, and the *Melaleuca minor* of De Candolle. By Bentham, it is regarded as a variety of *Melaleuca Leucadendron*. Several other species of Melaleuca, as *M. latifolia*, *M. viridifolia*, and *M. hypericifolia*, yield closely related oils, while an extract prepared from the *M. paraguayensis* has been used in rheumatic and allied complaints.

Fig. 181.

Melaleuca Leucadendron.

Preparation and Description.—*Cajuput oil* is obtained by distillation of the leaves, which are collected in autumn, allowed to steep for a night in water, and then distilled in copper vessels. The yield is very small. It is imported from the East Indies in green-glass bottles. The *U. S. P.* describes it as "a light, thin, bluish-green, or, after rectification, colorless liquid, having a peculiar, agreeable, distinctly camphoraceous odor, and an aromatic, bitterish taste. Specific gravity, 0.922 to 0.929 at 15° C. (59° F.). With an equal volume of alcohol it affords a clear solution, which either has a slightly acid reaction, or, in the case of the rectified oil, is neutral to litmus paper"—(*U. S. P.*). The odor of the oil has been stated to resemble the combined fragrance of camphor, rosemary, and cardamom. The green color is not essential, and may be removed by distillation; it is due chiefly to the presence of copper, and partly to the presence of some altered chlorophyll. The oil is slightly lævogyre. Sulphuric and nitric acids have but little action on cajuput oil.

Adulterations and Tests.—In consequence of its high price, oil of cajuput is subject to adulteration. Oils of rosemary or turpentine, combined with camphor and bruised cardamom seeds, and appropriately tinted with milfoil resin, have been sold as genuine oil. Oil of camphor has been used as an adulterant. Oils of lavender, origanum, and rosemary, frequently serve for adulteration, but are distinguished by the energetic action of a solution of iodine, besides, all would materially affect the nature of the residue of the iodine test subsequently described. "On shaking 5 Cc. of the oil with 5 Cc. of water containing a drop of diluted hydrochloric acid, the oil loses its green tint and becomes nearly colorless. If to this acid liquid, separated from the oil, a drop of potassium ferrocyanide T.S. be added, a reddish-brown color will usually be produced (presence of traces of copper). If 5 parts of the oil be heated to 50° C. (122° F.), and 1 part of powdered iodine gradually added, with avoidance of any further rise of temperature, the mixture, on cooling, will deposit a mass of crystals"—(*U. S. P.*).

Chemical Composition.—The chief constituent of cajuput oil is *cineol* (*cajeputene hydrate, cajeputol* $C_{10}H_{18}O$) (Blanchet, 1833; Wallach, 1884), *terpineol* ($C_{10}H_{18}O$), both free and as an ester of acetic acid, and small amounts of *terpenes*, such as *lævo-pinene.* The lowest fraction of the crude oil contained *valeric aldehyde* and *benzoic aldehyde* (Voiry, 1888). (For interesting details regarding this oil, see Gildemeister and Hoffmann, *Die Ætherischen Oele*, 1899.)

CINEOL (*Eucalyptol*, $C_{10}H_{16}O$) is a constituent of many essential oils. It is a colorless liquid, of a characteristic camphoraceous odor, optically inactive, boils at 177° C. (350.6° F.), congeals at a temperature slightly below the freezing point of water, and forms a characteristic addition product with hydrobromic acid which is decomposable by water into its constituents.

Action, Medical Uses, and Dosage.—Cajuput oil is a powerful diffusive stimulant, diaphoretic and antispasmodic. When swallowed, it occasions a warmth in the stomach, with an increased action of the pulse, and occasionally diaphoresis. It is very much valued in the islands of the Indian Ocean, the inhabitants of which employ it extensively in *rheumatism, palsy, epilepsy*, and many other diseases; using it both internally and as a local application. It may be advantageously employed internally in *chronic rheumatism, hysteria, colic, spasms* or *cramps of the stomach* or *bowels, cholera morbus, Asiatic cholera, congestive dysmenorrhœa, hiccough, nervous dysphagia*, in the *typhoid stage of fevers*, in *nervous vomiting*, and wherever a powerful stimulant is required. It also appears to be useful in removing *worms*, and in *chronic affections of mucous tissues*, being especially useful in *chronic laryngitis* and *chronic bronchitis*, as well as *catarrh of the bladder.* It should never be given internally when inflammation is present. Externally, it is very beneficial as an application to *rheumatic, neuralgic* and other *pains, nervous headache*, and may be used alone, or in combination with other oils. It has likewise been found efficient as a local application in *gutta rosea, parasitic* and other *cutaneous maladies.* Applied to the cavity of a carious tooth, it alleviates *toothache* The dose is from 1 to 10 drops, on sugar, in emulsion, or in sweetened brandy and water. Externally, it may be applied 3 or 4 times a day.

OLEUM CARI (U. S. P.)—OIL OF CARAWAY.

A volatile oil distilled from *Carum Carvi*, Linné.

Nat. Ord.—Umbelliferæ.

"It should be kept in well-stoppered bottles, in a cool place, protected from light"—(*U. S. P.*).

SYNONYMS: *Oleum carui, Oleum carvi.*

Preparation and Description.—This oil is easily separated by distillation of the fresh fruit (caraway) with water, which yields from 3.2 to 3.6 per cent (Russian, wild), or 6 to 7 per cent (Hessian, wild). The Dutch fruit, cultivated, yields from 4 to 6.5 per cent (Schimmel & Co.'s *Report*, April, 1897). The residue from the distillation of caraway seeds is used as feed for cattle. When fresh-prepared the oil is colorless, but by keeping it becomes yellow, and ultimately brown. It produces right-handed rotation on a ray of polarized light (+75° to +85°). The official oil is described as "a colorless, or pale yellow, thin liquid, having the characteristic, aromatic odor of caraway, and a mild, spicy taste. Specific gravity. 0.910 to 0.920 at 15° C. (59° F.). Soluble in an equal volume of alcohol, this solution being neutral to litmus paper"—(*U. S. P.*). Oil of caraway is little soluble in 70 per cent alcohol, but dissolves clear in 3 to 10 volumes of 80 per cent alcohol. Its boiling point is between 175° and 230° C. (347° and 446° F.).

Chemical Composition.—Oil of caraway is chiefly composed of two constituents, the hydrocarbon *dextro-limonene* (Schweizer's *carvene*, 1841), and the ketone *dextro-carvone* ($C_{10}H_{14}O$, Völckel, 1840; Wallach, 1893), formerly called *carvol.* The latter is the peculiar odoriferous principle of oil of caraway, and occurs therein to the extent of 50 to 60 per cent. *Carvone* is official in the *German Pharmacopœia* under the name of *Oleum Carvi* or *Carvol*, specific gravity 0.96, boiling point 224° C. (435.2° F.); according to Schimmel & Co., 229° to 230° C. (444.2° to 446° F.) if mercurial column is surrounded by the vapors. *Carvone* is soluble in 20 parts of 50 per cent alcohol to a clear liquid; the presence of 2 per cent of *carvene* is indicated by turbidity (Schimmel & Co.). *Carvone*, if exposed to air, turns yellow, and then produces a red-violet coloration with a *diluted* solution of ferric chloride. *Carvone* is an unsaturated ketone, forms a crystallizable compound with hydrogen sulphide ($C_{10}H_{14}O.H_2S$), by means of which it can be isolated and purified; with *hydroxylamine* (NH_2OH) it forms a crystallizable, not very volatile *oxime* ($C_{10}H_{14}$:NOH), melting at 72° C. (161.6° F.). E. Kremers and O. Schreiner (*Pharm. Review*, 1896, p. 76) estimate the quantity of carvone in oil of caraway by converting it into the *oxime* and separating the latter from the volatile carvene by distillation with steam.

Carvone, when heated with sulphuric acid, phosphoric acid, chloride of zinc, or alkalies, etc., is converted into its isomer *carvacrol* (*isopropyl-ortho cresol*) which is also an isomer of *thymol*, the principal constituent of oil of thyme. Carvacrol occurs chiefly in *Oleum Origani* (which see), and occasionally in the oil of *Monarda punctata* (see *Monarda*).

Action, Medical Uses, and Dosage.—Oil of caraway is a warm diffusible stimulant and carminative. It is frequently used to allay the griping and sickening effects of medicines, also to increase their flavor. Like oil of anise it allays *flatulent colic*, and is a local anodyne. The dose is from 1 to 5 or 10 drops. *Carvacrol*, placed on cotton and introduced into the cavity of a *carious tooth*, is said to give prompt relief.

OLEUM CARYOPHYLLI (U. S. P.)—OIL OF CLOVES.

A volatile oil distilled from the immature flower-buds of *Eugenia aromatica* (Linné), O. Kuntze (*Eugenia caryophyllata*, Thunberg).

Nat. Ord.—Myrtaceæ.

"It should be kept in well-stoppered bottles, in a cool place, protected from the light"—(*U. S. P.*).

Preparation.—Oil of cloves is procured by submitting cloves, with water, to repeated distillation; to extract the whole of the oil from cloves, they must be subjected to repeated cohobations. The addition of common salt is often resorted to to raise the point of ebullition. On an average they yield from 17 to 22 per cent of volatile oil. At the present time nearly all the oil is produced by means of superheated steam. The bulk of the oil used in this country is distilled here from South American cloves. In Europe *clove-stalks* are said to furnish a portion of the oil. The yield from this source is 5.5 to 6 per cent, and the specific gravity 1.055 to 1.065 (Schimmel & Co.).

Description.—The official oil is described as "a pale-yellow, thin liquid, becoming darker and thicker by age and exposure to the air, having a strongly aromatic odor of cloves, and a pungent and spicy taste. Specific gravity, 1.060 to 1.067 at 15° C. (59°F.). Soluble in an equal volume of alcohol, this solution being slightly acid to litmus paper; also soluble in an equal volume of glacial acetic acid"—(*U. S. P.*). It is also dissolved by ether and the fixed oils. Nitric acid reddens it, and when the mixture is heated, oxalic acid is formed. It is one of the least volatile and most difficult to distill of all the volatile oils. It boils between 250° and 260° C. (482° and 500° F.). It sinks in water, and is sparingly soluble in it. Its optical rotation is slightly left-handed.

Chemical Composition.—The principal constituents of oil of cloves are *eugenol* (70 to 85 per cent), *aceto-eugenol* (2 to 3 per cent, Erdmann, 1897), the sesquiterpene *caryophyllene* constituting the remainder. *Eugenol* (*allyl-guaiacol*, $C_6H_3.C_3H_5.OCH_3.OH$) is a faintly yellowish liquid possessing a strong clove odor and a burning taste. It is heavier than water, its specific gravity being 1.072 at 14.5° C. (58.1° F.). By oxidation it yields *vanillin*, which is also a constituent of the oil. Like the typical phenol (carbolic acid), eugenol dissolves in solution of caustic alkalies, forming phenolates, whereby its odor is lost; the eugenol may be liberated again by the addition of acid. On account of its being an ortho-diphenol-derivative, it turns blue in alcoholic solution with ferric chloride (compare *Guaiacolum*). *Caryophyllene* ($C_{15}H_{24}$, Church, 1875; Wallach, 1892) is a colorless liquid of a faint odor; it forms a crystallizable compound with 1 molecule of water (*caryophyllene hydrate*, $C_{15}H_{26}O$), melting at 96° C. (204.8° F.). Caryophyllene also occurs in oil of copaiba. Minor constituents of oil of cloves are *salicylic acid* (Scheuch, 1863; Erdmann, 1897), *methyl alcohol, furfurol* (*furfur-aldehyde*, $C_4H_3O.CHO$), to the presence of which is probably due the turning brown of oil of cloves upon exposure, and *methyl-amyl-ketone*, having an ethereal fruit odor (see Gildemeister and Hoffmann, *Die Ætherischen Oele*, 1899).

Tests.—The *U. S. P.* directs the following tests for oil of cloves: "When shaken with an equal volume of a concentrated solution of potassium hydrate, or of stronger ammonia water, it forms a semisolid, yellowish mass. If 2 drops of the oil be dissolved in 4 Cc. of alcohol, and a drop of ferric chloride T.S. added. a bright green color will be produced; and if the same test be made with a drop of dilute ferric chloride T.S., prepared by diluting the test-solution with four times its volume of water, a blue color will be produced which soon changes to yellow. If 1 Cc. of the oil be mixed with 2 Cc. of a mixture of 2 volumes of alcohol and 1 volume of water, it should form a clear and perfect solution (absence of petroleum, most fatty oils, oil of turpentine, and similar oils). If 1 Cc. of the oil be shaken with 20 Cc. of hot water, the water should show a scarcely perceptible acid reaction to litmus paper. If, after cooling, the aqueous layer be passed through a wet filter, the clear filtrate should yield, with a drop of ferric chloride T.S., only a transient grayish-green, but not a blue or violet color (absence of carbolic acid)"—(*U. S. P.*). A markedly lower specific gravity than that given above, points to the addition of lighter oils, as oil of turpentine, etc. Oil from clove-stalks is difficult to identify chemically; according to Gildemeister and Hoffmann (*loc. cit.*), it differs from oil of cloves in being devoid of *aceto-eugenol*.

The *eugenol* contents of oil of cloves may be determined quantitatively, according to H. Thoms (1891), by converting it into its benzoyl compound and weighing the latter; or, according to Umney (*Pharm. Jour. Trans.*, Vol. XXV. 1895, p. 950), by adding a 10 per cent (better a 4 to 5 per cent) solution of caustic potash to a definite quantity of the oil, and measuring the volume of the oil above the eugenol-potassium layer.

Action, Medical Uses, and Dosage.—Oil of cloves is stimulant and irritant, and is much used as a corrector of other medicines, and as an external counter-irritant. It is frequently inserted on cotton into the cavity of a carious tooth to alleviate *toothache*, and in the external auditory meatus to relieve *earache*. Its dose is from 2 to 5 drops on sugar, or in emulsion. One part of oil of cloves mixed with 3 parts of linseed oil, and given in doses of 6 or 8 drops in milk, 2 or 3 times a day, has been found useful in allaying pain, palpitation, and other annoying symptoms common to some forms of *heart disease*. It preserves mucilage of tragacanth prepared for adhesive purposes.

Derivatives of Eugenol.—EUGENOL-ACETAMIDE $C_6H_3.C_3H_3.OCH_3.OCH_2CONH_2$. This body is said to be obtained by the interaction of concentrated solution of ammonia and eugenol-acetic-ethyl-ether. It forms shining, crystalline needles or scales, which melt at 110° C. (230° F.). Water and alcohol dissolve it. It is reputed antiseptic and a local anæsthetic, acting somewhat like cocaine. It is a patented preparation (see *Pharm. Centralhalle*, 1892, p. 441).

BENZOYL-EUGENOL ($C_6H_3.C_3H_5[OCH_3]O.COC_6H_5$).—This compound forms colorless, odorless, slightly bitter needles, of a neutral reaction. It fuses at 70.5° C. (158.9° F.). Water scarcely dissolves it, but it is readily dissolved by hot alcohol, acetone, ether, and chloroform. It is recommended for the treatment of *tuberculous disorders*. It is patented.

CINNAMYL-EUGENOL ($C_6H_3.C_3H_5[OCH_3]O.CO[CH]_2C_6H_5$).—Tasteless, odorless, colorless, shining needles, fusing at 90° to 91° C. (194° to 195.8° F.). Hot alcohol, ether, acetone, and chloroform dissolve it. Its uses are the same as those of the preceding drug (see *Pharm. Centralhalle*, 1891, p. 366).

OLEUM CHENOPODII (U. S. P.)—OIL OF CHENOPODIUM.

"A volatile oil distilled from chenopodium. It should be kept in well-stoppered bottles, in a cool place"—(*U. S. P.*).

SYNONYM: *Oil of American wormseed.*

Preparation, History, and Description.—Oil of wormseed is prepared in this country; that produced near the city of Baltimore is the most esteemed. It is obtained by distillation of the bruised seed or ripe tops of the plant with water, and when first obtained is of a light-yellow color, but becomes darker by age. It possesses the odor and taste of the plant, and has a varying specific gravity which may become higher by age. An oil of less strength is prepared in the western states from the leaves, stalks, and seeds of the matured plant, and probably possesses similar properties when given in larger doses. That from the seeds always commands the highest price. Thirteen ounces of the seeds gave 3½ drachms of volatile oil, according to Engelhardt, which corresponds to a yield of about 3.4 per cent. Gildemeister and Hoffmann (*loc. cit.*), however, report a much smaller yield from the seeds, namely, 0.6 to 1 per cent. The herb of *C. ambrosioides* yields 0.25 per cent of oil, of specific gravity 0.901 (Schimmel & Co.'s *Report*, April, 1897). The oil is soluble in alcohol and ether. The *U. S. P.* describes it as "a thin, colorless or yellowish liquid, having a peculiar, penetrating, somewhat camphoraceous odor, and a pungent and bitterish taste. Specific gravity, about 0.970 at 15° C. (59° F.). One Cc. of the oil should form a perfectly clear solution with 10 Cc. of a mixture of 3 volumes of alcohol and 1 volume of water"—(*U. S. P.*). The oil is slightly lævo-rotatory.

Chemical Composition.—This oil has not been recently investigated. According to Garrigues (*Amer. Jour. Pharm.*, 1854, p. 404), it contains a hydrocarbon ($C_{10}H_{16}$), boiling at 176° C. (348.8° F.), probably *limonene*, and a body ($C_{10}H_{16}O$).

Action, Medical Uses, and Dosage.—This oil is used only as an anthelmintic. Its dose is from 3 to 6 drops for a child, repeated twice a day for 4 or 5 days, and then followed by an active cathartic. It forms the basis of several popular nostrums for *worms*. Poisonous effects have been observed, from its immoderate use. It has also been used in *dyspepsia of stomach and bowels*, and in certain *spasmodic nervous disorders*.

OLEUM CINNAMOMI (U. S. P.)—OIL OF CINNAMON.

"A volatile oil distilled from cassia cinnamon. It should be kept in well-stoppered bottles, in a cool place, protected from light"—(*U. S. P.*).

Synonyms: *Oil of cassia, Oleum cinnamomi cassiæ, Oleum cassiæ, Chinese oil of cinnamon.*

Source, Preparation, and Description.—There are several oils of cinnamon the chief commercial varieties of which are the *Oil of Chinese Cinnamon*, and the *Oil of Ceylon Cinnamon;* the former alone is recognized by the present edition of the *U. S. P.*

I. Oleum Cinnamomi Zeylanici, *Oil of Ceylon cinnamon.*—Oil of cinnamon is obtained in Ceylon, by macerating refuse bark and chips, reduced to a coarse powder, in sea-water for two days, adding chloride of sodium, and then distilling off the water. Part of the oil floats, and the other part sinks in the water which comes over; the whole amounting on an average to 8 ounces from 80 pounds, avoirdupois, of recently prepared cinnamon (0.5 to 1 per cent, Schimmel & Co.). The color of oil of cinnamon is pale-yellow, or wine-yellow, which slowly passes to cherry-red. Its taste is at first sweetish, afterward burning and aromatic. It is readily soluble in alcohol, also clearly soluble in 3 parts of 70 per cent alcohol. Its specific gravity varies from 1.024 to 1.040 (about 1.040, *U. S. P.*, 1880). This oil has the finest aroma of all cinnamon oils; the chemical nature of the aromatic principle, however, is not known. The oil contains 65 to 75 per cent of *cinnamic aldehyde*, and about 4 to 8 per cent of *eugenol*, both of which form the heavy distillate; the lighter distillate contains the hydrocarbon *phellandrene*. This oil is often adulterated with the oil from the leaves, which are frequently distilled along with the bark; the oil of the leaves (1.8 per cent) is characterized by a much higher percentage of its *eugenol* contents (70 to 90 per cent), and consequently by a higher specific gravity (1.044 to 1.065).

II. Oleum Cinnamomi Cassiæ.—*Oil of cassia*, or *Chinese oil of cinnamon*, resembles the Ceylon oil in color, odor, and taste, but it is much inferior. Its chemical reactions are similar to those of the oil of cinnamon, as well as are its medicinal virtues. The Chinese oil is optically inactive, while the Ceylon oil is slightly lævo- or dextro-gyrate. According to Schimmel & Co. (*Report*, Oct., 1892), this oil is obtained mainly from cassia leaves mixed with stem, twigs, and refuse portions of the trees. Schimmel & Co. (*Semi-Annual Report*, Oct., 1892 and Oct., 1893) obtained by separate distillations of various parts of cassia, the following percentages of cinnamic aldehyde:

Part.	Per cent.	Yield of oil. Per cent.	Specific gravity.
Cassia bark.	88.9	1.5	1.035 at 20° C.
Cassia buds	80.4	1.55	1.026 at 20° C.
Cassia bud-sticks	92	1.64	1.046 at 15° C.
Cassia branch tops	90	0.2	1.045 at 15° C.
Cassia leaves	93	0.54	1.056 at 15° C.
Cassia leaves, leaf-stalks, and young twigs, mixed.	93	0.77	1.055

The *U. S. P.* describes the official oil as follows: "A yellowish or brownish liquid, becoming darker and thicker by age and exposure to the air, having the characteristic odor of cinnamon, and a sweetish, spicy, and burning taste. Specific gravity, 1.055 to 1.065 at 15° C. (59° F.). Soluble in an equal volume of alcohol, the solution being slightly acid to litmus paper; also soluble in an equal volume of glacial acetic acid. When shaken with a saturated solution of sodium bisulphite, it solidifies to a crystalline mass. If 4 drops of the oil, contained in a test-tube, be cooled to 0° C. (32° F.), and then shaken with 4 drops of fuming nitric acid, crystalline needles or plates will be formed"—(*U. S. P.*). In the latter reaction, the cinnamic aldehyde of the oil and the nitric acid unite to form a decomposition product, decomposable by water.

Chemical Composition and Tests.—The chief constituent of cassia (*Chinese*) oil is *cinnamic aldehyde* ($C_6H_5CH{:}CHCHO$), discovered, in 1834, by Dumas and Péligot. It is a light-yellow liquid, of specific gravity 1.064 at 15° C. (59° F.), forming a crystallizable compound, as stated above, with nitric acid, also with sodium bisulphite. Upon the formation of this compound is based a method for the valuation of cinnamic aldehyde in oil of cassia, devised by Messrs. Schimmel & Co. (For a description of this process, see Gildemeister and Hoffmann, *Die Ætherischen Oele*, 1899.) Other constituents of oil of cassia are *cinnamyl-acetate* ($C_9H_9.C_2H_3O_2$) (Schimmel & Co., 1889), and 1 per cent of free *cinnamic acid*, formed by oxidation of cinnamic aldehyde. The presence of this acid causes corrosion of the leaden containers in which the oil is shipped. Oil of cassia was at one time much adulterated with colophony and petroleum. The *U. S. P.* directs the following tests: "If a portion of the oil be shaken with water, and the liquid passed through a wet filter, the clear filtrate should give, with a few drops of basic lead acetate T.S., a white turbidity, without a yellow color (absence of oil of cloves). If 4 drops of the oil be dissolved in 10 Cc. of alcohol, the subsequent addition of a drop of ferric chloride T.S. should produce a brown, but not a green or blue, color (absence of oil of cloves or of carbolic acid). If 1 Cc. of the oil be mixed with 3 Cc. of a mixture of 3 volumes of alcohol and 1 volume of water, a clear solution should result; and if to this solution there be gradually added 2 Cc. of a saturated solution of lead acetate in a mixture of 3 volumes of alcohol and 1 volume of water, no precipitate should be produced (absence of petroleum, or of colophony)"—(*U. S. P.*). The latter test is that of Hirschsohn (1890).

Action, Medical Uses, and Dosage.—Oil of cinnamon is stimulant, aromatic, antispasmodic, and carminative. It is frequently used to modify the taste of medicines, and is given as a stimulant in *flatulent colic, cramps of the stomach, paralysis of the tongue*, etc. It exerts an influence upon the uterus, and is one of the most valuable of agents, in the form of alcoholic tincture, in *uterine hemorrhage*. The tincture of the bark is frequently administered for this purpose, but we know from experience, that although destitute of astringency, yet the tincture or essence of the oil has the same, if not a better action, in such cases; again it is an unsafe remedy to exhibit during pregnancy, as it is very apt to produce miscarriage. The essence, or even cordial of cinnamon, stimulates the generative organs, and produces an aphrodisiac influence. Tincture of oil of cinnamon combined with ergot, ipecac, erigeron, or lycopus, as indicated, is an excellent remedy for *hemoptysis*. The dose of oil of cinnamon is 1 or 2 drops, given in emulsion; of the essence from ½ to 1 fluid drachm, given in a wine-glass of sweetened water. Ten drops of oil of cinnamon added to a fluid drachm of olive oil, gently heated and rubbed upon the spine, will frequently quiet a restless, fretful child suffering with *flatulence* or *colic*, and cause it to sleep; if the rubefacient power requires to be increased, 10 drops of aqua ammoniæ may be added.

Related Oils.—OLEUM CINNAMOMI RADICIS, *Oil of cinnamon root.* Distilled from the root-bark of *Cinnamomum Zeylanicum*, Breyn. This oil is nearly colorless, has a cinnamon-like and camphoraceous odor, and a camphor-like taste. It is not so heavy as water, and at ordinary temperature separates common camphor. It also contains *cinnamic aldehyde*.

OLEUM CINNAMOMI FOLIORUM, *Oil of cinnamon leaves.* Distilled from the leaves of *Cinnamomum Zeylanicum.* This is a bright, limpid, pale-yellow oil, with a combined cinnamon-clove odor. Its constituents are *eugenol*, *safrol*, and *cinnamic aldehyde*, sometimes replaced by *benzaldehyde* (also see *Oleum Cinnamomi Zeylanici*).

OIL OF CINNAMON from the bark of a north Indian tree, the *Cinnamomum Wightii*, of Meissner, is highly aromatic, has a specific gravity of 1.01, and boils between 130° and 170° C. (266° and 338° F.). The yield is 0.3 per cent (Schimmel & Co.).

OLEUM COCOS.—COCOANUT OIL.

The fixed oil obtained from *Cocos nucifera*, Linné.

Nat. Ord.—Palmæ.

SYNONYMS: *Oleum cocois, Cocoanut butter.*

Botanical Source and History.—The cocoanut tree (*Cocoanut palm*) yields the cocoanut (properly coconut), much used in this country for culinary purposes, and in the confectioner's art. The tree is met with in most tropical climes, growing from 50 to 100 feet high. The narrow, long, rigid leaflets compose the leaves, which are of great length (12 feet or more), and borne in a cluster at the apex of the tall trees. The flowers are yellowish-white and the fruits, borne in clusters of from 10 to 20, are the well-known cocoanuts. When unripe they are filled with a sweetish liquid. As many as 120 of these large nuts are sometimes to be found on the tree. The uses of the cocoanut palm, and its products, are probably more extensive than those of any other plant. (For an account of its varied uses, see *Practical Flora*, by O. R. Willis; *Useful Native Plants of Australia*, by Maiden; *Treasury of Botany;* and *Materia Medica of Western India*, by Dymock.) The oil is obtained by boiling in water, or preferably by hot expression.

Description.—*Cocoanut oil* must not be confused with *palm oil*, or with *cacao butter*. It is white, butyraceous, of a mild, bland taste, and a peculiar odor. It is capable of forming a hard, white soap, which is not precipitated by salt, and therefore may be used with sea-water. On exposure to the atmosphere, it becomes rancid. Its melting point ranges from 20° to 28° C. (68° to 82.4° F.), the cold expressed oil having the lowest melting point. When fused it is thin, yellowish, and transparent, congealing again between 14° and 23° C. (57.2° and 73.4° F.). It may retain its fluidity for many days after having been subjected to a heat of 240° C. (469° F.). The soap combines with much water when mixed with it near the congealing point.

Chemical Composition.—This oil contains a small amount of oleic acid, as glyceride (*olein*). The bulk of the oil consists of a glyceride sometimes called *coconin* (*cocinate of glycerin*), which is a mixture of several glycerides (Oudemans), chiefly *laurin*, the glycerin ester of lauric acid. *Myristin*, *palmitin*, and *stearin* are likewise present, as well as the glycerides of caproic, caprinic, and caprylic acids. The oil is separable by hydraulic pressure into a solid portion utilized in candle-making, and an oily portion used for salad dressings, illuminating purposes, the manufacture of soaps, etc.

Action, Medical Uses, and Dosage.—Besides the commercial uses above referred to, cocoanut oil has been employed, but without success, as a substitute for cod-liver oil. The dose is about ½ ounce.

OLEUM COPAIBÆ (U. S. P.)—OIL OF COPAIBA.

"A volatile oil distilled from copaiba. It should be kept in well-stoppered bottles, in a cool place"—(*U. S. P.*).

Preparation.—The oil is obtained by distilling copaiba balsam with water. "Take of copaiba, 12 ounces; water, 2 gallons. Distill, preserving the water;

when most of the water has passed over, heat, return it into the still, and resume the distillation; repeat this process so long as a sensible quantity of the oil passes over with the water" (*Ed.*).

Description and Chemical Composition.—The more recent the copaiba balsam, the greater the amount of volatile oil obtained. Usually about 33 to 50 per cent of oil may be distilled from copaiba, and it is stated that one specimen yielded 80 per cent (*Amer. Jour. Pharm.*, Vol. XXII, p. 289). It is inflammable, soluble in ether and sulphide of carbon; its boiling point is 243.3° C. (470° F.); it dissolves caoutchouc; absorbs hydrochloric acid gas, artificial camphor being deposited in crystals. The *U. S. P.* describes the oil as "a colorless or pale yellowish liquid, having the characteristic odor of copaiba, and an aromatic, bitterish, and pungent taste. Specific gravity, 0.890 to 0.910 at 15° C. (59° F.), increasing with age. Soluble in about ten times its volume of alcohol, forming a slightly turbid liquid, which is neutral to litmus paper"—(*U. S. P.*). Potassium may be preserved in the oil unchanged. When dropped on iodine, hydriodic acid is produced with sudden development of heat. It dissolves sulphur, iodine, and phosphorus, and is converted into a resinous substance by nitric and sulphuric acids. It has a left-handed optical rotation. It is composed mainly of the hydrocarbon *caryophyllene* ($C_{15}H_{24}$). (Compare *Oil of Cloves;* also see *Copaiba.*)

Action, Medical Uses, and Dosage.—The oil of copaiba exerts an influence upon the system similar to that of copaiba, to which it is preferred on account of the smaller dose required, and its non-tendency to cause nausea. It enters into many of the nostrums of the day for the cure of *gonorrhœa.* It is also reputed useful in *bronchial catarrh.* The dose is 10 or 20 drops, which should be given in syrup, peppermint, or cinnamon water, mucilage, or emulsion.

OLEUM CORIANDRI (U. S. P.)—OIL OF CORIANDER.

A volatile oil distilled from the fruit of *Coriandrum sativum*, Linné.

Nat. Ord.—Umbelliferæ.

"It should be kept in well-stoppered bottles, in a cool place"—(*U. S. P.*).

Preparation.—This is obtained by distilling ground coriander fruit with water or by steam. The yield ranges from 0.2 per cent (East Indian) to 0.8 to 1 per cent (Russian) (Schimmel & Co.).

Description and Chemical Composition.—"A colorless or slightly yellowish liquid, having the characteristic, aromatic odor of coriander, and a warm, spicy taste. Specific gravity 0.870 to 0.885 at 15° C. (59° F.). One Cc. of the oil forms a perfectly clear solution with 3 Cc. of a mixture of 3 volumes of alcohol and 1 volume of water, the solution being neutral to litmus paper. The oil is also soluble in an equal volume of glacial acetic acid"—(*U. S. P.*). The oil is dextrogyrate (+4° to +13°) and contains about 5 per cent of *dextro-pinene;* the bulk consists of the dextro-rotatory modification of *linalool* ($C_{10}H_{18}O$), formerly called *coriandrol.* Neither of these constituents nor their mixture exhibits the peculiar odor of coriander. The flowering herb distilled yields an oil of a repulsive bedbug odor, which disappears, however, upon standing.

Action, Medical Uses, and Dosage.—This oil is carminative, aromatic, and anodyne. It may be used locally for *neuralgic* and *rheumatic pains*, and internally for *flatulent colic, cramps*, etc. It gives an agreeable flavor to many medicines, senna in particular. Dose, from 1 to 5 drops.

OLEUM CUBEBÆ (U. S. P.)—OIL OF CUBEBS.

A volatile oil distilled from the fruit of *Piper Cubeba*, Linne filius.

Nat. Ord.—Piperaceæ.

"It should be kept in well-stoppered bottles, in a cool place"—(*U. S. P.*).

Preparation, Description, and Chemical Composition.—Cubebs ground and distilled with water, furnish from 10 to 18 per cent of this oil. The bulk of the oil boils between 250° and 280° C. (482° and 536° F.). It is lighter than water, of specific gravity 0.910 to 0.930 (Schimmel & Co.), and thickens on exposure to the air without losing its odor; occasionally it deposits crystals which are called cubeb camphor ($C_{15}H_{24}H_2O$). This camphor is deposited in old oil, or in that distilled from old fruit. Oil of cubeb is officially described as "a colorless, pale greenish, or yellowish liquid, having the characteristic odor of cubeb, and a warm, camphoraceous, aromatic taste. Specific gravity, about 0.920 at 15° C. (59° F.). Soluble in an equal volume of alcohol, the solution being neutral to litmus paper"—(*U. S. P.*). It contains some *dipentene* ($C_{10}H_{16}$), but is composed mainly of *cadinene* ($C_{15}H_{24}$).

Action, Medical Uses, and Dosage.—Oil of cubebs may be substituted for the powdered berries, in many instances with benefit. It is less pungent than the oleoresin or fluid extract, and is probably only one of the active principles of cubebs. The dose is 10 or 12 drops, 3 times a day, gradually increased, as the stomach will permit, or until it produces some decided results. It may be given in syrup, emulsion, or in the form of capsules, like copaiba.

OLEUM ERECHTITIS.—OIL OF FIREWEED.

Botanical Source and Description.—This oil is obtained by distilling the plant *Erechtites hieracifolia* with water. Thus obtained, it is quite fluid, transparent, yellowish, of a strong, peculiar, fetid, and slightly aromatic odor, and a fetid, bitterish, burning taste. In its odor and taste it somewhat resembles the oil of fleabane. It is soluble in ether, alcohol, and partially in acetic acid; its specific gravity, according to Prof. Power (*Pharm. Rundschau*, Vol. V, 1887, p. 201), is 0.838 at 18.5° C. (65.3° F.). According to Beilstein and Wiegand (1882), its chief constituent is a terpene ($C_{10}H_{16}$), boiling at 175° C. (347° F.). The oil of commerce is liable to be mixed with oil of fleabane (see *Oleum Erigerontis;* also see A. M. Todd, *Amer. Jour. Pharm.*, 1887, p. 302, and *Drugs and Med. of N. A.*, Vol. II, pp. 126–140).

Action, Medical Uses, and Dosage.—The therapeutical action of oil of fireweed is not well understood. It seems to resemble the oil of fleabane in its influence upon various *hemorrhages*, and for which agent it is frequently substituted, and is considered by many to be the most efficient in such cases, of the two oils. It also exerts a beneficial effect on mucous surfaces, and has been successfully used in *diarrhœa*, *dysentery*, *hemorrhoids*, etc. As an antispasmodic it has been found of value in *spasms of the stomach and bowels*, *colic*, *hiccough*, *hysteria*, and *pertussis*, though it is apt to disagree with the stomach, causing nausea, etc. It is chiefly employed for the same purposes as the oil of fleabane. The dose is from 5 to 20 drops on sugar, or in emulsion. When triturated with the extract of stramonium, oil of fireweed is said to form a valuable preparation for *piles*.

OLEUM ERIGERONTIS (U. S. P.)—OIL OF ERIGERON.

"A volatile oil distilled from the fresh flowering herb of *Erigeron canadense*, Linné (*Nat. Ord.*—Compositæ). It should be kept in well-stoppered bottles, in a cool place, protected from light"—(*U. S. P.*).

SYNONYMS: *Oil of fleabane, Oleum erigerontis canadensis* (*U. S. P.*, 1870), *Oil of Canada fleabane.*

Preparation, History, and Description.—This oil is obtained by distillation of the leaves and flowers of fleabane (*Erigeron canadense*) with water. When freshly obtained it is colorless, or of a light-yellow color, and transparent; both the odor and taste recall to mind those of oil of spearmint, combined with oil of amber. The oil is inflammable, burning with an abundant, sooty flame. The *U. S. P.* describes this oil as "a pale-yellow, limpid liquid, becoming darker and thicker by age and exposure to the air, having a peculiar, aromatic, persistent odor and an aromatic, slightly pungent taste. Specific gravity, about 0.850 at 15° C. (59° F.), increasing with age. Soluble in an equal volume of alcohol (distinction from oil of fireweed [derived from *Erechtites hieracifolia*, Rafinesque, *Nat. Ord.*—Compositæ] and from oil of turpentine), this solution being neutral or slightly acid to litmus; also soluble in an equal volume of glacial acetic acid. It distills for the most part between 175° and 180° C. (347° and 356° F.)"—(*U. S. P.*). Oil of erigeron was introduced into practice by Eclectic physicians.

Chemical Composition.—This oil is mainly composed of *dextro-limonene* (see Fritz W. Meissner, *Amer. Jour. Pharm.*, 1893, p. 420), and *terpineol* (Kremers and Hunkel, *Pharm. Rundschau*, Vol. XIII, 1895, p. 137).

Action, Medical Uses, and Dosage.—Oil of fleabane is hæmostatic, stimulant, and carminative, with scarcely any perceptible astringency. It appears, notwithstanding, to exert a very remarkable influence on the system in *hemorrhages*, to check which it is chiefly used. It is of superior value in all hemorrhages, but more especially when from the uterus. Further investigations with this remedy are required in order to know its proper therapeutic action. The dose is from 2 to 10 drops, dissolved in alcohol, and administered in mucilage or sweetened water. It should be repeated, according to circumstances, every 15 or 30 minutes, or every 1, 2, or 4 hours. Combined with 5 or 6 parts of castor oil, or of stramonium ointment, it forms a valuable application to *piles.* (For further uses, see *Erigeron.*)

OLEUM EUCALYPTI (U. S. P.)—OIL OF EUCALYPTUS.

"A volatile oil distilled from the fresh leaves of *Eucalyptus globulus*, Labillardière; *Eucalyptus oleosa*, F. von Mueller, and some other species of *Eucalyptus* (*Nat. Ord.*—Myrtaceæ). 'It should be kept in well-stoppered bottles, in a cool place, protected from the light"—(*U. S. P.*).

History and Description.—When the leaves are distilled with steam, and the distillate purified by treatment with caustic soda solution and again rectified, a fragrant, yellowish oil is obtained, which becomes brown and resinous from oxidation, when exposed to the atmosphere. *Eucalyptus tar* is the soap-like, brown residue from the purification of the crude oil with caustic soda. It is sometimes used as a cheap disinfectant. The flower buds yield eucalyptus oil in great quantity, and even when dry are found to contain numbers of large oil glands filled with oil. As described by the *U. S. P.*, it is "a colorless or faintly yellowish liquid, having a characteristic, aromatic, somewhat camphoraceous odor, and a pungent, spicy, and cooling taste. Specific gravity, 0.915 to 0.925 at 15° C. (59° F.). Soluble, in all proportions, in alcohol, carbon disulphide, or glacial acetic acid. Its alcoholic solution is neutral, or slightly acid, to litmus paper. If 1 Cc. of the oil be mixed with 2 Cc. of glacial acetic acid, and 1 or 2 Cc. of a saturated, aqueous solution of sodium nitrite be gradually added, the mixture, when gently stirred, should not form a crystalline mass (distinction from oils of eucalyptus containing a considerable portion of phellandrene)"—(*U. S. P.*). The oil, if rich in cineol, solidifies when surrounded by a freezing mixture; it dissolves resins readily, but does not dissolve gutta-percha. The oils of various species of Eucalyptus differ in many respects. Since 1854, the manufacture of eucalyptus oil has been established in Australia by Joseph Bosisto, and it is now an article of considerable commerce. (In this connection, see an interesting article by Mr. E. M. Holmes, on the manufacture, etc., of eucalyptus oil, in *Pharm. Jour. Trans.*, Vol. XXV, 1894, p. 501.) Large quantities of the oil are now also produced in Algeria.

Chemical Composition.—The oil of *Eucalyptus globulus* contains *cineol* ($C_{10}H_{18}O$, Jahns, 1884), formerly called *eucalyptol* (Cloëz, 1870). It is the chief constituent of this oil, as well as oil of cajuput (which see), and occurs in smaller quantities in a number of other oils (see enumeration, in Gildemeister and Hoffmann, *loc. cit.*). It is a colorless fluid of a characteristic camphoraceous odor, and crystallizing slightly below the freezing point of water. It boils at 177° C. (350.6° F.), and is optically inactive. It forms crystallizable addition compounds, chiefly with hydrobromic acid gas and with concentrated phosphoric acid, which serve in the isolation, and perhaps the quantitative determination of cineol.

The oil of Eucalyptus globulus also contains the hydrocarbon *dextro-pinene* (Wallach and Gildemeister, 1884), formerly called *eucalyptene*, and other hydrocarbons. The crude oil contains *valeric*, *butyric*, and *caproic aldehydes*, to which the acrid odor of the oil is due. The oil of the Australian *E. amygdalina*, Labillardière, or *White* and *Brown peppermint tree*, contains chiefly *phellandrene*, with little cineol. The aldehyde *citronellal* ($C_{10}H_{18}O$) is the principal constituent (80 to 90 per cent) of the oil of *E. citriodora*, Hooker, and other species; and *citral* ($C_{10}H_{16}O$) is found in large quantity in the oils from *Eucalyptus Staigeriana*, F. von Mueller, and *Backhousia citriodora*, F. von Mueller. *E. oleosa*, F. von Mueller, contains *cineol* and *cumin-aldehyde*. (For abundant information regarding eucalyptus oils, see Gildemeister and Hoffmann, *Die Ætherischen Oele*, 1899.)

Action, Medical Uses, and Dosage.—(For uses, see *Eucalyptus*.) Dose, 2 to 10 drops.

OLEUM FŒNICULI (U. S. P.)—OIL OF FENNEL.

"A volatile oil distilled from *Fœniculum capillaceum*, Gilibert (*Fœniculum vulgare*, Gaertner) (*Nat. Ord.*—Umbelliferæ). It should be kept in well-stoppered bottles, in a cool place, and, if it has partly or wholly solidified, it should be completely liquefied by warming before being dispensed"—(*U. S. P.*).

Description.—Oil of fennel is prepared from bruised fennel seeds, by distillation with water. The yield from different sources (Saxon, Galician, Moravian, Roumanian) varies from 4 to 6 per cent. As officially described, the oil is "a colorless or pale-yellowish liquid, having the characteristic, aromatic odor of fennel, and a sweetish, mild, and spicy taste. Specific gravity, not less than 0.960 at 15° C. (59° F.). Between 5° and 10° C. (41° and 50° F.) it usually solidifies to a crystalline mass, but occasionally it remains liquid at a considerably lower temperature. Soluble in an equal volume of alcohol, the solution being neutral to litmus paper; also soluble in an equal volume of glacial acetic acid"—(*U. S. P.*).

Chemical Composition and Tests.—Oil of fennel contains from 50 to 60 per cent of *anethol* (see *Oleum Anisi*) which crystallizes out upon cooling, and *dextro-fenchone* ($C_{10}H_{16}O$, Wallach and Hartmann, 1890), an oily, camphoraceous ketone of bitter taste, solidifying above the temperature of melting ice, boiling at 192° to 193° C. (377.6° to 379.4° F.) and forming with hydroxylamine a crystallizable *oxime* ($C_{10}H_{16}$:N.OH), characterized by its melting point, 164° to 165° C. (327.2° to 329° F.). Furthermore, *dextro-pinene* and *dipentene* are present. Tardy (1897) found in a specimen of French fennel oil, in addition, *methyl-chavicol* (see *Oleum Anisi*), and perhaps *anise-ketone* ($C_6H_4.OCH_3.CH_2COCH_3$). The relative amounts of these constituents vary according to the geographical sources of the oil; thus, fenchone is entirely absent in sweet or Roman fennel from southern France and Macedonia, while Sicilian fennel (*Fœniculum piperitum*, De Candolle) contains but traces of anethol. Oil of bitter fennel, growing wild in France, Spain, and Algeria, contains principally *dextro-phellandrene*, and traces of fenchone and anethol. According to Gildemeister and Hoffmann (*Die Ætherischen Oele*, p. 740), oil of fennel from which part of its anethol is removed by refrigeration, does not solidify at or above 3° C. (37.4° F.). An addition of alcohol or oil of turpentine reduces the specific gravity of the oil. The specific gravities, according to Schimmel & Co. (*Report*, April, 1897), range from 0.920 (Spanish fruit) to 0.987 (Asia Minor or Aleppo fruit). The *U. S. P.* gives the following tests for the purity of oil of fennel: "The oil is not colored by the addition of a drop of ferric chloride T.S. (absence of some foreign oils containing phenols, and of carbolic acid). If the oil be dropped into water, without agitation, it should not produce a milky turbidity (absence of alcohol)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Oil of fennel is principally used as a carminative, and for the purpose of correcting or concealing the unpleasantness of other medicines. It is emmenagogue, and increases the lacteal secretions. The dose is from 5 to 20 drops.

OLEUM GAULTHERIÆ (U. S. P.)—OIL OF GAULTHERIA.

"A volatile oil distilled from the leaves of *Gaultheria procumbens*, Linné (*Wintergreen*, *Nat. Ord.*—Ericaceæ), consisting almost entirely of methyl salicylate ($CH_3C_7H_5O_3$ = 151.64), and nearly identical with volatile oil of betula. It should be kept in well-stoppered bottles, protected from light"—(*U. S. P.*).

SYNONYMS: *Oil of wintergreen*, *Oil of teaberry*, *Oil of partridgeberry*.

History.—This volatile oil is not peculiar to gaultheria alone, but has been derived also from the bark of *Betula lenta*, the root of *Polygala paucifolia*, and the stems and roots of *Spiræa Ulmaria*, *Spiræa lobata*, the leaves of *Gaultheria hispidula*, *Gaultheria leucocarpa*, *Gaultheria punctata*, and from *Monotropa Hypopitys*. Gaultheria procumbens is a small, herbaceous plant, growing in the United States along the Atlantic coast as far south as Georgia and Alabama, and westward as far as Minnesota. The oil was first distilled early in this century, in the states of Pennsylvania, New Jersey, and New York, but its production has gradually been superseded, to a great extent, by the distillation of the oil from *Betula lenta*, and later by the manufacture of artificial methyl salicylate, which is the chief constituent of both oils, a fact discovered almost simultaneously by Wm. Procter, Jr. (1842), and Cahours, in France (1844). Oil of gaultheria was first mentioned in American literature by Jacob Bigelow, in 1818 (see historical notes in *Pharm. Review*, 1898, p. 176; and especially Dr. Frederick Hoffmann, in *Die Ætherischen Oele*, 1899, p. 765).

Description.—"A colorless or yellow, or occasionally reddish, liquid, having a characteristic, strongly aromatic odor, and a sweetish, warm, and aromatic taste. Specific gravity, 1.175 to 1.185 at 15° C. (59° F.). Boiling point, 218° to 221° C. (424.4° to 429.8° F.). It deviates polarized light slightly to the left. In other respects it has the same properties and conforms to the same reactions and tests as methyl salicylate (see *Methyl Salicylas;* also *Oleum Betulæ Volatile*)"—(*U. S. P.*). Oil of gaultheria is the heaviest essential oil known. It dissolves in 6 parts of 70 per cent alcohol, which is not the case if the oil is adulterated with petroleum oil. An addition of the latter also reduces the specific gravity of the oil. Its odor distinctly differs from that of synthetic methyl salicylate. The only physical difference between the oils of gaultheria and sweet birch, consists in the optical inactivity of the latter.

Chemical Composition.—According to Power and Kleber (*Pharm. Rundschau*, 1895, p. 228), 98.05 per cent of the oil consists of methyl salicylate, and may be removed by shaking the oil with solution of caustic potash (7.5 per cent); this converts the salicylate into the water-soluble potassium-methyl-salicylate ($C_6H_4.OK.COOCH_3$). The remainder, a semisolid, insoluble mass, was differentiated into the paraffin *triacontan* ($C_{30}H_{62}$); an aldehyde or ketone, possessing the odor of œnanth-aldehyde; its corrresponding alcohol ($C_8H_{16}O$); and an ester ($C_{14}H_{24}O_2$), saponifiable into the same alcohol ($C_8H_{16}O$), and an acid ($C_6H_{10}O_2$). Both alcohol and ester possess the characteristic odor of wintergreen not to be found in the artificial oil (Gildemeister and Hoffmann, *loc. cit.*). The terpene *gaultherilene*, observed by Cahours (1844) in the quantity of 10 per cent, must have been due to an adulteration of his specimen with oil of turpentine. Oil of gaultheria, according to recent investigations (see *Oleum Betulæ Volatile*), is formed in the plant by decomposition of the glucosid *gaultherin*, under the influence of a peculiar ferment; but some oil, at least, must exist ready-formed, judging from the odor it emits when rubbed between the fingers.

Action, Medical Uses, and Dosage.—This oil is stimulant and aromatic, and is largely employed to correct or disguise the taste of other medicines. The essence, or the oil dissolved in alcohol, is stated to have been found effectual in curing *intermittent fever*. Oil of wintergreen possesses decidedly active properties, and in ½ ounce doses has produced death. It acts much like salicylic acid, but death is preceded by coma. Congestion of the kidneys, stomach, and duodenum, and black fluid blood, are revealed upon autopsy. The symptoms produced are drowsiness, cerebral congestion with throbbing of the arteries, delirium, visual impairment with contracted or dilated pupils, tinnitus, paresis, somnolence and coma. Oil of wintergreen has been more recently largely employed in *gonorrhœa*, and in *gonorrhœal* and other forms of *rheumatism*, in *trigeminal neuralgia, tic douloureux*, and in *subacute* and *chronic cystitis*. As large doses as can be borne should be given in rheumatic disorders, but like salicylic acid and the salicylates its action upon the heart must be closely watched. Locally used, it relieves pain. The dose of the oil is from 5 to 10 to 30 drops on sugar, in capsules, or in emulsion.

OLEUM GOSSYPII SEMINIS (U. S. P.)—COTTON-SEED OIL.

"A fixed oil expressed from the seed of *Gossypium herbaceum*, Linne, and of other species of *Gossypium* (*Nat. Ord.*—Malvaceæ), and subsequently purified. It should be kept in well-closed vessels"—(*U. S. P.*).

SYNONYMS: *Oleum gossypii, Oil of cotton, Cotton oil.*

Source and Preparation.—Cleaned cotton seeds are about ⅓ inch long and ⅙ inch wide, irregularly ovoid, covered with a hard, somewhat fragile, brown testa marked with a conspicuous raphè. Internally, the cotyledons are folded, and, imbedded throughout their substance are a number of resin-glands of a blackish color. The embryo is whitish. To obtain the oil, of which 2 gallons are yielded by 1 bushel of the seeds, the testa is crushed by machines especially designed for this purpose, the fragments winnowed out, the kernel ground, placed in bags, and expressed by powerful hydraulic pressure.

Purification.—Cotton-seed oil, when freshly expressed, is thick, turbid, of a ruby-red to dark-brown color, and contains much albuminous matter. Upon standing it deposits a considerable quantity of its impurities, leaving the oil as a clear orange-yellow liquid. This is known as *clarified oil.* The albuminous constituents may be coagulated by heating the oil by means of boiling water. Another method of purifying the crude oil consists in agitating the oil in the cold with a weak solution of caustic soda, which removes the characteristic coloring matter of the oil (see *Chemical Composition*), and forms with part of the oil a soap which settles upon standing, in the form of a black deposit. Thus the oil becomes of a much lighter color and constitutes *refined oil.* The loss by this process is about 4 to 7 per cent, sometimes considerably more. Bleaching agents are also frequently employed in the refining of cotton-seed oil.

Description and Tests.—This oil is officially described as "a pale yellow, oily liquid, without odor, and having a bland, nut-like taste. Specific gravity, 0.920 to 0.930 at 15° C. (59° F.). Very sparingly soluble in alcohol, but readily soluble in ether, chloroform, or carbon disulphide. On cooling the oil to a temperature below 12° C. (53.6° F.), particles of solid fat will separate. At about 0° to —5 C. (32° to 23° F.), the oil solidifies"—(*U. S. P.*).

This oil stands intermediate between the non-drying and drying oils; it thickens upon exposure, but does not become solid. Strong solutions of alkalies readily saponify cotton-seed oil. Purified cotton-seed oil is largely employed for culinary purposes, *e. g.*, as salad oil, as a butter substitute, one of its chief uses being to adulterate other oils, especially olive oil. It also serves in the manufacture of soap, in the preparation of woolen and Morocco leather goods, and has taken a prominent place in pharmaceutical preparations, displacing, in a measure, olive and almond oils. The crude oil may be easily recognized by the beautiful purple or violet coloration (*cotton-seed blue*) which the soap prepared from it assumes upon exposure to the air. For the purified cotton-seed oil there are several color tests, in addition to the requirements of specific gravity and other physical constants. A red color is observed upon treating the oil with strong solution of lead acetate and allowing it to stand; S. S. Bradford (*Amer. Jour. Pharm.*, 1882, p. 481) regards it an easy test for the detection of this oil as an adulterant of olive oil. The *U. S. P.* tests are as follows: "When the oil is brought in contact with concentrated sulphuric acid, a dark reddish-brown color is instantly produced. If 6 Gm. of the oil be thoroughly shaken, in a test-tube, for about 2 minutes, with a mixture of 1.5 Gm. of nitric acid and 0.5 Gm. of water, then heated in a bath of boiling water for not more than 15 minutes, the oil will assume an orange or reddish-brown color, and, after standing for 12 hours at the ordinary temperature, will form a semisolid mass. If 5 Cc. of the oil be thoroughly shaken, in a test-tube, with 5 Cc. of an alcoholic solution of silver nitrate (made by dissolving 0.1 Gm. of silver nitrate in 10 Cc. of deodorized alcohol and adding 2 drops of nitric acid), and the mixture heated for about 5 minutes in a water-bath, the oil will assume a red or reddish-brown color."—(*U. S. P.*). The second of these includes the elaïdin test; the third is Becchi's test. Halphen's test, introduced in 1897, seems to be very delicate. According to A. H. Allen (*Commercial Organic Analysis*, Vol. II, Part I, 3d ed., 1889, p. 143), it is executed as follows: Carbon disulphide, containing about 1 per cent of sulphur in solution, is mixed with an equal volume of pentyl (amyl) alcohol. Equal volumes of this reagent and the sample—about 3 Cc. of each—are mixed and heated in a bath of boiling brine for 15 minutes. A red or orange tint is produced when cotton-seed oil is present. If the color is not produced, 1 Cc. more of the reagent is added, and heating continued for 5 or 10 minutes longer; in the absence of color, the addition is repeated once more.

Chemical Composition.—This oil is composed mainly of *palmitin* and *olein*. *Cotton-seed blue* ($C_{17}H_{24}O_4$), an amorphous body, has been obtained by Kuhlmann (1861) as an oxidation product of a chromogene contained in the oil. Exposure to light and air bleaches the blue substance, while oxidizers wholly destroy it. It dissolves in strong sulphuric acid with a purple color, is also soluble in ether and alcohol, while chloroform and carbon disulphide sparingly dissolve it. It is insoluble in water, diluted acids, and alkalies. The chromogene body, according to J. Longmore, is a pungent, golden-yellow substance insoluble in water, soluble in alcohol and alkalies. insoluble in acids. It is a fast dye for wool and silk (see A. H. Allen, *loc. cit.*).

Action, Medical Uses, and Dosage.—This oil is a wholesome and digestible food, and is employed in pharmacy, medicine, and surgery, for many of the purposes for which olive oil is employed. Dose, 1 fluid drachm to 2 fluid ounces.

Related Oils.—OIL OF BRAZIL NUTS. The tree, whose seed yields this oil, is the handsome South American *Bertholletia excelsa*, of Humboldt and Bonpland (*Nat. Ord.*—Lecythidaceæ). It is known to the Brazilians as *castanhiero de Para*, and the seeds are edible and an article of commerce under the names of *Brazil* or *Para nuts*. These nuts are the seeds of a large globular fruit nearly a foot in diameter, from 16 to 20 seeds being contained in 1 fruit. Brazil nuts are long (1½ to 2 inches), triangular, convex on back, and have a rough, hard, brownish-gray testa, inclosing a kernel of a creamy white hue, and tasting somewhat like almonds. It is considerably used in making a cream-syrup for soda fountain uses. The kernels yield over 60 per cent of a fixed oil used by the natives as a burning fluid, as an adulterant of copaiba, and in unguents. It is a bland oil of a light-yellow color, readily becoming rancid. At —1° C. (30° F.) it congeals. It is composed chiefly of olein, palmitin, and stearin.

OIL OF SAPUCAYA NUTS.—An oil similar to Brazil-nut oil is obtained from the nuts (*Sapucay nuts*) of *Lecythis Zabucajo*, Aublet, a Brazilian tree.

OLEUM FAGI, *Beech oil*, *Beech-nut oil*.—The fruit of the beech tree of Europe (*Fagus sylvatica*, Linné (*Nat. Ord.*—Cupuliferæ), yields a yellow oil, mild if prepared by cold expression, and acrid if heat be employed; in this case it becomes mild after a time. It is obtained from the kernels deprived of the integuments, the yield being about 22 per cent. Its specific gravity is 0.921 to 0.923; its congealing point near —17.5 C. (+.5° F.). A soft soap may be obtained from it by saponification. It does not readily become rancid. The oil contains stearin and palmitin, but is composed chiefly of olein. The press-cake, while eaten with impunity by fowls and swine, is said to produce untoward effects in horses or cattle. (See also interesting data on beech-nut oil by Charles H. La Wall, *Amer. Jour. Pharm.*, 1896, p. 11.)

OIL OF MAIZE.—The germ alone of our *Indian corn*, or *American maize*, contains about 22 per cent of a rich golden-yellow oil of a characteristic, not unpleasant odor and taste. It is obtained largely as a by-product in preparing starch, glucose and alcohol. It is thickish and has a specific gravity of 0.916 at 15° C. (59° F.). At —10° C. (14° F.) it congeals. It is composed of olein, stearin, and palmitin, and easily becomes rancid.

OLEUM HEDEOMÆ (U. S. P.)—OIL OF HEDEOMA.

A volatile oil distilled from the leaves and tops of *Hedeoma pulegioides* (Linné), Persoon. "It should be kept in well-stoppered bottles, in a cool place, protected from light"—(*U. S. P.*).

SYNONYMS: *Oil of pennyroyal*, *Oil of American pennyroyal*.

Preparation.—The oil of pennyroyal is distilled from the wild herb mainly in North Carolina, and eastern and southern Ohio, by means of rather crude apparatus, in the same manner as oil of sassafras (see T. C. Harris, *Pharm. Jour. Trans.*, Vol. XVII, 1887, p. 672; and J. F. Patton, *Proc. Amer. Pharm. Assoc.*, 1891, p. 548). The yield from the fresh herb in the districts named, is 10 to 25 pounds of oil from 1 ton of herb, gathered while in bloom and partially dried; Schimmel & Co. (*Report*, Oct., 1893) obtained 3 per cent from dried leaves, and 1.3 per cent from dried leaves and herb.

Description.—"A pale-yellowish, limpid liquid, having a characteristic, pungent, mint-like odor and taste. Specific gravity, 0.930 to 0.940 at 15° C. (59° F.). The oil should form a perfectly clear solution with twice its volume of a mixture of 3 volumes of alcohol and 1 volume of water, this solution being neutral or slightly acid to litmus paper. It is also readily soluble in carbon disulphide, or in glacial acetic acid"—(*U.S.P.*). By means of this test, adulteration with petroleum, oil of turpentine, etc., may be recognized. The oil is optically dextrogyrate (+18° to +22°

Chemical Composition.—The principal constituent of oil of pennyroyal is *pulegone*, identified by Habhegger (*Amer. Jour. Pharm.*, 1893, p. 417). Besides there are present two ketones ($C_{10}H_{16}O$), one *hedeomol*, the other probably *menthone*; furthermore, small quantities of formic, acetic, and isoheptylic acids ($C_7H_{14}O_2$) (E. Kremers, *Proc. Amer. Pharm. Assoc.*, 1887, pp. 546–561; and *Pharm. Rundschau*, 1891, p. 130).

Action, Medical Uses, and Dosage.—Oil of pennyroyal is a stimulant, carminative, antispasmodic, and emmenagogue. It has been used with benefit in *cramp of the stomach, flatulent colic, nausea, amenorrhœa*, and to diminish the harshness of griping, as well as nauseating, medicines. It is frequently employed for the purpose of occasioning abortion, but as with all agents of this sort, it is very dangerous. It is sometimes applied externally as a mild rubefacient. The dose is from 2 to 10 drops on sugar, or in emulsion. (For further uses, see *Hedeoma*.)

Related Oils. Oil of European Pennyroyal. Distilled from *Mentha Pulegium*, Linné (*Pulegium vulgare*, Miller). A strongly aromatic, mint-like, yellowish or greenish-yellow oil, whose purity is to be tested for in the same manner as the American oil; it appears to possess like therapeutic properties. Specific gravity, 0.935 to 0.955. Contains about 80 per cent of the ketone *pulegone* ($C_{10}H_{16}O$), a colorless fluid having an agreeable, peppermint-like odor. Optical rotation of the oil +18° to +23°; of pulegone, +21° 16′. The boiling point of the latter, at reduced pressure (60 Mm.), is 130° to 131° C. (266° to 267.8° F.). The major portion of the oil distills at 212° to 216° C. (413.6° to 420.8° F.), pure pulegone at 221° to 222° C. (430.8° to 431.6° F.) (see Power, *Essential Oils*).

Oil of Pulegium micranthum, Claus, resembles the preceding, but its boiling point is higher, and its specific gravity greater. This plant grows in southern Russia.

OLEUM JUNIPERI (U. S. P.)—OIL OF JUNIPER.

"A volatile oil distilled from the fruit of *Juniperus communis*, Linné (*Nat. Ord.*—Coniferæ). It should be kept in well-stoppered bottles, in a cool place, protected from light"—(*U. S. P.*).

Synonyms: *Oleum fructus juniperi*, *Oleum baccæ juniperi*, *Oil of juniper-berries*.

Preparation and Description.—Oil of juniper is procured from the bruised berries by distillation with water. The full-grown, green fruit yields more oil than the ripe, as in the process of ripening the oil becomes converted into resin. Schimmel & Co. (*Report*, April, 1897) obtained a yield varying from 0.6 per cent in east Prussian to 1.5 per cent in Italian berries. Oil of juniper is "a colorless or faintly greenish-yellow liquid, becoming darker and thicker by age and exposure to air, having the characteristic odor of juniper, and a warm, aromatic, somewhat terebinthinate and bitterish taste. Specific gravity, 0.850 to 0.890 at 15° C. (59° F.). Soluble in about four times its volume of alcohol, forming a somewhat turbid liquid, which is neutral or slightly acid to litmus paper. Also soluble in an equal volume of carbon disulphide"—(*U. S. P.*). The optical rotation of oil of juniper is mostly left-handed (to —18°), sometimes right-handed, rarely inactive. As a rule, the oil is soluble in about 8 to 10 parts of alcohol of 90 per cent by volume; age diminishes its solubility in alcohol.

Chemical Composition.—*Pinene* is contained in the fraction of the oil boiling from 155° to 162° C. (311° to 323.6° F.); *cadinene* in the fraction 260° to 275° C. (500° to 527° F.); the intermediary fractions, containing esters, have not been fully analyzed, but contain the characteristic aroma of the oil. The aroma can not be due to an ester, because it outlasts saponification. *Juniper-camphor*, frequently observed by older chemists, forms crystalline deposits in the higher fractions of the oil when exposed to cold. One such deposit of needles, upon purification, melted at 165° to 166° C. (329° to 330.8° F.) (Gildemeister and Hoffmann, *Die Ætherischen Oele*, p. 350).

Action, Medical Uses, and Dosage.—Oil of juniper is a stimulant diuretic, and is employed to arrest *chronic mucous discharges*, especially from the urethra. It may also be used as a diuretic with other agents in cases of *dropsy*. Locally, it reddens the skin, and may vesicate. The dose is from 5 to 15 or 20 drops. The peculiar taste and diuretic property of Holland gin is owing to the presence of this oil.

OLEUM JUNIPERI VIRGINIANÆ.—OIL OF CEDAR.

An essential oil distilled from the leaves of *Juniperus virginiana*, Linné (*Nat. Ord.*—Coniferæ). *Red cedar.*

Synonym: *Oil of cedar leaves* (American).

Preparation, History, and Description.—This oil is prepared by distillation of the tops and leaves of red cedar with water. Messrs. Schimmel & Co. (*Report*, April, 1898) state that commercial cedar oil is liable to be found admixed with oil from the leaves of *Thuja occidentalis*, because this is also called cedar in the United States, though distinguished as *White cedar;* also the leaves of other coniferæ are said to be used by distillers of cedar oil. A number of commercial oils examined, varied in specific gravities from 0.863 to 0.920, in optical rotation from—3° 40′ to —24° 10′; some were soluble in 4 or 5 volumes of 70 per cent alcohol, others were not. A genuine oil, distilled by the same authorities (yield 0.2 per cent), had the following properties: Specific gravity 0.887, optical rotation +59° 25′. Not soluble in 10 parts of 80 per cent alcohol. The fraction below 180° C. (356° F.) constituting the larger portion, consisted chiefly of *dextro-limonene:* the higher fractions yielded *cadinene*, some *borneol*, and small quanities of *bornyl esters* (Gildemeister and Hoffmann, *Die Ætherischen Oele*, p. 358).

Action, Medical Uses, and Dosage.—Internally this oil is stimulant and emmenagogue, possessing properties similar to those of the oil of savin; however, it is very seldom administered internally. It is chiefly used as a rubefacient, and forms an excellent application in *inflammatory rheumatism* and other *painful affections*, either alone or combined with other articles to form a liniment. The dose, internally, is from 2 to 10 drops on sugar.

Related Oil.—OIL OF CEDAR WOOD. Florida. Distilled from the wood of *Juniperus virginiana*, Linné. Light or greenish-yellow, thickish, having an agreeable and characteristic odor, and a specific gravity of 0.940 to 0.960. Its optical rotation is from —20° to —40°. It is largely employed in perfuming soaps, and is also employed as an adulterant of oil of sandal. Its constituents are *cedar camphor* (*cedrol*, $C_{15}H_{26}O$), melting at 84° C. (183.2° F. Rousset, 1897), and *cedrene* ($C_{15}H_{24}$).

OLEUM LAVANDULÆ FLORUM (U. S. P.)—OIL OF LAVENDER FLOWERS.

"A volatile oil distilled from the fresh flowers of *Lavandula officinalis*, Chaix (*Nat. Ord.*—Labiateæ). It should be kept in well-stoppered bottles, in a cool place, protected from light"—(*U. S. P.*).

Preparation.—Oil of lavender is distilled in France, from wild-growing, in England, from cultivated flowers. Distillation in France is effected by means of portable copper stills, in which the flowers are heated with water by direct fire, wood being used as fuel. The stills are carried to the fields where the flowers grow, because it is believed that the flowers deteriorate upon transportation. (In this connection, see an excellent illustration of such a *distillerie ambulante* in Gildemeister and Hoffmann, *Die Ætherischen Oele*, p. 785.) In stationary distilleries, the oil is obtained by distillation with steam. The yield is 1 pound of oil from 200 pounds of fresh flowers. Schimmel & Co. obtained from dried French flowers a yield of 1.2 per cent, from dried German flowers, 2.8 per cent. All lavender oils were indiscriminately termed *oil of spike* in former centuries (see *Related Oils*).

Description.—The official oil is described as "a colorless or yellowish liquid, having the fragrant odor of lavender flowers, and a pungent and bitterish taste. Specific gravity, 0.885 to 0.897 at 15° C. (59° F.). It is soluble in all proportions in alcohol (distinction from oil of turpentine), and in three times its volume of a mixture of 3 volumes of alcohol and 1 volume of water (distinction from, and absence of, oil of turpentine); it is also soluble in glacial acetic acid. With an equal volume of carbon disulphide it forms a turbid mixture. The alcoholic solution of the oil is neutral or slightly acid to litmus paper. When heated on a water-bath, in a flask provided with a well-cooled condenser, the oil should yield no distillate having the characters of alcohol"—(*U. S. P.*). The oil is optically lævo-rotatory (—3° to —10°). Upon exposure to the air it has been observed to absorb oxygen to the amount of about 120 volumes in 4½ months.

Oil of lavender is distinguished from all other oils of the natural order Labiateæ by the quick and violent fulmination which takes place with iodine when about 0.1 Gm. of dry iodine is placed on a watch-glass and about 4 to 6 drops of the oil are brought in contact with it. Oil of lavender shares this property with oils of turpentine, lemon, orange peel, bergamot, spike, etc. A number of other oils, *e. g.*, peppermint, cajuput, rue, etc., does not react in this manner, and this difference in behavior toward iodine, may sometimes be useful in detecting adulterations. (See classification of oils along this line in Hager's *Handbuch der Pharm. Praxis*, Vol. II, 1886, p. 565.)

Chemical Composition.—French lavender oil, according to Bertram and Walbaum (1892), and Schimmel & Co. (1893 and 1898), consists of large quantities of *linalool* ($C_{10}H_{18}O$, or $CH_3.C[CH_3]:CH.CH_2.CH_2.C[CH_3]OH.CH:CH_2$), *l-linaloyl-acetate* (30 to 45 per cent), *butyrate*, and probably *propionate* and *valerianate;* traces of *pinene* and *cineol*, and *geraniol*. Contrary to the statements of older observers, no camphor is present in true oil of lavender. The esters are the carriers of the aroma. English lavender oil, according to Semmler and Tiemann (1892), and Schimmel & Co. (1894), contains *limonene*, *l-linalool*, *l-linaloyl acetate* (7 to 10 per cent), a sesquiterpene, and appreciable quantities of *cineol*. (For method of determining the quantity of *linaloyl acetate* in lavender oils, see Power, *Essential Oils*, p. 20.) Large amounts of cineol in lavender oil indicate adulteration by oil of spike; pinene, by oil of turpentine.

Action, Medical Uses, and Dosage.—Oil of lavender possesses stimulant and carminative properties, and is sometimes administered in *hysteria*, *nervous debility*, and *headache*. Its fragrance renders it an important article in perfumery, in which it is principally used. Its dose is from 1 to 6 drops.

Related Oils.—Oil of Spike. The broad-leaved variety of lavender (*Lavandula spica*, De Candolle) furnishes the *Oil of spike;* it is not so fragrant as the preceding oil, and has a camphoraceous odor. Its specific gravity is 0.905 to 0.920; optical rotation, +3° (Schimmel & Co.). It is chiefly used in the manufacture of varnishes for artists, in painting on porcelain, and in veterinary practice. With 3 volumes of 70 per cent alcohol at 20° C. (68° F.), according to Power (*Essential Oils*), it should produce a clear solution (absence of turpentine). It contains *camphor* (Kane, 1838), *cineol* (10 per cent), *pinene* (?), *camphene*, *linalool*, *borneol*, and possibly *geraniol* and *terpineol*.

Oil of Lavandula stœchas, Linné.—Distills between 180° and 245° C. (356° and 473° F.); specific gravity, 0.942; odor, rosemary-camphor; known constituent, cineol.

Oil of Lavandula dentata, Linné.—Distills almost entirely between 170° and 200° C. (338° and 392° F.); specific gravity, 0.926; known constituent, cineol.

OLEUM LIMONIS (U. S. P.)—OIL OF LEMON.

"A volatile oil obtained by expression from fresh lemon peel. It should be kept in well-stoppered bottles, in a cool place, protected from light"—(*U. S. P.*).

Preparation.—Oil of lemon is obtained by lightly grating the fresh rind of the lemon, placing it in a fine cloth bag, and then subjecting it to pressure; the sediment is allowed to settle, and the clear oil is poured off (C.). It may also be obtained by distillation, but this mode is not advisable, because the distilled oil readily decomposes. Other methods, such as the process of rupturing the oil glands and gathering the product upon sponges, etc., are likewise followed (see *Oleum Aurantii Corticis*). The oil is imported from the southern parts of Europe, as Italy, Portugal, etc.

Description and Tests.—Oil of lemon as officially described, is "a pale yellow, limpid liquid, having the fragrant odor of lemon, and an aromatic, somewhat bitterish taste. Specific gravity, 0.858 to 0.859 at 15° C. (59° F.). Its optical rotation should not be less than 60° to the right in a 100 Mm. tube, and at a temperature of about 15° to 20° C. (59° to 68° F.). Soluble in three times its volume of alcohol, the solution being neutral or slightly acid to litmus paper; also soluble, in all proportions, in absolute alcohol, carbon disulphide, or glacial acetic acid. When kept for some time, the oil should not develop a terebinthinate odor or taste (absence of oil of turpentine, or other oils consisting chiefly of pinene)"—(*U. S. P.*). When exposed to light and air, oil of lemon readily decomposes, becoming thicker, and forming a brown, sticky sediment.

Oil of lemon is frequently adulterated by alcohol, the fixed oils, or more frequently oil of turpentine. Alcohol may be detected by the milky fluid which forms upon agitating the oil with water. The fixed oils may be known by leaving a residue of more than 5 per cent upon evaporation of the oil. Well rectified coal oil has its odor entirely covered when added to oil of lemon, but the adulteration may be detected by the difference in specific gravity, and by the almost complete insolubility of the coal oil in alcohol. Oil of turpentine may be detected by the turpentine odor evolved when the impure oil is evaporated from heated paper. Its presence can be more accurately established by its diminishing influence upon the optical rotation of the oil. Oil of lemon contains no pinene (Schimmel & Co., 1897).

Chemical Composition.—Ninety per cent of oil of lemon consists of terpenes, the chief constituent of which is *dextro-limonene* (Wallach, 1885; Tilden's *citrene*, 1877), with a small quantity of *phellandrene* (Schimmel & Co., 1897). The highest fractions contain a *sesquiterpene* (Olivieri, 1891). The agreeable fragrance of lemon oil is due to oxygen compounds, especially *citral* ($C_{10}H_{16}O$, or $CH_3.C[CH_3]:CH.CH_2.CH_2.C[CH_3]:CH.CHO$), a doubly unsaturated aldehyde, present in the quantity of about 7 to 10 per cent (J. Bertram, 1888). Its chief occurrence is in lemon-grass oil (70 to 80 per cent). It is a golden-yellow fluid, optically inactive, boiling with slight decomposition at 228° to 229° C. (442.4° to 444.2° F.), under atmospheric pressure. It is the aldehyde of *geraniol* (see *Oleum Rosæ*), and forms a crystallizable compound with sodium bisulphite. It is convertible into *ionone*, an isomer of *irone*, both possessing the essential odor of orris root (see Gildemeister and Hoffmann, *Die Ætherischen Oele*, p. 215). Oil of lemon furthermore contains the fragrant aldehyde *citronellal* ($C_{10}H_{18}O$), and small amounts of the esters *geranyl-acetate* (in Messina and Palermo oils), and *linaloyl-acetate* in the latter oil alone (Umney and Swinton, *Pharm. Jour. Trans.*, Vol. VII, 1898, pp. 196 and 370). The non-volatile *lemon camphor* is not a uniform substance.

Action, Medical Uses, and Dosage.—Stimulant and aromatic. Its chief use is in perfumery, and to impart an agreeable flavor to medicines. It has been recommended in certain *affections of the eye*, as a local application. A very agreeable drink for the summer and for febrile patients may be made of white sugar, 4 ounces; oil of lemon, 10 drops; triturate together, and add citric acid, 2 drachms; a teaspoonful of this to a tumbler of water forms a pleasant, refreshing draught. Tartaric acid may be substituted for the citric, if desired.

OLEUM LINI (U. S. P.)—LINSEED OIL.

"A fixed oil expressed from linseed without the use of heat. It should be kept in well-stoppered bottles"—(*U. S. P.*).

SYNONYM: *Oil of flaxseed.*

Preparation.—When prepared by cold expression the yield varies from 15 to 20 per cent. Prepared by the aid of heat, the gummy substance in the tegument of the seeds is often removed by roasting or steaming them previous to expression, and after expression, the oil in the expressed fluid separates and floats above the mucilaginous water. The yield by hot expression varies from 24 to 28 per cent. For medicinal purpose only that prepared without heating is admissible, because otherwise it has a darker color and an acrid taste. The press-cake remaining in the expression of the oil is known as *oil cake* (see *Linum*). The oil as first obtained is called *raw oil*, and is mostly purified by agitation with about 1 per cent of strong sulphuric acid, the latter being removed by boiling water. The oil thus obtained is called *refined oil*.

Description.—The *U. S. P.* describes linseed oil as a "yellowish, or yellow, oily liquid, having a slight, peculiar odor, and a bland taste. When exposed to the air, it gradually thickens, and acquires a strong odor and taste; and if spread, in a thin layer, on a glass plate, and allowed to stand in a warm place, it is gradually converted into a hard, transparent, resin-like mass (absence of non-drying oils). Specific gravity 0.930 to 0.940 at 15° C. (59° F.). It does not congeal above —20 C. (—4° F.). Soluble in about 10 parts of absolute alcohol, and, in all proportions, in ether, chloroform, benzin, carbon disulphide, or oil of turpentine" (*U. S. P.*). When cooled to —27° C. (—16.6° F.) linseed oil congeals to a yellowish mass. Upon exposure to the air, old oil is liable to become rancid. On account of its drying properties, facilitated by warmth, linseed oil is a most important article, being used in the making of paints and varnishes, of printer's ink, oilcloth, etc. Its affinity for the oxygen of the air is so great that it is liable to inflame cotton waste and other fibrous material soaked with it.

Boiled Linseed Oil.—For technical purposes, the raw oil absorbs oxygen and hardens too slowly. This process is promoted by heating the oil to a temperature of 130° C. (266° F.) while a current of air is made to pass through it; its temperature is then raised until bubbles arise, due to decomposition of the oil. Then it is called *boiled oil*, as contrasted with the *raw* or *unboiled oil*. Boiled oil is thicker, darker, has a somewhat higher specific gravity (0.939 to 0.950) and dries more rapidly than raw oil, hence is preferred by painters for outside work when it is desired that the paint dry rapidly. The drying properties are materially increased by incorporating during the process certain metallic oxides, as litharge, ferric oxide, red lead, manganese dioxide, especially lead acetate, manganous borate, etc., whose function seems to be partly to facilitate the transmission of oxygen, and partly to form more readily oxidizable metallic salts of the fatty acids. The nature of these substances, as well as the mode of manipulation, is usually kept secret. Of late, oil-soluble "driers" or "siccatives" have come into use—namely resinates of certain metals, as lead and manganese. (Concerning these, see A. H. Allen, *Commercial Organic Analysis*, Vol. II, Part I, 3d ed., Philadelphia, 1899, p. 150.)

Chemical Composition and Tests.—Linseed oil consists of 10 to 15 per cent of *stearin*, *palmitin*, and *myristin;* the remainder is chiefly *isolinolenin* (the glyceride of *isolinolenic acid*, $C_{18}H_{30}O_2$, of the type $C_nH_{2n}—_6O_2$), and smaller amounts of *linolein* (the glyceride of *linoleic acid*, $C_{18}H_{32}O_2$, type $C_nH_{2n}—_4O_2$), and *olein* (the glyceride of *oleic acid*, $C_{18}H_{34}O_2$, type $C_nH_{2n}—_2O_2$). Unsaponifiable constituents amount to about 1 per cent (also see *Linum*). The drying qualities of linseed oil depend on the presence of the highly unsaturated linolein, linolenin, and isolinolenin. Upon drying, linseed oil becomes gradually converted into a hardened varnish, which is insoluble in ether. Chemically, it is an ester, called *hydroxy-linolin* (Mulder's *linoxyn*). Linseed oil is subject to many sorts of adulteration. Flaxseed itself is often found mixed with oil-bearing weed seeds, adulterated with hemp-seeds, and the oil may be adulterated with cotton-seed, niger-seed, and fish oils, mineral oils, and turpentine. These additions influence the specific gravity, congealing point, iodine absorption, and other physical and chemical constants of pure linseed oil. (For details regarding the analysis of linseed oil, see A. H. Allen, *loc. cit.*, pp. 152–155.)

The *U. S. P.* gives the following tests for linseed oil: "It should not more than slightly redden blue litmus paper previously moistened with alcohol (limit of free acid). If 2 Cc. of the oil be shaken with 1 Cc. of fuming nitric acid and 1 Cc. of water, it should neither completely nor partially solidify, even after standing for 1 or 2 days (absence of non-drying oils). If 10 Cc. of the oil, contained in a small flask, be mixed with a solution of 3 Gm. of potassium hydrate in 5 Cc. of water, then 5 Cc. of alcohol added, and the mixture heated for about 5 minutes on a water-bath, with occasional agitation, a dark-colored, but clear and complete solution should be obtained. If this liquid be diluted with water to the measure of 50 Cc., then cooled, and shaken with 50 Cc. of ether, the clear, ethereal layer, after having separated, should not show a bluish fluorescence, and, when carefully decanted, and allowed to evaporate spontaneously, should leave not more than a slight, and not oily, residue (absence of paraffin oils)"—(*U. S. P.*).

Rancid linseed oil may be again made sweet by shaking it with warm water, allowing it to stand a while, and finally decanting.

Action, Medical Uses, and Dosage.—(See *Linum.*)

Related Oils.—The following are drying oils:

Candle-nut Oil.—This oil is obtained by boiling in water the crushed seeds of *Aleurites triloba*, Forster (*Aleurites moluccana*, Willdenow), found in tropical regions, in the isles of the Indian and Pacific Oceans, India, and the West Indies. The oil is known by several names, as *Kekune oil*, in Ceylon; *Bankul oil*, in India; *Spanish-walnut oil*, in Jamaica, *Kukui oil*, in the Sandwich Isles, where it is used as a mordant for vegetable colors. The tree yielding the fruit is known as the *Candleberry tree*, from the fact that the seeds, strung upon palm-fibers, are used for lighting purposes by the Polynesians. The nuts taste like walnuts, and are used as food by the natives of New Georgia. The tree is called *Indian akrot* (walnut) in India. On account of the oil being much used by painters, it is sometimes known as *country-walnut oil* or *artist's oil* (see *Treasury of Botany*). The oil is limpid, transparent, syrupy, amber-yellow, odorless, and rapidly drying. The yield is about 60 per cent. It consists of *palmitin*, *stearin*, *myristin*, and *olein*, the latter being somewhat like *linolein* from linseed oil. The oil is laxative (see *Wood Oil of China*).

Grape-seed Oil.—From 10 to 20 per cent of a slowly drying, odorless, pale-yellow or brownish oil is obtained from the seeds of grapes (*Vitis vinifera*, Linné). It has a feebly bitter taste. At near —16° C. (3.2° F.) it congeals. Its chief constituent is the *glyceride of erucic acid* ($C_{22}H_{42}O_2$). At 34° C. (93.2° F.) this acid fuses, and, if melted with caustic potash, yields *arachic* and *acetic acids*. The lesser constituents are *stearin* and *palmitin*.

Niger-seed Oil.—A yellow oil, intermediate between the drying and non-drying oils, obtained to the extent of about 40 per cent from the black akenes of *Guizotia oleifera*, De Candolle (*Verbesina sativa*, Roxburgh), a composite plant of India and East Africa. It has a nut-like flavor, and congeals at —10° C. (14° F.). It is composed of two kinds of olein, one closely analogous to *linolein*, and *myristin* and *palmitin*.

Madia Oil.—The akenes of *Madia sativa*, Molina, a composite annual found native in Chili and cultivated in the Old World, yields a bland, yellow, fixed oil (about 40 per cent), having a distinctive odor, a specific gravity of 0.930, and congeals at about —20° C. (—4° F.). It readily turns rancid on exposure, and gradually assumes a semisolid state.

Walnut Oil.—(See *Juglans*.)

OLEUM MENTHÆ PIPERITÆ (U. S. P.)—OIL OF PEPPERMINT.

A volatile oil distilled from *Mentha piperita*, Smith (*Nat. Ord.*—Labiateæ).

"It should be kept in well-stoppered bottles in a cool place"—(*U. S. P.*).

History and Preparation.—The three most important peppermint-growing countries are the United States, Japan, and England, the Japanese oil being derived from the species *Mentha arvensis*, Linné, var. *piperascens*, Holmes. Distillation in the United States began in 1816, in Wayne county, in the State of New York; since 1835, peppermint has been grown and oil distilled therefrom in Michigan. Until 1846 distillation was carried out by means of simple copper stills heated by direct fire; since that date distillation by steam has become the rule. Indiana also distills large quantities of oil. Much care is now taken to exclude from the peppermint fields such weeds as *Erechtites* (fireweed), *Erigeron*, and *Hedeoma* (pennyroyal), to prevent undesirable contamination with the oils from these plants. The total production of oil of peppermint has reached enormous proportions, the United States alone, in 1897, producing 251,000 pounds. Minor quantities of oil of peppermint are produced in Russia, Germany, Italy, Norway, etc. (For much interesting detail regarding the history and statistics of this oil, see Dr. Frederick Hoffmann, in *Die Ætherischen Oele*, pp. 825–836.) The yield from German herb (fresh) is reported by Schimmel & Co. to be 0.1 to 0.25 per cent; from dried herb, 0.7 per cent.

Description.—The *U. S. P.* describes oil of peppermint as "a colorless, or yellowish, or greenish-yellow liquid, becoming darker and thicker by age and exposure to the air, having the characteristic, strong odor of peppermint, and a strongly aromatic, pungent taste, followed by a sensation of cold when air is drawn into the mouth. Specific gravity, 0.900 to 0.920 at 15° C. (59° F.). The oil does not fulminate with iodine. It form a clear solution with an equal volume of alcohol, becoming turbid when somewhat further diluted, and is soluble in all proportions, in carbon disulphide and in glacial acetic acid. The alcoholic solution of the oil is neutral to litmus paper"—(*U. S. P.*). The oil is optically lævo-rotatory varying in American oil from —25° to —33°. The better grades of oil from Wayne county, New York, do not form a clear solution with 3 to 5 volumes of 70 per alcohol, while the Michigan (western oils), the English and the Japanese oils do. Schimmel & Co. suggest that this difference may be due to the practice of previously drying the herb, which yields an oil not soluble in diluted alcohol, while that from fresh herb is soluble (Gildemeister and Hoffmann, *loc. cit.*, p. 838). When American oil of peppermint is subjected to cold, crystals of *menthol* fall out (see *Tests* below). The Japanese oil is semisolid at ordinary temperature, owing to the large quantity of menthol it contains.

Tests.—Adulterations of the oil with alcohol and oil of turpentine are not infrequent; the latter may be known by the turpentine odor, by the imperfect solution it forms with alcohol, and by its fulmination when iodine is added to it; the former may be known by the formation of a dirty-white liquid when an equal volume of water is added to it. Sometimes adulteration is practiced by removing part of the menthol by freezing. The following are the official tests, which include the characteristic color reactions of the oil of peppermint: "If 5 drops of the oil be added to 1 Cc. of glacial acetic acid, and the mixture gently warmed, the liquid will assume a blue color, with a red fluorescence. If 2 Cc. of the oil be mixed with 1 Cc. of glacial acetic acid, and 1 drop of nitric acid added, the liquid will soon acquire a green, greenish-blue, blue, or violet tint with a copper-red fluorescence. If 1 Cc. of the oil be dissolved in 5 Cc. of alcohol, 0.5 Gm. of sugar, and 1 Cc. of hydrochloric acid added and the mixture gently heated, a deep-blue or violet color will gradually be produced. If to 5 Cc. of nitric acid 1 drop of the oil be added, and the mixture gently agitated, and allowed to stand for about 3 hours, it should have a yellowish, but not a bright red color (absence of oil of camphor and of oil of sassafras). If a portion of the oil, contained in a test-tube, be placed in a freezing mixture of snow (or pounded ice) and salt for 15 minutes, it should become cloudy and thick, and after the addition of a few crystals of menthol, being still exposed to cold, it should soon form a crystalline mass (distinction from dementholized oil). When heated on a water-bath, in a flask provided with a well-cooled condenser, the oil should not yield a distillate having the characters of alcohol"—(*U. S. P.*).

Chemical Composition.—The chief constituent of peppermint oil is *menthol*, known also as *mint stearopten*, or *mint camphor* (see *Menthol*). New York oil contains 50 to 60 per cent total menthol, of which 40 to 45 per cent are free, and the rest combined in the form of ester. It also contains 12 per cent of *menthone*. Michigan oil contains about 48 to 58 per cent total menthol, of which 43 to 50 per cent are free menthol. By distilling menthol with phosphoric anhydride, a colorless liquid of an agreeable odor, *menthene* ($C_{10}H_{18}$) results. This hydrocarbon has been said to occur in Russian oil of peppermint; the American oil does not contain it. According to a detailed research on American peppermint oil by F. B. Power and C. Kleber (*Pharm. Rundschau*, 1894, p. 157), this oil contains the following substances: (1) *Acetaldehyde;* (2) *isovaleric aldehyde;* (3) *amyl alcohol;* (4) free *acetic*, and (5) *isovalerianic acids;* (6) *pinene;* (7) *phellandrene;* (8) *l-limonene;* (9) *cadinene;* (10) *cineol;* (11) a *lactone* ($C_{10}H_{16}O_2$); (12) *menthone;* (13) *menthol;* (14) *menthyl-acetate;* (15) *menthyl-isovalerianate;* (16) *menthylester* of an *acid*, $C_8H_{12}O_2$; (17) *dimethyl sulphide* ($S[CH_3]_2$). Substances 3 and 17 were additionally found in the laboratory of Schimmel & Co., in 1894 and 1896.

English oil of peppermint, according to Umney (*Pharm. Jour. Trans.*, 1896, Vol. II, p. 123, and Vol. III, p. 103), contained of total menthol, 63 to 66 per cent; menthol in the form of ester, 3 to 14 per cent; *menthone*, 9 to 11 per cent. Gildemeister and Hoffmann (*loc. cit.*, p. 844) believe that the other constituents of the English oil will prove the same as those of the American oil above enumerated. The Japanese oil contains of total menthol, 70 to 91 per cent; of free menthol, 65 to 85 per cent. It does not give the above-described color reactions, or but very faintly, with glacial acetic acid.

Action, Medical Uses, and Dosage.—Oil of peppermint is a powerful diffusible stimulant, with carminative, antispasmodic, and antiemetic properties. It is much employed to relieve flatulence, gastrodynia, nausea, spasms of the stomach, and to cover the taste of other drugs. Externally, it is occasionally employed as a rubefacient and anodyne. It relieves the pain of *burns, scalds*, and *toothache* from carious teeth. In spray, it is useful to alleviate *painful and inflamed fauces and tonsils*, and by inhalation relieves many of the unpleasant symptoms of *asthma* and *chronic bronchitis* in old persons. It enters into a liniment, which at one time was a popular remedy for various painful local affections; it is composed as follows: Take of oil of olives, oil of peppermint, oil of turpentine, tincture of opium, alcohol, aqua ammoniæ, each, 1 fluid ounce. Mix. To be applied 3 or 4 times a day. Peppermint oil is commonly used under the name of essence of peppermint, which is a tincture of it. The dose of the oil is 2 to 10 drops on sugar.

OLEUM MENTHÆ VIRIDIS (U. S. P.)—OIL OF SPEARMINT.

"A volatile oil distilled from *Mentha viridis*, Linné (*Nat. Ord.*—Labiatæ). It should be kept in well-stoppered bottles, in a cool place, protected from light"—(*U. S. P.*).

Preparation and Description.—The oil is obtained by distillation of spearmint herb with water; the yield from American fresh herb, gathered at the beginning of flowering, was 0.3 per cent (Schimmel & Co.). It is extensively distilled in this country, and in smaller quantities in Germany and Russia. The *U. S. P.* describes it as "a colorless, yellowish, or greenish-yellow liquid, becoming darker and thicker by age and exposure to the air, having the characteristic, strong odor of spearmint, and a hot, aromatic taste. Specific gravity. 0.930 to 0.940 at 15° C. (59° F.). With an equal volume of alcohol it forms a clear solution, which is neutral or slightly acid to litmus paper. When somewhat further diluted with alcohol, it becomes turbid. It also yields a clear solution with an equal volume of glacial acetic acid, and with half its volume of carbon disulphide; but with an equal volume of the latter it forms a turbid mixture"—(*U. S. P.*). The oil is optically lævo-rotatory (as high as —43°). An exceptionally high specific gravity (0.980) is reported by Schimmel & Co. for the oil above mentioned.

Chemical Composition.—This oil consists of two, and probably three, lævogyrate bodies. One is *lævo-carvone* ($C_{10}H_{14}O$), a ketone of a pure caraway odor, found also in the oils of caraway and dill (in the latter two as *dextro-carvone*). The quantity of carvone in spearmint oil was found by Kremers and Schreiner (*Pharm. Review*, 1896, p. 244) to be 56 per cent. The second body is *lævo-limonene*, once known as *carvene* ($C_{10}H_{16}$). The third constituent is probably *pinene*.

Action, Medical Uses, and Dosage.—Oil of spearmint is carminative, antispasmodic, and diuretic. It is used very frequently as a substitute for the oil of peppermint, and is more often prescribed on account of its diuretic properties. The tincture of the oil combined with potassium acetate renders the latter more efficient as a diuretic, besides imparting a pleasant flavor to it. The dose of the oil is 5 or 10 drops on sugar.

OLEUM MONARDÆ.—OIL OF HORSEMINT.

A volatile oil distilled from the fresh herb of *Monarda punctata*, Linne (*Nat. Ord.*—Labiatæ).

Preparation and Description.—Oil of horsemint is obtained in this country from the fresh herb, by distillation with water. The yield is about 3 per cent. The oil is of a yellowish or brownish-amber color, having a penetrating, aromatic, thyme-like odor, like that of the plant, and a strong, pungent, somewhat acrid taste; and is soluble in alcohol. Its specific gravity is 0.930 to 0.940.

Chemical Composition.—Oil of horsemint contains *thymol* (*monardin*) and *cymol*, sometimes *carvacrol*, and traces of *dextro-limonene*. (For details, see *Monarda*.)

Action, Medical Uses, and Dosage.—Oil of horsemint is stimulant, antispasmodic, and antiemetic, and in the form of the essence, has been much used to allay *nausea* and *vomiting* in *Asiatic cholera*, *cholera morbus*, etc.; it relieves the *diarrhœa of debility*, its action in these cases being prompt and permanent. It stimulates the nervous system and increases cardiac force. It gives sleep and quiet when there is exhaustion with nervous excitation. It restores *suppressed menses* when due to colds, and given with turpentine or wintergreen it renders good service in the *tympanites of enteric fever*. Oil of horsemint serves well in the *vomiting of inebriates*, and in *nausea* accompanying a flatulent distension of the stomach. Externally, it is rubefacient and even vesicant, and has been advantageously used in *low forms of fever*, *cholera infantum*, *paralysis*, *rheumatic* and *neuralgic pains*, etc. It soon causes rubefaction when locally applied, affording in many instances almost immediate relief. The dose of the oil is from 2 to 5 drops on sugar; of the essence, from 10 to 30 drops in sweetened water.

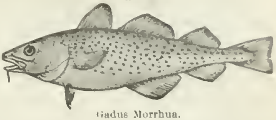
OLEUM MORRHUÆ (U. S. P.)—COD-LIVER OIL.

"A fixed oil obtained from the fresh livers of *Gadus Morrhua*, Linné, and of other species of *Gadus* (Class, *Pisces;* Order, *Teleostia;* Family, *Gadidæ*). It should be kept in well-stoppered and perfectly dry bottles"—(*U. S. P.*).

SYNONYMS: *Oleum jecoris aselli*, *Cod oil*, *Oleum hepatis morrhuæ*.

Source and History.—The common codfish is the *Gadus Morrhua* of Linnæus, or *Morrhua vulgaris* and *Asellus major* of other naturalists. It is a fish 2 or 3 feet in length, having a gray back with yellowish spots, and a white abdomen. The body is somewhat flattened, and symmetrical; the ventral fins are pointed and placed under the throat. There are 3 dorsal and 2 anal fins, and a cirrus or beard at the end of the snout. The teeth are pointed and unequal, and are disposed in several rows. The large gills are 7-rayed. On the external surface of the body are scales, rather soft, and not of large size. It is an inhabitant of cold or temperate seas, and is found, at certain seasons of the year, in abundance on the coast of Norway, in the neighborhood of Iceland, in the Russian Arctic Sea, and on the New England and Newfoundland coasts. The Norwegian oil, from the Lofoten Archipelago, is the most famous, and much of it is consumed in this country; but in recent years, the oil from the Newfoundland coast is gradually gaining in favor, owing to improvements in its manufacture. Other species of Gadus from which cod-liver oil is sometimes obtained, are coal-fish (*G. carbonarius*, Linné, or *Merlangus carbonarius*, Cuvier), dorsch, or dorse (*G. callarius*, Linne), turbot (*Rhombus maximus*, Cuvier), and occasionally from the pollack (*Gadus pollachius*, Linne, or *Merlangus pollachius*, Cuvier), hake (*Gadus Merluccius*, Linné, or *Merluccius communis*, Cuvier), whiting (*Gadus Merlangus*, Linné, or *Merlangus vulgaris*, Cuvier), ling (*Gadus Molva*, Linné, or *Lota Molva*, Cuvier), and haddock (*Gadus æglifinus*, Linné). In the Lofoten Islands, the codfish come in innumerable quantities in the month of January to deposit their spawn, all other fishes disappearing as if by enchantment. The codfishing commences about the early part of January and terminates about the middle of April; there being no less than 25,000 persons engaged in the business, and the quantity of the fish is prodigious, incalculable. The annual production in the Lofoten Archipelago alone is on an average about 400,000 gallons. Three barrels of liver yield 1 barrel of first quality oil, and ½ barrel of brown oil obtained by heat and expression. (For details regarding the Norwegian codfisheries, we refer those interested to an exceedingly readable monograph entitled *Cod-liver Oil and Chemistry*, published quite recently, by Dr. F. Peckel Möller, London and Christiania, 1895.) Among many other items of interest, it is demonstrated how the peculiar formation of the Norway seaboard together with the habits of the codfish serves to make the Lofoten Islands the natural center of the Norwegian fisheries. (Also see résumé of the commerce in cod-liver oil and its chemistry, by J. H. Stallmann and E. H. Gane, in *Amer. Drug.*, Jan., 1899, pp. 37–40.)

Fig. 182.



Gadus Morrhua.

Preparation.—The principal process by which the oil is now prepared is to remove blood and impurities from the carefully sorted livers by repeated washings; then the gall-bladder is removed and the livers, as soon as practicable, are put into iron kettles and subjected to steam heat with constant stirring. The oil separates from the liver tissue, and, after decantation and filtration through a funnel, is drawn off into barrels. In the Newfoundland fisheries, the oil obtained by steam heat is exposed to intense cold until it is partly solidified; the mass is then put into bags and subjected to strong pressure. In this manner the American *shore oil* is obtained. The residual stearin is sold to soap-makers.

Description.—Three kinds of cod-liver oil are usually met with in commerce: The white or pale-yellow, which is obtained from fresh and perfectly healthy livers (*shore oil*). It is the official oil and is described by the *U. S. P.* as "a pale-yellow, thin, oily liquid, having a peculiar, slightly fishy, but not rancid odor, and a bland, slightly fishy taste. Specific gravity, 0.920 to 0.925 at 15° C. (59° F.). Scarcely soluble in alcohol, but readily soluble in ether, chloroform, or carbon disulphide; also in 2.5 parts of acetic ether"—(*U. S. P.*). The second form is pale-brown, or brownish-yellow (*straits oil*); less care is exercised in the selection of the livers and the preparation of the oil. The third kind is dark-brown (*banks oil*), and is an inferior grade, being derived from putrefied livers; its odor is disagreeable, its taste acrid and bitter; and it has an acid reaction. The best grade is universally preferred in the United States.

Adulterations and Tests.—Cod-liver oil is subjected to adulterations in several ways. One method is to bleach an inferior, dark oil, it is stated, by exposure to the rays of the sun. The addition of mineral oils can be recognized by saponification which leaves the adulterant unaffected. An oil that has undergone partial putrefaction may be judged by the quantity of free volatile acids in the oil. Such oils also absorb much less iodine than fresh cod-liver oil. Refined seal oil and seed oils are also used as adulterants of cod-liver oil. (For a more detailed consideration of this phase of the subject, see special works on analysis, *e. g.*, A. H. Allen, *Commercial Organic Analysis*, Vol. II, Part I, 3d ed., 1899, p. 197.) The *U. S. P.* gives the following tests for the purity of cod-liver oil: "If 1 drop of the oil be dissolved in 20 drops of chloroform, and the solution shaken with 1 drop of sulphuric acid, the solution will acquire a violet-red tint, rapidly changing to rose-red and brownish-yellow. If a glass rod, moistened with sulphuric acid, be drawn through a few drops of the oil, on a porcelain plate, a violet color will be produced. Cod-liver oil should be only very slightly acid to litmus paper previously moistened with alcohol (limit of free fatty acids). When the oil is allowed to stand for some time at 0° C. (32° F.), very little or no solid fat should separate (absence of other fish oils, and of many vegetable oils). If 2 or 3 drops of fuming nitric acid be allowed to flow alongside of 10 or 15 drops of the oil, contained in a watch-glass, a red color will be produced at the point of contact. On stirring the mixture with a glass rod, this color becomes bright rose-red, soon changing to lemon-yellow (distinction from seal oil, which shows at first no change of color, and from other fish oils, which become at first blue, and afterward brown and yellow"—(*U. S. P.*). The presence of seal oil may also be detected by means of Amagat and Jean's oleo refractometer (see *Proc. Amer. Pharm. Assoc.*, 1898, p. 888).

Chemical Composition.—For a chronological history of the chemical study of cod-liver oil, see M. P. Heyerdahl in F. Peckel Möller's monograph above mentioned. According to older analyses, especially by De Jongh (1843), cod-liver oil was accepted to consist of about 19 to 26 per cent of palmitin and stearin, 72 to 76 per cent of olein, and from 2 to 5 per cent of non-fatty matters. The following substances have been observed in cod-liver oil in minor quantities, although the presence of many are no doubt due to putrefactive changes in the liver:

(1) *Volatile acids* (valerianic, Spaarmann, 1828, acetic and butyric acids, De Jongh); (2) *iodine* (De l'Orme, 1836; on an average only 0.000322 per cent, Stanford, 1884); (3) *bromine* (Herberger, 1839); (4) *phosphorus* (De Vrij, 1838); (5) *biliary constituents* (De Jongh, 1843; this is not confirmed by subsequent researches; if the gall-bladders are excluded from the process, no bile reaction can be obtained in cod-liver oil; Buchheim, 1884, Salkowsky, 1887); (6) *cholesterin* (Allen and Thompson, 1885; 0.46 to 1.32 per cent); (7) *lipochrom* (of W. Kühne, to which, in part, the color reaction with sulphuric acid is due; Salkowsky, 1887); (8) volatile bases: *butyl-amine, amyl-amine, hexyl-amine, dihydro-lutidine;* (9) non-volatile alkaloids—*asellin* ($C_{25}H_{32}N_4$) and *morrhuine* ($C_{19}H_{27}N_3$), both occurring only in the darker oils; (10) crystallizable *morrhuic acid* ($C_9H_{13}NO_3$), a pyridine derivative, existing in the oil to the extent of 0.1 per cent. Numbers 8, 9 and 10 were observed by Gautier and Mourgues, 1888; the existence of alkaloids in light-brown Norwegian oil, as well as in Newfoundland and Maine oils, was also confirmed by J. O. Schlotterbeck, *Pharm. Jour. Trans.*, Vol. XXV, 1895, p. 585, from *Pharm. Era.* A solid, fatty acid, *gadinic acid*, melting at 63° to 64° C. (145.4° to 147.2° F.), was obtained by Luck, in 1856, from a deposit in cod-liver oil. *Morrhuol* is an alcoholic extract of cod-liver oil obtained by Chapoteaut (*Amer. Jour. Pharm.*, 1886, p. 19).

According to M. P. Heyerdahl's researches, published in the monograph aforementioned, pure cod-liver oil contains no stearin, no olein, and only about 4 per cent of *palmitic acid* as *tri-palmitin*. Two new glycerides, however, were discovered, namely, 20 per cent of *tri-therapin*, the glyceride of *therapic acid* ($C\ .H_{26}O_{.}$), a hitherto unobserved, unsaturated fatty acid containing four double bonds, and forming an octo-bromine addition product ($C_{17}H_{26}Br_8O_2$); and over 20 per cent of *tri-jecoleïn*, the glyceride of *jecoleïc acid* ($C_{19}H_{36}O_2$) which contains only one double bond, and is isomeric with *dœglic acid*. The remainder of the oil contains glycerides with one or more unsaturated acids belonging to the same series as jecoleïc acid, but as yet entirely unknown. The solid fat removed in the manufacture of cod-liver oil by cooling and subsequent pressure, and believed to be stearin, probably contains chiefly these undetermined acids. *Therapic* and *jecoleïc* acids, both free and as glycerides, become rapidly oxidized when exposed to air, especially if heated at the same time. They are converted into hydroxyacids which the author demonstrates to be the cause of rancidity in the oil, hitherto ascribed to the presence of free fatty acids. These hydroxyacids are thus shown to be physiologically undesirable, hence the necessity of absolutely excluding the air in the preparation of the oil; this is done by a patented process, in which an inert gas (carbonic acid) remains in contact with the oil during its manufacture.

Action, Medical Uses, and Dosage.—Cod-liver oil is nutritive and alterative. It has long been used as a domestic remedy in *chronic rheumatic* and *strumous diseases*, especially in the northern parts of Europe, and has been in general medicinal use only since the treatise upon it by Prof. Bennett, of Edinburgh, in 1841, although employed occasionally in the profession as early as 1766. Cod-liver oil is a remedy for defective nutrition, and when tolerated can be relied upon to give good results; but if it provokes persistent nausea, vomiting, disgust, and diarrhœa, it can not be expected to be other than harmful. Cod-liver oil is a fat-producing agent, excelling other fats which have been proposed as substitutes for it, in digestibility. When cod-liver oil "is kindly received by the stomach it increases the quantity of red corpuscles, improves the appetite and general strength, and the pulse becomes full and strong, flesh increases, and nutrition is improved" (Locke's *Syllabus of Mat. Med.*, p. 346). Though used for many conditions, it has been shown to do the most good in the poorly nourished, suffering from *phthisis pulmonalis, tabes, rickets, chronic bronchitis*, and *chronic rheumatism* in the scrofulous. It is not necessarily a curative agent, but in many conditions it tides the patient over while other agents exert their curative effects. In *tubercular arthritis*, and so-called *scrofulous inflammations of the joints*, its influence is often marked. Where there is necrosis, however, its effects are less evident. It may be given in *tabes mesenterica* when there is emaciation, a hard abdomen, offensive breath, and cough. When *epilepsy* depends upon a scrofulous and debilitated condition, cod-liver oil often proves a good remedy (Locke). In *rickets*, given internally and applied locally to the spine, it is one of our best remedies. *Fistula in ano, scrofulous enlargements*, and *scrofulous ulcerations* call for it. It undoubtedly prolongs the consumptive's life, but it should not be forced if the stomach persistently refuses to tolerate it. In some cases it does not seem to derange the stomach, but nauseates by its unpleasant taste. In these cases the difficulty is sometimes overcome by persisting in the use of the remedy or by changing from one to another preparation of the oil. In all cases where it can be tolerated, the pure oil should be preferred over the emulsions.

The diseases, besides those enumerated, in which it is said to be most efficient, are *strumous diseases, strumous ophthalmia, pseudo-syphilis*, in *scrofulous constitutions*, and various *chronic cutaneous diseases*, as in *eczema, impetigo, prurigo, lichen, squamous affections, pityriasis, ichthyosis*, etc. *Gout*, and occasionally *caries*, it is said, have yielded to its influence. It is also asserted to have been found useful in *diseases of the joints and spine, lupus, obstinate constipation, worms*, and *incontinence of urine;* and may be advantageously employed in all chronic cases, in which the disease appears to consist mainly in impaired digestion, assimilation, and nutrition. Externally used in *opacities of the cornea*, a drop or two placed on the cornea with a camel's-hair pencil; also in various *chronic cutaneous diseases, rhagades, chaps, eczema, excoriations*, and *fissures*. Its use is contraindicated in plethora, or where there is a strong tendency to it, lest hemorrhage be provoked. When long used, it is said to frequently occasion an eruption on the surface of an eczematous character. But little advantage will be apparent from the administration of cod-liver oil, until its use has been persevered in for 5 or 6 weeks, though it often commences earlier. The light-colored oil is the best. Some prefer the darker colored oils. The dose of cod-liver oil is ½ fluid ounce, twice a day, or more; but it is best to begin with small doses at first, say 1 drachm only, in order to lessen the risk of nausea and vomiting. Patients soon accustom themselves to its use without repugnance. It is best given alone, followed by some claret, or a little sugar and cinnamon powder, or prepared with aromatic oils, the same as castor oil (which see). It may be given in coffee, milk, or brandy, and for consumptives in Bourbon. A pinch of salt sometimes renders it palatable, while others advise the chewing of a small portion of smoked herring. Tomato catsup, and particularly the froth of malted beverages appears to mask the unpleasantness of the oil. (For various methods of rendering the oil palatable, see *Emulsio Olei Morrhuæ*.)

Dr. Alexander Wallace recommends a mixture of equal parts of lime-water and cod-liver oil, well shaken together, as a tonic, sedative, antacid, and nutrient; it forms a thick, milky emulsion, palatable, especially when taken with a little sherry wine, and may be used in all the forms of disease in which cod-liver oil is recommended.

In Germany a ferruginous cod-liver oil is much employed; it is prepared by first making a soda soap, from which its glycerin is removed by concentrated solution of sea salt, giving as the result an iron soap by double decomposition—this last soap is dissolved in sixteen times its weight of cod-liver oil. The oil thus prepared is brown and holds in solution $\frac{1}{500}$ of iron, the taste of which is hardly discernible.

Related Oils.—OLEUM RAJÆ, *Ray*, or *Skate oil*. From the *livers* of *Raja Batis*, Linné. Specific gravity, 0.928. Odor and taste, fishy; color, bright or pale-yellow; reaction, neutral. Said to contain a greater quantity of iodine than cod-liver oil. It is used by the Belgians and French as a substitute for cod-liver oil.

OLEUM BALÆNÆ, *Whale oil*, *Train oil*.—Obtained from the blubber of *Balæna mysticetus*, Linné, *Greenland whale;* and *Balæna australis*, Desmoulins, *Cape whale*. Specific gravity, 0.926. Odor, fishy; taste, disagreeable. At 10° C. (50° F.) it deposits a solid material, palmitin. Some whale oils contain notable quantities of *valerin*.

MENHADEN OIL.—Obtained on the New England coast from the *Alosa Menhaden*, Cuvier. It constitutes one of the oils known as the *fish oils* or *whale oils*, and is used in the manufacture of leather. The term *train oils* now includes all oils from the fleshy parts of the seal, shark, cod, and like fishes or marine mammals.

OLEUM SQUALI, *Shark oil*.—Specific gravity varies from 0.911 to 0.928. Taste, acrid; color, pale-yellow. At —6° C. (21.2° F.) it is still a limpid fluid. It is obtained from the liver of *Squalus Carcharias*, Linné, or *Shark*, besides some other related species. The livers of *Pastinaca hastata*, De Kay, or *American stingray*, also yield an oil by expression. From 0.7 to 17.3 per cent of *cholesterol* (*cholesterin*) have been obtained from six specimens of shark oil by A. H. Allen (*Org. Chem. Anal.*, Vol. II, Part I, 3d ed., p. 200).

OLEUM CETI, *Sperm oil*.—Found in the cranial cavity of the *Physeter macrocephalus*, Linné, or *Sperm whale*, and obtained by expression. Specific gravity, about 0.879. Color, yellow or brownish-yellow. It is distinguished from the oils of the *Whale-oil group* by its lower specific gravity and its composition. Upon cooling, spermaceti is deposited. Sperm oil proper yields, upon saponification, chiefly *oleic acid* and *dodecatyl alcohol* ($C_{12}H_{25}OH$). It is a valuable lubricant.

OULACHON OIL, or EULACHON OIL.—A proposed substitute for cod-liver oil, yielded abundantly by the *Candle-fish* (*Thalicthys pacificus*) of the north Pacific coast. Congelation of this oil begins at—7° C. (19.4° F.), though according to some statements it is of the consistence of lard at common temperatures. Specific gravity, 0.907 at 15.5° (60° F.). It contains *oleic acid* (60 per cent), *stearic*, and *palmitic acids* (20 per cent), and non-saponifiable matter (about 13 per cent).

DUGONG OIL.—The Dugong (*Halicore Dugong*, Cuvier) is an herbivorous mammal found in shallow waters throughout the Indian seas. There are two species of them—the Malay or Indian Dugong (*Halicore indicus*), and the Australian (*Halicore australis*). They are from 6 to 16 feet in length, and weigh from 400 to 600 pounds upon an average; occasionally, however, they are found of larger size. They frequent the neighborhood of ocean inlets where sea-grass, algæ, and fuci abound, and the water is shallow. They are called Sea-hogs, and their flesh (intermediate in flavor between beef and pork), is esteemed a great delicacy by the natives of the islands and countries near which the animal abounds. Underneath the skin (which is about ½ inch in thickness, and is often made into gelatin) is found a layer of adipose tissue, which yields from 4 to 16 gallons of oil, according to the size of the dugong. This oil is very palatable, and is acceptable to the most sensitive stomach, and has obtained somewhat of a reputation as a substitute for cod-liver oil. The oil is fully as nutritious as cod-liver oil, and may be administered in all forms of *tuberculous* and *wasting diseases*, and with equal advantage in cases where there is a decided repugnance to the cod-liver oil (J. King).

TURTLE OIL.—This oil is said to be fully as efficacious as cod-liver oil in malnutrition, especially in strumous individuals. Large quantities of it are consumed in South America, where it is prepared from turtle-eggs; in Jamaica and the Seychelle Island it is prepared from turtle-fat.

OLEUM MYRCIÆ (U. S. P.)—OIL OF MYRCIA.

"A volatile oil distilled from the leaves of *Myrcia acris*, De Candolle (*Nat. Ord.*—Myrtaceæ). It should be kept in well-stoppered bottles, in a cool place, protected from light"—(*U. S. P.*).

SYNONYM: *Oil of bay*.

Botanical Source and History.—The tree producing the leaves which yield *oil of bay*, is indigenous to Venezuela and the West Indies, where it is known as the *Wild cinnamon*, *Bayberry*, and *Wild clove tree*. Its branches are 4-angled, and support broad-ovate, almost obtuse, short-petiolate, strongly-veined, entire, leathery leaves. These are dotted with pellucid oil-glands, and when bruised give off a pleasant, clove-like aroma. The flowers are small and reddish, and the fruit is a smooth, subglobular berry. *Oil of bay* and *Spirit of bay*, or *Bay rum*, are distilled from this plant.

Preparation.—This oil is obtained partly in the islands from the fresh leaves, but mostly in the United States, from the dried leaves, by distilling them with water, or by means of steam. An oil lighter than water first distills over, followed by another heavier than water. The commercial oil consists of a combination of these two fractions.

Description and Tests.—"A yellow or brownish-yellow liquid, having an aromatic and somewhat clove-like odor, and a pungent, spicy taste. Specific gravity, 0.975 to 0.990 at 15° C. (59° F.). With an equal volume of alcohol, glacial acetic acid, or carbon disulphide, it yields slightly turbid solutions. The alcoholic solution is slightly acid to litmus paper. When mixed with an equal volume of a concentrated solution of sodium hydrate, it forms a semisolid mass. If 2 drops of the oil be dissolved in 4 Cc. of alcohol, and a drop of ferric chloride T.S. be added, a light-green color will be produced; and if the same test be made with a drop of diluted ferric chloride T.S., prepared by diluting the test-solution with four times its volume of water, a light-bluish coloration will be produced, which soon disappears. If to 3 drops of the oil, contained in a small test-tube, 3 drops of concentrated sulphuric acid be added, and, after the tube has been corked, the mixture be allowed to stand for ½ hour, a resinous mass will be obtained. On adding to this mass 4 Cc. of diluted alcohol, vigorously shaking the mixture, and gradually heating to the boiling point, the liquid should remain nearly colorless, and should not acquire a red or purplish-red color (distinction from oil of pimenta and oil of cloves). If 1 Cc. of the oil be shaken with 20 Cc. of hot water, the water should not give more than a scarcely perceptible acid reaction with litmus paper. If, after cooling, the liquid be passed through a wet filter, the clear filtrate should produce, with a drop of ferric chloride T.S., only a transient grayish-green, but not a blue or violet color (absence of carbolic acid)"—(*U. S. P.*). The test for distinguishing between this oil and oil of pimenta, above given, is regarded by Schimmel & Co. (Prof. F. B. Power, *Essential Oils*, 1894) as unreliable.

Chemical Composition.—The following substances, arranged in the order of their relative proportions, have been ascertained to occur in oil of bay: (1) *Eugenol*, first observed in this oil by Prof. Markoe (1877); (2) *myrcen* ($C_{10}H_{16}$), a liquid, unsaturated, open-chain hydrocarbon (*olefine*) of a characteristic odor, specific gravity 0.802, and convertible by hydration into *linalool;* (3) *chavicol* ($C_9H_{10}O$); (4) *methyl-eugenol;* (5) *methyl-chavicol;* (6) *l-phellandrene;* (7) *citral.* No pinene is present, hence oil of turpentine may easily be recognized if present as an adulterant (Gildemeister and Hoffmann, *Die Ætherischen Oele*, p. 669).

Action, Medical Uses, and Dosage.—This oil is chiefly employed in perfumes, and is a constituent of *Spiritus Myrciæ*, or *Bay rum.*

OLEUM MYRISTICÆ (U. S. P.)—OIL OF NUTMEG.

"A volatile oil distilled from *Nutmeg*. It should be kept in well-stoppered bottles, in a cool place, protected from light"—(*U. S. P.*).

Synonyms: *Oleum nucistæ æthereum*, *Volatile oil of nutmeg.*

Preparation.—This oil is obtained by distilling ground nutmegs by means of steam. It may be prepared as suggested by Cloëz (1864), by exhausting the nuts with carbon disulphide or ether, and finally distilling the extract thus obtained with the aid of steam. Nutmegs yield from 8 to 15 per cent (Schimmel & Co.) of oil.

Description and Chemical Composition.—The *U. S. P.* describes oil of nutmeg as "a thin, colorless or pale yellowish liquid, having the characteristic odor of nutmeg, and a warm, spicy taste. It becomes darker and thicker by age and exposure to the air. Specific gravity, 0.870 to 0.900 at 15° C. (59° F.). Soluble in an equal volume of alcohol, the solution being neutral to litmus paper; also soluble in an equal volume of glacial acetic acid, and in carbon disulphide in all proportions"—(*U. S. P.*).

The specific gravity at 15° C. (59° F.), according to Schimmel & Co., may be as high as 0.920. It is dextrogyre (+14° to +30°), fulminates with iodine, and forms a clear solution with 3 parts of 90 per cent alcohol. Oil of nutmeg consists of (1) *pinene* (Wallach, 1884; Schacht's *macene*, 1862); (2) *dipentene*; (3) Gladstone's *myristicol* ($C_{10}H_{14}O$; Wright, $C_{10}H_{16}O$) boiling at 224° C. (435.2° F.); specific gravity, 0.9466; convertible into cymol; (4) *myristicin (isomyristicin)* (C H O) in the highest fractions, melts at 30° C. (86° F); its specific gravity is 1.150 at 25° C. (77° F.), and it has a strong odor of mace; (5) *myristic acid* ($C_{14}H_{28}O_2$), formerly called *myristicin*, often forms a sediment (stearopten) in old oils. Oil of nutmeg contains more terpenes than oil of mace, otherwise their composition and properties are alike (Gildemeister and Hoffmann, *Die Ætherischen Oele*).

Action, Medical Uses, and Dosage.—Rarely used in medicine. In 2 or 3-drop doses it may be used for the same purposes as nutmeg.

OLEUM MYRISTICÆ EXPRESSUM.—EXPRESSED OIL OF NUTMEG.

The fixed oil obtained from nutmegs.

SYNONYMS: *Adeps myristicæ, Adeps nucistæ, Balsamum nucistæ, Butyrum nucistæ, Nutmeg butter, Oleum nucistæ expressum, Concrete oil of nutmeg.*

Preparation, Description, and Chemical Composition.—The powder of nutmegs, beaten to a pulp with a little water, and pressed between heated plates, yields from 20 to 30 per cent of a fragrant, orange-colored, concrete oil, mottled with white, sometimes, but incorrectly, called *oil of mace*. It may also be obtained by extracting the bruised nutmegs with disulphide of carbon. This oil is imported from the East Indies (Penang and Singapore) in the form of rectangular cakes about 2½ inches wide and thick, and 10 inches long, enveloped in bast-fibers or pisang leaves. The best grade is the Java article. Much oil is also obtained in Europe from unsalable nutmegs. The fat has the consistence of suet, and possesses the odor and taste of the nutmeg. It is inflammable, burns with a bright, nearly smokeless flame, and, when free from tallow, etc., does not emit a tallow odor when the flame is extinguished. Nutmeg butter is soluble in boiling alcohol and ether, depositing *myristin* upon cooling; its specific gravity is about 0.995; its melting point is given by the *German Pharmacopœia* as 45° to 51° C. (113° to 123.8° F.). The crude article, when melted, leaves a sediment of foreign matters, and must therefore be purified by melting and sedimentation. Nutmeg butter consists chiefly (to 40 or 50 per cent) of *myristin* (Playfair, 1841), the glyceride of *myristic acid* ($C_{14}H_{28}O_2$). It melts at 55° C. (131° F.), and is insoluble in cold alcohol or ether. The fat also contains free *myristic acid*, some *palmitin*, and *olein*, about 6 per cent of volatile oil, and a red-brown coloring matter. Factitious nutmeg butter has been made by melting together tallow, spermaceti, etc., flavoring this with essential oil of nutmeg, and coloring it with saffron. Adulteration with fat is recognized by its being left in the residue when treated with hot alcohol; smaller quantities of fat which go into solution, fall out with the *myristicin* upon cooling, and reduce its melting point.

Action and Medical Uses.—This oil is bland, and does not readily become rancid; hence it furnishes a good vehicle for topical applications. It has been employed alone by friction for the relief of *rheumatism*.

Related Fats.—BECUIBA TALLOW (*Bicuhiba fat*, or *B. balsam*). This fat is obtained from the seeds of a Brazilian species *Myristica Becuhyba*, Schott, by expression. It resembles expressed oil of nutmeg, except in its taste, which is sharp and acidulous. Fusing point, 47° C. (116.6° F.). Alcohol but partially dissolves it.

OCUBA WAX, or VIROLA TALLOW.—A subcrystalline, yellowish fat, melting at 45° to 50° C. (113° to 122° F.), dissolving wholly in alcohol, obtained from the fruit of a Para shrub, the *Virola sebifera*, Aublet (*Myristica sebifera*, Swartz).

OTOBA BUTTER.—Obtained from the fruit of *Myristica Otoba*, Humboldt and Boupland. A nearly colorless or yellowish fat, the odor resembling that of nutmegs when fresh, but becoming brownish in color and disagreeable in odor with age. It fuses at 38° C. (100.4° F.). It contains *myristin*, *olein*, and *otobit*. The latter forms colorless, odorless, tasteless, prismatic crystals, which fuse at 133° C. (271.4° F.). Cold alcohol sparingly dissolves them.

UCUHUBA FAT.—A yellow solid fat obtained from *Ucuhuba nuts*, the fruit of *Myristica surinamensis*. (Compare *Myristica, Related Species.*)

OLEUM OLIVÆ.—OLIVE OIL.

"A fixed oil expressed from the ripe fruit of *Olea europæa*, Linné (*Nat. Ord.*—Oleaceæ). It should be kept in well-stoppered bottles, in a cool place"—(*U. S. P.*).

SYNONYM: *Sweet oil.*

ILLUSTRATION: (Tree) Bentley and Trimen, *Med. Plants*, 172.

Botanical Source.—The olive-tree is an evergreen, from 12 to 20 feet high, with hoary, rigid branches, and a grayish bark. The leaves are opposite, lanceolate, or ovate-lanceolate, mucronate, short-petioled, green above, and hoary on the underside. The flowers are small, in short, axillary, erect racemes, very much shorter than the leaves. The corolla is short, white, with 4 broad, ovate segments; the calyx short and 4-toothed. Stamens 2, rather projecting; style very short; stigma bifid, with emarginate segments. The fruit is a drupe about the size of a damson, smooth, purple, 2-celled, with a nauseous, bitter flesh, inclosing a sharp-pointed stone (L.).

Fig. 183.

Olea europæa.

History.—The native country of the olive-tree is unknown; it is supposed to have been originally from Asia, since it is mentioned in the Bible. At present it is extensively cultivated in the south of Europe, especially in Spain, France, Sicily, Italy, Calabria, and Apulia. It has been introduced into South America, California, and our southern states; in the latter section it does not thrive successfully, but in California it promises to have a commercial future. The tree commences yielding fruit in its third year; in its sixth year it is very productive, and remains so for an indefinite length of time. Varieties of the tree are based on the size, color and taste of fruit, and character of the foliage. The bark of the tree was formerly used in medicine, as well as the leaves, which have a bitter and acrid taste. In the warmer provinces of Europe a substance exudes from the bark, which has been called *Gomme d'Olivier*, and which, according to Pelletier, consists of a peculiar resin containing a small quantity of benzoic acid, and a peculiar crystalline principle, which he called *olivin* or *olivile.* This was at one time used as a remedial agent. The fruit, gathered when not quite ripe, is very solid, bitter, and acrimonious; but when steeped for several days in a lye of wood ashes, and then pickled in brine, it constitutes the olive of commerce, much valued by many as a food. According to Flückiger, the bitterish seeds yield a bland, non-drying oil, which, when obtained together with that of the pulp, amounts to $\frac{1}{10}$ of the whole quantity. The leaves and fruit of this tree, before maturing, contain mannit, but when the fruit has ripened this substance has wholly disappeared.

Preparation.—The oil is obtained by expression from the fleshy pericarp of the fruit. The fruit is carefully collected immediately previous to its ripening, or when it assumes a reddish hue, one day usually completing the gathering; if the olives be collected when fully ripe, the tree will bear only every other year. Without delay, the drupes are passed through a mill, having its stones so arranged as not to break the olive nuts; the pulpy mass thus obtained undergoes cold expression, from which the finest oil, termed *virgin oil*, is procured. The residual press cake is crushed, dampened with boiling water, and again exposed to pressure, thus yielding a second-rate oil, which is made use of as a *salad oil* and for preparing fine soaps; it is the ordinary olive oil of commerce. Upon again breaking up the press-cake, steeping it in water, allowing it to remain for 10 or 12 days, until it begins to ferment, and then expressing it, an inferior oil is obtained, which is used in lamps, and for making plasters, inferior soaps, etc. Carbon disulphide is sometimes used to extract residual oil in marc that has already been treated with pressure and water. Such an oil is very inferior. The process here described is followed in more or less modified form in the different olive-growing countries.

Description.—The best grade of olive oil comes from the south of France (*Provence oil*), and from Italy (*Lucca oil*, *Gallipoli oil*, etc.). Spain and, recently, California yield good grades of olive oil. Olive oil that is dark in color, cloudy, having a pronounced acrid after-taste, easily becomes rancid, and congeals at a point lower than that given below, is inferior in quality and should have no place in medicine. The *U. S. P.* describes the best oil as follows: "A pale-yellow, or light greenish-yellow, oily liquid, having a slight, peculiar odor, and a nutty, oleaginous taste, with a faintly acrid after-taste. Specific gravity, 0.915 to 0.918 at 15° C. (59° F.). Very sparingly soluble in alcohol, but readily soluble in ether, chloroform, or carbon disulphide. When cooled to about 10° C. (50° F.), the oil begins to become somewhat cloudy from the separation of crystalline particles, and at 0° C. (32° F.) it forms a whitish, granular mass"—(*U. S. P.*). Olive oil is little soluble in alcohol if free from uncombined oleic acid. It is soluble in petroleum benzin and benzol, and in 5 parts of acetic ether. If exposed to light and air, olive oil becomes rancid and liberates oleic acid. Olive oil is the type of non-drying oils, and is therefore much used as a lubricant, although its tendency to become rancid prevents its unrestricted application for this purpose. Pure olive oil is also characterized by giving the *elaïdin* reaction (see *Tests* below).

Chemical Composition.—Olive oil may be differentiated by cold and pressure into about 30 per cent of a solid fat, chiefly consisting of *palmitin*, *stearin*, and a small amount of *arachin*, the glyceride of *arachic acid* ([$C_{20}H_{40}O_2$], a constituent of earthnut oil), and about 70 per cent of a fluid oil composed of *olein* with about 7 per cent of *linolein* (the glyceride of *linoleic acid;* see *Oleum Lini*). Rancid olive oil may contain from 2 to 24 per cent of free *oleic acid*. Chlorophyll and small amounts of the alcohol *cholesterin* ($C_{26}H_{43}.OH$) likewise occur in olive oil. Olive oil is frequently adulterated, being substituted, wholly or in part, by cotton-seed oil, earthnut oil, poppy, rape-seed, sesame, and lard oil. Its physical and chemical characteristics, such as specific gravity, point of congelation, saponification equivalent, its non-drying quality, the elaïdin test, its low iodine number, resulting from its limited power to absorb iodine, and other tests, assist in detecting adulterations.

Tests.—The *U. S. P.* gives the following tests for the purity of olive oil: "If 10 Cc. of the oil be shaken frequently, during 2 hours, with a freshly prepared solution of 1 Gm. of mercury in 3 Cc. of nitric acid, a perfectly solid mass of a pale straw-color will be obtained. If 6 Gm. of the oil be thoroughly shaken, in a test-tube, for about 2 minutes, with a mixture of 1.5 Gm. of nitric acid and 0.5 Gm. of water, then heated in a bath of boiling water for not more than 15 minutes, the oil should retain a light-yellow color, not becoming orange or reddish-brown, and, after standing at the ordinary temperature for about 12 hours, it should form a perfectly solid, light-yellowish mass (absence of appreciable quantities of cotton-seed oil, and most other seed oils). If 5 Cc. of the oil be thoroughly shaken, in a test-tube, with 5 Cc. of an alcoholic solution of silver nitrate (prepared by dissolving 0.1 Gm. of silver nitrate in 10 Cc. of deodorized alcohol, and adding 2 drops of nitric acid), and the mixture be heated for about 5 minutes in a water-bath, the oil should retain its original, pale-yellow color, not becoming reddish or brown, nor should any dark color be produced, at the line of contact of the two liquids (absence of more than about 5 per cent of cotton-seed oil, and of many other foreign oils). If 30 Cc. of the oil be saponified by heating with 20 Cc. of alcohol and 5 Gm. of potassa, the liquid then diluted with 200 Cc. of water, and freed from alcohol by boiling, on supersaturating the solution with diluted sulphuric acid, the fatty acids will form a layer on the surface. If these be separated as far as possible, free from water, and filtered, 5 Cc. of the filtrate, when shaken in a test-tube with 5 Cc. of concentrated hydrochloric acid, should not color the latter green; and, on the subsequent addition of about 0.5 Gm. of sugar, and again shaking the mixture, no violet or crimson tint should be produced in the acid layer within 15 minutes (absence of sesamum oil)"—(*U. S. P.*). (For the detection of oil of sesame in olive oil, by a new color test, see J. F. Tocher, *Amer. Jour. Pharm.*, 1891, p. 140. For details of analysis, we must refer the reader to special works, such as A. H. Allen's *Commercial Organic Analysis*, Vol. II, Part I, 3d ed., 1899, p. 126.)

Action, Medical Uses, and Dosage.—According to Mr. Sidney H. Maltass, a strong decoction of the leaves of the olive-tree, given in doses of a wineglassful every 3 hours, has cured the most obstinate and severe forms of *intermittent fever*. He considers it more effectual than quinine. Olive, or sweet oil, as it is often called, is emollient, nutritive, and aperient. A fluid ounce or two purges, but is uncertain and often ineffective; yet is very useful in teaspoonful doses for newly-born infants, where the mother's milk does not prove sufficiently laxative. As a demulcent, it is very useful in *irritation of the mucous surfaces of the air passages*, and of the *alimentary tube*. It may be given as a gentle aperient in cases where other agents would cause too much intestinal irritation; and is of service as an *antidote to the strong alkalies*, in which it acts by combining with them to form soap. It has been used in cases of *poisoning by cantharides*, but owing to its readily dissolving their active principle, it increases the peril of the patient. As an article of diet it is generally harmful to dyspeptics. Olive oil is largely used by workers in lead to prevent *constipation* and *lead poisoning*. Large doses, prepared in emulsion with egg and mint, have been successful in removing *biliary concretions*. It is said to be effectual in *phthisis*, particularly to control *excessive sweating*. Externally (with lime-water), it is a valued agent for anointing *bruises, excoriations, superficial wounds, burns* and *scalds*. It is a good application to the body outlets to prevent excoriation from acrid discharges. Olive oil is frequently used as a vehicle for anodynes and local anæsthetics, such as morphine, menthol, camphor, etc. An olive oil solution of camphor, applied warm, is very effective in *mastitis*. Olive oil relieves the various forms of *earache*. It removes *rectal worms*, and has a soothing effect upon the rectum in *dysentery*. Live *insects in the ear* may be destroyed and removed by filling the canal with the oil. Applied warm it gives relief to the *bites and stings of insects*. Rubbed over the whole surface of the body, it has been considered beneficial in the treatment of *plague, scarlatina*, and some other *exanthematous affections*. Finally, it is largely used as a lubricant for the operator's hands, and for specula, bougies, and other instruments to be introduced into the orifices of the body. To facilitate the passage of catheters, first introduce into the urethra a quantity of warm olive oil. Olive oil enters largely into the formation of liniments, cerates, ointments and plasters. The dose of olive oil ranges from 2 fluid drachms to 2 fluid ounces. In the countries where the olive grows the oil is used as a food.

OLEUM ORIGANI.—OIL OF ORIGANUM.

SYNONYM: *Oil of wild marjoram.*

Preparation and Description.—This oil is produced from the *Origanum vulgare*, by distillation of the plant with water. The yield referred to dried herb is 0.15 to 0.4 per cent (Schimmel & Co.). It is of a yellowish or reddish-yellow color, of a peculiar, agreeable, balsamic odor, and a warm, very pungent taste. Its specific gravity ranges from 0.87 to 0.91. It is imported from Europe, and frequently contains oil of turpentine. Very little true oil of origanum is met with in this country; that generally sold for it is imported from France.

Chemical Composition.—A camphor-like stearopten has been observed in this oil by Kane (1839). Two phenols, one being *carvacrol*, were found in the oil by Jahns (1880) in small quantity, not exceeding 0.1 per cent. The bulk of the oil is probably composed of *terpenes* ($C_{10}H_{16}$). Its chemical examination is incomplete.

Action, Medical Uses, and Dosage.—Oil of origanum is stimulant and rubefacient, and is chiefly employed in the form of liniment as an application to various parts suffering from *painful affections*. As with many other essential oils, it affords relief in *toothache* upon being applied to the decayed tooth by means of lint or cotton. It is very seldom administered internally.

Related Oils.—OLEUM MAJORANÆ. The *Oil of sweet marjoram*, obtained by distillation of the *Origanum majorana*, Linné, is a pale yellow or greenish-yellow oil with the strong odor and taste of sweet marjoram, and on standing deposits a camphor. Its specific gravity is 0.890 to 0.91. Optical rotation +17° 10′ (Schimmel & Co.). According to W. Biltz (1898), this oil contains 40 per cent of terpenes, chiefly *terpinene*, and in addition, *dextro-terpineol*, partly in the form of ester. It is employed as a medicine and as a perfume for soaps. It is seldom used in the United States.

OLEUM ORIGANI CRETICI, *Cretian oil of origanum.*—This herb is distilled from several species of *Origanum*, as *O. creticum*, Linné; *O. hirsutum*, Link; *O. macrostachyum*, Link, and *O. megastachyum*, Link. A golden-yellow oil when fresh, becoming yellowish or brownish with age. It has an aromatic, penetrating, thyme-like odor. Specific gravity, 0.960 to 0.980 (Power). The Trieste commercial variety, probably derived from *O. hirsutum*, Link, contains, according to

Jahns (1879), *carvacrol* (*isopropyl ortho-cresol*, $C_6H_3.CH_3.OH.C_3H_7$), a colorless, thick, liquid phenol, solidifying in the cold. Good origanum oil should contain from 60 to 85 per cent. Jahns furthermore found 0.2 per cent of a second phenol and a large amount of *cymol*. Smyrna origanum oil (from the herb of *Origanum smyrnæum*, Linné) also contains cymol, but less *carvacrol* (25 to 60 per cent), and contains in addition *l-linalool* (Gildemeister, *Archiv der Pharm.*, 1895, p. 182). Origanum oil forms a clear solution with 3 parts of 70 per cent alcohol. For microscopical purposes the oil should be pale-yellowish and kept in well-filled and closely-stopped bottles, placed in a dark situation (Power, *Essential Oils*).

OLEUM PALMÆ.—PALM OIL.

The fixed oil from the fruit of *Elæis guineensis*, Jacquin.

Nat. Ord.—Palmæ.

SYNONYMS: *Palmöl*, *Palm butter*.

Botanical Source.—The oil palm is a native of western Africa, and is found growing in other tropical sections. It is a very handsome, graceful tree, growing to a great height, and supports on its spine-armed petioles, large, pinnately-divided leaves, the leaflets of which are narrow, long, and linear. The fruit is a drupe, yellow, mottled, and about an inch in length. Its leathery sarcocarp contains much oil; the seed kernel is likewise oily.

Preparation and History.—Palm oil, or fat is obtained either by pressure of the oily sarcocarp, or by boiling it in water. It is produced in western Africa, West Indies, Brazil, and Cayenne. The best varieties are those known as *Lagos prima* and *Lagos secunda*, the bulk of the oil being shipped from that port and from Palmas.

Description.—Palm oil is of a butyraceous consistence, of a reddish-yellow or orange-yellow color, and a pleasant odor. It melts at 27° C. (80.6° F.). By exposure and age the fat becomes whitish and rancid, a large portion of it being decomposed into glycerin and fatty acids; this change is not objectionable to its use in soap-making. Such changes are accompanied by rise of melting point, which reaches occasionally as high as 42° C. (107.6° F.). When fresh it will melt by the heat of the hand. Its specific gravity is 0.945. Ether completely dissolves it, while it is but partially soluble in alcohol.

The kernels also yield an oil (*palm-kernel oil*, or *palm-nut oil*), which has a white or pink color and an agreeable, orris-like, or violaceous odor. Palm oil is largely employed in the making of soaps, which retain the agreeable odor of the fat. To prepare a white soap, the oil is first bleached by means of potassium dichromate solution. It is the most easily saponified of the fixed oils.

Chemical Composition.—Palm oil consists of *palmitin*, *olein*, and free *palmitic acid*. Palm-kernel oil differs from palm oil in containing a considerable quantity of glycerin esters of lower fatty acids. According to Oudemans (see A. H. Allen, *Com. Org. Anal.*, Vol. II, Part I, 3d ed., 1899, p. 164), one sample of palm-kernel oil consisted of *olein* (26.6 per cent); *stearin*, *palmitin*, and *myristin* (33 per cent), and *laurin*, *caprin*, *caprylin*, and *caproin* (40.4 per cent). All fatty acids here represented contain an even number of carbon atoms.

Action, Medical Uses, and Dosage.—This is an agreeable emollient, useful as an application to *bruises*, *sprains*, and like *injuries*. It is less drying than most of the vegetable oils used for this purpose.

Related Oils.—(Compare *Oleum Cocos.*) TUCUM OIL. A bright-red, pleasantly fragrant oil obtained from the fruit of the South American *Astrocaryum vulgare* of Martius.

MACAJA BUTTER. A yellowish, butyraceous oil, having an agreeable, violaceous odor, prepared from the seeds of the *Cocos aculeata*, Jacquin, of the American tropical belt.

OLEUM PHOSPHORATUM (U. S. P.)—PHOSPHORATED OIL.

Preparation.—"Phosphorus, one gramme (1 Gm.) [15.5 grs.]; expressed oil of almond, ether, each, a sufficient quantity to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Introduce a sufficient quantity of expressed oil of almonds into a flask, heat it on a sand-bath to 250° C. (482° F.), and keep it at that temperature for 15 minutes. Then allow it to cool, and filter it. Put ninety grammes (90 Gm.) [3 ozs. av., 76 grs.] of the filtered oil together with the phosphorus, previously well dried by filtering paper, into a dry, tared bottle capable of holding about one hundred and twenty cubic centimeters (120 Cc.) [4 fl℥, 28♏]; insert the stopper, and heat the bottle in a water-bath until the phosphorus melts. Then agitate it until the phosphorus is dissolved, allow it to cool, add enough ether to make the mixture weigh one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.], and agitate again. Lastly, transfer the solution to small glass-stoppered vials, which should be completely filled and kept in a cool and dark place"—(*U. S. P.*).

To prevent the oxidation of the phosphorus the oil is heated to expel any moisture or air that may be present. Dr. Squibb advises that the phosphorus be dissolved in the oily fluid only in the presence of carbon dioxide. In this way he prepares a solution of 1 part of thoroughly dried phosphorus in 99 parts of cod-liver oil. The ether is present to preserve the preparation by preventing oxidation, and to impart a more agreeable taste. In the *British Pharmacopœia* formula ether is omitted, hence the strong phosphorescence of the British official product, which fumes in the air through combination of the phosphorus with atmospheric oxygen. The *U. S. P.* oil contains 1 per cent of phosphorus, that of the *British Pharmacopœia*, 0.99 per cent.

Description.—The *U. S. P.* describes phosphorated oil as "a clear, yellowish liquid, having the odor of phosphorus and of ether, but not phosphorescent in the dark. It should be perfectly free from any particles of undissolved phosphorus"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This is a convenient form for the administration of *Phosphorus* (which see).

OLEUM PICIS LIQUIDÆ (U. S. P.)—OIL OF TAR.

"A volatile oil distilled from tar"—(*U. S. P.*).

Preparation.—When common wood-tar is distilled, that portion of less density than water passing over, is called *oil of tar;* a residue known as *pitch* is left in the retort.

Description and Chemical Composition.—"An almost colorless liquid when freshly distilled, but soon acquiring a dark reddish-brown color, and having a strong, tarry odor and taste. Specific gravity, about 0.970 at 15° C. (59° F.). It is readily soluble in alcohol, the solution being acid to litmus paper"—(*U. S. P.*).

The density of oil of tar is apt to vary according to the amounts of its various constituents present. If prepared from coniferous tars turpentine is likely to form a large portion of the oil. Oil of tar contains empyreumatic substances, several acids, among them acetic acid, and a number of hydrocarbons.

Action and Medical Uses.—This oil has the uses of *Tar* (which see). It is applied locally in scaly and other forms of *skin diseases.* It has been used for the relief of *chronic coughs.* The dose is 1 to 5 drops in emulsion or capsule.

OLEUM PIMENTÆ (U. S. P.)—OIL OF PIMENTA.

A volatile oil distilled from *Pimenta officinalis*, Lindley. "It should be kept in well-stoppered bottles, in a cool place, protected from light"—(*U. S. P.*).

SYNONYMS: *Oil of allspice, Oil of pimento.*

Preparation, Description, and Tests.—When unripe and sun-dried allspice or pimento berries are bruised and distilled with water, they yield a volatile oil to the extent of from about 3 to 4.5 per cent. The ripe fruits are nearly odorless. The oil is heavier than water, its lowest density being given as 1.024 (Schimmel & Co.'s *Report*, April, 1899). The official oil is "a colorless, or pale-yellow liquid, having a strong, aromatic, clove-like odor, and a pungent, spicy taste. It becomes darker and thicker by age and exposure to the air. Specific gravity, 1.045 to 1.055 at 15° C. (59° F.). With an equal volume of alcohol it forms a clear solution which is slightly acid to litmus paper. It also forms a clear solution with an equal volume of glacial acetic acid, and a nearly clear solution with an equal volume of carbon disulphide. When mixed with an equal volume of a concentrated solution of sodium hydrate, it forms a semisolid mass. If 2 drops of the oil be dissolved in 4 Cc. of alcohol, and a drop of ferric chloride T.S. be added, a bright green color will be produced; and if the same tests be made with a drop of diluted ferric chloride T.S., prepared by diluting the test-solution with four times its volume of water, a blue color will be produced changing to green, and soon becoming yellow. If 1 Cc. of the oil be shaken with 20 Cc. of hot water, the water should not give more than a scarcely perceptible acid reaction with litmus paper. If, after cooling, the liquid be passed through a wet filter, the clear filtrate should produce, with a drop of ferric chloride T.S., only a transient grayish-green, but not a blue or violet color (absence of carbolic acid)"—(*U. S. P.*).

Chemical Composition.—This oil contains over 60 per cent of the heavy *eugenol* ($C_6H_3.C_3H_5[OH][OCH_3]$), the chief constituent of oil of cloves (which see). and a sesquiterpene of the composition $C_{15}H_{24}$, boiling at 255° C. (491° F.).

Action, Medical Uses, and Dosage.—Oil of pimenta is stimulant and aromatic, and may be used for similar purposes as the other oils of like character, in doses of from 2 to 10 drops.

OLEUM PINI SYLVESTRIS.—FIR-LEAF OIL.

The volatile oil distilled from the *Pinus sylvestris* (*silvestris*), Linné.

Nat. Ord.—Coniferæ.

SYNONYM: *Oleum folii pini sylvestris*, *Fir-wool oil*, *Pine-needle oil*, *Oleum pini foliorum.*

Preparation and History.—This oil is in use in various parts of Europe, and is distilled in Scotland, Sweden, and Germany, from the leaves of *Pinus sylvestris*, or "*Scotch pine*," which is found in the highlands of Scotland, where it occurs, as tree or shrub, according to the locality of its growth. The oil was admitted into the *Pharmacopœia of the Throat Hospital*, London (1872). It must not be confounded with *oil of turpentine*, which is abundantly produced from the trunk of same tree. This oil is, like that from the other species of pine, also known as pine-needle oil, and is prepared by distilling with water the leaves pounded into a fibrous condition, and then known as *fir-wool*. The yield is about 0.5 per cent. Scotch leaves yielded in winter 0.13 per cent.

Description and Chemical Composition.—Fir-leaf oil is a limpid, greenish-yellow fluid, soluble in about 10 volumes of 90 per cent alcohol. It has a strong, but agreeable, coniferous odor, combined somewhat with that of lavender. The German and Swedish oils are dextro-rotatory (about +10°), but the Scotch oil is lævo-rotatory (about —8° to —19°). The specific gravities of the German and Scotch oils vary from 0.884 to 0.889; that of the Swedish is 0.872. The German oil contains *dextro-pinene*, *d-sylvestrene*, *cadinene*, and probably *bornyl-* or *terpinyl-acetate* (about 3.5 per cent). The Swedish and English oils are similarly constituted, except that the hydrocarbons occur in the left-handed modification, in the English oils. (For other *pine-needle oils*, see table of oils in Schimmel & Co.'s *Report*, April, 1897, and especially Gildemeister and Hoffmann, *Die Ætherischen Oele*, 1899.)

Action, Medical Uses, and Dosage.—It is said that fir-leaf oil is largely sold in England and on the continent, as a patent liniment for the cure of *rheumatism*. In *maladies of the throat* it may be administered internally in the dose of a few drops, diluted, and likewise locally applied to the throat and chest.

OLEUM RICINI (U. S. P.)—CASTOR OIL.

"A fixed oil expressed from the seed of *Ricinus communis*, Linné (*Nat. Ord.*—Euphorbiaceæ). It should be kept in well-stoppered bottles"—(*U. S. P.*).

Botanical Source.—*Ricinus communis*, the *Castor-oil bush*, in the United States, is a herbaceous annual, with a white, frosted, or glaucous, hollow, smooth stem, of a purplish-red color upward. The root is long, thick, and fibrous. The leaves are large, alternate, deeply divided into 7 or 9 lanceolate segments, peltate, palmate, serrate, 4 to 12 lines in diameter, and on long, tapering, purplish petioles The flowers are borne in long, green, and glaucous spikes, springing from the divisions of the branches; males from the lower part of the spike, females from the upper. The capsule is prickly, 3-celled, and 3-seeded; the seeds ovate, shining, and black dotted with gray (L.—W.)

History.—Ricinus communis, or *Palma Christi*, is an East Indian plant, in which country it attains the size of a tree. In the United States, where it has become naturalized, it seldom grows higher than 8 or 10 feet, flowers in July and August, and matures its seeds in August and September. The plant is much grown in California for its oil, also in Italy. The fixed oil of the seeds is the castor oil of commerce, and was known to the ancient Egyptians. The seeds are poisonous, about 4 lines in length, 3 lines in width, and about 1½ lines in thickness, and consist of a smooth external coat, covering a thick, hard, and dark-brown shell, composed of two layers which inclose the white nucleus or oleaginous kernel, which has within it a large, dicotyledonous, leafy embryo. A non-griping cathartic oil, *Tambor oil*, is obtained from a Central American euphorbiacea, *Omphalea oleifera*, Hemsley. (For a detailed historical account of the castor-oil plant, see H. Stillmark's dissertation on *Ricin*, 1889.)

Fig. 184.

Ricinus communis.

Preparation.—Castor oil may be obtained by several methods, mostly by warm or cold pressure after the seeds are deprived of their husks. The *cold-drawn* oil is the most esteemed, although the *U. S. P.* does not expressly demand it. In order to remove the acridity of the fresh oil, and to coagulate albuminous matter, the oil is purified by repeatedly boiling it with water. By cold expression the seeds yield 40 to 45 per cent of oil, and a smaller quantity upon subsequent warm expression. The latter oil, however, is not used medicinally. The poisonous principle contained in the seed remains in the press-cake, and is destroyed by boiling with water.

Description and Tests.—Castor oil, as demanded by the *U. S. P.*, is "a pale-yellowish or almost colorless, transparent, viscid liquid, having a faint, mild odor, and a bland, afterward slightly acrid, and generally offensive taste. Specific gravity, 0.950 to 0.970 at 15° C. (59° F.). Soluble in an equal volume of alcohol, and in all proportions in absolute alcohol, or in glacial acetic acid; also soluble at 15° C. (59° F.), in three times its volume of a mixture of 19 volumes of alcohol and 1 volume of water (absence of more than about 5 per cent of most other fixed oils). With an equal volume of benzin, it forms, at 15° C. (59° F.), a turbid mixture, but at 17° C. (62.6° F.), it yields a clear solution. When exposed to the air in a thin layer, it slowly dries to a varnish-like film. When cooled to 0° C. (32° F.), it becomes turbid, with the separation of crystalline flakes, and at about —18° C. (—0.4° F.) it congeals to a yellowish mass. If 3 Cc. of the oil be shaken for a few minutes with 3 Cc. of carbon disulphide and 1 Cc. of sulphuric acid, the mixture should not acquire a blackish-brown color (absence of many foreign oils)"—(*U. S. P.*).

This oil is one of the heaviest and most viscid of the fixed oils, and is distinguished from all other oils except croton oil, by its ready solubility in alcohol and acetic acid in the cold. Its remarkable insolubility in an excess of benzin (see above) may be overcome by the admixture of a third fatty oil, *e. g.*, lard oil. When exposed to the air in bulk, its viscidity increases, and the oil becomes rancid; in thin layers it slowly dries, it also yields with nitrous acid (according to *Pharmacographia*, 6 parts of castor oil warmed with 1 part of starch and 5 parts of nitric acid of specific gravity 1.25) solid *ricin-elaidin*. Thus castor oil shares the conspicuous properties of both drying and non-drying oils. Unlike most other fixed oils, some specimens of castor oil, *e. g.*, East Indian oils, show a right-handed optical rotation. When heated to temperatures above 100° C. (212° F.), castor oil becomes altered, the characteristic *œnanthol* being among the products of decomposition (see below).

It is stated that rancid, acrid castor oil may be deprived of its disagreeable odor and taste, as well as of acrimony, by boiling it for 15 minutes with water and a little calcined magnesia. Castor oil, in addition to its medicinal uses, is much employed in the preparation of lubricants and cheap soaps, and in the making of turkey-red oil, which is used as a mordant in dyeing cotton with alizarin dyes.

Chemical Composition.—I. Seeds. According to Geiger, the seeds consist to about one-fourth of the husks, and three-fourths of nucleus. The *seed-coats* contain tasteless resin and extractive, 1.91; brown gum, 1.91; ligneous fiber, 20.00. The *nucleus of the seeds* contains fatty oil, 46.19; gum, 2.40; casein (albumen), 0.50; ligneous fiber, with starch, 20.00; loss or moisture, 7.09 (P.). They also contain a peculiar and acrid principle which does not enter the oil, for the seeds are powerfully active after the oil has been expressed. The active poisonous principle, according to Stillmark (*loc. cit.*, 1889), is an unorganized albuminous ferment, called *ricin*. In air-dry seeds it is present in the quantity of about 3 per cent. It is obtained in largest amount by extracting the press-cake cold, with a 10 per cent solution of sodium chloride, and precipitating the filtrate with magnesium sulphate. The poison is destroyed by boiling with water, although not by dry heat. It is not a glucosid.

II. Oil.—According to Alfred H. Allen (*Com. Org. Anal.*, Vol. II, Part I, 3d ed., 1889, p. 156), castor oil is free from *palmitin* or *olein*, but contains small amounts of *stearin*. Its chief constituents are *ricinolein* ($C_3H_5[C_{18}H_{33}O_3]_3$), *isoricinolein*, and *dihydroxystearin*. Ricinoleic acid ($C_{18}H_{34}O_3$) is the principal acid of the oil; it forms a thick oily liquid, solidifying below 0° C. (32° F.), soluble in alcohol and ether. It does not absorb oxygen from the air, although as an unsaturated acid it absorbs 2 atoms of bromine. By the action of nitrous acid it is slowly converted into its stereo-isomer, *ricinelaïdic acid*, which crystallizes in needles melting at 50° C. (122° F.). By distillation under diminished pressure, ricinoleic acid yields among other products *œnanthol* (*œnanthic* or *heptoic aldehyde* $C_7H_{14}O$ or $C_6H_{13}.CHO$), a highly refractive liquid of a characteristic odor, boiling at 154° C. (309.2° F.). Castor oil also yields *œnanthol* when rapidly distilled. In addition, *œnanthic acid* ($C_6H_{13}.COOH$), *acrolein*, and other substances are formed. In this connection we may refer to *œnanthic ether* ($C_6H_{13}.COOC_2H_5$), a constituent of the bouquet of wines, which is prepared by conducting dry hydrochloric acid gas into a solution of *œnanthic acid* in absolute alcohol. It boils at 188° C. (370.4° F.).

Action, Medical Uses, and Dosage.—The castor-oil seed or bean is a powerful cathartic and gastric irritant, and has proved fatal to man when taken to the extent of 20 seeds at once. Yet the oil expressed from it is only a mild cathartic, operating promptly, producing thin, feculent, but not watery stools, and causing but little griping or nausea. From its mildness of action, it is especially adapted to young children, pregnant or puerperal females, likewise in *hemorrhoidal affections*, *colic*, *diarrhœa*, *dysentery*, *enteritis*, after the *reduction of hernia*, *obstinate constipation*, *collections of indurated feces*, *accumulation of acrid secretions*, and in *worms*. It is frequently used to remove constipation, and also in diarrhœa when due to undigested material. When throat and skin disorders depend upon intestinal accumulations, castor oil is an efficient purgative. One part of oil of turpentine mixed with 3 or 4 parts of castor oil increases its purgative and anthelmintic effect. The greatest objections to this cathartic are its nauseous taste and its tendency to cause sickness or unconquerable disgust. This may be overcome by adding to 1 pint of the oil ½ fluid ounce each of oils of origanum and wintergreen, or 1 ounce of sassafras oil; the dose of this may be given in sweetened water. Any other aromatic oils will answer equally as well. When not contraindicated it may be taken in wine, spirituous liquors, or the froth of beer, likewise in cinnamon or peppermint water. I find it a very pleasant mode of administration to boil the dose of oil with about a gill of good sweet milk for a few minutes, sweeten with loaf-sugar, and flavor with essence of cinnamon or other favorite aromatic; it somewhat resembles custard in its taste and appearance, and is readily taken by even the most delicate stomach (J. King).

Stuncke states that castor oil saponifies readily with alkalies, and gives with soda a white solid soap, which, in the form of pills, is a certain and agreeable purgative. M. Parola proposes an ethero-alcoholic extract and the ethereal and alcoholic tinctures of the seeds as a substitute for the oil; he states that the above tinctures have a purgative action four times as strong as the oil, are less irritating, and remain unalterable in all climates. As an enema, castor oil may be used in the quantity of 2 or 3 fluid ounces mixed with some mucilaginous liquid. Externally, it has been recommended in *itch*, *ringworm*, and other *cutaneous diseases*. Daily applications of castor oil to *warts* is said to remove them in a few weeks. Dose for an adult, 1 or 1½ fluid ounces; for an infant, 1, 2, or 3 fluid drachms, according to its age. Equal parts of castor oil and copal varnish form an excellent local application for *hemorrhoidal affections*. A hairwash for keeping the hair from falling, and cleansing it of *dandruff*, is sold by the perfumers, and is made as follows: Take castor oil, ½ pound; strongest alcohol, ½ pint; powdered cantharides, 48 grains; oil of bergamot, ½ ounce; otto of roses, 4 drops. Mix, let them stand for 7 days, frequently shaking, and then filter, and keep in well-closed bottles.

CASTOR-OIL LEAVES.—According to Dr. J. O. McWilliam, the natives of the Cape Verde Islands use the leaves of the castor-oil plant, which they term "*Bofareira*," for accelerating and increasing the flow of milk, in cases where it is tardy in appearing or deficient in quantity, and also in cases of emergency, where the females are not child-bearing, or have not suckled a child for many years. The *white* plant, known by the light-green color of the leaf-stem, is used instead of the *red*, having a purplish-red leaf-stem. The breasts are frequently fomented, and the boiled leaves placed upon the breasts in the form of a poultice. This operation is frequently repeated, and in obstinate cases the thighs and generative organs are exposed to the vapor from the decoction. One, two, or three days are required before the child can procure a supply of milk from the breasts of persons thus treated—according to circumstances.

Women with well-developed breasts are most easily affected by it, while those with small and shriveled breasts have the uterine system acted upon, bringing on the menses, if their period be distant, or causing their immoderate flow if their advent be near. Exposure to cold is carefully avoided by women brought under its influence; they scrupulously abstain from wetting the hands or feet with cold water. It is said to affect virgins of adult age, similar to child-bearing women. It sometimes produces swelling and pain in the breasts and axillary glands, pain in the back, and an increase of a leucorrhœal discharge.

This remedy, and the Red bofareira, both of which are common to this country, have been tried by physicians, as an emmenagogue, and the results have been sufficiently favorable to render further investigation very desirable.

OLEUM ROSÆ (U. S. P.)—OIL OF ROSE.

"A volatile oil distilled from the fresh flowers of *Rosa damascena*, Miller (*Nat. Ord.*—Rosaceæ). It should be kept in well-stoppered vials, in a cool place, protected from light. When dispensed, it should be completely liquefied by warming, if necessary, and well mixed by agitation"—(*U. S. P.*).

SYNONYMS: *Otto of roses, Attar of roses, Essence of rose.*

History and Source.—The earliest nations gave attention to the rose aroma, and employed oil of rose in many of their religious ceremonies. This oil consisted for centuries merely of some fatty oil saturated with the aroma of the flower. Arab writers mention the distillation of the oil of rose in the eighth and ninth centuries. In the middle ages Persia was the principal country of its production. It gradually extended to India and westward, and gained a foothold in Bulgaria early in the seventeenth century. Since about 1850 the French, and in more recent years the German rose industries, have become important. Adulteration with santal-wood oil was practiced in Persia (E. Kämpfer, 1682–1684), and with East Indian geranium (Palma rosa) oil in Kashmir (Polier, 1788). (See Dr. Hoffmann in *Die Ætherischen Oele*, p. 556.) Rose oil is distilled in Bulgaria as well as in Germany, from the fresh leaves of *Rosa damascena*, Miller; in southern France from *Rosa centifolia*, Linné. The yield of German oil is 1 pound from 5,000 to 6,000 pounds of flowers, or about 0.02 per cent.

Description.—The official oil of rose is thus described: "A pale-yellowish, transparent liquid, having the strong, fragrant odor of rose, and a mild, slightly sweetish taste. Specific gravity, 0.865 to 0.880 at 20° C. (68° F.). It is but slightly soluble in alcohol, and neutral to litmus paper moistened with alcohol. The congealing and melting points of the oil are subject to some variation, depending upon the amount of stearopten, but, when slowly cooled to a temperature, usually between 16° and 21° C. (60.8° and 69.8° F.) it becomes a transparent solid, interspersed with numerous slender, shining, iridescent, scale-like crystals. Upon the application of the heat of the hand, the crystals should float in the upper portion of the liquefied oil"—(*U. S. P.*). It is combustible, and its vapor is said to form an explosive mixture with oxygen. The pharmacopœial description is that of the Bulgarian oil. The German oil is stated to have a much stronger rose odor than the Bulgarian, and to be of absolute purity (see Power, *Essential Oils*, p. 30). At ordinary temperatures, it is a semisolid, soft mass, congealing between 27° and 37° C. (80.6° and 98.6° F.), and containing from 26 to 34 per cent of stearopten, while Bulgarian oil contains from 10 to 15 per cent.

Chemical Composition.—*Rose-stearopten*, or *rose camphor*, is odorless, and was recognized by Flückiger (1869) to be a paraffin hydrocarbon. It may be differentiated, by distillation in vacuo, into two paraffins, one melting at 22° C. (71.6° F.), the other at 40° and 41° C. (104° and 105.8° F.). The presence of this paraffin renders the oil partly insoluble in alcohol. The liquid portion of oil of rose contains as its chief constituent the alcohol *geraniol* (Bertram and Gildemeister, 1894; U. Eckart's *rhodinol*, 1891).

GERANIOL is a colorless liquid, boiling at 230° C. (446° F.), of a rose-like odor, having the formula $C_{10}H_{18}O$ or $(CH_3.C[CH_3]:CH.CH_2.CH_2.C[CH_3]:CH.CH_2OH)$. It is a primary alcohol, and yields, upon oxidation, the aldehyde *citral* ($C_{10}H_{16}O$). It is likewise the principal constituent of East Indian geranium, rose geranium, citronella, and lemon-grass oils. It forms a characteristic, crystallizable addition compound with dry calcium chloride insoluble in the usual organic solvents, but decomposable by water; this regenerates therefrom geraniol, which may be obtained chemically pure by this method. Oil of rose furthermore contains about 20 per cent of *l-citronellol* (Tiemann and Schmidt, 1896). Both geraniol and citronellol are, for the smaller part, combined in the form of ester (about 3 per cent). The exact honey-like odor of rose oil has not yet been obtained by a combination of the constituents enumerated.

Adulterations and Tests.—Owing to its high price, oil of rose is subject to adulteration; the additions to it are mostly the oils of palma rosa (East Indian geranium from *Andropogon*) and of rose geranium (from *Pelargonium*). A deficiency in rose camphor, resulting from the addition of these oils, is sometimes made up by adding spermaceti. The addition of these oils, if carried out intelligently, is very difficult to detect. Crude adulterations may be recognized by determining the following constants: Specific gravity, optical rotation, congealing point, amount and chemical nature of stearopten, saponification, and acetylation (see details of these determinations in Gildemeister and Hoffmann, *Die Ætherischen Oele*, pp. 566–570). The *U. S. P.* gives the following color tests for the purity of oil of rose: "If to 5 drops of the oil, contained in a test-tube, 5 drops of concentrated sulphuric acid be added, a reddish-brown, thick mixture will be produced, but no white fumes or tarry odor should be developed, and the fragrant odor of the oil should not be destroyed. If this mixture be then shaken with 2 Cc. of alcohol, the resulting liquid may be turbid, but should be nearly colorless, and should not at once assume a red or reddish-brown color (absence of oil of ginger-grass or Turkish oil of geranium, from *Andropogon Schœnanthus*, Linné [*Nat. Ord.*—Gramineæ], and from oil of rose geranium, from *Pelargonium Radula* [Cavanilles], Aiton, *Pelargonium capitatum* [Linné], Aiton, and *Pelargonium odoratissimum* [Linné], Aiton [*Nat. Ord.*—Geraniaceæ])"—(*U. S. P.*). Power (*loc. cit.*) suggests that the foregoing test is rather reliable if 5 Cc. of alcohol is employed instead of 2 Cc., and if the adulterant is present in considerable quantity. The oils mentioned in the above test all have an acid reaction, as well as the *oil of rhodium* (from roots of *Convolvulus* [*Rhodorrhiza*, Webb] *Scoparius*, Linne, and *Convolvulus floridus*, Linné, of Canary Isles), which is occasionally an adulterant. The latter has the combined odor of rose, copaiba, and cubeb, and is bitter.

Uses.—Oil of rose is used altogether as a perfume, and is frequently added to cerates, ointments, liquors, etc., for the purpose of rendering them fragrant.

OLEUM ROSMARINI (U. S. P.)—OIL OF ROSEMARY.

"A volatile oil distilled from the leaves of *Rosmarinus officinalis*, Linne (*Nat. Ord.*—Labiatæ). It should be kept in well-stoppered bottles, in a cool place, protected from light"—(*U. S. P.*).

Source and Description.—*Rosmarinus officinalis*, Linné, is a shrub growing in the European Mediterranean countries from Greece to Spain. There are two kinds of oil in commerce, the Italian and the French oil. The former is obtained from the Dalmatian Islands in the Adriatic Sea. The French oil has the finer aroma. The yield from Dalmatian leaves is 1.4 to 1.7 per cent, from dry French leaves 2 per cent, from the flowers 1.4 per cent (Schimmel & Co., *Reports*, October, 1893 and 1897). The commercial oils are often adulterated with oil of turpentine. The *U. S. P.* gives the following description of oil of rosemary: "A colorless or pale yellow, limpid liquid, having the characteristic, pungent odor of rosemary, and a warm, somewhat camphoraceous taste. Specific gravity, 0.895 to 0.915 at 15° C. (59° F.). Soluble in an equal volume of alcohol, the solution being neutral or very slightly acid to litmus paper; also soluble in an equal volume of glacial acetic acid" (*U. S. P.*). Oil of rosemary is optically dextro-rotatory, but is *never* lævo-rotatory, unless adulterated with oil of French turpentine. The oil requires from 2 to 10 volumes of alcohol of 80 per cent (by volume) for complete solution.

Chemical Composition and Tests.—Pure oil of rosemary contains *camphor* (Lallemand, 1860); *borneol* (Bruylants, 1879), about 18 per cent (Gildemeister and Stephan, 1897); *cineol* (E. Weber, 1887); *d*-and *l-pinene* and *camphene* (Gildemeister and Stephan, 1897). In order to test the oil for adulterations, its optical rotation, especially that of the lowest fraction, which is always dextro-rotatory in pure oil, and its specific gravity and solubility in alcohol render useful aid.

Action, Medical Uses, and Dosage.—Oil of rosemary is stimulant and rubefacient; it is principally employed, however, in perfumery. It may be used in *colic*, *nervous disorders*, *debility*, *painful* or *tardy menstruation*, etc., and locally to *painful parts*. The dose of oil of rosemary is from 2 to 10 drops.

A very pleasant *cologne* may be made as follows: Take of oil of rosemary, oil of lemon, each, 2 fluid drachms; oil of lavender, oil of bergamot, of each, 1 fluid drachm; oil of cinnamon, oil of cloves, oil of rose, of each, 8 minims; alcohol, 1 pint. Mix, agitate well, and after allowing the mixture to stand for a few days, with frequent agitation, filter. The following formula has been published by Farina, one of the originators of Cologne: Take of purified benzoin, oil of rosemary, each, by weight, ¼ ounce; oil of lavender, ½ ounce, by weight; strong alcohol, 9 pints. Mix, and agitate thoroughly together, and then add, successively, oil of neroli (*petit grains*), oil of lemon, each, 1 ounce and 144 minims; oil of sweet orange (*Aurantii dulcis*), oil of limmetta (lime), oil of bergamot, each, 2 ounces and 228 minims; tincture of rose geranium flowers, a sufficient quantity to impart the desired fragrance. Macerate for several weeks, and then fill into flasks (*Amer. Drug. Cir.*, Vol. VIII, p. 85; *Amer. Jour. Pharm.*, 1864, p. 375). I have reduced the weights and measures in the above (J. King).

OLEUM RUTÆ.—OIL OF RUE.

The essential oil distilled from *Ruta graveolens*, Linné.

Nat. Ord.—Rutaceæ.

Preparation and Description.—The fresh leaves and tops of *Ruta graveolens*, Linne, an herbaceous plant indigenous to the Mediterranean countries, yield, when distilled with water, about 0.06 per cent of volatile oil (Gildemeister and Hoffmann, *loc. cit.*). It is a colorless to yellow liquid, of a strong, penetrating, persistent odor. Its specific gravity is 0.833 to 0.840, this being nearly the lowest of all essential oils. It is slightly dextro-rotatory (+0° 30′ to +2° 10′), and congeals between 8° and 10° C. (46.4° and 50° F.). The bulk of the oil distills between 215° and 232° C. (419° and 449.6° F.); 5 per cent distills below 200° C. (392° F.) (Umney, 1895 and 1897). The oil forms a clear solution with 2 to 3 volumes of 70 per cent alcohol.

Chemical Composition and Tests.—About 90 per cent of oil of rue consists of *methyl-nonyl-ketone* ($CH_3CO.C_9H_{19}$, Giesecke, 1870; Gorup-Besanez and Grimm, 1874). Below 15° C. (59° F.) it is solid, boils at 224° C. (435.2° F.), and has a specific gravity of 0.8295 at 17.5° C. (63.5° F.). The oil is also said to contain *lauric aldehyde* ($C_{12}H_{24}O$) (C. G. Williams, 1858). No terpene is present in oil of rue. Adulterations with other essential oils increase the specific gravity and decrease the congealing point of oil of rue. Petroleum and oil of turpentine may be recognized by being insoluble in alcohol of 70 per cent by volume.

Action, Medical Uses, and Dosage.—Oil of rue is stimulant, antispasmodic, and emmenagogue. It has decidedly active properties. Locally it is irritant, and internally, even in small doses, it has produced severe gastro-intestinal and nervous disturbances. Oil of rue, in the dose of from 1 to 5 drops, 3 times a day, has been used with advantage in *hysteria*, *convulsions*, *pertussis*, *amenorrhœa*, and *dysmenorrhœa*. It is sometimes criminally used for the purpose of producing abortion, in which it is highly dangerous, having been followed by fatal consequences.

OLEUM SABINÆ (U. S. P.)—OIL OF SAVINE.

A volatile oil distilled from the tops of *Juniperus Sabina*, Linné.

Nat. Ord.—Coniferæ.

"It should be kept in well-stoppered bottles, protected from light"—(*U. S. P.*).

SYNONYM: *Oil of savin.*

Preparation and Description.—The tops and leaves of savine, when submitted to distillation with water, yield this oil in the quantity of from 4 to 5 per cent (Schimmel & Co., *Report*, April, 1897). The official oil is described as "a colorless or yellowish liquid, having a peculiar, terebinthinate odor, and a pungent, bitterish, and camphoraceous taste. It becomes darker and thicker by age and exposure to the air. Specific gravity, 0.910 to 0.940 at 15° C. (59° F.). Soluble in an equal volume of alcohol (distinction from oil of juniper and oil of turpentine), the solution being neutral to litmus paper; also soluble in an equal volume of glacial acetic acid"—(*U. S. P.*). The oil is dextro-rotatory.

Chemical Composition.—The chief constituent of oil of savine is the alcohol *sabinol* (Schimmel & Co., *Report*, 1895), of the formula $C_{10}H_{16}O$, and boiling at 208° to 209° C. (406.4° to 408.2° F.) (E. Fromm, 1898). It exists partly free (10 per cent), partly in the form of acetate (40 to 44 per cent) The highest fractions of oil of savine contain *cadinene* (Wallach, 1877). The lowest fractions contain *terpenes*, probably *pinene*. According to Umney (*Pharm. Jour. Trans.*, 1895), not more than 25 per cent of the oil distills below 200° C. (392° F.). If the quantity of distillate exceeds this figure, adulterations with oil of turpentine may be looked for. French oil of savine is stated to be frequently adulterated with oil of turpentine. An addition of the latter (if of French origin) also reduces the optical rotation of the oil (see Gildemeister and Hoffmann, *Die Ætherischen Oele*, 1899, p. 352).

Action, Medical Uses, and Dosage.—Oil of savine is a powerful irritant to the mucous tissues, and powerfully deranges the nervous system. It may induce gastro-intestinal inflammation, vesical tenesmus and strangury, congestion of the pelvic organs, fever, mental excitation and intoxication, coma, and death. Oil of savine is an emmenagogue, and is seldom used for any other purpose, save as a liniment to the lumbar and sacral regions, and internally in *amenorrhœa* from torpor of the reproductive organs, in which it is sometimes very efficient. It also acts as a stimulant and abortivant. Ten drops of the oil on sugar, repeated 3 times a day, will, it is stated, positively produce abortion in from 1 to 3 weeks; but, as with all other agents of this kind, is apt to be followed by very serious consequences. It has been used for the relief of *uterine leucorrhœa*, *uterine hemorrhage*, *dysmenorrhœa*, and *sterility*. It is reputed to cure *condylomata*. The dose of oil, ordinarily, is from 2 to 10 drops.

OLEUM SANTALI (U. S. P.)—OIL OF SANTAL.

"A volatile oil distilled from the wood of *Santalum album*, Linné (*Nat. Ord.*—Santalaceæ). Oil of santal should be kept in well-stoppered bottles, in a cool place, protected from the light"—(*U. S. P.*).

SYNONYMS: *Oil of sandal-wood*, *Oleum ligni santali*, *Oleum santali flavi*, *East Indian oil of santal.*

Botanical Source and History.—The White santal is indigenous to the Indian Peninsula, and to some of the islands of the Indian Archipelago, notably Sumba

(Sandal-wood Island) and Timul. It grows in the mountainous districts in dry open places, and not in woods, a strip of country 250 miles long, north and northwest of the Nilgherry Hills, lying mainly in Mysore and Coimbatore, yielding the most valuable wood. By the provisions of a treaty made in 1770, with Hyder Ali, the cutting of the trees in Mysore is entirely under the control of the East India Company, whose officers see to the felling of the trees. In other places these restrictions have been removed (see *Pharmacographia*).

The Santalum album is a small tree growing to a height of 20 or 30 feet, the trunk measuring in girth from 18 to 35 inches. The leaves are opposite, smooth, glaucous on under surface, oval or lanceolate in shape, or rather varying between these two forms. Its numerous small flowers are without odor and of varying hues, and borne in a panicled cyme. The tree attains about a foot in diameter when from 20 to 30 years old, when they are in their prime. The tree is parasitic, and will attach itself to other plants by tuberous processes on its roots. In regard to the manner of collecting the wood, the authors of *Pharmacographia* give the following account: "A tree having been felled, the branches are lopped off, and the trunk allowed to lie on the ground for several months, during which time the white ants eat away the greater part of the inodorous sapwood. The trunk is then roughly trimmed, sawn into billets 2 to 2½ feet long, and taken to the forest depots. There the wood is weighed, subjected to a second and more careful trimming, and classified according to quality. In some parts it is customary not to fell, but to dig the tree up; in others the root is dug up after the trunk has been cut down, the root affording valuable wood, which, with the chips and sawdust, are preserved for distillation, or for burning in the native temples. The sapwood and branches are worthless"—(*Pharmacographia*, p. 601).

SANTAL-WOOD (*Lignum santali album*, *Santalum album*, *Lignum santali citrinum*), *Yellow* or *White sanders wood*.—Whitish or brownish-yellow billets, from 3 to 9 inches thick, and 3 or 4 feet long, hard, heavy, of a bitterish, subacrid, aromatic taste, and an agreeable, rose-like odor (when rubbed or rasped). On transverse section the wood has a lustrous, waxy appearance, showing alternate light and dark, irregularly-concentric circles, which are, however, sometimes not well marked. The medullary rays are delicate and the vessels very fine. The darker-colored wood is most highly valued (that from the root being the best quality), and the taste and odor vary according to the source of the wood. In the Chinese markets three grades are known: *South Sea Island*, *Timor*, and *Malabar*, the last far exceeding the others in price.

Preparation.—Santal oil is procured by distilling the wood with water or by means of steam. The most and best oil is obtained from the root-wood. According to Flückiger, 2.5 per cent are obtained in India, notwithstanding imperfect apparatus. The yield, according to Schimmel & Co., is 1.6 to 3 per cent for *Macassar* (Dutch Indian), and 3 to 5 per cent for *East Indian*. Speaking of its uses, Prof. Flückiger says: "It is employed as a perfume and for the fabrication of small articles of ornament. Among the natives of India it is largely consumed in the celebration of sepulchral rites, wealthy Hindus showing their respect for a departed relative by adding sticks of sandal-wood to the funereal pile. The powder of the wood, made into a paste with water, is used for making the caste mark, and also for medicinal purposes. The consumption of sandal-wood in China appears to be principally for the incense used in the temples"—(*Pharmacographia*, p. 603).

Description and Tests.—Oil of sandal-wood is described officially as "a pale yellowish or yellow, somewhat thickish liquid, having a peculiar, strongly aromatic odor, and a pungent, spicy taste. Specific gravity, 0.970 to 0.978 at 15° C. (59° F.). It deviates polarized light to the left, distinction from *Australian* (specific gravity, 0.953) and *West Indian* (specific gravity, 0.965) *sandal-wood oils*, which deviate polarized light to the right. Readily soluble in alcohol, the solution being slightly acid to litmus paper. If to 1 Cc. of the oil, at 20° C. (68° F.), there be added 10 Cc. of a mixture of 3 volumes of alcohol and 1 volume of water, a perfectly clear solution should be obtained (test for cedar-wood oil, castor oil, and other fatty oils, etc.)"—(*U. S. P.*). According to Schimmel & Co., the optical rotation remains rather constantly between the limits —17° to —20°. Oil of copaiba, as an adulterant, has the effect of diminishing the optical rotation to some extent. West Indian sandal wood oil may also be recognized by being very little soluble in alcohol. True sandal-wood oil, however, when exposed to air and light, or by age, becomes less soluble in diluted alcohol than when fresh, which must be considered in applying the above pharmacopœial test.

Chemical Composition.—The official oil is the *East Indian Oil of Santal*, and according to Chapoteaut (1882), and Chapman and Burgess (1896), contains some *santalal* ($C_{15}H_{24}O$), presumed to be an aldehyde boiling at 300° C. (572° F.), and from 93 to 98 per cent of *santalol* ($C_{15}H_{26}O$), an alcohol boiling at 310° C. (590° F.). Phosphoric anhydride converts the latter into the hydrocarbon *santalene* ($C_{15}H_{24}$), which boils at 260° C. (500° F.). When oil of sandal-wood is heated to 150° C. (302° F.) with acetic anhydride, the acetic ester of santalol ($C_{15}H_{25}O.COCH_3$) is formed. Upon this reaction is based a method of valuation for oil of sandal-wood (see Gildemeister and Hoffmann, *Die Ätherischen Oele*, 1899, p. 446).

Action, Medical Uses, and Dosage.—Oil of santal is an active substance of agreeable odor employed in the treatment of *subacute* and *chronic affections of mucous tissues*, particularly *gonorrhœa* after the active symptoms have been mitigated. *Chronic bronchitis*, with fetid expectoration, *chronic mucous diarrhœa*, *chronic inflammation of the bladder* and *pyelitis* are also said to be benefited by it. It occasionally disturbs the gastro-intestinal tract, and, like copaiba, which it was introduced to supersede, it will occasion cutaneous eruptions. The dose ranges from 5 to 20 drops, in capsules or emulsion.

Related Products.—I. OTHER SANTAL-WOODS. The following species furnish varieties of santal-wood. (For *Pterocarpus santalinus*, see *Santalum Rubrum*.)

Santalum freycinetianum, Gaudin.—Sandwich or Hawaiian Isles.

Santalum pyrularium, A. Gray.—Sandwich or Hawaiian Isles.

Santalum Gasi, Seeman.—Fiji Islands.

Santalum austro-caledonicum, Veiell.—New Caledonia.

Fusanus spicatus, R. Brown (*Santalum spicatum*, A. De Candolle; *S. cygnorum*, Miquel), *Fragrant sandal-wood.*—Australia. Not very fragrant, and shipped to China and India for the production of oil.

Fusanus acuminatus, R. Brown (*Santalum Preissianum*, Miquel; *Santalum acuminatum*, A. De Candolle), *Native peach.*—Australia. Edible fruit and seed. The nuts yield a fatty oil which is used as an illuminant. The wood is pleasantly fragrant, takes a very fine polish, and is much used in cabinet work.

Fusanus persicarius, F. von Mueller (*Santalum persicarium*, F. von Mueller), *Native sandal-wood.*—Australia. Yields a grade of sandal-wood.

Santalum lanceolatum, R. Brown (*S. oblongatum*, R. Brown).—Australia. *Sandal-wood* of the colonists. Yields an agreeable purple fruit. Wood firm, yellow, and close-grained. Useful in cabinet work.

Santalum obtusifolium, R. Brown (*Santalum ovatum*, R. Brown), *Sandal-wood.*—Australia. Yields a portion of Australian sandal-wood.

The source of JAPANESE SANDAL-WOOD is unknown. WEST INDIAN SANDAL-WOOD is derived from *Amyris balsamifera*, Linné, not belonging to *Santalaceæ* (Schimmel & Co., 1899).

The wood furnishing the last-named oil is called *Venezuela sandal-wood*.

The *Eremophila mitchelli*, Bentham (*Nat. Ord.*—Myropinæ), is known in Queensland as *Sandal-wood*, *Bastard sandal-wood*, and *Rosewood*. It is very fragrant, beautifully grained, brown, and used for veneers. It is not a true sandal-wood. The so-called *sandal-wood bark* bears no relation to the sandal-woods, and is thought to be derived from a species of *Myrospermum*, or *Myroxylon*. A fluid resembling Peru balsam may be obtained from it. The bark is used as an altar incense.

II. OTHER SANTAL OILS. (See Schimmel & Co., *Report*, Oct., 1893; also Power's *Essential Oils*.) OIL OF SANTAL (*South Australian*).—From *Santalum Preissianum*, Miquel (*Fusanus acuminatus*, R. Brown). Color, cherry-red; congeals at ordinary temperature; specific gravity, 1.022; constituent, a crystallizable alcohol, melting at 101° to 103° C. (213.8° to 217.4° F.); yield 1.5 per cent.

OIL OF SANTAL (*African*).—Botanical source unknown. From Madagascar. Color, ruby-red; specific gravity, 0.969; consistence, like the official santal oil; yield, 3 per cent.

OIL OF SANTAL (*West Indian*).—(For botanical source, see *Related Woods*.) Specific gravity, 0.963 to 0.967; optical rotation, about +26°; yield, 1.5 to 3.5 per cent.

OIL OF SANTAL (*West Australian* from Swan River). From *Santalum cygnorum*, Miquel (*Fusanus spicatus*, R. Brown). Specific gravity, 0.953; optical rotation, −5° 20′; odor, resinous, empyreumatic, and sharp; yield, 2 per cent; seems to contain 75 per cent santalol (E. J. Parry, 1898).

OLEUM SASSAFRAS (U. S. P.)—OIL OF SASSAFRAS.

A volatile oil distilled from the bark of the root of *Sassafras variifolium* (Salisbury), O. Kuntz (*Sassafras officinale*, Nees). "It should be kept in well-stoppered bottles, protected from light"—(*U. S. P.*).

Nat. Ord.—Laurineæ.

History and Preparation.—The sassafras tree grows in North America from Canada to Florida and Alabama, and westward as far as Kansas, and early attracted the attention of the American Indians on account of its peculiar and pleasant aroma, and its supposed power to purify the blood. Until about 1860, oil of sassafras was distilled from the root-bark in the states of Pennsylvania, Maryland, and Virginia, often in a rather primitive manner; since then, the oil has been manufactured on a large scale in other states, as New Jersey, New York, Tennessee, and the New England states. In large plants, one charge consists of 20,000 pounds of wood, which is exhausted of its oil in about 48 to 50 hours. The yield is from 6 to 9 per cent, the wood of the root yields only about 0.9 per cent. (For interesting details regarding the history of sassafras and the preparation of its oil, see Dr. Frederick Hoffmann, in *Die Ätherischen Oele*, 1899, p. 514; also see J. U. Lloyd, "An Historical Study of Sassafras," in *American Druggist*, 1898, p. 258.)

Description.—According to Prof. W. Procter, Jr. (*Amer. Jour. Pharm.*, 1866, p. 481), a reddish colored oil is yielded from the bark of old stump roots, while young roots are said to yield a colorless oil. The *U. S. P.* describes the oil as "a yellowish or reddish-yellow liquid, having the characteristic odor of sassafras without the odor of camphor, and a warm, aromatic taste. It becomes darker and thicker by age and exposure to air. Specific gravity, 1.070 to 1.090 at 15° C. (59° F.). Soluble, in all proportions, in alcohol, the solution being neutral to litmus paper; also soluble, in all proportions, in glacial acetic acid, and in carbon disulphide. If to 5 drops of the oil 5 drops of nitric acid be added, a violent reaction will take place, producing at first a red color, and finally converting the oil into a red resin. If to a few drops of the oil a drop of sulphuric acid be added, a deep-red color will be produced at first, which soon becomes blackish"—(*U. S. P.*). The oil is slightly dextro-rotatory (+3° to +4°). The above reaction with nitric acid, first observed by Bonastre (1828), is attended with emission of flame.

Chemical Composition.—Oil of sassafras, according to Gildemeister and Hoffmann (*loc. cit.*, p. 522), has the following percentage composition, ascertained by Power and Kleber (*Pharm. Review*, 1896, p. 101): *safrol* ($C_{10}H_{10}O_2$), 80 per cent; *pinene* (*safrene* of Grimaux and Ruotte, 1869) and *phellandrene*, together 10 per cent; *dextro-camphor* (ordinary *Japan camphor*), 6.8 per cent; *eugenol* (Pomeranz, 1890), 0.5 per cent; *sesquiterpene* in the highest fractions, and residue, 3 per cent.

SAFROL is a colorless or yellowish liquid, possessing the pure sassafras odor, and becomes solid upon moderate cooling; it melts again at 11° C. (51.8° F.). It was first observed by Binder, in 1821, as a deposit from the oil. Its specific gravity is 1.108, its boiling point 233° C. (451.4°). Chemically, it is the *methylene ether* of an *allyl-pyrocatechin* ($C_6H_3.C_3H_5.OOCH_2$), and also occurs in large quantity in camphor oil, and in oils of star anise and cinnamon leaves.

Adulteration.—The substitution of sassafras oil by camphor oil is very difficult to detect, since the constituents of both are the same; sometimes deviations in specific gravity will point to substitution. *Artificial oil of sassafras* is thought to be a fraction of camphor oil having the same specific gravity as oil of sassafras (see Gildemeister and Hoffmann, *loc. cit.*, p. 522). Oil of sassafras is rarely adulterated in this country with oils of turpentine, cloves, or lavender.

Action, Medical Uses, and Dosage.—Sassafras oil is stimulant, diuretic, carminative, alterative and diaphoretic. It may be used for all the purposes for which the bark is recommended. It is said to be an efficient application to *wens*. It is much used as a local application to *rheumatic* and other *pains*, and has proved advantageous when given internally in *chronic gonorrhœa* and *cystirrhœa*. Its dose is from 3 to 12 drops on sugar, or in emulsion. It is stated by Dr. Shelby, of Huntsville, that oil of sassafras will not only prevent the injurious effects of tobacco, but speedily remove them when produced; he has verified this either by combining the tobacco with some sassafras bark, and by smoking tobacco, in a strong pipe, to which a few drops of the oil has been added (*Boston Jour. Chem.*, 1860).

OLEUM SESAMI (U. S. P.)—OIL OF SESAMUM.

"A fixed oil expressed from the seed of *Sesamum indicum*, Linné (*Nat. Ord.*—Pedaliaceæ It should be kept in well-stoppered bottles"—(*U. S. P.*)

SYNONYMS: *Sesame oil*, *Teel* or *Til oil*, *Benne oil*, *Gingili* or *Jingili oil*

Preparation.—This oil is obtained by expressing the seeds, the yield being about 50 per cent by weight. When pure, it is one of the least alterable of oils (Flückiger). *German sesame oil* is derived from *Camelina sativa*, Crantz.

Description and Tests.—Oil of sesamum stands intermediate between the drying and the non-drying oils. It shares with castor oil and croton oil the property of being optically active; it is dextro-rotatory. The *U. S. P.* describes the oil as "a yellowish or yellow, oily liquid, inodorous or nearly so, and having a bland, nut-like taste. Specific gravity, 0.919 to 0.923 at 15° C. (59° F.). When cooled to —3° C. (26.6° F.) it becomes thick, and at —5° C. (23° F.) it congeals to a yellowish-white mass. Concentrated sulphuric acid converts it into a brownish-red jelly. If 5 Cc. of the oil be shaken with an equal volume of concentrated hydrochloric acid, the latter will usually assume a bright emerald-green color, especially if the oil has been exposed for some time to the action of air and light; and, on the subsequent addition of about 0.5 Gm. of sugar, and again shaking the mixture, a blue color, changing to violet, and finally to deep crimson, will be produced"—(*U. S. P.*). The latter test is that known as *Baudoin's Test*. It was modified by Villavecchia and Fabris (*Jahresb. der Pharm.*, 1893, p. 693) who observed that furfurol is the active principle in Baudoin's test. They proceed as follows: Mix 0.1 Cc. of a solution of 2 Gm. furfurol ($C_4H_3O.CHO$) in 100 Cc. of alcohol with 10 Cc. of the oil, and shake with 10 Cc. of hydrochloric acid (specific gravity, 1.19) in a test-tube. As little as 1 per cent of sesame oil may be recognized by the crimson coloration produced in the aqueous layer. This test is characteristic for oil of sesame (also see *Amer. Jour. Pharm.*, 1894, p. 99). Another color reaction with nitro-sulphuric acid, discovered by Behrens (1852), is mentioned in *Pharmacographia*. In this connection, see J. F. Tocher's *sesamin* (*Amer. Jour. Pharm.*, 1891, p. 142, and 1893, p. 194).

Chemical Composition and Uses.—Flückiger found the oily portion to contain 76 per cent of *olein*, and a small quantity of a peculiar resinoid substance giving the above color test of Behrens. The solid portion of oil of sesamum consisted of *palmitin*, *stearin*, and *myristin* (*Pharmacographia*). The oil also contains small quantities of *linolein*, to the presence of which its partial drying qualities are due. According to Villavecchia and Fabris (see *Jahresb. der Pharm.*, 1893, p. 693), there are present crystallizable *sesamin* ($C_{11}H_{12}O_3$), melting at 123° C. (253.4° F.); an alcohol ($C_{25}H_{44}O$), melting at 137° C. (278.6° F.); and a non-nitrogenous oil to which the color reaction (in Baudoin's test) is due. Oil of sesamum is used for cooking purposes; in Germany, an addition of 10 per cent sesamum oil to oleomargarine is required in order to facilitate the detection of adulteration of butter. Sesamum oil is also used in soap manufacture, for illuminating purposes, and as a substitute for almond and olive oils.

Action, Medical Uses, and Dosage.—(See *Sesamum*.)

Related Oils.—OLEUM ARACHIS, *Peanut oil*, *Ground-nut oil*, *Earth-nut oil*, *Arachis oil*. This non-drying oil is obtained from the nutritious oily seeds known as *peanuts*, and derived from the leguminous plant *Arachis hypogæa*, Linné. The yield is nearly 50 per cent. It is obtained by cold expression. When the seeds are first warmed an inferior oil is obtained. It is thin, almost colorless, or pale yellow, has a faint, pleasant odor, and a bland, nutty taste. The specific gravity of the best product is about 0.918 (*Pharmacographia*). At 3° C. (37.4° F.) it is turbid; at —3° to —4° C. (26.6° to 24.8° F.) it concretes, and hardens at —7° C. (19.4° F.). Exposure to air slowly causes it to thicken; even in closed containers it becomes disagreeably rancid (*Pharmacographia*). It is composed of the glycerides of four fatty acids, chiefly *oleic acid*. The other acids which are present in the form of glycerides, are *palmitic*, *stearic*, *arachic* ($C_{20}H_{40}O_2$), *hypogæic* ($C_{16}H_{30}O_2$), and *linoleic acids*. This oil is official in India where it is largely consumed as a substitute for olive oil, under the name of *Katchung oil*. It is extensively employed in soap-making, and the Chinese use it for illuminating purposes.

SOY OIL.—A yellowish, bland oil, furnished to the extent of 18 per cent by the edible seeds of *Soja hispida*, Moench (*Dolichos Soja*, Linné) (*Nat. Ord.*—Leguminosæ), of Japan and southern Asia. A sauce called *soy* is also prepared from the seeds.

GERMAN SESAME OIL.—The seeds of *Camelina sativa*, Crantz, yield a slowly drying oil, sometimes feebly pungent, sometimes bland, to which the name *German sesame oil* is occasionally applied.

KURUNG OIL.—Derived from the gray, reniform seeds of *Pongamia glabra*, Ventenat (*Dalbergia arborea*, Roxburgh) (*Nat. Ord.*—Leguminosæ). A tree of the East Indies. The oil is yellow and thickish, becomes turbid at about 7° C. (44.6° F.), and has a specific gravity of 0.945. The leaves and root of this tree have been used in medicine; the oil in *skin diseases*.

NICKER-SEED OIL.—*Bonduc-nuts*, the seeds of a tropical vine, the *Cæsalpinia Bonducella*, Roxburgh (*Guilandina Bonducella*, Linné), yield, by expression, an oil which is used in liniments by the natives of India. There the seeds, as well as the root-bark, are employed as an antiperiodic and tonic. The seed is variously known as *Semen bonducellæ*, *Semen guilandinæ*, *Grey nicker seeds* (or *Nuts*), and *Bonduc seeds*. Flückiger obtained from them a non-alkaline, very bitter powder, sparingly soluble in water, and soluble in alcohol and ether (*Pharmacographia*, p. 212).

Ben Oil, Behen Oil.—The expressed oil of *ben nuts*, the seeds of *Moringa pterygosperma*, Gaertner (*Moringa oleifera*, Lamarck, and *Guilandina Moringa*, Linné), of the *Nat. Ord.*—Moringaceæ, is a palatable product, more employed in the arts than in medicine. The tree furnishing the seeds is known as the *Horseradish-tree*, on account of the resemblance of its root-bark, both in taste and odor, to our common horseradish. Several allied species are also said to yield a portion of the oil. Oil of ben resembles olive oil, and is employed for like purposes. Its density is 0.912 to 0.917; its color, yellowish and clear; it is odorless and bland in taste. If, however, the oil be expressed by heat, it becomes acrid and bitter, and possesses cathartic powers. It does not easily become rancid. At 7° C. (44.6° F.) it begins to deposit fatty materials; at 0° C. (32° F.) it becomes solid. The liquid portion overlying the solid fats is employed in extracting from flowers their delicate odors. Ben oil is composed of the glycerides of *oleic*, *palmitic*, *myristic*, *stearic*, *moringic* ($C_{15}H_{28}O_2$), and *benic* (*behenic* [$C_{22}H_{44}O_2$]) *acids* The latter acid is crystalline; *moringic acid* is fluid. The yield of this fixed oil is about 30 per cent, and it is expressed in Europe from Egyptian seeds.

OLEUM SINAPIS VOLATILE (U. S. P.)—VOLATILE OIL OF MUSTARD.

"A volatile oil obtained from *Black mustard* by maceration with water, and subsequent distillation. It should be carefully kept in well-stoppered bottles, in a cool place, protected from light"—(*U. S. P.*).

Synonyms: *Oil of mustard*, *Oleum sinapis æthereum*.

Preparation and Description.—Volatile oil of mustard does not pre-exist in black mustard seed, but is formed in the decomposition of its glucosid *sinigrin* by a process of fermentation (see *Chemical Composition*). The fixed oil is first removed by hydraulic pressure, the press-cake is crushed, digested with water at a temperature not exceeding 70° C. (158° F.), and the volatile oil of mustard is then distilled off with steam. The yield is about 0.5 to 0.75 per cent. White mustard seed does not yield a volatile oil when thus treated (see *Sinapis*).

The volatile oil of mustard thus obtained is "a colorless or pale-yellow, limpid, and strongly refractive liquid, having a very pungent and acrid odor and taste. Specific gravity, 1.018 to 1.029 at 15° C. (59° F.). Boiling point, 148° to 150° C. (298.4° to 302° F.). Freely soluble in alcohol, ether, or carbon disulphide, the solutions being neutral to litmus paper"—(*U. S. P.*). The oil is soluble in from 160 to 300 parts of water, and in 10 parts of 70 per cent by volume of alcohol. Exposed to light, volatile oil of mustard decomposes, turning reddish-brown, and depositing a thin brown film on the walls of its containing vessel.

Chemical Composition.—The principal constituent of volatile oil of mustard is *allyl-isothiocyanide* (*allyl-mustard oil*, $S:C:N.C_3H_5$), with small amounts of *allyl cyanide* ($CN.C_3H_5$) and *carbon disulphide* (CS_2), the latter being of somewhat obscure origin. *Allyl-cyanide* is formed by decomposition of allyl-mustard oil, which takes place, for example, when the oil is in prolonged contact with the copper of the still, thus: $SCNC_3H_5+Cu$ $CuS+CNC_3H_5$. Notable quantities of this compound, which has the specific gravity 0.835, may render the volatile oil of mustard lighter than water (Will, 1863).

Allyl-isothiocyanide is formed by the decomposition of the glucosid *sinigrin* (or *potassium myronate* $C_{10}H_{16}NS_2KO_9$), under the influence of the albuminous ferment *myrosin*, both being constituents of black mustard seed. The reaction, as elucidated by J. Gadamer and his predecessors (see *Archiv der Pharm.*, 1897, p. 44), takes place as follows: $C_{10}H_{16}NS_2KO_9$ (sinigrin) + H_2O $SCNC_3H_5$ (allyl-mustard oil) + $C_6H_{12}O_6$ (dextrose) + $KHSO_4$ (acid potassium sulphate). It may also be prepared synthetically by the interaction of potassium sulphocyanide (NCSK), and allyl iodide (C_3H_5I) in alcoholic solution, whereby a molecular rearrangement from $N:C.S.C_3H_5$ (*allyl-thio-cyanide*) to $S:C:N.C_3H_5$ (*allyl-isothiocyanide*) takes place

Tests and Assay.—The *U. S. P.* directs the following tests for the volatile oil of mustard: "If to 3 Gm. of the oil 6 Gm. of sulphuric acid be gradually added, the liquid being kept cool, the mixture, upon subsequent addition, will evolve sulphur dioxide, but will remain of a light-yellow color, and at first perfectly clear, becoming afterward thick, and occasionally crystalline, while the pungent odor of the oil will disappear"—(*U. S. P.*). The final product in this reaction is *sulphate of allylamine* ($C_3H_5NH_2$).

"If a portion of the oil be heated in a flask connected with a well-cooled condenser, it should distill completely between 148° and 150° C. (298.4° and 302° F.), and both the first and the last portion of the distillate should have the same specific gravity as the original oil (absence of alcohol, chloroform, carbon disulphide, petroleum, or fatty oils). If a small portion of the oil be diluted with 5 times its volume of alcohol, and a drop of ferric chloride T.S. be added, no blue or violet color should be produced (absence of phenols). If a mixture of 3 Gm. of the oil and 3 Gm. of alcohol be shaken, in a small flask, with 6 Gm. of ammonia water, it will become clear after standing for some hours, or rapidly when warmed to 50° C. (122° F.), and usually deposit, without becoming colored, crystals of *thiosinamine* (*allyl-thio urea*, $CS.N_2H_3[C_3H_5]$). To determine the proportion of thiosinamine obtainable from the oil, decant the mother water from the crystals, and evaporate it gradually in a tared capsule, on a water-bath, adding fresh portions only after the ammoniacal odor of each preceding portion has disappeared. Then add the crystals from the flask to those in the capsule, rinsing them out of the flask with a little alcohol, and heat the capsule on a water-bath until its weight remains constant. The amount of thiosinamine thus obtained from 3 Gm. of the oil should be not less than 3.25 Gm., nor more than 3.5 Gm. After cooling, thiosinamine forms a brownish, crystalline mass, fusing at 70° C. (158° F.), and having a leek-like, but no pungent odor. The mass should be soluble in 2 parts of warm water, forming a solution which should not redden blue litmus paper, and which possesses a somewhat bitter, not persistent taste"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—(See *Sinapis.*)

OLEUM SUCCINI.—OIL OF AMBER.

The volatile oil obtained by dry distillation of amber and purified by rectification.

Preparation.—The *crude oil of amber* (*Oleum Succini Crudum*) is obtained by destructive distillation of amber as a by-product in the preparation of succinic acid from this source (see *Amber*, below). It is of a syrupy consistence, dark-brown, and of an unpleasant, empyreumatic, persistent odor. In order to make *rectified oil of amber* (*Oleum Succini Rectificatum*), the *U. S. P.* (1870) directs to mix in a glass retort, oil of amber, 1 pint; water, 6 pints, and to distill until 4 pints of water have passed with the oil into the receiver; then separate the oil from the water, and keep it in a well-stopped bottle. According to Hager, the yield is from 65 to 70 per cent of the crude oil.

Description.—The oil thus obtained is thin, colorless or pale-yellow, but turns brown and viscid if not carefully kept. It has an empyreumatic, balsamic, yet disagreeable odor, and a bitter and acrid taste. Its specific gravity varies from 0.88 to 0.93; Power (*Essential Oils*) records 0.975 for crude, and 0.915 for the rectified oil. The latter is readily dissolved in absolute alcohol, chloroform, ether, disulphide of carbon, or the fixed oils; alcohol of 90 per cent by volume dissolves only about one-fifth of it. It is not soluble in water, though this fluid acquires its taste and odor in a slight degree. It is a solvent for caoutchouc. It is principally a mixture of hydrocarbons containing some phenols (Power), and has no constant boiling point. It does not fulminate with iodine. Fuming nitric acid added gradually forms with it a balsamic resin, called *artificial musk*. *Eau de Luc* is formed by dissolving 1 part of rectified oil of amber in 24 parts of alcohol, specific gravity 0.830, and 96 parts of caustic ammonia, specific gravity 0.916.

Adulterations.—Oil of amber is sometimes adulterated with oil of turpentine. Dr. Bolley suggests the following method of detecting it: In a cylindrical glass vessel about a foot high, place the suspected oil, and pass a current of hydrochloric acid gas into it by a tube dipping to near the bottom. The gas must be previously dried by passing it through two bottles containing coarsely-broken chloride of calcium, before entering the oil. The current is to be continued an hour, and if oil of turpentine is present to the extent of even 5 per cent, the mixture gives crystalline evidence of it after standing 12 hours. Of course, where the adulteration is large, the artificial camphor is apparent much sooner (*Amer. Jour. Pharm.*, 1854, p. 119). According to Mr. A. E. Ebert, rectified oil of amber is liable to adulteration with kerosene, rendering the oil insoluble in absolute alcohol, imparting an opalescence to it by exposure to direct sunlight, and forming no resin or artificial musk when treated with nitric acid. He believes that there is but a small amount of the true rectified oil of amber to be had in our markets, that which is sold for it consisting principally either of turpentine agitated with the crude oil of amber until it has the desired color, and which may be detected by its odor, and violent fulminating action with iodine; or kerosene may be substituted for the turpentine on account of the cost of the latter (*Proc. Amer. Pharm. Assoc.*, 1865, p. 149). It may be owing to this adulteration that piles are cured by a local application of it to them, as named by Prof. Procter in *Amer. Jour. Pharm.*, 1866, p. 217, as I have known numerous instances where persons have cured or relieved themselves of piles by the application of ordinary coal-oil (J. King).

Action, Medical Uses, and Dosage.—Rectified oil of amber is the only form in which oil of amber should be employed for internal use. It is stimulant, diuretic, and antispasmodic; and has been employed with benefit in *amenorrhœa, hysteria, dysmenorrhœa, tetanus, epilepsy, pertussis, infantile convulsions*, and various other *spasmodic affections*. The dose is from 5 to 30 drops on sugar, repeated as often as required. Applied externally it is a rubefacient, and has been efficaciously used as a liniment in *palsy, chronic rheumatism, pertussis*, and *infantile convulsions;* in the latter affection it should be rubbed along the spine, either alone or combined with an equal part of laudanum and 3 or 4 parts of olive oil. ROCHE'S EMBROCATION, for *pertussis* and other *spasmodic affections*, is composed of oil of olive, oil of cloves, each, 1 fluid ounce; oil of amber, ½ fluid ounce. Mix.

Related Products.—SUCCINUM, or AMBER, *Ambra flava, Electrum*. The origin of amber is somewhat uncertain; it is believed to be a fossil resin, produced by the hardening of the resinous exudates of certain extinct coniferæ. That it was at one time liquid, is obvious from the insects which are occasionally found buried in it. No living insect is known exactly similar to those found in amber; showing that a very long period must have elapsed since the trees producing it vegetated (T.). The greatest part of the amber of commerce is found in Prussia, on the south shore of the Baltic, being thrown up from the sea between Königsberg and Memel. It is supposed to be derived from beds of wood-coal from *Pinites succinifer*, Goeppert (*Pityoxylon succiniferum*, Kraus), in the basin of the Baltic. It is also met with on the Sicily coast, in Poland, in France near Paris, in China, and in several parts of the United States. Amber is a brittle, light, hard substance, usually nearly transparent; sometimes almost colorless, but commonly yellow, deep-brown, or red. It usually occurs in irregularly shaped pieces, tasteless, and without smell, except when pounded or heated, when it emits a fragrant odor. Amber is capable of acquiring a fine polish, on account of which it is used for small articles of ornament. It yields readily to the knife, has a conchoidal vitreous or resinous fracture, becomes negatively electrical by rubbing, and has a specific gravity of 1.065. Water has no action on it, but alcohol, by long digestion, dissolves about one-eighth of the amber, and forms a colored solution which, when concentrated, becomes milky when mixed with water; the precipitate possesses the properties of a resin. Volatile oils and ether but partially dissolve it. A boiling solution of fixed alkali almost wholly dissolves amber, forming a kind of soap, soluble in alcohol or water. Diluted acids have no action on amber; sulphuric acid converts it into a black resinous mass; nitric acid acts upon it, dissolving it completely.

Heated in the air, amber softens at about 215° C. (419° F.), and fuses at about 290° C. (554° F.), evolving an agreeable aromatic odor, and burning with a clear yellow flame. It can not be fused without undergoing some chemical change. By destructive distillation in a retort, amber yields first an acid liquor, which contains succinic and acetic acids; then some succinic acid is deposited in the neck of the retort, and an empyreumatic oil (oil of amber) comes over, at first thin and yellowish, afterward brown and thick; toward the end of the operation, a yellowish light sublimate is observed in the neck of the retort; this is called by Gmelin, *amber-camphor*. An inflammable gas is evolved during the whole time of the operation. The residue in the retort consists of a brown resin (*colophonium succini*). The proximate principles of amber are a volatile oil, with a strong but agreeable odor; a resin soluble in cold alcohol, a resin soluble in boiling alcohol, succinic acid as high as 6 per cent, and a bituminous matter on which alcohol, ether, fixed and volatile oils, and alkaline solutions exert no solvent action. Baudrimont found 0.48 per cent of sulphur in 100 parts of amber. *Roumanian amber* yielded to O. Helm (*Amer. Jour. Pharm.*, 188[illegible], p. 442) [illegible]15 per cent of sulphur, and 5.2 per cent of succinic acid. *Sicilian amber* yielded only 0.4 per cent of the latter acid, and a dark variety of amber, called *glessite*, had a specific gravity of only 1.015 to 1.027, and yielded no succinic acid upon dry distillation.

Amber is not used as a medicine; its principal employment is in the preparation of its oil, succinic acid, and varnish. Amber varnish is made by roasting 2 pounds of amber, and then dissolving it in 3 pounds of linseed oil, and a sufficient quantity of oil of turpentine. Adulteration with colophony may be recognized by alcohol, which dissolves out the adulterant.

Acidum Succinicum, *Succinic acid*, *Sal succini volatile* ($H_2C_4H_4O_4$). Molecular weight: 117.72. Succinic acid was observed by Agricola in 1550, and was long believed to be a volatile salt of amber, until its acid character was demonstrated in 1675, by Lemery. It exists in nature, also in fossilized wood, and in many vegetable and animal fluids. It may be obtained by the action of nitric acid upon the higher fatty acids, wax, or spermaceti. Pasteur discovered its formation in the vinous fermentation of sugar. It has also been obtained synthetically. The medicinal acid is obtained by the distillation of amber, although another and more convenient method consists in the fermentation of calcium malate or of tartaric acid (see details in Roscoe and Schorlemmer's *Chemistry*, Vol. III, Part II, New York, 1884, p. 185). The acid, when pure, forms white or transparent and odorless crystals; when prepared from amber the crystals are yellow or brown, with a smoky, acid taste, and have the odor of amber oil. They may be purified by boiling with nitric acid, of specific gravity 1.32. Succinic acid is soluble in 20 parts of cold, 2 parts of hot water, less soluble in alcohol, and nearly insoluble in ether. The pure acid melts at 180° C. (356° F.). Its salts are called succinates. It was formerly used to considerable extent in medicine, but it is now seldom employed. It has but little action except to accelerate the pulse and promote cutaneous and bronchial excretion. The dose of succinic acid is from 5 to 15 grains.

Succinate of Ammonium has been employed in *spasmodic conditions* and as a remedy for *delirium tremens*, *hysteria*, *rheumatism*, and *bronchitis*. A liquor of succinate of ammonium, known also as *Liquor Cornu Cervi Succinici*, has been considerably employed in Germany for similar purposes.

OLEUM TANACETI.—OIL OF TANSY.

The very poisonous, oxygenated volatile oil distilled from *Tanacetum vulgare*, Linné (*Nat. Ord.*—Compositæ).

Description and Chemical Composition.—Oil of tansy is prepared by distilling the flowering herb with water. It is usually yellow, sometimes of a green color, turning brown on exposure to air and light, a warm, extremely bitter taste, and an odor like that of tansy, but more intense. An oil distilled from English cultivated tansy (Schimmel & Co., *Report*, Oct., 1895) had a camphoraceous odor resembling rosemary, and upon cooling to 0° C. (32° F.) deposited part of its camphor. It also differed from American and German oils by being lævo-rotatory (—27°), the former exerting a right-handed optical rotation (+30° to +45°). Oil of tansy is soluble in alcohol; the American oil, when pure, forms a clear solution also with 70 per cent alcohol. The specific gravity of oil of tansy (fresh plant) varies from 0.925 to 0.940; dry herb 0.955. The yield of oil ranges from 0.10 to 0.20 per cent for fresh, and 0.20 to 0.30 per cent for dry herb (Schimmel & Co.). The characteristic odor of oil of tansy is due to its chief constituent *thujone* or *tanacetone* (Bruylants, 1878; Semmler, 1892). It is a ketone ($C_{10}H_{16}O$) boiling at 203° C. (397.4° F.), and combines with sodium bisulphite, and forms an oxime with hydroxylamine. The oil also contains preformed (Schimmel & Co.) the *lævo-rotatory* modification of camphor ($C_{10}H_{16}O$) with small quantities of *borneol*; a *terpene* boiling at 160° C. (320° F.) is likewise present (Bruylants).

Action, Medical Uses, and Dosage.—Oil of tansy possesses the properties of the plant (see *Tanacetum*), but is seldom employed internally on account of its bitterness. It has been employed to produce abortion, but almost always with fatal results. Dose of the oil from 2 to 5 drops. According to Peyraud (1887), the oil produces in animals a disease similar to hydrophobia, called "rage tanacetique" (Gildemeister and Hoffmann, *Die Ætherischen Oele*, 1899, p. 890).

OLEUM TEREBINTHINÆ (U. S. P.)—OIL OF TURPENTINE.

"A volatile oil distilled from turpentine"—(*U. S. P.*). (See *Terebinthina*.)

"Oil of turpentine should be kept in well-stoppered bottles, protected from light"—(*U. S. P.*).

Synonyms: *Spirits of turpentine*, *Essence of turpentine*.

Preparation and History.—Oil of turpentine is the volatile constituent of the oleoresinous exudate obtained from coniferous trees and known as turpentine (see *Terebinthina*). The oil is separated by distillation with water or steam; the residue in the still is known as *rosin* or *colophony* (see *Resina*). By subjecting turpentine to a dry heat, an empyreumatic oil is produced, to which the term *resin* *oil* is more properly applied. By distilling the leaves or fruit-cones of various species of the natural order Coniferæ with water or steam, the so-called *pine-needle oils* are obtained which have a somewhat different composition (see *Oleum Pini Sylvestris*).

In former centuries, the large pine forests extending through central Europe westward to the Atlantic, supplied the oils of commerce. In the eighteenth century, American turpentine made its appearance and was first distilled in North Carolina and Virginia. Up to the present time the American oil ranks first in the world's market, the French oil, which is esteemed for its finer odor, ranking second. The center of the manufacture of oil of turpentine in the United States is slowly marching southward, on account of the gradual depletion of the pine forests where the industry is carried out. The leading place of export not long ago was Charleston, South Carolina; now its position is taken by Savannah, Georgia. (For a full account of the manufacture of the oil, on the so-called "turpentine farms," see Dr. Frederick Hoffmann, in *Die Ætherischen Oele*, p. 310; also see Bastin & Trimble's "North American Coniferæ," in *Amer. Jour. Pharm.*, 1896, p. 242.)

Description.—Official oil of turpentine is "a thin, colorless liquid, having a characteristic odor and taste, both of which become stronger and less pleasant by age and exposure to the air. Specific gravity, 0.855 to 0.870 at 15° C. (59° F.). It boils at 155° to 170° C. (311° to 338° F.). Soluble in three times its volume of alcohol, the solution being neutral or slightly acid to litmus paper; also soluble in an equal volume of glacial acetic acid"—(*U. S. P.*). It is scarcely soluble in water, but is easily dissolved by chloroform, benzol, ether, etc. Of 90 per cent alcohol, 5 to 12 parts are required for complete solution. Old oil dissolves more easily than fresh oil. It dissolves resins, fixed oils, fats, sulphur, phosphorus, many alkaloids and neutral vegetable principles, and is also a solvent for caoutchouc. Unless purified, oil of turpentine has a slightly acid reaction, owing to the presence of acetic and formic acids. "Bromine or powdered iodine acts violently upon it. When brought in contact with a mixture of nitric and sulphuric acids, it takes fire"—(*U. S. P.*). It also takes fire when brought into contact with chlorine gas. The oil is inflammable, burning with a fierce, red flame and much black smoke. The various oils of turpentine are optically active; the French oil is markedly *lævo*-rotatory (—20° to —40°) while the American oil is, as a rule, *dextro*-rotatory (to +10°), and in rare cases slightly lævo-rotatory (to —2° 5′) (Gildemeister and Hoffmann, *loc. cit.*, p. 320). Oil of turpentine is quite volatile at ordinary temperatures. When exposed to the atmosphere, especially in the presence of moisture, it becomes "ozonized" by absorption of oxygen; it thickens, resinifies, and acquires an acid reaction. In this condition it is a strongly oxidizing agent, due to its containing oxygen in some active form, which is not, however, that of ozone; this has been pointed out by Kingzett (1874) and others. Hydrogen peroxide is one of the active products formed. C. Engler and J. Weissberg have more recently shown (*Berichte d. Deutsch. Chem. Ges.*, 1898, p. 3046) that absolutely dry oil of turpentine absorbs a maximum volume of active oxygen at 100° C. (212° F.), no ozone, nor hydrogen peroxide being formed. The oil thus charged with oxygen retains its active properties for years if it is kept in a dark place. Above this temperature oxidation of the oil takes place. Among the products of oxidation of "ozonized" oil are formic and acetic acids, and *camphoric acid* ($C_{10}H_{16}O_4$), and small quantities of an *aldehyde* ($C_{10}H_{16}O_3$) (Schiff, *Chem. Zeitung*, 1896, p. 361), to which the penetrating odor of old, rancid oil is probably due. For further details on this subject, see Gildemeister and Hoffmann, *Die Ætherischen Oele*, p. 300.)

Tests.—Oil of turpentine may be adulterated with petroleum, paraffin oils, or resin. For their detection, the *U. S. P.* directs that "if a little of the oil be evaporated in a small capsule on a water-bath, it should leave not more than a very slight residue (absence of petroleum, paraffin oils, or resin)"—(*U. S. P.*). The lighter petroleum oils reduce the specific gravity of oil of turpentine. The heavier paraffin oils may be recognized by not being volatile with steam, and may be identified in the residue by their indifference toward strong sulphuric or nitric acid. A quantitative separation of mineral oils from oil of turpentine, may be effected (Burton, 1890; Allen, 1890) by means of fuming nitric acid which destroys the latter oil only.

Chemical Composition.—Oil of turpentine consists chiefly of hydrocarbons (*terpenes*), of the formula $C_{10}H_{16}$ (Houton-Labillardière, 1817). Among these, *pinene*, boiling point 155° to 156° C. (311° to 312.8° F.), is the most prominent. *Camphene*, melting point 50° C. (122° F.), boiling point 159° to 160° C. (318.2° to 320° F.), and probably *fenchene*, boiling point 154° to 156° C. (309.2° to 312.8° F.), are also regular constituents of oil of turpentine, as well as *dipentene*, boiling point 175° to 176° C. (347° to 348.8° F.), and *sesquiterpenes*, boiling at higher temperatures. Certain pine-needle oils also contain the hydrocarbons *l-limonene*, *dipentene*, *d-sylvestrene*, *l-phellandrene* and *cadinene*, and the fragrant ester *bornyl* (*borneol*) *acetate*.

Pinene occurs in two modifications which are chemically identical. *Lævo-pinene* (Wallach, 1885; Berthelot's *terebentene*) is the principal constituent of the French oil of turpentine, while *dextro-pinene* (Berthelot's *australene*) occurs, as a rule, in the American oil. It is a colorless, mobile liquid, which, to some extent, resinifies and absorbs oxygen when exposed to the air. It is an unsaturated hydrocarbon with one double bond. Accordingly, it combines, when surrounded by ice, with dry hydrochloric or hydrobromic acid gas, the former yielding the solid compound $C_{10}H_{16}.HCl$, which has the odor of camphor, hence is called *artificial camphor*. It melts at 125° C. (257° F.), the bromine compound at 90° C. (194° F.). *Pinene* is best identified by the melting point of its nitroso-chloride ($C_{10}H_{16}.NOCl$) which lies at 103° C. (217.4° F.). When heated to 250° to 270° C. (482° to 518° F.), pinene is changed into *dipentene*, the inactive (racemic) modification of *d*-and *l-limonene*, boiling at 176° C. (348.8° F.). Alcoholic sulphuric acid converts pinene into *terpinolene* and *terpinene*. Pinene in prolonged contact with diluted mineral acids, is converted into crystallizable *terpin hydrate* ($C_{10}H_{18}[OH]_2H_2O$) (see *Terpini Hydras*). By the action of sulphuric and glacial acetic acids, pinene forms the alcohol *terpineol* ($C_{10}H_{18}O$), which has the odor of hyacinth and is much used in perfumery. By the action of diluted nitric acid, or chromic acid, pinene is oxidized with formation of the lower fatty acids, and *terephtalic* ($C_8H_6O_4$) and *terebenic* ($C_7H_{10}O_4$) *acids*. By distillation with sulphuric acid, pinene is converted into inactive *terebene* (see *Terebenum*).

Action, Medical Uses, and Dosage.—The actions of oil of turpentine are complex. It is irritant, stimulant, cathartic, diuretic, vermifuge, and, in relation to chronic mucous discharges, astringent. Given in large doses it occasions fullness of the head, or giddiness, with a feeling similar to that of intoxication, or a state resembling trance; sometimes it gives rise to pain in the stomach, nausea and vomiting, and more frequently it gives rise to violent strangury, bloody urine, and other symptoms of renal or vesical irritation. In small doses long continued, or when absorbed from its external application, or its vapor inhaled, it produces in the urine an odor resembling that of violets, and sometimes produces strangury. Its most constant effect is purgation, and when this occurs, the other effects seldom present themselves. In medicinal doses it warms the stomach, elevates the temperature of the surface, quickens the pulse, and when given at short intervals, in slight doses, it acts upon the kidneys, causing an increased urinary discharge. In the *typhoid stage of febrile diseases*, especially when *intestinal ulceration* is diagnosed from the symptoms, the tongue becoming dry and dark-colored, the skin dry and husky, and *tympanites* is present, with occasionally mental derangement, small doses given at short intervals and continued for some time, will act as a stimulant and remove all these symptoms. It is supposed, in these instances, to normally influence the ulcerated tissues. It is likewise recommended in *neuralgia*, *chronic rheumatism*, *dropsy*, *suppression of urine*, *worms*, especially *tænia*—*tympanitic distension in typhoid fever*, *peritonitis*, or other diseases—*chorea*, *hysteria*, *croup*, *colic*, *jaundice*, and in cases where gravel is habitually carried off by copious discharge of lithic acid and lithate of ammonium. It has a tendency to diminish excessive mucous discharges, and has been employed with advantage in *chronic catarrh*, *chronic bronchitis*, *fetid bronchitis*, and *pulmonary gangrene* (in lung troubles by inhalation as well as internally), *chronic dysentery*, *chronic diarrhœa*, *chronic inflammation of the bladder*, *gleet*, *chronic gonorrhœa*, and *leucorrhœa*. The dose in ordinary cases is from 6 drops to ½ fluid drachm, and even to 1 drachm, at intervals of an hour or two in acute and every 3 or 4 hours in chronic diseases. In the course of its action it is absorbed, and imparts its odor to the breath and perspiration. In doses varying from 20 minims to 1 fluid drachm, according to the urgency of the symptoms, and repeated every 3 or 4 hours, it is a most efficacious astringent, and may be used in *epistaxis, hematemesis, hemoptysis,* and other sanguineous discharges. It may be administered in water, flavored with some agreeable aromatic syrup, or in infusion of matico, in *hemoptysis;* in the decoctions of uva ursi, epigæa, or eupatorium, etc., in *hematuria;* or in the decoction or infusion of cinchona, in *purpura hemorrhagica.* Where much arterial blood has been lost, tincture of chloride of iron will form a valuable adjunct. Combined with castor oil, it is an excellent vermifuge. It probably prevents the formation of biliary calculi. Externally it is a rubefacient, and is used as a counter-irritant in the form of liniment in *rheumatism, paralysis, neuralgia, inflammation of internal organs,* in the neighborhood of *indolent tumors,* to *chilblains, indolent and erysipelatous ulcers, caries, sloughing,* especially from pressure in exhausting diseases, *gangrene, chronic inflammation of the edge of the eyelids,* and, combined with linseed oil, in *recent burns* or *scalds.*

Turpentine, locally and internally, has given signal results in *diphtheria* and *sciatica.* In the latter affection about 30 drops, 3 times a day, is the proper dose. It forms a good local application in *mammitis, pleurisy, pneumonia, bronchitis, laryngitis,* and *rhus poisoning.* It has given relief in *puerperal peritonitis.* Its vapor kills the *itch insect.* Where *deafness* is occasioned by a *scanty* or *abnormal secretion of cerumen,* the oil of turpentine rubbed up with some bland oil, may be passed into the ear, on cotton. In *amenorrhœa* arising from torpor of the uterine vessels, in *obstinate constipation,* in *tympanites,* or when the bowels are distended with *flatus,* and in *ascarides,* oil of turpentine used as an injection will frequently be found a superior remedy. From 4 to 8 fluid drachms may be rubbed up with half a pint of water and the yolk of a few eggs, or with some mucilage, and injected into the rectum, where it should be retained for some time. When given internally, it may be administered in simple or aromatized syrup, or rubbed up with sugar, or taken in gin, when not contraindicated, etc.; or it may be triturated with the yolk of egg, gradually adding syrup and essence of cinnamon, with a portion of water. One yolk is sufficient for trituration with every 2 fluid drachms of the oil. In *tapeworm,* it has been combined with gin, and given in doses of 1 or 2 fluid ounces. As an ordinary vermifuge, 3 or 4 parts of castor-oil may be added to 1 part of the oil of turpentine.

Dr. James Warren has used a preparation for a number of years in the treatment of *hemorrhages,* with uniform success. It acts both by its sedative power, in diminishing the force of the circulation, and by its astringent qualities, in contact with the bleeding vessels. He is satisfied that no known remedy exerts a more specific power and gives more speedy relief, especially in *hemoptysis, hematemesis, epistaxis,* and *menorrhagia.* Dr. Warren terms it *Styptic Balsam.* It is made as follows: Place sulphuric acid, 5 drachms by weight, in a Wedgewood mortar, and slowly add to it oil of turpentine 2 fluid drachms, stirring it constantly with the pestle; then add in the same manner alcohol 2 fluid drachms, and continue stirring until no more fumes arise, when it may be bottled, and should be stopped with a ground stopper. It should be prepared from the purest materials; and when made should exhibit a dark but clear red color, like dark blood; but if it be a pale, dirty red, it will be unfit for use. The dose is 40 drops, to be used as follows: into a common-sized teacup put a teaspoonful of brown sugar, thoroughly incorporate the 40 drops by rubbing together, and then slowly stir in water until the cup is nearly full, when the mixture should be immediately swallowed. The dose may be repeated every hour, for 3 or 4 hours, and its use should be discontinued as soon as fresh blood ceases to flow. After standing a few days, a pellicle forms upon the surface of the balsam, which should be broken, and the liquid below it used. If in well-stoppered bottles, age does not deteriorate it (*N. Y. Jour. Med.*). French oil of turpentine and old oil of turpentine are antidotes to *poisoning by phosphorus.*

Related Oil.—ABIETENE (C_7H_{16}). This highly volatile and very inflammable oil was obtained by Prof. W. T. Wenzell (*Amer. Jour. Pharm.,* 1872, p. 97) from the terebinthinous exudate of the *Nut pine* or *Digger pine* (*Pinus Sabiniana,* Douglas) of California. The nut of this species is eaten by the Digger Indians. The crude oil is colorless and boils from 101° to 115° C. (213° to 239° F.); the boiling point of the largest fraction is 101° C. (213° F.). Its specific gravity is 0.694; its odor penetrating, strong, and orange-like. According to T. E. Thorpe (*Chem. News,* 1879) it is identical with *heptane* (C_7H_{16}), one of the low-boiling petroleum hydrocarbons.

Abietene (*heptane*) dissolves both bromine and iodine without fulmination, and is soluble in 95 per cent alcohol (5 parts). According to Prof. Sadtler (*Amer. Jour. Pharm.*, 1879, pp. 176 and 293), an oil of the same composition is furnished by the Californian *Pinus ponderosa*, of Douglas.

OLEUM TEREBINTHINÆ RECTIFICATUM (U. S. P.)—RECTIFIED OIL OF TURPENTINE.

Preparation.—"Oil of turpentine, a convenient quantity; lime-water, a sufficient quantity. Shake the oil thoroughly with six (6) times its volume of lime-water, and introduce the mixture into a copper still connected with a well-cooled condenser. Then distill, until about three-fourths of the oil have passed over, and separate the clear oil from the water. Keep the product in well-stoppered bottles, in a cool place, protected from light"—(*U. S. P.*).

Description.—"A thin, colorless liquid, having the general properties mentioned under oil of turpentine (see *Oleum Terebinthinæ*). Specific gravity, 0.855 to 0.865 at 15° C. (59° F.). Boiling point, about 160° C. (320° F.). Its alcoholic solution should be neutral to litmus paper. If about 10 Cc. of the oil be evaporated in a capsule on a water-bath, no weighable residue should be left"—(*U. S. P.*). "Rectified oil of turpentine should always be dispensed when oil of turpentine is required for internal use"—(*U. S. P.*).

OLEUM THEOBROMATIS (U. S. P.)—OIL OF THEOBROMA.

"A fixed oil expressed from the seed of *Theobroma Cacao*, Linné (*Nat. Ord.*—Sterculiaceæ)"—(*U. S. P.*).

SYNONYMS: *Oleum theobromæ* (*U. S. P.*, 1880), *Butter of cacao*, *Oleum cacao*, *Butyrum cacao*.

Preparation and Description.—*Butter of cacao* must not be confounded with cocoanut oil from *Cocos nucifera;* with *palm oil* from *Elæis guineensis;* nor with *coca*, the dried leaves of *Erythroxylon Coca;* it is obtained by two or three processes, one of which is to roast the seeds, and, after removing the testa, grind the seeds, put them in canvas bags, expose them to steam, and press between hot iron plates. The butter thus expressed may be purified by melting it in hot water, by passing it through hot animal charcoal, or by the use of acids, and then running it into molds. The seeds contain about 45 per cent of this fat, 6 to 11 per cent of starch, 1 to 4 per cent of *theobromine*, nitrogenous matter, cacao-red, ash, etc. The yield of cacao butter is about 30 to 35 per cent.

Butter of cacao is officially described as "a yellowish-white, solid, having a faint, agreeable odor, and a bland, chocolate-like taste. Specific gravity, 0.970 to 0.980 at 15° (59° F.). Readily soluble in ether or chloroform, also soluble in 100 parts of cold and in 20 parts of boiling absolute alcohol, all these solutions being neutral to litmus paper. It is brittle at 15° (59° F.), and melts at 30° to 33° C. (86° to 91.4° F.), to a clear liquid"—(*U. S. P.*). The melted fat solidifies again at 20.5° C. (68.9° F.), accompanied by a sudden rise of temperature to about 27° C. (80.6° F.). It is not easily liable to become rancid.

Chemical Composition.—Butter of cacao consists of the glycerides *stearin* and *olein*, with small quantities of *laurin*, *palmitin*, and *arachin*. Kingzett's *theobromic acid* ($C_{64}H_{128}O_2$, 1877) could not be reobtained (M. C. Traub, *Archiv der Pharm.*, 1883, p. 19). P. Graf (*Archiv der Pharm.*, 1883, p. 830) also found small quantities of *formic*, *acetic*, and *butyric acids*, and *cholesterin* (*phytosterin*).

Adulterations and Tests.—Butter of cacao may be adulterated with tallow, beef suet, stearin, stearic acid, wax, spermaceti and paraffin, oils of cocoanut, almond, etc. Some of these admixtures may be recognized by determining the acid and iodine numbers and the saponification equivalent of the fat. The *U. S. P.* directs the following test: "If 1 Gm. of oil of theobroma be dissolved in 3 Cc. of ether, in a test-tube, at a temperature of 17° C. (63° F.), and the tube subsequently plunged into water at 0° C. (32° F.), the liquid should not become turbid, nor deposit a granular mass in less than 3 minutes; and if the mixture, after congealing, be exposed to a temperature of 15° C. (59° F.), it should gradually form a perfectly clear liquid (absence of paraffin, wax, stearin, tallow, etc.)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Oil of theobroma is emollient and nutrient. It forms a good dressing for *wounds* and *abraded* or *excoriated parts*, and on account of its melting at the temperature of the body, furnishes a good base for suppositories for the relief of *rectal, vaginal*, and *uterine lesions*. Internally, in 5 to 30-grain doses, it has been employed in *chronic bronchial* and *intestinal disorders*.

Related Oils.—SHEA BUTTER, also known as *Bambuk* or *Galam butter*, is a light-greenish or grayish fat, mild to the taste, and having an odor like cacao butter. It fuses near 28° C. (82.4° F.). It is expressed from the seeds of *Bassia Parkii*, De Candolle, an African tree.

MANWAH BUTTER.—From the seeds of the Indian *Bassia latifolia* of Roxburgh. The oil is yellowish or greenish. Its fusing point is near 45° C. (113° F.). The flowers of this species are fleshy and said to yield 50 per cent of sugar, and are employed by the natives in the making of a spirituous beverage, and for food. (For other species of *Bassia*, see *Monesia*.)

MAFURA BUTTER.—The seeds of the *Trichilia emetica*, Vahl (*Mafureira oleifera*, Bertero) (*Nat. Ord.*—Meliaceæ), are bitter and have the characteristic odor of cacao-beans, and yield a fat much resembling cacao-butter. It is yellow, not so soft as tallow, is mild in taste, and has the odor of cacao-butter. It fuses at 42° C. (107.6° F.). *Olein* and *palmitin* are its constituents, and when saponified it yields a large amount of *palmitic acid*. The oil is obtained in tropical Africa by boiling the seeds in water.

OLEUM THYMI (U. S. P.)—OIL OF THYME.

"A volatile oil distilled from the leaves and flowering tops of *Thymus vulgaris*, Linné (*Nat. Ord.*—Labiatæ). It should be kept in well-stoppered bottles, in a cool place, protected from the light"—(*U. S. P.*).

Preparation.—This oil is chiefly obtained in southern France, where the plant grows in immense quantity. Spain also produces oil of thyme, although this is of somewhat different physical and chemical characters. The crude product is known as *red oil of thyme*, and is usually sold under the name of *oil of origanum* (see *Oleum Origani*). The rectified oil is known as *white oil of thyme*. In southern France these two grades are known respectively as *huile rouge de thyme* and *huile blanche de thyme*. In this connection, Gildemeister and Hoffmann (*Die Ætherischen Oele*, 1899, p. 817) point out that rectified oil of thyme, unless rectified under especial precautions, soon acquires the red color of the crude oil again. The permanently pale French oil is stated to be produced by distilling the crude oil with an excess of oil of turpentine; hence such oils contain at most 5 per cent of phenols, as against 20 to 25 per cent, sometimes 42 per cent in normal oils. The yield of oil of thyme varies from 0.3 to 0.4 per cent (fresh herb, German) to 1.7 per cent (dry, German), and 0.9 per cent (fresh, French) to 2.5 and 2.6 per cent (dry, French).

Description.—"A yellowish or yellowish-red liquid, having a strong odor of thyme, and an aromatic, pungent, afterward cooling taste. It becomes darker and thicker by age and exposure to the air. Specific gravity, 0.900 to 0.930 at 15° C. (59° F.). It does not fulminate with iodine. The oil is soluble in half its volume of alcohol, forming a clear solution which is neutral or only very slightly acid to litmus paper. The oil is also soluble, in all proportions, in carbon disulphide, and in glacial acetic acid. With a drop of ferric chloride T.S. the oil yields a greenish-brown color, which changes to reddish"—(*U. S. P.*). French and German oil of thyme is soluble in 1 or 2 volumes of alcohol of 80 per cent, but 15 to 30 volumes of 70 per cent are required for complete solution, while the Spanish oil, probably from another botanical source, forms a clear solution with the latter solvent.

Chemical Composition and Tests.—The characteristic constituents of oil of thyme are the solid *thymol* and the liquid *carvacrol*, two isomeric phenols of the formula $C_{10}H_{14}O$ (see *Thymol*). As stated before, the total amount of phenols in oil of thyme (French and German oils) is 20 to 25 per cent, seldom as high as 42 per cent; *thymol* is usually the only phenol present; sometimes it is either entirely or to a small extent, replaced by *carvacrol*. The Spanish oil contains from 50 to 70 per cent of carvacrol exclusively (compare *Oleum Origani*). The correct formula for thymol was established by Lallemand (1853). He also found oil of thyme to contain the hydrocarbons *cymol* ($C_{10}H_{14}$), and a small quantity of *l-thymene*, which was identified by Schimmel & Co. (1894) as *l-pinene*. The latter also established the presence of *borneol* and *linalool* in the higher fractions of oil of thyme; these results were confirmed by Labbé (1898).

The presence of oil of turpentine in oil of thyme may be recognized by the specific gravity being lower than 0.900, or by the diminished solubility in alcohol, and the deficiency in the phenol contents of the oil. A convenient method for determining the amount of phenols in oil of thyme consists in shaking a given volume of the oil (*e. g.*, 10 Cc.) in a burette with an equal volume of a 5 per cent caustic soda solution, allowing to stand from 12 to 24 hours, and measuring the volume of the remaining non-phenols (compare *Oil of Cassia*). By drawing off the aqueous phenolate, and rendering acid with sulphuric acid, the regenerated phenols will solidify upon standing when consisting of thymol, but will remain fluid when they consist of carvacrol. An iodometric method for the estimation of phenols in oil of thyme was devised by E. Kremers and O. Schreiner (see *Pharm. Review*, 1896, p. 221). The *U. S. P.* directs the following test: "If 1 Cc. of the oil be shaken with 10 Cc. of hot water, and, after cooling, the liquid be passed through a wet filter, the filtrate should not assume, with a drop of ferric chloride T.S., a bluish or violet color (absence of carbolic acid)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—(See *Thymus* and *Thymol.*)

Related Oils.—OLEUM SERPYLLI, *Oil of wild thyme*. The essential oil distilled from *Thymus Serpyllum*, Linné. A colorless or golden-yellow, lævogyrate oil of the specific gravity 0.905 to 0.930. Odor slightly like thyme, but more like melissa. Constituents, chiefly *cymol* ($C_{10}H_{14}$), with 1 per cent of *thymol*, *carvacrol*, and probably other phenols.

OIL OF THYMUS CAPITATUS.—Has a pronounced thyme-like odor; specific gravity, 0.901; constituents, *thymol* (6 per cent), *cymol*, *pinene*, *dipentene*, *bornyl-acetate*, and possibly *carvacrol* (Schimmel & Co.'s *Report*, October, 1889). Produced in Spain.

OIL OF THYMUS CAMPHORATUS.—Specific gravity, 0.904. Constituent, *carvacrol* (Power, *Essential Oils*).

OLEUM TIGLII (U. S. P.)—CROTON OIL.

The expressed fixed oil of the seeds of *Croton Tiglium*, Linné; *Tiglium officinale*, Klotzsch.

Nat. Ord.—Euphorbiaceæ.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 239.

Botanical Source.—Croton Tiglium is a middle-sized tree, the young branches of which are terete, smooth, shining, and somewhat furrowed toward the extremities. The leaves are alternate, petiolate, oval, oblong, acute, 3 to 5-nerved at the base, acuminate at the apex, with shallow, glandular serratures; thin, membranous, with 2 glands at their base, and covered when young with very minute, scattered hairs, dark-green above, and paler below. The petioles are about one-third the length of the leaf, channeled, having stellate hairs when quite young, but soon losing them. The flowers are downy, in erect, terminal racemes; male flowers at the apex, female below. The male flowers have a 5-cleft calyx, 5 lanceolate, woolly, straw-colored petals, and 15 distinct stamens; female have a 5-cleft, permanent calyx, with long and bifid styles. The fruit is a smooth, oblong, obtusely triangular capsule, about the size of a hazel-nut, closely covered with minute, stellate hairs, with 3 cells, each of which is completely filled with a solitary seed. The skin of the seeds is of a pale, dull-brown color, and overlies a harder, dark integument (L.—Wi.).

Fig. 185.

Croton Tiglii.

History and Preparation.—This tree is a native of the East Indies, growing in Ceylon, in the Molucca Islands, in China, etc., and is cultivated in Japan and European countries. The tree was probably first known in China. Its wood (*lignum pavana*) and seeds (*pini nuclei moluccani*) were made known to the Europeans in 1578, by the Portuguese physician, Christobal Acosta. Like the various plants of this natural order, it is imbued in all its parts (root, bark, leaves, seeds) with a sharp, energetic, drastic cathartic element. The oil obtained from the seeds is the official part. The seeds are of an ovoid form, about the size of a pea, reddish-brown when recent, grayish-brown when old, sometimes brownish-black. They consist of a thin, brittle, ligneous shell; a delicate, white, membranous integument; and an oleaginous kernel composed of a pale, yellowish-white albumen, and a beautiful embryo, with large, leafy cotyledons. The oil, which constitutes about 50 to 60 per cent of the kernels, is obtained by removing the shells from the seeds, bruising these to a pulp, and subjecting the pulp to a strong pressure. By digesting the residue with sulphuric ether, filtering, and expelling the ether by a gentle heat, an additional quantity of oil is often obtained. The residual press-cakes must be burned up in order to guard against accidents that might possibly result from handling them. Or, the seeds may be extracted altogether with sulphuric ether, or with carbon disulphide, and the solvent evaporated. These methods, however, are not recognized by the *U. S. P.* A. H. Allen (*Com. Org. Anal.*, Vol. II, Part I, 1899, p. 161) reports that extraction with ether removes three times as much oil as when the oil is expressed, or extracted with alcohol. Expression yields a pale oil, ether a light-brown, and alcohol a dark-brown oil, containing twice as much free acid as the specimens obtained by the other methods. Its saponification value is also much higher.

Description and Tests.—The croton oil of commerce is partly imported from India, and partly expressed in England from the imported seeds. *English croton oil* is of a reddish-brown color, and forms a uniform, transparent mixture with equal parts of absolute alcohol, without the aid of heat. The *East Indian croton oil* is pale-yellow, like Canada balsam, and mixed with equal parts of absolute alcohol, forms an opaque, milky solution, which is rendered transparent and uniform upon the application of heat. The East Indian is the official oil, and is described as "a pale-yellow or brownish-yellow, somewhat viscid, and slightly fluorescent liquid, having a slight, fatty odor, and a mild, oily, afterward acrid and burning taste (*great caution is necessary in tasting*). When applied to the skin, it produces rubefaction or a pustular eruption. Specific gravity, 0.940 to 0.960 at 15° C. (59° F.). It reddens blue litmus paper moistened with alcohol. When fresh, it is soluble in about 60 parts of alcohol, the solubility increasing by age. It is freely soluble in ether, chloroform, carbon disulphide, and in fixed or volatile oils. When gently heated with twice its volume of absolute alcohol, it forms a clear solution from which the oil usually separates on cooling"—(*U. S. P.*). The *U. S. P.* also directs that "croton oil should be kept in small, well-stoppered bottles, and should be handled with caution"—(*U. S. P.*).

Croton oil has the highest specific gravity (see above) of all fatty oils, except castor oil. It is also soluble in glacial acetic acid, and soluble in petroleum ether, while castor oil is insoluble in the latter solvent. Croton oil is intermediate between the drying and non-drying oils, and does not give the elaïdin reaction. Accordingly the *U. S. P.* directs that "if to 2 Cc. of the oil 1 Cc. of fuming nitric acid and 1 Cc. of water be added, and the mixture vigorously shaken, it should not solidify, either completely or partially, after standing for 1 or 2 days (absence of other non-drying oils)"—(*U. S. P.*). The presence of castor oil may probably be detected by its insolubility in petroleum ether.

It is stated that an oil not quite as active as the pure croton is obtained from the *Barbadoes nuts*, or the seeds of *Curcas purgans*, Adanson (*Jatropha Curcas*, Linne (see *Curcas*); it is an active purgative in a dose of 3 to 5 drops. The seeds of the *Croton pavanæ*, Hamilton, are likewise supposed to furnish some of the commercial croton oil. An inferior oil which has been recommended as a substitute for croton oil is obtained from the Caper spurge, or Garden spurge (*Euphorbia Lathyris*, Linne) of south Europe. It is extracted with carbon disulphide, and deposits a crystalline body on standing. *Croton oblongifolius*, Roxburgh, has similar seeds, while the seeds of *Croton morifolius*, of Mexico, yield an oil, mildly cathartic in 2 or 3-drop doses.

Chemical Composition.—I. THE SEEDS. These, according to Flückiger, consist of 31.6 per cent of husks, and 68.4 per cent of kernels, the latter containing from 50 to 60 per cent of croton oil. The husks hold about 1.65 per cent of oil (Zinnel, *Amer. Jour. Pharm.*, 1890, p. 122). The seeds contain, beside the oil and the usual seed constituents, two powerfully poisonous albuminous bodies, *croton-globulin* and *croton-albumin* (Ufstrand, 1897). The poisonous principle remains to some extent in the press-cake (H. Stillmark's Dissertation, *Ueber Ricin*, 1889, p. 146).

II. THE OIL.—Croton oil was found by Schlippe (1858) to contain the *glycerides of stearic*, *palmitic*, *lauric*, *myristic*, and *oleic acids*, and a vesicating resinous principle *crotonol*. The additional *angelic acid*, of Schlippe, was found by Guenther and Fröhlich (1870) to differ from true angelic acid in melting point, and was named *tiglinic acid*. Schmitt and Berendes (1878) found this acid to be identical with Frankland and Duppa's *methylcrotonic acid* ($C_6H_8O_2$), and also established the presence of *isobutyric* and *isovaleric acids* in croton oil. *Acetic acid* was previously shown by Guenther and Fröhlich to be present.

Regarding the active principles of croton oil, it has long been known (Nimmo, 1823) that alcohol differentiates the oil into an alcohol-soluble vesicant part and an alcohol-insoluble, purgative part (Harold Senier, *Pharm., Jour. Trans.*, 1878, p. 705; and 1883, p. 446). In 1857, Buchheim and Krich, by saponification of the purgative portion, isolated therefrom a vesicant principle; hence a close relation must exist between the alcohol-soluble and insoluble portions of the oil. Kobert and von Hirschheydt, in 1890 (*Ueber die Crotonol-säure*, R. Buchheim's), came to the conclusion that the efficacy of the alcohol-soluble, vesicant part is due to the presence of free *crotonoleic acid*, a rather unstable body, while the alcohol-insoluble part contains it as a glyceride. The authors also demonstrated, by experiment, that the neutral oil (insoluble in alcohol) is decomposed by the pancreatic ferment, whereby the vesicating crotonoleic acid is liberated. More recently, Prof. W. R. Dunstan and Miss L. E. Boole (*Pharm. Jour. Trans.*, 1895, p. 5) investigated crotonoleic acid. After separating therefrom some inert oily acids, the last fraction contained a powerfully vesicating resin, *croton resin*, a hard, light-yellow, brittle substance, nearly insoluble in water, readily soluble in alcohol, ether, and chloroform. Prolonged boiling with caustic alkalies destroys its vesicating power. (Adapted from an article on Croton Tiglium, by J. U. Lloyd, in *The Western Druggist*, April, 1898.)

Action, Medical Uses, and Dosage.—Croton oil is a powerful irritant and cathartic. In large doses it is a dangerous poison, occasioning emesis, painful gripings, hypercatharsis, and other serious symptoms. Its action is prompt, frequently causing catharsis within an hour; and, from the smallness of its dose, it is especially adapted to cases where medicines requiring large doses can not be given, as in *trismus*, *coma*, *insanity*, *congestive apoplexy*, etc. In most cases, catharsis may be produced by placing a drop or two on the back part of the tongue. It is principally used as a purgative when the bowels are very torpid; in comatose conditions as a revellant; and in *dropsy* as a hydragogue. It is admissible in *obstinate constipation* when no inflammation exists, and is the most efficient purgative in *lead colic*. It is likewise asserted that, irrespective of its cathartic property, it possesses efficacious influences in *spasmodic* and *painful nervous affections*. It may be used in all cases where prompt and active purgation is indicated. It is distinguished from other powerful cathartics by occasioning much borborygmus or rumbling of wind, by its action commencing speedily and ending soon, and by the purgative effect, however exhausting at the time, being followed by little debility. In certain forms of *diarrhœa* and other *enteritic affections*, I have derived great benefit by dissolving croton oil, ½ fluid drachm, in alcohol, 2 fluid ounces, and administering it in doses of from 5 to 15 drops, according to circumstances (J. King). Externally, it produces erythematic redness, intense burning, and an eruption of minute vesicles.

A croton-oil liniment is made by mixing 1 part of croton oil with 4 or 5 parts of olive oil, or 6 parts of turpentine; it is rubbed on the skin several times a day, to cause redness and a pustular eruption; it is very beneficial in *follicular disease of the throat*, *affections of the larynx*, *bronchial vessels*, and *lungs*, *indolent tumors*, and all *painful attacks*. The dose of croton oil is from 1 to 6 drops, which is best given on sugar, or made into a pill with crumb of bread, in order to avoid the disagreeable, acrid sensation it occasions in the throat, with a constant tendency to hawk, as well as to prevent nausea or vomiting. Four drops of the oil, thoroughly rubbed around the navel, will, it is said, produce catharsis. Croton oil is now seldom used externally; it was once very popular as a counter-irritant. Soubeiran recommends the following lozenges: Take of vanilla chocolate, ½ ounce; sugar, 2 drachms; starch, 40 grains; croton oil, 10 drops; mix thoroughly together, and form into 60 lozenges.

Related Drug.—*Bocconia.* South American natives employ several species of this genus as purgative, abortifacients, and topical irritants (H. H. Rusby, *Bull. of Pharm.*, 1891).

OLEUM VALERIANÆ.—OIL OF VALERIAN.

The essential oil distilled from the root of *Valeriana officinalis*, Linné.

Nat. Ord.—Valerianaceæ.

Preparation and Description.—The root of Valeriana officinalis distilled with water yields about 1 per cent of volatile oil. When freshly prepared it is a yellowish-green, faintly acid, thin liquid, the odor of which is not unpleasant. Upon exposure to the air it becomes dark-brown, viscid, strongly acid, and of a very disagreeable odor, owing to the liberation of *valerianic acid* ($C_5H_{10}O_2$). Fresh oil of valerian has a specific gravity of 0.93 to 0.96 and is optically lævo-rotatory.

Chemical Composition.—The characteristic constituent of oil of valerian is *bornyl- (borneol-) valerianate* (Bruylants, 1878), an ester which undergoes spontaneous decomposition into borneol and valerianic acid when the oil is exposed to air. The stearopten sometimes deposited in old oil is borneol. According to Gerock (1892), about 9.5 per cent of this ester is present, with 1 per cent, each, of *bornyl-formiate, acetate*, and *butyrate*. Upon saponification of these esters with caustic alkali and fractionating the resultant oil, the hydrocarbons *l-pinene* and *l-camphene* were found in the lowest fractions, then followed *l-borneol, terpineol*, a *sesquiterpene*, and an alcohol, $C_{15}H_{26}O$ (Olivieri, 1893). From the saponification water, Olivieri isolated a crystallizable, lævo-rotatory alcohol ($C_{10}H_{20}O_2$), melting at 132° C. (269.6° F.). The highest fractions of oil of valerian, according to Prof. Flückiger (1876), contain a blue oil (Gildemeister and Hoffmann, *Die Ætherischen Oele*, 1899); its taste is warm and camphoric. Caustic alkalies saponify the oil uniting with its valerianic acid to form valerianates.

Action, Medical Uses, and Dosage.—Oil of valerian possesses the properties of the root in a concentrated degree, and may be substituted for it in all cases where the root is applicable. It has been found especially useful in *hysteria, chorea, restlessness*, etc. An efficient preparation for nervous, sleepless, and hysterical cases is composed of: Tincture of lupulin, tincture of hyoscyamus, of each, 4 fluid ounces; camphor, 1 drachm; and oil of valerian, 22 minims. Mix, and give 1 or 2 fluid drachms for a dose. The dose of the oil of valerian is 2 to 6 drops in alcoholic solution, pill, or emulsion.

OLIBANUM.—FRANKINCENSE.

A dry gum-resin obtained from *Boswellia Carterii*, Birdwood, with its varieties, and several other species of *Boswellia*.

Nat. Ord.—Burseraceæ.

Synonyms: *Gummiresina olibanum, Thus.*

Illustration: (*Boswellia Carterii*) Bentley and Trimen, *Med. Plants*, 58.

Botanical Source and History.—The individual species of Boswellia yielding this product are not well known. Several trees, possibly distinct species, are classed as varieties of *B. Carterii*. The genus comprises trees having odd-pinnate leaves, with leaflets serrate, flowers small, 10-stamened, and borne in racemes, and succeeded by 3-celled, drupe-like capsules, each cell of which is 3-seeded. The trees are found in East Africa (Somali country), South Arabia, and India. (For an account of the several species consult *Pharmacographia*, 2d ed., pp. 133 and 139.) Olibanum is the frankincense of the ancients and was among the offerings of the Magi to the infant Savior. It constituted a large part of the *incense* so frequently alluded to in the Scriptures. It is collected in the Somali country by making deep incisions into the trunk of the tree from which the milky gum-resin exudes and soon concretes. The clear tears are first gathered, and the portion which has run down the side of the tree or has fallen to the ground, constitutes an inferior sort.

Description.—Olibanum is a translucent, brittle, whitish-yellow substance, in roundish, club-shaped, pear-shaped, or irregular tears, and usually covered by a whitish, farinaceous substance produced by the pieces rubbing against each other. It has a sub-acrid, terebinthinate, bitter taste, and a pleasant, resinous odor, and when burned, it produces a brilliant flame, and diffuses an agreeable aroma. It melts with difficulty, not without decomposition, becomes soft and adhesive by chewing, forms an incomplete, white emulsion when rubbed up with water, and is dissolved by alcohol to the amount of about 65 per cent. It has a specific gravity of 1.22.

Chemical Composition.—Olibanum consists chiefly of an acid *resin* (56 per cent), soluble in alcohol and having the formula $C_{20}H_{32}O_4$ (Hlasiwetz, 1867); it yields no benzene derivatives when fused with caustic potash. When burned, it emits an agreeable odor. Water removes from it a bitter, viscid substance, little soluble in ether. Olibanum also contains *gum* (30 to 36 per cent), insoluble in alcohol, and resembles ordinary gum arabic. With 3 parts of water it forms a thick mucilage (*Pharmacographia*). Finally, olibanum contains about 3 per cent of *ash*, and from 4 to 7 per cent of a *volatile oil*. According to Kurbatow (1874), it consists chiefly of a terpene *olibene* ($C_{10}H_{16}$), boiling at 158° C. (316.4° F.). Flückiger found it lævo-rotatory, and Wallach (1889) identified it as *l-pinene*, and in addition found *dipentene*. Schimmel & Co. also report the occurrence of *phellandrene* in the oil (Gildemeister and Hoffmann, *Die Ætherischen Oele*, p. 641).

Action, Medical Uses, and Dosage.—Olibanum is a stimulant, producing results similar to those from the tolu and Peru balsams; it is principally used as a fumigating article, and occasionally forms an ingredient of plasters. The dose, when used internally, is from 5 to 40 grains, in emulsion.

Related Species.—Another gum-resin is obtained from an unidentified tree inhabiting the neighborhood of the Red Sea; it grows upon the bare rocks, without any other support than the very round, thick substance, of a nature between bark and wood, which is thrown out from the base of the trunk, and which adheres very firmly to the rocks. Kempthorne (1843) alludes to this species as being the tree furnishing olibanum.

Boswellia serrata, Roxburgh, is the *Boswellia thurifera*, Colebrooke, a leafy forest tree of the Coromandel coasts and other parts of India. Though formerly thought to furnish olibanum, this tree is not the source of that drug, but yields a soft odorous resin which slowly hardens within a period of a year, and is used only by the natives as *incense*.

Boswellia papyrifera, Richard, yields a transparent resin, probably destitute of gum, though thought to contain a volatile oil. It grows in western Abyssinia.

Boswellia Frereana, Birdwood, the *Yegaar* of the Somalis, yields a fragrant resin of a lemon odor. It contains no gum, and is employed in the East as a masticatory.

Hedwigia balsamifera.—An alcoholic extract of this plant, administered hypodermatically, proved a nerve and cardiac poison. A convulsing alkaloid is contained in it, and a resin capable of lowering the body heat and inducing paralysis (*Ann. de Thérap.*, 1889). (See also p. 1318.)

ONOSMODIUM.—FALSE GROMWELL.

The root and seeds of *Onosmodium virginianum*, A. De Candolle (*Lithospermum virginianum*, Linné).

Common Names: *False gromwell, Gravel weed, Wild Job's tears.*

Botanical Source.—This plant is a perennial herb, clothed all over with harsh and rigid appressed bristles. The stems are rather slender, 1 or 2 feet in height. The leaves are oblong, or oblong-lanceolate, often oval, and even ovate-lanceolate, sessile, minutely strigose, 3 to 5-veined; lower ones narrow at base, 1 inch to 2½ inches long, ½ or ¾ of an inch broad. The flowers are yellowish-white, in terminal, leafy racemes, which are recurved at first, but finally become erect and elongated. Calyx 5-cleft, lobes lanceolate, pilose on both sides, half as long as the corolla. Corolla oblong-tubular, with a ventricose, half 5-cleft limb, with lance-subulate segments clothed externally with long hispid hairs. Stamens 5, with very short, flattened filaments supporting included, sagittate apiculate anthers. Style much exserted and smooth. Achenia ovoid, smooth and shining, fixed by a flat base (G.—W.).

History.—This plant is found growing from New York to Florida, in dry, hilly grounds, flowering from June to September. The root and seeds are the parts employed, and yield their virtues to water. There are two other species of this genus which possess similar properties (see next page).

Action, Medical Uses, and Dosage.—Diuretic and tonic. Said to dissolve *calculi*. A strong infusion of the root and seeds, taken in doses of 4 fluid ounces, every 2 hours for about a day, or until it purges, is highly extolled as a cure for *calculous affections.* It occasions excessive urination, hence care must be taken that it be not employed too long, for fear of producing too great a flow of urine. It is worthy of a full investigation. *Onosmodium carolinianum*, De Candolle, and *Onosmodium strigosum*, possess similar properties (see also *Lithospermum officinale*).

OPIUM (U. S. P.)—OPIUM.

"The concrete, milky exudation obtained by incising the unripe capsules of *Papaver somniferum*, Linné (*Nat. Ord.*—Papaveraceæ), and yielding, in its normal, moist condition, not less than *nine* (9) *per cent* of crystallized morphine, when assayed by the process given below"—(*U. S. P.*). (For *botanical description* of poppy, see *Papaveris Capsula*.)

SYNONYMS: *Meconium*, *Succus thebaicus.*

Official Forms of Opium.—I. OPIUM (as above indicated). II. OPII PULVIS, *Powdered opium*. III. OPIUM DEODORATUM, *Opium denarcotisatum*, *Deodorized opium*, *Denarcotized opium.*

History, Commercial Sources, and Description.—Opium was known to the ancient Greeks, being mentioned in the writings of Theophrastus (about 370 to 286 B.C.), and by the writers of the first century, *e. g.*, Dioscorides and Pliny. Its most probable geographical source was then Asia Minor. Egyptian (Thebaïc) opium is recorded as early as the sixth century. The knowledge of the drug was spread eastward by the Arabs. During the middle ages it was used in Europe only as a medicine, and entered into most of the narcotic preparations known as *theriac*. In eastern Asia, however, its use as a stimulant gradually increased and received a powerful impetus, since about 1770, by the exportations of opium from India into China. This trade has fallen off considerably, owing to extensive production of the drug by the Chinese themselves. The most notable event in the chemical history of the drug was the discovery of the first alkaloid known, morphine, by Sertürner, in 1811.

Fig. 186.

Papaver somniferum

The opium met with in commerce is principally that from Asia Minor, which was the kind expressly demanded by the *U. S. P.*, 1880, and the *Br. Pharm.*, 1885, and which is still required by the *Ger. Pharm.*, 1890. The present *U. S. P.* and *British Pharmacopœia* do not specify the origin of opium; still, most of the opium entering this country, comes from Asia Minor. Other opium-producing countries are Persia, India, Egypt, China, Australia, and some parts of Europe.

ASIA MINOR OPIUM, *Turkey opium*, *Smyrna opium*, *Constantinople opium.*—This is obtained from *Papaver somniferum*, Linné, var. *glabrum*, Boissier. In the northwestern provinces of Asia Minor, opium cultivation is in the hands of small holders of land, owing to the scarcity of hired labor. The poppy requires a naturally moist and rich soil, much manure, and diligent hoeing and weeding, which is done mostly by women and children, yet the opium crop is very uncertain, because the poppy may be injured or destroyed by spring frosts, drought or locusts. About the end of May the plants begin to ripen, and a few days after the petals have fallen, the head or capsule is ready for incision. This is done on hot afternoons in order that the exuding juice may dry rapidly. A transverse cut is made with a knife in the lower part of the capsule, the incision being carried round to near its starting point. Great care must be taken not to cut too deep, *i. e.*, to avoid penetrating the interior wall of the seed-vessel, because in this case the juice would flow into the inside and be lost. The following morning, the capsules are scraped off with a blunt instrument and the dried juice placed on a leaf. Night-dew promotes the flow of juice and increases the yield, but the opium is darker than when the night is dry. A high wind is also harmful, because of the dust it throws on the opium. A crop of 5 to 8¼ pounds of opium, and 200 pounds of poppy-seed, from 1 *toloom* of land (1600 square yards), is considered a good yield; in some years only a little over ½ pound has been obtained. After the opium is collected, the seeds are shaken out, expressed in hand presses, and the oil thus obtained is used for burning and for eating purposes. Part of the poppy-seeds are sold to Smyrna merchants who find a market for them in Europe. The opium, before it is marketed, is wrapped in poppy leaves, and dried in the shade, and then put into thin cotton bags which are sealed and placed into round baskets. These are sent to Smyrna, carried by mules, each animal carrying two baskets, weighing from 130 to 162 pounds each. Most of these baskets also contain about 5 per cent of inferior grades, partly adulterated with sand, pounded poppy-heads, half-dried apricots, dried grape-juice mixed with flour and sometimes turpentine, figs, or gum tragacanth. The bags are opened in Smyrna, examined by a government official, and the lowest grades (*chicantee, chikinti*) are rejected and sold at cheaper rates to manufacturers of morphine. Upon repacking, the seeds of some Rumex species are strewn between the opium cakes, in order to prevent their agglutinating together. Mr. Sidney H. Maltass, who gives the foregoing information (*Pharm. Jour. Trans.*, Vol. XIV, 1855, pp. 395–400), also states that the distinction usually made between Constantinople and Smyrna opium does not really exist, as the opium from the intermediate districts may be sent to both places. At the time of his report, preference was given to Smyrna, because the opportunities for smuggling were greater in the latter place. (For additional information on Smyrna opium, see an excellent article by E. R. Heffter, *Amer. Jour. Pharm.*, 1868, p. 362, and translation of an official Turkish bulletin on poppy-growing, *Amer. Jour. Pharm.*, 1883, p. 413, from *Pharm. Jour. Trans.*)

Good commercial opium is described by the *U. S. P.* as occurring "in irregular or subglobular cakes, with the remnants of poppy leaves and fruits of a species of Rumex adhering to the surface; plastic, or of a harder consistence; chestnut-brown or darker, and somewhat shining; internally showing some tears and fragments of vegetable tissue. It has a sharp, narcotic odor, and a peculiar, bitter taste"—(*U. S. P.*). The Smyrna opium cakes vary in weight from about 300 to 700 grammes, or about ½ to 2 pounds; in rare cases, they weigh as much as 3 kilogrammes, or over 6 pounds (Flückiger, *Pharmacognosie*, 3d ed., 1891, p. 178). The only change that good opium undergoes by keeping, is that of becoming gradually hard; too moist varieties are apt to become moldy.

Persian Opium.—This variety first appeared on the market in the later fifties. It is chiefly grown in the provinces of Kermanshah and Ispahan, from the variety *Papaver somniferum*, Linné, var. *album* (*Papaver officinale*, Gmelin), and is said to contain, when pure, from 13 to 16 per cent of morphine, while the Smyrna opium contains, at best, little over 13.5 per cent (*Amer. Jour. Pharm.*, 1885, p. 36). Persian opium, however, has greatly lost in favor, owing to its being frequently adulterated. It is mixed, for example, with evaporated grape must, or linseed oil (8 to 10 per cent), probably in order to facilitate its being rolled into small balls or cylinders. W. Stoeder (*Jahresb. der Pharm.*, 1884, p. 335) found the best variety to contain about 12 per cent of morphine. It occurs in commerce in the form of cones, weighing about 180 to 300 grammes, or in brick shape, or in circular, flat cakes of 600 grammes weight, or in the form of small cylinders wrapped in glazed paper, and weighing about 15 grammes (see Reveil, *Pharm. Jour. Trans.*, Vol. II, 1860, p. 271). It is shipped from the Persian ports Bushahr and Bender Abbas, and now and then reaches the London market, it being used chiefly in the preparation of pure morphine.

East India Opium.—About 1770 the Calcutta authorities embarked upon the cultivation of opium and its exportation into China, in order to raise revenue for the benefit of the government officials. The astonishing financial success of this measure, however, induced the East Indian Company to assume entire control of this trade, and to exercise strict supervision over the production and disposition of opium (see K. von Scherzer, *Fach. Berichte ü. d. Œst. Ung. Exp. n. Siam, China and Japan*, 1872). For the last 30 years, this trade has been gradually falling off, owing to the competition of the Chinese products (see *Pharm. Jour. Trans.*, Vol. III, 1896, p. 465).

Although East India opium is raised in greater quantity than any other kind of opium, probably, except the Chinese, it reaches the western markets only in small quantities. The principal varieties are the *Bengal* and *Malwah opium*. The *Bengal opium* is raised in the Central Ganges territory between Patna and Benares, and is fully controlled by the government. The opium growers must obtain a license, and must sell their product, which must possess a specified consistency (70 per cent of dry substance), to the government. It is produced in nearly the same manner and under the same precautions as Smyrna opium. The capsules are repeatedly cut by means of a knife with several parallel blades tied together. The opium growers bring their product to the government factories where it is roughly assayed, mixed in vats and filled into previously prepared shells of agglutinated poppy leaves. The balls thus formed weigh about 2 kilogrammes each; they are then rolled in "poppy-trash," *i.e.*, broken leaves, capsules, and stalks, then dried by exposure to the air and in drying rooms, and finally put in chests, each holding 40 balls. (See an explicit description of the Bengal opium manufacture, and the mode of its official supervision, by W. C. B. Eatwell, *Pharm. Jour. Trans.*, Vol. XI, 1851, pp. 269, 306, and 359; also J. R. Jackson, *Pharm. Jour. Trans.*, Vol. I, 1871, p. 782.) This opium is a rather inferior grade, owing to possible fermentation, during the several months which are consumed in its manufacture. It contains only from 3 to 4 per cent of morphine, and about as much narcotine. A better grade is the *Patna garden opium* (see Guibourt, *Hist. d. Drogues*, 1876), which is said to reach Smyrna opium in quality. *Malwah opium* is made in Central India; its cultivation is free, only the product has to pay a tax upon delivery at Bombay, from whence it is shipped. It is formed in balls of about 300 grammes each. Malwah opium has been most esteemed by the Chinese. The opium intended for export to China, is called in India *provision opium;* that grown for local consumption is called *excise opium* (*Benares Akbari*). In recent years the latter yielded to the Indian government an annual revenue of about £1,000,000. During 1893 the value of the total exports of opium from India was about £8,000 000 P. L. Simmonds, *Amer. Jour. Pharm.*, 1895, p. 325). The cultivation of opium in other parts of India is insignificant. In the Madras presidency it is prohibited.

CHINESE OPIUM.—Opium was hardly known in China until the importations from India began, about 1780, notwithstanding the protests of the Chinese government. The drug being admitted into China since 1858, the Chinese production has been greatly stimulated by the high import duties placed upon the foreign drug. The Chinese government, although without avail, has, from time to time, issued proclamations placing the penalty of death upon the cultivation of opium, "which covers the nourishing rice-fields with useless and harmful plants" (Scherzer, *loc. cit.*). The chief provinces where opium is now grown are Ssuchuan and Yünnan, and in recent years the import into Shanghai from the western provinces seems to correspond with the decrease in the imports of the English drug (see statistics in *Pharm. Jour. Trans.*, Vol. III, 1896, pp. 465 and 532). The Chinese opium was at one time inferior to the English opium, while also much cheaper, 20 to 50 per cent; but its quality has since improved. (For some interesting information regarding the smoking of opium by the Chinese, see editorial in the *Pharm. Jour. Trans.*, Vol. XIII, 1882, p. 225; G. Birdwood, *ibid.*, Vol. XII, 1881, p. 500; and S. Culin, *Amer. Jour. Pharm.*, 1891, p. 497.)

EGYPTIAN OPIUM.—This is now used only by the natives, and is produced at Akmim, and at Assiout, both on the river Nile. Mr. Martindale (*Amer. Jour. Pharm.*, 1889, p. 187) reports the former to contain 7.24 per cent, the latter only 0.6 per cent of morphine.

AUSTRALIAN OPIUM.—Poppy was first grown in Australia in 1871, and is sown and cultivated in the same manner as Smyrna opium, except that, on account of the antipodal seasons, sowing is done at three different times in the months of June and July, instead of from November to February, as practiced in Asia Minor. An analysis of Bacchus Marsh opium showed 10.65 per cent morphine, and 6.48 per cent narcotine (W. E. Matthews, *Amer. Jour. Pharm.*, 1888, p. 45).

EUROPEAN OPIUM.—Poppy has been planted in various parts of Germany; but while it yields a high percentage of morphine (8.7, 14.8, and 22 per cent in Würtemberg opium, E. Dieterich, 1888), the culture of opium is not promising on account of the great value of ground, and the large cost of labor. Guibourt (*Jour. Pharm. Chim.*, 1862, p. 199) reports on a number of French opiums of high percentage in morphine (from 12 to 22.8 per cent).

American Opium.—Attempts have been made to cultivate poppy in Mississippi, Louisiana, Virginia, Tennessee, Illinois, California, and other states; but while an opium rich in morphine may be obtained from the capsules, the labor it requires would make the cultivation unprofitable. Poppy grown in New Ulm, Minn., yielded 15.23 per cent of morphine, 0.325 per cent narcotine, 0.416 per cent codeine, and 3.5 per cent meconic acid (E. Weschcke, *Amer. Jour. Pharm.*, 1886, p. 407).

Pharmaceutical Preparations of Opium.—(See also other opium preparations under their respective heads.) Opii Pulvis (*U.S.P.*), *Powdered opium:* "Opium dried at a temperature not exceeding 85° C. (185° F.), and reduced to a very fine (No. 80) powder. Powdered opium, for pharmaceutical or medicinal purposes, when assayed by the process given under opium, should yield not less than 13 nor more than 15 per cent of crystallized morphine. Any powdered opium of a higher percentage may be brought within these limits by admixture with powdered opium of a lower percentage, in proper proportions"—(*U. S. P.*).

Opium Deodoratum (*U.S.P.*), *Deodorized opium*, *Opium denarcotisatum* (*U.S.P.*, 1880), *Denarcotized opium.*—"Powdered opium, containing 13 to 15 per cent of morphine, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs]; ether, fourteen hundred cubic centimeters (1400 Cc.) [47 fl℥, 163 ♏]; sugar of milk, recently dried and in fine powder, a sufficient quantity to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Macerate the powdered opium with seven hundred cubic centimeters (700 Cc.) [23 fl℥, 321 ♏] of ether, in a well-closed flask, during 24 hours, agitating from time to time. Pour off the clear, ethereal solution as far as possible, and repeat the maceration with two further portions of ether, each of three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏], first for 12 hours, and the last time for 2 hours. Collect the residue in a weighed dish, dry it, first by a very gentle heat, and finally at a temperature not exceeding 85° C. (185° F.), and mix it thoroughly, by trituration, with enough sugar of milk to make the product weigh one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]"—(*U. S. P.*). The purpose of this process is to remove narcotine from opium by means of ether, in which it is soluble, while morphine is nearly insoluble (see *Morphina*).

Adulterations and Tests.—In addition to the adulterants before enumerated, opium may be falsified with stones, sand, clay, gypsum, litharge, starch, gum Arabic, ashes, fragments of poppy capsules, resins, wax, licorice juice, etc. Some of these additions may be recognized by closer ocular or microscopic examination; others may be more difficult to detect. Inorganic matter will be indicated by the increase in ash, of which good opium yields not more than 5 or 6 per cent. Gum would be indicated by a gelatinous consistency of a hot aqueous infusion of opium; starch by the iodine test; licorice extract by a dark coloration of the moderately diluted aqueous infusion.

The presence of morphine alone in a vegetable extract does not suffice to prove the extract to contain opium; it must also give the tests for *meconic acid*. This is done in the following manner: Filter the aqueous infusion of the supposed opium, treat it with excess of solution of acetate of lead, and set aside in a tall vessel for the precipitate of meconate of lead to subside; the clear liquor holds in solution acetate of morphine. Pour off the supernatant fluid, and collect the precipitate on a filter. Test the clear filtrate for morphine by evaporating to dryness with potassium carbonate, abstracting the morphine with alcohol, and applying to it the tests as given under morphine (see *Morphina*). Test the precipitate for meconic acid by suspending it in water and decomposing the lead salt by a current of hydrogen sulphide gas or with diluted sulphuric acid; filter, and in the first case, expel the excess of gas by warming on the water-bath, and apply to the solution the tests for meconic acid (see *Meconic Acid*, p. 1413).

Purchasers of opium in former years relied almost exclusively on external characters, as color, odor, taste, texture, moisture, and freedom from obvious admixture. In recent years, the quality of a given opium is judged mainly by its morphine contents, ascertained by reliable assay methods.

As stated above, the *U. S. P.* demands good opium to contain, in its natural moist condition, not less than 9 per cent of morphine. This is to be ascertained by the following official process:

ASSAY OF OPIUM, U. S. P.—"Opium, in any condition to be valued, ten grammes (10 Gm.) [154.3 grs.]; ammonia water, three and five-tenths cubic centimeters (3.5 Cc.) [57 ♏]; alcohol, ether, water, each, a sufficient quantity. Introduce the opium (which, if fresh, should be in very small pieces, and if dry, in very fine powder) into a bottle having a capacity of about 300 Cc., add 100 Cc. of water, cork it well, and agitate frequently during 12 hours. Then pour the whole as evenly as possible upon a wetted filter having a diameter of 12 Cm., and, when the liquid has drained off, wash the residue with water, carefully dropped upon the edges of the filter and the contents, until 150 Cc. of filtrate are obtained. Then carefully transfer the moist opium back to the bottle by means of a spatula, add 50 Cc. of water, agitate thoroughly and repeatedly during 15 minutes, and return the whole to the filter. When the liquid has drained off, wash the residue, as before, until the second filtrate measures 150 Cc., and finally collect about 20 Cc. more of a third filtrate. Evaporate in a tared capsule, first, the second filtrate to a small volume, then add the first filtrate, rinsing the vessel with the third filtrate, and continue the evaporation until the residue weighs 14 Gm. Rotate the concentrated solution about in the capsule until the rings of extract are redissolved, pour the liquid into a tared Erlenmeyer flask having a capacity of about 100 Cc., and rinse the capsule with a few drops of water at a time, until the entire solution weighs 20 Gm. Then add 10 Gm. (12.2 Cc.) of alcohol, shake well, add 25 Cc. of ether, and shake again. Now add the ammonia water from a graduated pipette or burette, stopper the flask with a sound cork, shake it thoroughly during 10 minutes, and then set it aside, in a moderately cool place, for at least 6 hours, or over night.

"Remove the stopper carefully, and, should any crystals adhere to it, brush them into the flask. Place in a small funnel two rapidly acting filters, of a diameter of 7 Cm., plainly folded, one within the other (the triple fold of the inner filter being laid against the single side of the outer filter), wet them well with ether, and decant the ethereal solution as completely as possible upon the inner filter. Add 10 Cc. of ether to the contents of the flask, rotate it, and again decant the ethereal layer upon the inner filter. Repeat this operation with another portion of 10 Cc. of ether. Then pour into the filter the liquid in the flask, in portions, in such a way as to transfer the greater portion of the crystals to the filter, and, when this has passed through, transfer the remaining crystals to the filter by washing the flask with several portions of water, using not more than about 10 Cc. in all. Allow the double filter to drain, then apply water to the crystals, drop by drop, until they are practically free from mother water, and afterward wash them, drop by drop, from a pipette, with alcohol previously saturated with powdered morphine. When this has passed through, displace the remaining alcohol by ether, using about 10 Cc., or more if necessary. Allow the filter to dry in a moderately warm place, at a temperature not exceeding 60° C. (140° F.), until its weight remains constant, then carefully transfer the crystals to a tared watch-glass, and weigh them.

"The weight found, multiplied by 10, represents the percentage of crystallized morphine obtained from the opium"—(*U. S. P.*).

The characteristic feature of the foregoing process, which is practically that of Dr. E. R. Squibb (see *Ephemeris*, 1888, p. 967), consists in precipitating the morphine, by aqua ammoniæ, from a hydro-alcoholic solution of about 30 per cent alcohol. The addition of the latter has the purpose of keeping the coloring matter dissolved. The addition of alcohol is objected to, by E. Dietrich and others, because alcoholized mother liquors will retain a certain quantity of morphine in solution, at least more than an aqueous mother liquor would hold; the addition of alcohol also facilitates the precipitation of calcium meconate which will be added to the weight of, and counted as, morphine. It is believed, however, that these opposite sources of error about balance each other. Ether is used in the assay in order to remove narcotine, which is soluble, while morphine is nearly insoluble, in this solvent (see *Morphina*).

The *U. S. P.* assay process lacks directions for testing the purity of the morphine obtained. The degree of its purity may be judged by several methods: (1) Titration with volumetric acid solutions; (2) incinerating the assay morphine, calculating the weight of the ash as calcium meconate, and deducting this value from the weight of morphine employed; (3) treating the assay-morphine with 100 parts of lime-water and weighing the non-morphine residue; (4) separating the morphine from inorganic salts by means of alcohol. Regarding these methods, and the desirability of perfecting the *U. S. P.* assay method in general, see L. F. Kebler, *Amer. Jour. Pharm.*, 1895, p. 398, and 1896, p. 257; also F. X. Moerk, *ibid.*, 1894, pp. 433–446, and 1897, pp. 343–350. The *German Pharmacopœia*, following Dieterich's process (see *Pharm. Centralh.*, 1886, p. 541, and 1890, p. 597), avoids the use of alcohol. An aqueous infusion of opium (which contains the morphine as sulphate and meconate) is first treated with just sufficient diluted ammonia water to precipitate the bulk of narcotine; the filtrate is then treated with ether and sufficient ammonia water to precipitate the morphine.

Among the recently proposed methods for the assay of opium, the volumetric method of H. M. Gordin and A. B. Prescott (*Pharm. Archives*, 1898, p. 121) stands conspicuous. Its principle is as follows: The opium alkaloids are set free by trituration of the opium sample with a mixture of stronger ammonia water and alcohol, of each 1 part, ether 4 parts, and chloroform 2 parts. The free narcotine, papaverine, codeine, and thebaïne, are then removed by percolation with benzol, after which the morphine is taken out by percolation with acetone or pure amyl alcohol. This solvent is evaporated, the residue taken up with lime-water which completely dissolves and purifies the morphine. Filter the lime solution, acidulate it, to a very slight excess, with hydrochloric acid, and determine the morphine as *periodide* ($C_{17}H_{19}NO_3.HI.I_3$) by adding an excess of decinormal iodine volumetric solution, shaking thoroughly until the precipitate has subsided and the liquid is clear; the excess of iodine is then titrated back in an aliquot part of the liquid, with decinormal sodium thiosulphate solution. One Cc. of decinormal iodine solution corresponds to 0.00947937 gramme of morphine. This method gives higher results than the *U. S. P.* assay method (see *Proc. Amer. Pharm. Assoc.*, 1898, p. 372).

Chemical Composition.—The characteristic constituents of opium are its alkaloids, of which about 20 have been discovered. They occur mostly combined with sulphuric acid and with *meconic acid;* narcotine, being a weak base, seems to occur in the free state. Some opiums do not contain all these alkaloids. For example, specimens of French opium, according to Decharme (1862), were free from narcotine, narceïne and thebaïne. E. Kauder (*Archiv der Pharm.*, 1890, pp. 419–431) found eleven *crystallizable* alkaloids in opium, viz.: morphine, codeine, narceïne, narcotine, papaverine, thebaïne, and the rarer alkaloids, cryptopine (70), laudanine (20), protopine (3.5), laudanosine (1), and a new alkaloid, *tritopine* (2); the relative proportions of the latter being indicated by the numbers affixed. The alkaloids lanthopine, codamine, and hydrocotarnine of O. Hesse (1870 and 1871), were not observed in E. Kauder's opium material. Morphine, however, occurs in all opiums. Indifferent substances in opium are *meconin* ($C_{10}H_{10}O_4$), and *meconoiosin* ($C_8H_{10}O_2$). According to Flückiger (*Pharmacognosie des Pflanzenreichs*, 3d ed., 1891, p. 182), opium contains also small amounts of caoutchouc, wax, and sugar; mucilage, not identical with gum Arabic, albumen, pectin, coloring matter, and inorganic matter (3 to 5 per cent of ash). Starch, fat, and tannin, seem to be absent. The following table enumerates the peculiar constituents of opium:

Name.	Formula.	Discoverer.	Per cent.	Notes.
ALKALOIDAL				
Narcotine	$C_{22}H_{23}NO_7$ (Matthiessen and Foster, 1863)	Derosne, 1803 Robiquet, 1817	2 to 10	*Opianine* of Hinterberger; weak base.
Morphine	$C_{17}H_{19}NO_3+H_2O$ (Laurent)	Sertürner, 1811	2.7 to 22.8	(See *Morphina*.
Codeine	$C_{18}H_{21}NO_3+H_2O$ (Gerhardt	Robiquet, 1832	0.2 to 0.75	Methyl-morphine (see *Codeina*
Narceïne	$C_{23}H_{29}NO_9$ Anderson	Pelletier, 1832	0.1 to 0.4	Weak base; not very poisonous.
Thebaïne	$C_{19}H_{21}NO_3$. (Anderson)	Thibouméry, 1835	0.2 to 1	Strongly basic.

Name.	Formula.	Discoverer.	Per cent.	Notes.
ALKALOIDAL				
Pseudo-morphine	$C_{34}H_{36}N_2O_6$	Pelletier and Thiboumery, 1835	0.02 or traces	Identical with Polstorff's *Oxy-dimorphine* (1880) see *Morphina*.
Papaverine	$C_{20}H_{21}NO_4$	Merck, 1848	0.5 to 1	Not very poisonous.
Rheadine	$C_{21}H_{21}NO_6$	Hesse, 1865	2.1	From red poppy *Papaver rhœas*; weak base; sublimable.
Cryptopine	$C_{21}H_{23}NO_5$ (O. Hesse, 1871	T. & H. Smith 1867	0.003 hydrochloride	*Pharm. Jour. Trans.*, Vol. VIII, p. 595.
Codamine	$C_{20}H_{25}NO_4$	O. Hesse, 1870	....	Sublimable.
Laudanine	$C_{20}H_{25}NO_4$	O. Hesse, 1870	....	Acts like strychnine.
Lanthopine	$C_{23}H_{25}NO_4$	O. Hesse, 1870	....	Not basic.
Meconidine	$C_{21}H_{23}NO_4$	O. Hesse, 1870	....	Amorphous.
Protopine	$C_{20}H_{19}NO_5$	O. Hesse, 1871	....	Also in *Chelidonium* and *Sanguinaria* (see *Amer. Jour. Pharm.*, '90, p. 13).
Hydrocotarnine	$C_{12}H_{15}NO_3+\frac{1}{2}H_2O$	O. Hesse, 1871	....	Obtainable from narcotine.
Laudanosine	$C_{21}H_{27}NO_4$	O. Hesse, 1871	....	Resembles tritopine.
Oxy-narcotine	$C_{22}H_{23}NO_8$	Beckett and Wright, 1875	....	From the mother liquors of narceïne.
Gnoscopine	$C_{22}H_{23}NO_7$	T. & H. Smith 1878, 1893	....	Isomeric with narcotine.
Tritopine	$C_{42}H_{54}N_2O_7$	E. Kauder, 1890	....	*Amer. Jour. Pharm.*, 1890, p. 492.
Xanthaline	$C_{37}H_{36}N_2O_9$	T. & H. Smith 1881, 1893	....	*Amer. Jour. Pharm.*, 1893, p. 240.
NON-ALKALOIDAL				
Meconic acid	$C_7H_4O_7+3H_2O$	Sertürner, 1805	2.5 to 5.5	
Meconin	$C_{10}H_{10}O_4$	Dublanc, 1828 Couerbe, 1832	0.01 to 0.086	Or *opianyl*; bitter, neutral; by reduction of narcotine.
Meconoiosin	$C_7H_4O_7$	T. & H. Smith, 1878	....	*Pharm. Jour. Trans.*, Vol. VIII, p. 981.
Opionin	Nitrogen free	O. Hesse, 1885	....	*Amer. Jour. Pharm.*, 1885, p. 425.

The separation of these substances is effected, according to the method of Gregory, Robiquet, and Anderson (see *Morphina*). (For details, see Husemann and Hilger, *Pflanzenstoffe*, p. 669.) An analytical scheme of separating opium alkaloids has been devised by P. C. Plugge (*Amer. Jour. Pharm.*, 1887, p. 511, and *Pharm. Jour. Trans.*, Vol. XVIII, 1888, p. 692).

I. NARCOTINE (*Narcotia*) ($C_{22}H_{23}NO_7$, Matthiessen and Foster) may be obtained by extracting opium, first with cold ether, which removes wax and fatty matter, then with warm ether, and recrystallizing the narcotine from alcohol. It crystalizes in rhombic prisms, is tasteless and odorless, little soluble in boiling water, soluble in 100 parts of cold, in 20 parts of boiling 85 per cent alcohol, in 166 parts of cold, in 48 parts of warm ether, and in 2.69 parts of chloroform, in 60 parts of acetic ether, in 22 parts of benzol, and 300 parts of amyl alcohol; insoluble in cold, but soluble in hot solution of caustic potash or lime.

Narcotine is a weak base, forming with acids uncrystallizable, bitter, and soluble salts of acid reaction, decomposable by excess of water, or by evaporation if combined with a volatile acid. Concentrated sulphuric acid dissolves narcotine first colorless and then yellow, and later reddish-yellow; the colorless solution, gradually heated, turns orange-red and exhibits beautiful blue-violet streaks, finally a red-violet color. Neutral narcotine solutions, *e. g.*, in chloroform, are optically lævo-rotatory; in acid solution the rotation is reversed to the right. *Narcotine*, when oxidized with sulphuric acid and manganese dioxide, yields needles of *cotarnine* ($C_{12}H_{13}NO_3+H_2O$), little soluble in water, and crystallizable, bitter *opianic acid* ($C_{10}H_{10}O_5$), soluble in hot water (Wöhler, 1844). The latter acid yields upon further oxidation *hemipinic acid* ($C_{10}H_{10}O_6$), and upon reduction with nascent hydrogen *meconin* ($C_{10}H_{10}O_4$). *Cotarnine* is a soporific, and is also a motor paralyzant. The complete graphic formula of narcotine is now known; according to Roser, it is closely related to hydrastine (see A. R. L. Dohme's report in *Western Druggist*, 1895, p. 58). The effects of *narcotine* upon the system are but imperfectly known. Magendie states that a grain of it dissolved in olive oil and administered to a dog, was followed by death in about 24 hours, while 24 grains, dissolved in acetic acid, diluted, produced no effect. It is very probable that pure narcotine does not possess any very active narcotic powers, and that the first experiments were made with an impure article. Undoubtedly, some morphine is often present in narcotine. Three grains of narcotine, dissolved in diluted hydrochloric acid, and repeated 3 times daily, have been strongly recommended as a powerful antiperiodic, acting without occasioning constipation, uneasiness, and cephalalgia, but frequently causing copious diaphoresis (*Br. and For. Med. Rev.*, Vol. VIII, p. 263 . Upon animals narcotine exhibits convulsive effects, but not upon man. Bartholow compares its action upon man to the actions of the alkaloids of the berberine class; upon animals to those of strychnine, etc.

II. MORPHINE (*Morphia*) ($C_{17}H_{19}NO_3$) (see *Morphina*).—*Apomorphine* (*Apomorphia*) ($C_{17}H_{17}NO_2$) is the name given to an artificial base derived from morphine by Matthiessen and Wright. It is white or grayish-white, non-crystalline, but soon turns green when exposed to the air, is partly soluble in water, soluble in alcohol, ether and chloroform, yielding different colored solutions with each menstruum, and in very small doses is a powerful, non-irritant emetic and contrastimulant. Its crystallized hydrochlorate is now official (see *Apomorphinæ Hydrochloras*).

III. CODEINE (*Codeia, Methyl-morphine*) ($C_{18}H_{21}NO_3.H_2O$). (See *Codeina*.)

IV. NARCEINE (*Narceia*) ($C_{23}H_{29}NO_9$).—It is obtained from the mother liquors remaining from the preparation of morphine. It crystallizes in rhombic prisms or needles, is first bitter, afterward styptic, and without odor. Very divergent melting points have been found. The crystals contain some water which it is difficult to expel at 100° C. (212° F.). They are soluble in boiling water and boiling alcohol, insoluble in ether, benzol, petroleum ether, slightly soluble in amyl alcohol and chloroform. Narceine is more soluble in diluted alkalies and ammonia water than in cold water. Narceine is a weak base, but forms with diluted acids crystallizable and soluble salts. When exposed to heat, a smell resembling that of herring-brine (*trimethylamine*) is evolved. Concentrated sulphuric acid colors pure narceine brown, but the solution is light-yellow, and changes to deep red. If rhœadine, thebaine, or papaverine are present, a blood-red or blue color will result. Narceine dissolves in concentrated nitric acid with blood-red color. Diluted solution of iodine colors it blue. If narceine is treated with a little concentrated sulphuric acid, and a small amount of sodium nitrite is added, a brown-green coloration is formed, turning blue at the edges; upon heating, a blue-violet color arises. The therapeutical properties of *narceine* are not well known; it is supposed, however, to influence the inferior part of the spinal marrow, diminishing sensation and mobility in the inferior extremities. It was once thought to be equal to morphine, but free from the unpleasant effects of the latter. Five grains or more of it act as a feeble hypnotic in man. It is not convulsant, and by some is regarded as wholly inert.

V. THEBAÏNE (*Thebaina* of Couerbe, 1835; *paramorphia* of Pelletier, 1832) ($C_{19}H_{21}NO_3$), was discovered by Thiboumery, in 1832, in Pelletier's chemical establishment. It may occur in rectangular scales or needles, or crystalline granules It has an acrid, styptic taste, and is of a strong alkaline reaction, forming water-soluble salts with acids, crystallizable from alcohol and ether. Thebaïne melts at 193° C. (379.4° F.), and becomes negatively electric upon friction. It is insoluble in water and diluted alkalies; soluble in boiling alcohol, and ether, in about 10 parts of benzol and 60 parts of amyl alcohol; little soluble in chloroform, insoluble in petroleum ether. Boiling with diluted hydrochloric acid converts thebaine into the amorphous bases *thebenine* and *thebaïcine*. Both turn blue with concentrated sulphuric acid. Thebaïne is dissolved by concentrated sulphuric acid with blood-red color, changing to yellow-red. (See additional reactions of this and all other opium bases in Charles E. Sohn, *Dictionary of the Active Principles of Plants*, London, 1894; also see discussion of the probable graphic formula of *thebaine* by Prof. Freund, in *Chem. Centralblatt*, Vol. II, 1897, p. 314. *Thebenine* has the formula $C_{18}H_{19}NO_3$ (Freund).

Thebaïne is considered to be a poison analogous to strychnine, occasioning, in a small dose, tetanic symptoms resembling those produced by that alkaloid. One and one-half grains, hypodermatically, produce in man anodyne and hypnotic effects without nausea or headache, being equal in power to ¼ grain of morphine.

VI. PAPAVERINE (*papaverina*) ($C_{21}H_{21}NO_4$).—Pure papaverine crystallizes from alcohol in the form of a network of acicular, white crystals, insoluble in water, but readily soluble in boiling alcohol or ether, in 37 parts of benzol and 76 parts of amyl alcohol; also soluble in warm petroleum ether. Chloroform abstracts it both from acid and alkaline solutions (Dragendorff). It melts at 147° C. (291.4° F.). Papaverine forms crystallizable salts with acids, soluble with difficulty in water. From solution of papaverine in diluted hydrochloric acid addition of strong hydrochloric acid precipitates a heavy oil, the hydrochloride, which soon solidifies to a crystallized mass. Papaverine is colored a deep blue by concentrated sulphuric acid; the solution becomes violet and slowly fades. Potassium permanganate colors this solution green, which changes to a slate color. Strong sulphuric acid containing 0.1 per cent of sodium molybdate, produces with papaverine a beautiful violet coloration changing to blue, and fading within 24 hours. Papaverine has been recommended as a sedative and soporific in mental affections, mania, etc., by certain physicians; while on the other hand, others state that it does not possess any therapeutical virtues. The graphic formula of papaverine has been elucidated by Goldschmidt (see Dohme, *loc. cit.*).

VII. RHŒADINE ($C_{21}H_{21}NO_6$) was discovered by Hesse in 1865. Besides being a constituent of opium, and the ripe capsules of *Papaver somniferum*, it is found in all parts of *Papaver rhœas*. It forms tasteless, non-poisonous, white, prismatic crystals, melting at 232° C. (449.6° F.), and sublimes in the form of long crystals at a slightly higher heat. It is indistinctly alkaline, almost insoluble in water, alcohol, ether, benzene, chloroform, and ammonia water. Moderately strong hydrochloric or sulphuric acids dissolve *rhœadine* with a deep purple-red color. This alkaloid is thereby differentiated into a colorless, crystallizable isomer of rhœadin called *rhœagenine*, and a red coloring matter. *Rhœagenine* is distinctly basic to litmus, and forms salts with acids. The coloring matter is sufficiently intense to be still visible in a dilution of 1 in 800,000. *Rhœadine* is dissolved by concentrated sulphuric acid with olive-green, by concentrated nitric acid with yellow color.

VIII. CRYPTOPINE (*Cryptopia*) ($C_{21}H_{23}NO_5$) was discovered, in 1867, by T. & H. Smith, of Edinburgh (see process in *Amer. Jour. Pharm.*, 1867, p. 421), in minute, silky, white, hexagonal prisms or plates, inodorous, slightly bitter, but soon followed by a peculiar sense of coolness recalling the taste of oil of peppermint. When heated it is volatile without residue; it fuses at 217.3° C. (422° F.). It is decidedly alkaline, perfectly neutralizing the strongest acids, and forming salts, of which the sulphate, acetate, hydrochlorate, etc., have been obtained in distinct crystals; however, they all have a tendency to form a jelly. Cryptopine is almost insoluble in water, ether, and benzol; it is soluble in alcohol, or chloroform; insoluble in benzin, oil of turpentine, ammonia water, and caustic mineral alkalies, but readily soluble in diluted acetic, nitric, sulphuric, or hydrochloric acids. Concentrated sulphuric acid gives a blue color with it; but the slightest tinge of purple (or blood-red) indicates the presence of thebaïne. A small particle of niter (potassium nitrate) added to the blue acid solution produces a permanent green color. Papaverine would change through green to orange-red. Cryptopine is anodyne and hypnotic, acting upon man similarly to morphine without the disadvantages of the latter. Said to be four times weaker than morphine; upon the lower animals it is reputed tetanizing and convulsant.

As regards the rarer opium bases, *laudanine*, *laudanosine*, *codamine*, *protopine*, etc., see O. Hesse (Liebig's *Annalen*, Vol. CLIII, p. 47, and Supplement, Vol. VIII, p. 261); and O. Kauder (*Archiv der Pharm.*, 1890, p. 419), as well as the references given in the above table.

IX. MECONIC ACID ($C_7H_4O_7.3H_2O$).—This acid may be obtained from an aqueous infusion of opium by precipitating it with calcium or barium chloride, as calcium or barium meconate, and decomposing these salts by means of sulphuric or oxalic acids (compare *Morphina*). Meconic acid crystallizes from water in the form of micaceous scales or rhombic prisms, which lose their water of crystallization at 100° C. (212° F.). Meconic acid tastes sour, and reddens blue litmus paper. It is little soluble in cold water, easily soluble in 4 parts of boiling water, also in alcohol; insoluble in chloroform, not easily soluble in ether. Meconic acid is dibasic, and accordingly forms two series of salts with bases; only the neutral alkali and ammonium meconates are soluble in water; the salts of other metals are insoluble. Thus meconic acid forms insoluble white meconates with silver nitrate, barium chloride, and lead acetate, the precipitates being soluble in nitric acid. A green precipitate of copper meconate is formed when solution of meconic acid is mixed with solution of ammoniated copper sulphate. Morphine seems to combine with meconic acid only in one proportion, forming the neutral dimorphine meconate ($[C_{17}H_{19}NO_3]_2.C_7H_4O_7.5H_2O$) (see *Morphinæ Bimeconas*).

A characteristic reaction for meconic acid consists in the blood-red coloration it yields with a neutral solution of ferric chloride. This reaction is similar to that produced when ferric chloride is mixed with potassium sulphocyanate (*rhodanate*). The ferric meconate, however, is insoluble in ether, while the ferric rhodanate is soluble; solution of corrosive sublimate destroys the rhodanate of iron, while it does not affect the meconate. Boiling the solution of ferric meconate does not cause a precipitate or discoloration; while solution of ferric acetate which is of a similar color, would precipitate brown ferric oxyacetate, while the solution would become colorless.

When exposed to about 120° C. (248° F.), meconic acid is decomposed into carbonic dioxide and crystallizable *comenic acid* ($C_6H_4O_5$), upon further heating, sublimable *pyromeconic acid* ($C_5H_4O_3$) is formed, with additional loss of carbon dioxide, water, acetic acid, and benzol. Meconic acid partly undergoes the first-named decomposition even when heated in aqueous solution.

Action and Toxicology.—Opium is narcotic and stimulant, acting under various circumstances as a sedative, antispasmodic, febrifuge, diaphoretic, and an inspissant of the mucous secretions. Topically, it is a direct stimulant and indirect sedative of the nervous, muscular, and vascular systems. A medium dose, taken while in health, augments the volume and velocity of the pulse, increases the heat of the surface, gives energy to the muscles, renders the mind more acute, and produces a general excitement of the whole system: the brain is especially acted upon, the faculties becoming more clear, the ideas more brilliant, precise, and under control, the power of application more intense, the conversational energies augmented, and frequently a state of frenzy or hallucination is induced. After a time this stimulation abates, leaving a calm, careless, indifferent, pleasurable sensation, with a series of obscure fleeting ideas, which is succeeded, after a longer or shorter period, by sleep, which may continue for several hours, and is followed by giddiness, languid pulse, sickness at stomach, cephalalgia, tremblings, want of appetite, and other indications of derangement of the nervous system. Other effects likewise occur during the period of its influence upon the system, thus—the mucous secretions become suspended, constipation is induced, the cutaneous secretion is increased, and the urinary and biliary secretions may be unaffected, or merely inspissated, in consequence of their discharges being impeded. The retention of urine and constipation, sometimes exist for several days. Generally, no serious results occur from this action of opium, except from a repetition of the dose, so often as to impair the vital powers by continuous over-stimulation. The unpleasant symptoms following the sleep caused by opium may be removed by lemon-juice, strong coffee, or a cathartic.

The effects of opium vary in different persons, and not unfrequently in the same individual under dissimilar circumstances. In some persons the smallest dose will cause nausea, emesis, and gastro-intestinal spasm; in others it will occasion feverishness, headache, watchfulness, restlessness, startling, disagreeable visions, delirium, anxiety, and afterward, an aggravated degree of the more familiar subsequent effects of this drug; these phenomena constitute what is called the *idiosyncratic action of opium*. Though commonly the result of idiosyncrasy, yet these symptoms are often induced in persons with whom opium in general agrees, simply because the specific indications for the drug are unheeded. Lemon-juice or vinegar renders the action of opium more favorable and less liable to produce the above disagreeable consequences. An unpleasant prickling sensation on the surface of the body, or a troublesome itching, occasionally accompanied with a slight eruption, is sometimes produced by opium, or more readily by salts of morphine. Occasionally, the rash resembles that produced by scarlatina, and desquamation follows. Again, the efflorescence may be of an urticarial nature. The narcotic power of opium is lessened by certain states of disease, as in the advanced stage of pneumonia, or peritonitis, by profuse hemorrhage, especially uterine, by severe dysentery, delirium tremens, some varieties of mania, tetanus, and severe pain or spasm of any kind. It is also modified by the conjunction of other remedies; camphor is thought to diminish the chance of its subsequent or idiosyncratic effects; and given with ipecacuanha, three or four times the ordinary hypnotic dose may be administered without inducing sleep, but with the effect of bringing on sweating with much greater certainty. Belladonna is antagonistic in its effects to those of opium and has been used in cases of poisoning by the latter agent, as an antidote; but when used for this purpose the means hereafter named must not be omitted. Persons who are ordinarily very nervous are very susceptible to the effects of opium. Females are more easily impressed by it than males, and it should be remembered that infants are extremely susceptible to it, even very small doses having been energetic enough to produce death. Nursing infants may be narcotized by the mother's milk while opiates are being taken. On account of the imperfect eliminative powers, opium and its derivatives should be cautiously used upon the aged.

Through whatever channel opium is introduced into the body—the stomach, the rectum, a wound, vein, excoriation, blistered surface, etc.—its remote action is exerted on the brain. It acts most energetically when it is promptly absorbed. When opium, or any of its preparations, is applied freely to a blistered, excoriated, or inflamed surface, its effects should be attentively watched, for dangerous accidents have occasionally happened in this way.

In large doses, opium is a poison, producing death if the proper remedies are not promptly and unremittingly resorted to. The state of stimulation and vivacity, if caused at all, is of short duration, being speedily followed by depression of the circulation, and of the functions of the brain, as manifested by diminution of the frequency of the pulse, but not of force, prostration of muscular power, slow, stertorous, and afterward soft or almost imperceptible respiration, flaccidity of the extremities, languor, drowsiness, torpor, or coma, first livid or turgid, afterward pale features, livid lips, excessively contracted pupils, coldness of the limbs, generally retention of the urine, and frequently profuse, cold perspiration, together with an almost entire apathy to external agencies. This state ends in death, unless speedily relieved. Convulsions may precede death, especially in children, and the pupils dilate just previous to death. It is said that in children the strong pupillary contraction may persist until dissolution. Death is due to respiratory paralysis or asphyxia. Post-mortem examination may reveal cerebral congestion, the brain sometimes being ecchymosed in spots. The cerebral convolutions have been observed to be flattened, and serum may or may not be collected in the ventricles and at the base of the brain, between the membranes. Extravasation of blood on the brain is rarely found, but upon cutting the cerebral substance minute drops of dark blood may ooze from the divided capillaries. The vessels of the spinal cord may be engorged with blackish blood. The spleen, liver, heart, and lungs are sometimes filled to distension with dark blood, and this is especially true when convulsions have preceded death. Great lividity of the skin is frequently observed, and the pupils are often dilated. Taylor observes (*Med. Jurisprudence*, p. 180) that there is nothing specially indicative of opium poisoning but "fullness of the vessels of the brain;" and this is not always present. If vomiting freely occurs before stupor supervenes, there is a fair chance of recovery. Four grains of opium killed a man of thirty-two, convulsions preceding death, while 2 drachms of laudanum have produced death in an adult. Hypodermatically, $\frac{1}{6}$ grain of morphine has killed an adult. Instances are common where persons addicted to the morphine or opium habit have taken enormous doses without injury; but in those unaccustomed to these drugs, the ordinarily recognized medicinal doses should never be exceeded, and treatment should always be begun with the minimum amounts. When a toxic dose of morphine is injected, narcotism ensues very speedily. Opium may kill within 2 hours, though from 6 to 18 hours usually lapse before death ensues (Taylor). The majority die in from 6 to 12 hours. It must not be forgotten that death may occur after the patient has apparently recovered, this being due to syncope, or to pulmonary congestion.

The remedies are, emetics of mustard and lobelia seed, zinc or copper sulphate, ipecac, or apomorphine subcutaneously, with strong coffee, stomach-pump, external counter-irritation, cold applications to the head and spine, forced exercise, galvanism, and artificial respiration. As soon as the stomach has been properly evacuated by emesis, internal stimulants must be administered, the best of which are brandy and carbonate of ammonium. Alcoholic stimulants should be given in small amounts, lest they increase the narcosis. The importance of keeping the patient in motion must not be overlooked. This may be accomplished by walking the patient between two attendants. The pleadings of the patient to rest must not be heeded, but he should be forced to move and keep awake by flagellations, electric shocks, and alternate dashings of warm and cold water upon the spine. Tickling the throat with a feather may assist in provoking emesis. Sometimes, when vomiting can not be produced, the shock to the nervous system produced by the means employed to prolong wakefulness, will so impress the nerve centers that they will so far recover their powers as to allow emesis to be produced. The respiration must not be allowed to flag. Ammonia may occasionally be inhaled. As before stated, belladonna is antagonistic to opium. Indeed, atropine is regarded as the best antagonist to poisoning by opium and morphine. Repeated small doses, $\frac{1}{70}$ to $\frac{1}{40}$ grain of atropine should be subcutaneously injected at intervals until the pupils begin to dilate. This method is preferable to giving a large dose at once, and is attended with results not otherwise obtainable. Stramonium may be used; also gelsemium, giving it short of sedation. Strychnine and cocaine have also been advised, and nitrate of amyl has some advocates. Permanganate of potassium is said to destroy the activity of morphine, and thus prevents its toxic effects. This requires further confirmation. As soon as consciousness is once fairly restored, an active cathartic, with the continuation of the forced exercise, generally completes the cure. The same toxicological treatment should be pursued in case of poisoning by any of the salts of morphine.

Physiologically, opium and its chief alkaloid affect chiefly the functions of the cerebro-spinal tract. In man, the cerebral functions are most impressed; in animals, the spinal axis. The motor and sensory, as well as the higher nerve-centers, are affected, and the terminal nerve-organs respond to its action. It, at first, stimulates and then paralyzes the cardiac motor ganglia and the end-organs of the vagus. The action of the heart and arteries are, at first, increased, and, secondarily, lowered by these drugs. The overstimulation of the spinal cord observed in the lower animals is not generally observed in the human species, and, when occurring, children being generally the individuals so affected. Opium depresses the sexual functions, and impotence in the male and cessation of the menses are not uncommon in opium habitues.

Medical Uses and Dosage.—The special uses of opium are so numerous that it is impossible to do more here than mention the most important of them. In all *febrile* and *inflammatory diseases*, it was formerly given either alone, or in combination with ipecacuanha to produce diaphoresis. While, in some instances, it will prove useful, as a rule it is now seldom used in *fevers*, as we possess better agents to accomplish the results formerly sought from the use of opium. In cases of *painful inflammatory affections*, however, it is of considerable value. But to prescribe opium and its derivatives intelligently, it is necessary to understand the conditions which are benefited by them, and those in which they produce harmful effects. The patient with the *hard*, small pulse, the dry tongue, dry, contracted skin, the flushed face, bright eye, and contracted pupil, is always injured by the administration of opium. On the contrary, the patient will be benefited when the pulse is *soft* and open, or when small, the waves are short and give a sensation of fullness and always lacking hardness, the skin is soft, the tongue moist, the face pale, and the eyes dull, expressionless, immobile, or dilated. In the last case the drug will act kindly, both in relieving *pain* and *spasm*, as a cerebral and spinal stimulant, and as a stimulant to the vegetative processes, and one need not fear the untoward effects usually attributed to idiosyncrasy. When, in *typhoid* and other *low fevers*, an exhausted state of the nervous system supervenes, then opium, in stimulant doses only, may be employed. In *intermittents*, it sometimes aids the action of quinine. While it has been used in the *exanthematous diseases*, to hasten the appearance of the eruptions, this use of it is not extensive, for better agents are possessed by us, and the use of opium in children's affections should be avoided as far as possible.

As an anodyne-diaphoretic opium, with ipecac, is likewise beneficial in *rheumatic*, *neuralgic*, and *gouty diseases*, in *nervous irritability*, *morbid vigilance*, *restlessness*, *diarrhœa*, and *dysentery*. Opium, as a pain-reliever, is of inestimable value when properly used, while, when improperly administered, it still relieves the pain, but may mask conditions of disease so that the physician may be unable to properly watch the progress of the case, the amount of pain often being his best guide to the seriousness and extent of the trouble. When opium, in stimulant doses, relieves pain, no untoward results need be expected, for, in these cases, it does not relieve the pain unless indicated. The danger lies in its employment as a sedative and narcotic. Fortunately, *neuralgia*, in which opium is so extensively and beneficially used, depends, as a rule, upon a state, the symptoms of which are those in which the drug is specifically indicated. There is nervous debility and often anemia, and opium or morphine acts kindly.

As an antispasmodic, opium is valuable in *asthma*, *colic*, *cholera*, *hysteria*, *tetanus*, some forms of *dyspepsia*, *spasmodic* and *convulsive affections*, especially in spasms accompanying the passage of *biliary* and other *calculi*, or which are present during an attack of *nephritis* or *gout*. Not only does opium relieve the pain, but it also relaxes the spasm attending the passage of the concretions. Here large doses may be necessary. In fact, when no contraindications are present, it is one of our most valued agents in *spasmodic disorders*. Morphine is generally employed in place of opium where pain and spasm are very severe. Hypodermatic injections of full doses of morphine form the best known treatment of *puerperal eclampsia;* its action may be assisted by the inhalation of chloroform and other internal treatment as indicated. When opium or morphine are previously administered, anæsthetization is more easily accomplished with chloroform, and much less of the latter is required. Opium is often useful after severe *surgical operations* to prevent shock and irritative febrile reaction. In *respiratory* and *digestive affections* opium, when indicated, will allay cough, soothe pain, relieve nausea, overcome tenesmus, and calm nervous irritability. It is of much utility in checking abnormal and increased discharges, as in *chronic catarrh*, *excessive secretions from the pulmonary mucous membranes*, *diarrhœa*, *uterine* and other *hemorrhages*, etc. In those painful conditions of the digestive tract, in which the food acts as an irritant and causes distress, bismuth or nux with opium generally relieves. Morphine with bismuth subnitrate is frequently demanded in *gastralgia*. In *diarrhœa*, opium is frequently indicated, and its tincture injected into the rectum, with starch-water, is the only agent, sometimes, that will give relief from tenesmus in *acute dysentery*. At the same time, the proper internal treatment must be pursued. An injection of morphine is the promptest agent for the relief of *cholera morbus*. In the exhausting *choleraic diarrhœa*, rendering one liable to an attack of true *Asiatic cholera*, during the prevalence of that dreaded disease in this country, Prof. Locke employed the following combination with the best of results: ℞ Tincture of opium, tincture of camphor, essence of peppermint, tincture of kino, aa, fl℥j; tincture of capsicum, fl℥ss; neutralizing cordial, fl℥iijss. Mix. Dose, a teaspoonful every $\frac{1}{2}$ hour in severe cases, 3 times a day in mild cases. But little of fluids should be taken, and a mustard plaster applied to the abdomen. In true *cholera*, stimulant injections of morphine often check the cramps, vomiting, and diarrhœa. When *constipation* is due to spasm of the bowels, opium relieves it. Opium, in well-selected cases, is one of the best remedies in *peritonitis* and *enteritis*. Aconite, veratrum, and bryonia will also usually be indicated, but opium, in the form of the diaphoretic or Dover's powder, or even morphine, will give rest from pain and peristaltic movements. In *nervous affections*, opium is a very important remedy, and many of the symptoms of other disorders partake largely of the nervous element. Indeed, it will be found valuable in all symptoms or forms of disease characterized by pain, wakefulness, inflammation, increased nervous excitability, increased mucous secretions, or spasmodic action.

Probably opium formerly killed more individuals suffering from *delirium tremens* than all other agents combined. This was owing to the enormous doses administered without regard to conditions. If the patient can not sleep or can not take food, he will die; if there is kidney disease, opium will probably kill the patient; if there is a flushed countenance, bloodshot eyes, wild and furious delirium, pain in the head, red and turgid tongue, and full, bounding pulse, opium will kill the delirium tremens patient; if, on the contrary, the skin is relaxed and moist, the circulation feeble, the face pale, and the tongue moist and dirty, opium is a safe remedy, for here it stimulates and sustains the nervous powers, and favors sleep. Here morphine is generally employed in a ⅛ or not more than ¼ grain dose, every 3 or 4 hours until sleep is induced (Locke, *Mat. Med.*, p. 241). In *traumatic tetanus*, opium is less valuable than morphine; the patient should be kept fully under the influence of the latter until the spasms are over. Though opium and its preparations should be carefully used in *affections of the heart*, it is one of the very best agents for the relief of *angina pectoris*. Here it, or morphine, which is usually preferred, is to be given in stimulant doses only. Under its use the pain and dyspnœa are relieved, and the action of the heart strengthened. Opium is not a remedy for continuous and persistent *dyspnœa*, but that form which is paroxysmal and occurring particularly upon going to bed. In *asthma*, morphine is one of the palliatives, and may be employed until the action of other agents may be obtained. It is occasionally resorted to in alleviating the distressing *cough of phthisis*. In *threatened abortion*, from over-exertion or nervous agitation, ½ drachm of tincture of opium, injected into the rectum, frequently prevents the accident. Dover's powder may also be used. Opium may be employed in *insomnia*, where cerebral stimulation is required. Of all conditions, it is here that the specific indications must be closely followed. The small or stimulant dose only should be given. The same may be said of it in *insanity*, in the puerperal form of which it seems to give the best service. Opium and morphine are the direct antagonists to the *poisonous effects of atropine*, *belladonna*, *physostigma*, *stramonium*, and *strychnine*.

Opium should not be used internally in cases of excessive inflammatory action, without having first allayed this action considerably by other means; or, if opium be administered, it should be combined with ipecacuanha, as in the compound powder of ipecac and opium, for the purpose of modifying its influence and promoting a determination to the surface. In phrenitis, cerebral congestion, accumulation of blood in the vessels of the head, inflammation of the mucous tissues with diminished secretion, and in ordinary states of costiveness, its employment is not proper. If the costiveness be due to spasmodic action, it may then be given as an antispasmodic in combination with a laxative. Opium is often eaten by persons until it becomes a habit exceedingly difficult to overcome; when taken to excess in this manner it may be known by the deadly pale or sallow aspect, with tokens of emaciation, and a gradual loss of the energies and activity of the whole system. A morphine habitue does not regard truth, and will say and do anything to get the coveted drug. Nervousness, trembling, neuralgic pains, insomnia, loss of appetite, spasms, hyperæsthesia, hallucinations, impotence, cessation of the menses, excessive perspiration, and tendency to self-destruction are among the effects of the habitual use of opium or its alkaloid, by mouth or subcutaneously. Some, however, take them for years without uncomfortable effects only when the supply of the drug is deficient. When the habit can be cured it is usually accomplished by the gradual withdrawal of the drug, and the substitution of small amounts of atropine until the full effects of the latter are obtained. Tonics, capsicum, good feeding, amusements, exercise in the open air, and pleasant society do much to assist in the cure. There is, however, a strong tendency to return to the habit. When the nervous system can withstand the shock it is best to wholly withdraw the drug at once. Murrell very properly remarks that "a good cook is half the battle," for good, stimulating, and nourishing food must be taken and assimilated if good results are to be expected. De Quincy, in his work entitled "*Confessions of an English Opium-eater*," states that he has taken 8,000 drops of laudanum, or 210 grains of opium daily; and attributes his cure of this lamentable vice to the use of the ammoniated tincture of valerian as a substitute for his opiate stimulant. Probably any other stimulant would have answered the same purpose (see also *Morphinæ Sulphas*).

Externally, opium is employed chiefly to subdue *pain*, and arrest *local inflammatory action;* it is applied in the form of lotion, liniment, or plaster, and is of service in *neuralgia*, *rheumatism*, some forms of *cutaneous diseases*, *irritable blistered surfaces*, *diseased mucous surfaces*, and in *erysipelatous inflammations.* It is likewise added to topical preparations for *inflammation of the eye*, and to *gonorrhœal injections.* There is much variety of opinion among physicians as to the use of this drug as a medicine, some contending against its use and others in its favor. That it is a useful agent in many diseases, and exerts an influence not possessed by any other one, no person will attempt to deny; neither does it, when given in the proper medicinal doses, leave the seeds of after-disease in the system, as is the case with mercurial preparations, which in small doses decompose the constituents of the body; therefore, although its present results may be disagreeable, yet. as they are not permanent, there is no good reason why we should dispense with an agent so well calculated to lessen the effects of disease upon the human system. When we administer the almost death-like prostrating emetic, lobelia, the energetic, prostrating, and nauseating hydragogue, resin of podophyllum, etc., etc., it is too much like prejudice without reason to oppose opium because its effects continue for a few days, or improper doses and carelessness in its use have resulted in death, and which may, in a degree, be said of every active remedy in the materia medica (J. King). In suppository it is useful in *hemorrhoidal* and other *rectal troubles*, as well as some *bladder* and *urethral disorders*, and to allay *reflex vomiting* therefrom.

Dose of opium in pill or powder, from ¼ to 3 grains, according to its influence upon the patient, the character of the disease, and the object to be accomplished. Sometimes larger quantities are given, as in severe tetanic, or other nervous affections, and in cases of severe pain. The medium dose to ease pain and produce sleep, is 1 grain. The dose of the tincture is from 10 to 50 drops. When it can not be taken by mouth, as in cases of *persistent vomiting*, and in *strangury*, severe pain accompanying *diseases of the kidneys*, *bowels*, or *uterus*, and *painful tenesmus*, it may be injected into the rectum with much benefit, adding to it a small quantity of water, flaxseed or elm infusion, starch-water, mucilage of gum Arabic, etc. When thus given the quantity may be twice that exhibited by the mouth—yet the practitioner should be cautious, as some patients are more powerfully influenced by it than others. (For the action of the opium constituents, see respective alkaloids under the chemical composition of opium, and under Morphina and Codeina.)

Specific Indications and Uses.—To give rest from pain and spasm, and to stimulate the vegetative functions and restrain secretions when the pulse is soft and open, or with short waves, the skin soft and moist, and the tongue moist and sometimes dirty.

Some Opium Preparations. Poppy capsules are much weaker in their action than opium; they are occasionally used in the form of syrup or decoction among children, but are in every way inferior to opium itself prepared similarly. The decoction, or the poppy capsules, are used for emollient and anodyne fomentations (see *Papaveris Capsulæ*).

Syrup of Poppies.—A *syrup of poppies* may be made by depriving of their seeds, poppy-heads, 9 ounces, reduce them to a coarse powder, moisten them thoroughly with diluted alcohol and digest for 48 hours; then transfer the whole to a percolator, and gradually pour upon it diluted alcohol until 2 pints of the filtered liquor are obtained; then evaporate by means of a water-bath to 8 fluid ounces, filter, add sugar, 15 ounces; proceed in the manner directed for simple syrup. When cool, add best French brandy, 2 fluid ounces, and mix (C. W. Epting). (See also *Syrupus Papaveris.*)

Sydenham's Laudanum.—*Sydenham's laudanum* is a vinous tincture of opium, made according to the *Parisian Codex*, by macerating for 2 weeks in 1 pint of sherry wine, 2 ounces of opium, 1 ounce of saffron, and 1 drachm each of bruised cinnamon and cloves; then filter. A fluid drachm of this laudanum is equivalent to 3 grains of opium (see also *Tinctura Opii*).

Rousseau's Laudanum.—*Rousseau's laudanum* is made by exposing a vessel, in which 6 ounces of honey have been dissolved in 1½ pounds of hot water, to a temperature of about 26.6° C. (80° F.), until fermentation commences; then add 2 ounces of good opium previously diffused in 1 pound of water, and again expose to a temperature of 26.6° C. (80° F.), for a month; express, filter, and evaporate to 5 ounces, to which 1 ounce of alcohol should be added. Six drops of this preparation are equivalent to 1 grain of opium.

Black Drop.—*Black*, or *Quaker's drop*, is variously made; the Edinburgh formula is: "Take of opium, 4 ounces; distilled vinegar, 16 fluid ounces. Cut the opium into small fragments, triturate it into a pulp with a little of the vinegar, add the rest of the vinegar, macerate in a closed vessel for 7 days, and agitate occasionally. Then strain and express strongly, and filter." The aromatics added in some formulæ are unnecessary (see also *Acetum Opii*).

Related Preparation.—PAPINE. A specialty of Battle & Co., of St. Louis, Mo., containing the anodyne principle of opium without the narcotic and convulsive constituents. Used to control *pain* and *acute inflammatory disorders*. One fluid drachm, the dose for an adult, equals in pain-relieving power ⅛ grain of morphine; for infants under 1 year, from 2 to 10 drops.

Related Species and Product.—*Eschscholtzia californica*, Chamisso; *California poppy*. This papaveraceous plant, the adopted flower of the state of California, is reputed analgesic and soporific without the dangers attending opiates. Prof. G. F. Walz years ago (1844) found in it two alkaloids, one acrid, the other bitter, besides *sanguinarine* and some succinic acid. Bardet and Adrian, in 1888, found in it a glucosid and two alkaloids, one of which gave the reactions for morphine. According to E. Schmidt and L. Reuter (*Pharm. Centralhalle*, 1889, pp. 590 and 611), the morphine-like body is *protopine*, one of the alkaloids of opium. By some the alcoholic extract has been used to the extent of 185 grains in a day, commencing with a 12-grain dose. Its action is pronounced valuable, quieting pain and producing calm sleep. Respiration is depressed by large doses, while toxic quantities impress the spinal cord.

METHYLTHEBAINE ($C_{20}H_{23}NO_3$), a derivative of thebaine, found by physiological tests to act similarly to, but less energetically, than thebaine.

ORIGANUM.—ORIGANUM.

The plant *Origanum vulgare*, Linné.

Nat. Ord.—Labiatæ.

COMMON NAME: *Wild marjoram.*

Botanical Source.—*Origanum vulgare*, or *Wild marjoram*, is a perennial herb, with erect, leafy, hairy, purple, quadrangular, corymbose stems, from 6 inches to 2 feet in height. The leaves are opposite, petiolate, broad-ovate, obtuse, subserrate, hirsute, rounded at the base, green on both sides, sprinkled with resinous dots, and paler beneath; the petioles hairy, and one-fourth as long as the leaves. The flowers are numerous, purplish-white, in smooth, erect, roundish, panicled, and fasciculate spikes, accompanied with ovate, purplish bracts longer than the calyx. Calyx ovate-tubular, striated, with 5 nearly equal teeth, and hairy in the throat. Corolla funnel-shaped, about the length of the calyx, and slightly 2-lipped; upper lip suberect, flat, and emarginate, the lower trifid, with lobes nearly equal. Stamens 4, exserted, somewhat didynamous, with double anthers; stigma bifid and reflexed. Achenia dry and somewhat smooth (G.—W.—L.).

History and Chemical Composition.—Wild marjoram is common to Europe and America. It is found in limestone regions, on dry banks, and in dry fields and woods, flowering from May to October. The whole herb is medicinal, but it is seldom collected, except for the purpose of procuring its volatile oil (see *Oleum Origani*), on which its virtues depend, and which may be separated by distillation with water. The plant has a strong, peculiar, rather agreeable balsamic odor, and a warm, bitterish, aromatic taste, which properties are imparted to alcohol, or boiling water by infusion. This plant contains a bitter body and some tannin.

Action and Medical Uses.—Origanum is gently stimulant, tonic, and emmenagogue. A warm infusion produces diaphoresis, and tends to promote menstruation, when recently suppressed from cold. It is sometimes employed externally in fomentation.

Related Species.—*Origanum Majorana*, Linné (*Majorana hortensis*, Moench), or *Sweet marjoram*, possesses properties similar to the above species. It is a native of Portugal, but cultivated in our gardens, and much used in cookery as a seasoning. Its leaves are oval or obovate, obtuse, entire, petiolate, hairy, pubescent, flowers pink-colored, in compact, roundish, pedunculate, terminal spikes, with roundish bracts. It flowers a month earlier than the preceding species. Its odor is stronger and more agreeable, and its taste more camphoraceous (W.). It yields a volatile oil (see *Oleum Majoranæ*, under *Oleum Origani*). Used in cookery and for the same purposes as origanum.

Origanum creticum, Linné.—South Europe. Leaves pungent and aromatic. Flowers whitish. It yields a volatile oil, used like those above.

Origanum hirtum, Link.—This plant yields an essential oil, often substituted in commerce for the oil of the preceding species (see under *Oleum Origani*).

Origanum Dictamnus, Linné, Levant.—Deep-purple flowers. Plant pungent and aromatic.

Lippia origanoides, Kunth (*Nat. Ord.*—Verbenaceæ). Mexico. This plant is known among the native Mexicans as *origano*.

Lippia Mexicana.—An evergreen shrub of Mexico. In ½ to 1 drachm doses a saturated tincture (1 in 4) of the stalks and leaves has been used as a demulcent expectorant

ORYZA.—RICE.

The seeds, deprived of their husks, of *Oryza sativa*, Linne.

Nat. Ord.—Gramineæ.

COMMON NAME: *Rice.*

Botanical Source.—Rice is an annual plant, with several jointed culms or stems, from 2 to 10 feet in height. The leaves are long, slender, and clasping. The panicle is terminal, diffuse, and bowing when the seed is weighty. The spikelet is hermaphrodite and 1-flowered. Glumes 2, and small. Paleæ 2, and adhering to the ovary. Scales 2, smooth; stamens 6; ovaries sessile; styles 2; stigma feathery. Caryopsis compressed, and inclosed by the paleæ (W.—G.—P.).

History and Chemical Composition.—Rice is supposed to have been originally a native of China, from whence it came to the East Indies; it is at present cultivated in nearly all parts of the world where the soil and climate are favorable. The harvesting of the new rice in India is introduced by religious worship. Rice, in order to thrive, requires a marshy, moist soil, and is accordingly now grown with success in Florida. Several species of cultivated rice are recognized. The husked seeds of the plant constitute the ordinary commercial rice. When boiled with water, the grains swell up, become soft, and absorb about twice their weight of water. Carolina rice, on analysis, has been found to consist of 85.07 per cent of starch, 3.60 of nitrogenous matter, 0.71 of gum, 0.29 of uncrystallizable sugar, 0.13 of fatty oil, 4.80 of woody fiber, 5.00 of water, and 0.40 of saline matters (Braconnot, *Jour. Pharm. Chim.*, 1817, p. 314).

J. König (*Die Menschl. Nahrungs- und Genussmittel*, 3d ed., 1893, p. 527) records the average of 35 analyses of ordinary cooking rice as follows: Water, 12.55 per cent; nitrogenous matter, mostly albuminous substance, 7.88 per cent; fat, 0.53 per cent; nitrogen-free extractive matter, 77.79 per cent (containing 75.79 per cent of starch, 1.3 per cent of sugar, gum, etc.); crude fiber, 0.47 per cent, and ash, 0.78 per cent. Of all cereals, the rice grain is richest in pure starch. The ash of rice grain contains much potassium phosphate and magnesium salts. Manganese is also contained in the ash. Rice is used as food by millions of people in China and certain parts of India (see consular report on the rice crop in India, *Amer. Jour. Pharm.*, 1898, p. 272). In addition to its employment for culinary and medicinal purposes, it is used in making ardent spirits (*Arrack*, see *Alcohol*), or *rice beer;* in Japan, a wine is made from it, called *sake* or *saki*. What is known as Chinese "rice paper," is obtained from the pith of *Aralia papyrifera*, by skillfully slicing it with a sharp knife (see *Amer. Jour. Pharm.*, 1878, p. 340).

Action and Medical Uses.—Rice is nutritious, and boiled in water until perfectly soft, is very useful in cases of *debilitated stomach* or *bowels*, and *diarrhœa;* it is likewise reputed a valuable article of food to overcome the diarrhœa so common to those who, for the first time, use the river waters of the western states. It is, by some, considered injurious to the eyes when used in any quantity, but this is an erroneous opinion, as many nations employ it almost exclusively as a diet, without any such effects. A decoction of rice (*rice-water*) is an excellent soothing and nutritive drink in *febrile diseases*, and likewise in *inflammations of the internal organs.*

OSMORRHIZA.—SWEET CICELY.

The root of *Osmorrhiza longistylis*, De Candolle (*Uraspermum Claytoni*, Nuttall).

Nat. Ord.—Umbelliferæ.

COMMON NAMES: *Sweet cicely, Smoother sweet cicely.*

Botanical Source.—This plant has a perennial, thick, fleshy, branching root, of an agreeable, aromatic flavor, and an erect, nearly smooth stem, branching above, and from 2 to 3 feet high. The leaves are large, decompound, the ultimate divisions often pinnate; radical leaves on long, slender petioles, cauline sessile The leaflets are irregularly divided by clefts and sinuses into lobes and teeth; the lobes broadly ovate and slightly pubescent. The flowers are white, in axillary and terminal umbels, about 5-rayed; central ones barren, outer ones fertile. Calyx-margin obsolete; petals oblong, nearly entire, with a short inflexed point. Involucres of linear bracts longer than the rays. The style is as long as the villose germ, filiform, erect, and deflexed. The fruit is linear-oblong, about an inch in length, angled, tapering downward into a stalk-like base, contracted at the sides, blackish, and crowned with the persistent styles. Carpels with 5 equal, acute, upwardly bristly ribs; commissure with a deep, bristly channel; intervals without vittæ (W.—G.).

History and Chemical Composition.—This plant grows in various parts of the United States, in rich moist woods, on the sides of low meadows, on the banks of running streams, and on the borders of low woodlands. It flowers in May and June. The root is the part employed; it has a sweet smell and taste, resembling anise seed. By distillation of the root with water, L. Eberhardt (*Pharm. Rundschau*, 1887, p. 149) obtained 0.63 per cent of an oil heavier than water, of specific gravity, 1.0114 at 10° C. (50° F.). The oil solidified at 10° to 12° C. (50° to 53.6° F.), and was chiefly composed of *anethol* (see *Oleum Anisi*). The air-dry root contained about 12 per cent of moisture, much sugar, some fat, resin, tannin, but no alkaloids. The ash referred to dried substance was 4.6 per cent. Mr. H. L. Green (*Amer. Jour. Pharm.*, 1882, p. 149) records 68.5 per cent of moisture in the fresh root.

Action, Medical Uses, and Dosage.—Sweet cicely is aromatic, stomachic, carminative and expectorant. Useful in *coughs*, *flatulence*, and as a gentle stimulant tonic to *debilitated stomachs;* the fresh root may be eaten freely, or it may be used in infusion with brandy or water.

OSMUNDA.—BUCKHORN BRAKE.

The rhizome of *Osmunda regalis*, Michaux (*Osmunda spectabilis*, Willdenow).
Nat. Ord.—Filices.

Common Names: *Buckhorn brake*, *Royal flowering fern.*

Botanical Source.—This fern has a hard, scaly, tuberous rhizome, beset with numerous fibers, and having a whitish core in the center. The fronds are several, erect, 3 or 4 feet high, doubly pinnate, smooth, bright green; primary divisions or pinnæ from 6 to 10, nearly opposite, remote, and hardly a span long. The leaflets are more numerous, often alternate, sessile or nearly so, oblong, bluntish, entire or obscurely-crenate, with 1 rib, and numerous transverse veins; base dilated, heart-shaped, or somewhat lobed. Some of the upper leaflets are cut, and as it were, partially transmuted, into dense clusters or spikes of innumerable, small, light-brown, veiny, globular, 2-valved thecæ, entirely covering the segments; several of the upper divisions of the leaf consisting entirely of such thecæ, composing a compound panicle. Spores green (L.—W.—G.).

History and Description.—This beautiful fern is found in meadows and low moist grounds, throughout the United States, flowering in June. The main root or caudex is the medicinal part; it is about 2 inches long, and has the shape of a buck's horn. It is composed of a number of layers or scales, which are elongated, imbricated, with satiny, translucent margins, and throws out a mass of entangled, delicate radicles. It contains an abundance of mucilage, which is extracted by boiling water. The ash of osmunda consists, to about 50 per cent, of silica. The roots should be collected in August, or about the latter part of May, and dried with great care, as they are apt to become moldy.

The *Osmunda cinnamomea*, or *Cinnamon-colored fern*, is inferior to the preceding, but is frequently used for the same purposes. Its root is similar, but much larger, and when its stems are young, during the spring months, they present a white or cinnamon-colored, pubescent appearance, with the leaves circinate and downy.

Action, Medical Uses, and Dosage.—Mucilaginous, tonic, and styptic. Used in *chronic coughs* with profuse perspiration, *diarrhœa*, and *dysentery;* also as a tonic during convalescence from exhausting diseases. One root, infused in a pint of hot water for half an hour, will convert the whole into a thick jelly. Very valuable in *leucorrhœa*, and other female weaknesses, and said to be an almost certain cure for *rickets*, in doses of 3 drachms of the root, 3 times a day. The mucilage mixed with brandy is a popular remedy as an external application for *subluxations* and *debility of the muscles of the back*. For internal use, the roots may be infused in hot water, sweetened, and ginger, cinnamon, brandy, etc., added, if not contraindicated.

OSTRYA.—IRON-WOOD.

The inner wood and bark of *Ostrya virginica*, Willdenow.

Nat. Ord. Cupuliferæ.

COMMON NAMES: *Iron-wood, Hop-hornbeam, Lever-wood.*

Botanical Source.—This is a small tree from 25 to 30 feet in height, remarkable for its fine, narrow, longitudinally divided, and brownish bark. The wood is white, hard, and strong. The leaves are oblong, ovate, subcordate, acuminate, unequally serrate, and somewhat downy; the buds acute. The sterile flowers are in cylindrical aments; scales orbicular-ovate, acuminate, ciliate, 1-flowered; filaments somewhat united irregularly; anthers bearded at the summit. The fertile flowers are in pairs, numerous, in a short, oblong, pendulous, loosely imbricated, linear, terminal ament, with small, deciduous bracts; scales none, but each flower is inclosed in a membranous sac-like involucre, bristly hairy at the base, and which enlarges, forming a bladdery closed bag in fruit, these being imbricated to form a sort of strobile appearing like that of the hop. The ovary is 2-celled, 2-ovuled, crowned with entire and bearded border of the perianth, forming a small and seed-like, smooth nut. Styles 2, united at the base; nut lance-oblong, somewhat compressed, and included in the enlarged, imbricated, bladder-like sac (G.—W.).

History.—This is a tree common to the United States, growing in rich woods, and flowering in April and May. The flowers are green, and appear with the leaves, and the large and handsome oval-oblong strobiles are matured in August. The inner wood and bark are the parts used; they are bitter and yield their virtues to water. Prof. Trimble found it to contain 6.5 per cent of tannin referred to dried substance (*Bull. of Pharm.*, 1895, p. 412).

Action, Medical Uses, and Dosage.—Iron-wood is antiperiodic, tonic, and alterative. It has been used with efficacy in *intermittent fevers, neuralgic affections, dyspepsia, scrofula*, and all diseases where an antiperiodic tonic is indicated. Dose of the decoction, 1 or 2 fluid ounces, 3 or 4 times a day; of the fluid extract, 1 fluid drachm.

Related Species.—*Carpinus americana*, Michaux. This is another tree known as *Iron-wood* and *Hornbeam*, closely resembling the above. It grows from 10 to 20 feet high, has a smooth gray bark, with an irregularly ridged trunk, and very fine-grained, compact, white wood. The scales of the fertile aments are 3-parted, the middle segment being much the largest, oblique, with a lateral tooth, persistent, and becoming foliaceous. The nut small, ovoid, bony, ribbed, with a simple, one-sided, enlarged, and open leaf-like involucre. This tree is not bitter, and must not be confounded with the *Ostrya* (G.—W.).

OXALIS.—WOOD-SORREL.

The whole herb of *Oxalis Acetosella*, Linné.

Nat. Ord.—Geraniaceæ.

COMMON NAME: *Wood-sorrel.*

Botanical Source.—Wood-sorrel is a small, perennial, acaulescent herb, with a creeping, scaly-toothed root-stock. The leaves are numerous, radical, palmately 3-foliate, on long, weak, hairy stalks; leaflets broadly obcordate, with rounded lobes entire, pubescent, of a yellowish-green color, but frequently purplish beneath; they close and droop at night-fall. The scape is longer than the petioles, and 1-flowered, with 2 scaly bracts near the middle. The flowers are white, yellowish at the base, delicately veined with purple, and scentless. Stamens 10, monadelphous at the base, alternately shorter; sepals 5, persistent; style as long as the inner stamens. Capsule 5-lobed, 5-celled, and oblong; seeds several, with an elastic testa (G.—W.).

History and Chemical Composition.—Wood-sorrel is indigenous to Europe and this country, growing in woody and shady places, and flowering from April to June. It is inodorous and has a pleasantly acid taste, which is somewhat impaired by drying. The acidity is due to the presence of *oxalic acid* in combination with potassium forming *acid potassium oxalate*, sometimes called *potassium binoxalate* (HKC_2O_4). In some parts of Europe this salt was formerly separated from the plant, and sold under the name of *salts of sorrel* (sometimes under the name *salt of lemons*), for the purpose of removing ink spots and iron marks from linen. This salt is poisonous when taken internally. It can now be conveniently prepared from oxalic acid.

Fig. 187.

Oxalis Acetosella.

Action, Medical Uses, and Dosage.—The several varieties of sorrel are cooling and diuretic. Useful in *febrile diseases*, *hemorrhages*, *gonorrhœa*, *chronic catarrh*, *urinary affections*, and in *scurvy;* it may be used in infusion, or it may be infused in milk to form whey, or the herb may be eaten, but in neither case to excess, on account of the potassium binoxalate they contain. Externally, the bruised leaves or inspissated juice have been found useful as an application to *scrofulous*, *malignant*, and *indolent ulcers*. The *Rumex Acetosa*, or Garden sorrel, *R. Acetosella*, or Sheep sorrel, and *R. vesicarius*, possess similar properties (which see). The antidote to poisoning by any of the species of Oxalis, or by oxalic acid or potassium binoxalate, is a mixture of chalk with water.

Related Species.—There are other species of *Oxalis* possessing analogous properties, as the *Oxalis stricta*, Linné, and *O. violacea*, Linné. They all have ternate leaves with obcordate leaflets, and with the exception of *O. violacea*, bear yellow flowers.

Oxalis crassicaulis.—Peru. Root edible; the syrup of an astringent, acidulous juice expressed from the leaves, has been employed in *catarrhal troubles*, *gonorrhœa*, and *hemorrhages*.

Oxalis corniculata, Linné.—Europe. This species has properties similar to *Oxalis Acetosella*.

OXYDENDRON.—SOURWOOD TREE.

The leaves of *Oxydendron arboreum*, De Candolle (*Andromeda arborea*, Linné). *Nat. Ord.*—Ericaceæ.

Common Names: *Sourwood*, *Sorrel tree*.

Botanical Source.—Oxydendron arboreum is a tree growing from 40 to 50 feet high, with a trunk from 10 to 15 inches in diameter. The leaves are oblong-lanceolate, acuminate, serrate, petiolate, deciduous, from 5 to 6 inches long, from 1 to 2 inches broad, villous when young, at length smooth, with a distinctly acid taste, and early in autumn they turn bright scarlet. The flowers are pedicellate, secund, spreading, at length reflexed; panicles terminal, consisting of numerous spicate racemes. Calyx without bractlets. The corolla is ovate-oblong, narrowed at the summit, 5-toothed, and pubescent externally. The filaments are thickened; anthers awnless, the cells long and pointed. The capsule pyramidal and pentangular; the seeds are ascending from the base, linear, with a loose coat and taper-pointed at both ends; and bracts and bractlets minute and deciduous (W.—G.).

History.—This elegant tree inhabits rich woods from New York to the Gulf of Mexico, and in the Allegheny valleys, and bears white flowers in July. The leaves are the parts used. They have an agreeable tartness, and yield their properties to water. According to Plugge and De Zaayer (1889), no andromedotoxin occurs in this plant.

Fig. 188.

Oxydendron arboreum.

Action, Medical Uses, and Dosage.—Sorrel tree leaves are tonic refrigerant, and strongly diuretic. Fever patients will find a decoction of the leaves a pleasant, cooling, and diuretic drink. A tincture of the leaves and twigs in whiskey is said to have been a popular remedy in Kentucky for the *kidney* and *bladder ailments* of aged men, being employed to increase the renal secretion, and to relieve the unpleasant symptoms attending *prostatic enlargement, vesical calculi*, and *chronic irritation of the neck of the bladder*. The remedy was specially recommended in the treatment of *dropsies* by Dr. J. W. Davis, of Lewisburg, Ky., in 1881 (*Ec. Med. Jour.*, 1881, p. 497). Its strong diuretic powers were generally recognized, and several experimenters reported remarkable success from its employment in *anasorca, hydrocele, pleuritic effusions*, and *hydropericardium*. It was asserted to give marked relief in urinary troubles, with frequent desire to urinate, with burning pain at urethral outlet, and the urine passing in drops, mixed with blood. It was subsequently employed in *bowel troubles* from exposure to cold, as when a determination of blood to the viscera occurred, causing *diarrhœa* or *dysentery*. It undoubtedly acts by giving increased tone to relaxed capillaries. Pills of a solid extract, containing 3 to 6 grains may be given every 2 hours; specific oxydendron, 1 to 20 minims every 2 or 3 hours.

Specific Indications and Uses.—Anasarca, ascites, and other forms of dropsy; the urinary difficulties of old men; painful micturition, with scanty renal secretion.

Related Species.—(Compare *Kalmia* and *Rhododendron*.) Some species of *Andromeda* are poisonous, *e. g.*, *Andromeda nitida*, Bartram, an elegant evergreen, known as *Fetter-bush*; *Andromeda polyfolia*, Linné, the *Wild rosemary*, growing in boggy situations, and containing *andromedotoxin*; *Andromeda mariana*, Linné, *Stagger-bush*, a seaboard plant, found also in Tennessee and Arkansas, and said to produce staggers in calves and lambs (see illustration in Meehan's *Native Flowers and Ferns*, Vol. II, p. 185); and *Andromeda angustifolium*, Pursh, a swamp growth. The blossoms and leaves of the *Andromeda speciosa*, Michaux, have a pulverulent substance upon their surface, which is reputed a strong sternutatory.

OXYGENIUM.—OXYGEN.

SYMBOL: C. ATOMIC WEIGHT: 15.96.

History.—Oxygen, the most abundant of the elements, was discovered, in 1774, by Priestley, of England, and Scheele, of Sweden, independently of each other. Lavoisier, of France, first recognized its function in the phenomena of combustion. He named it oxygen from two Greek words, meaning "I produce sour"—*i. e.*, a generator of acids. The waters of the globe consist of 88.87 per cent of oxygen. From 33 to 45 per cent of the whole weight of the earth has been estimated to consist of this element. It is one of the chief constituents of animal and vegetable structures. In gaseous form, it constitutes about 21 per cent, by volume, of the atmosphere, the balance being nitrogen, argon, and a small portion of carbon dioxide.

Preparation.—Oxygen is prepared from certain oxides or other oxygen compounds, which readily part with their oxygen under the influence of heat or reagents. Thus oxygen may be produced by subjecting mercuric oxide to a red heat in a glass retort: $2HgO = Hg_2 + O_2$. Likewise manganese dioxide is decomposed by heat with evolution of oxygen, thus: $3MnO_2 = Mn_3O_4 + O_2$. The usual mode of obtaining oxygen is to heat, in a retort, powdered potassium chlorate ($KClO_3$), the reaction being broadly expressed by the equation: $2KClO_3 = 2KCl + 3O_2$. In practical operation, the powdered chlorate is mixed with about one-fifth or one-fourth its weight of pure manganese dioxide. This must previously be ascertained to be free from charcoal or antimony sulphide, else dangerous explosions may occur. The purpose of the addition of manganese dioxide is to bring the temperature at which the oxygen commences to be given off, below the melting point of the salt, which is about 350° C. (662° F.); the gas is then disengaged at as low a temperature as 200° C. (392° F.). The manganese dioxide remains unchanged in this process. Otto Brunk has shown (*Amer. Jour. Pharm.*, 1894, p. 144) that the chlorine-like odor observed in this process is due to ozone, the quantity of which is 0.3 per cent of the oxygen evolved, if equal amounts of potassium chlorate and manganese dioxide are taken. Pure potassium chlorate, when heated, yields no ozone, but when it contains traces of impurities, even potassium chloride, evolution of ozone takes place. The gas must be washed by passing it through a strong solution of caustic soda.

Oxygen (containing ozone) is also produced by the electrolysis of water, being liberated at the positive pole. Other methods of producing oxygen are enumerated in every text-book on chemistry. Several methods, based on the action of hydrogen peroxide upon reducible substances, such as potassium permanganate. or ferricyanide, or chlorinated lime, have also been proposed (see *Amer. Jour. Pharm.*, 1882, p. 407; 1889, p. 565; 1890, p. 489; also see paper on oxygen and its medicinal applications, by Mr. J. W. England, *ibid.*, 1892, p. 11).

Description.—Oxygen is a colorless, odorless, and tasteless gas, whose density when compared to air, is 1.1056. The weight of 1 liter oxygen at 0° C. (32° F.) and 760 Mm. atmospheric pressure is 1.43028 grammes. Cailletet and Pictet, in 1878, succeeded in condensing oxygen to a liquid, a pressure of 475 atmospheres and a temperature of —130° C. (—202° F.), being necessary to accomplish it. Metals in the molten state, especially silver, absorb oxygen, but give it off again upon cooling. It is slightly soluble in water and alcohol. With the possible exception of fluorine it combines with all the elements, forming *oxides*. When a substance combines with oxygen, the process is called *oxidation*. If this process is accompanied with emission of light or flame, it is termed *combustion*. Processes of oxidation producing no light or flame, are termed *slow combustion*. An instance of the latter is the chemical change in the human body of venous to arterial blood, effected by the oxygen taken in during respiration. The chief supporter of combustion is oxygen, and substances burn more readily in pure oxygen than in ordinary air. A piece of wood glowing without flame ignites when held into a current or an atmosphere of oxygen. The gas is recognized by this reaction. A glowing piece of iron wire held in pure oxygen gas, burns with a display of brilliant sparks.

Oxides are of three classes, according to the chemical nature of the element with which the oxygen combines, and according to the combining quantity of the latter. Thus we have: (1) *basic oxides*, mostly those of the metals, *e.g.*, sodium oxide (Na_2O), calcium oxide (CaO), chromic oxide (Cr_2O_3); they form *bases* or *hydroxides* with the elements of water; (2) *acid-forming oxides*, mostly those of non-metallic elements, such as sulphur trioxide (SO_3), forming with water sulphuric acid (H_2SO_4); phosphorus pentoxide (P_2O_5), forming phosphoric acid (H_3PO_4); chromic trioxide (CrO_3), forming chromic acid (CrO_4H_2), etc. These oxides are also called *anhydrides*, *e. g.*, chromic anhydride; (3) *peroxides*, mostly those of metals, rarely of non-metals, as sodium peroxide (Na_2O_4); barium dioxide (BaO_2); lead dioxide (PbO_2); manganese dioxide (MnO_2), etc. They contain an excess of combined oxygen, with which they easily part. They are therefore typical *oxidizers*. Oxidizers should not be triturated with easily combustible material. It is dangerous to triturate together such substances as chlorate or nitrate of potassium and sulphur.

Other well-known oxidizers are chromic acid or potassium bichromate in sulphuric acid solution, potassium permanganate, ozone (see below), hydrogen peroxide, etc. The term *oxidizer*, in its broadest sense, includes also substances capable of producing oxygen available for oxidation; thus chlorine, although it contains no oxygen, is a strong, though indirect oxidizer, in the presence of water, because it combines with its hydrogen, for which it has great affinity, thus setting free the oxygen of the water. Substances which have a tendency to combine with oxygen and to abstract it from oxygen-bearing compounds, are called *reducing substances* or *deoxidizers*, such as glowing charcoal, sulphurous acid (H_2SO_3), nascent hydrogen, etc.

Action, Medical Uses, and Dosage.—Since the researches a few years ago of Smith, Richardson, Buchheim, and others, proving that no more oxygen than that proportion which is present in atmospheric air could be appropriated by the blood through the respiratory organs, the use of oxygen as a food to the system and vivifying agent seems to have been on the wane. Large doses, instead of acting as a vivifying stimulant, appear to relax and consequently debilitate the system, and even induce a narcotic condition if carried sufficiently far. That a certain amount of it inhaled admixed with the air, however, appears to increase the appetite, quicken the circulation, increase bodily weight, and slightly elevate temperature, seems established. Notwithstanding the fact that it is asserted to have been overrated as a therapeutic agent, it has been successfully employed in several forms of *anemia*, particularly those resulting from *hemorrhages* and *suppurative diseases.* It is also thought useful, though not curative, in many exhausting and wasting conditions. Some claim that it augments the appetite, lessens expectoration, hectic, and *colliquative sweats*, and increases weight in *phthisis*, but does nothing more. In *asthmatic seizures* and *diseases of the lungs* attended with symptoms of asphyxiation, life is occasionally saved, and often prolonged by its judicious inhalation. *Asphyxia from carbonic acid fumes, narcotic poisoning*, and *noxious gases* have been reported restored by oxygen inhalations. In *diabetes* it decreases the renal secretion and lessens the production of sugar, but fails to cure; the quantity of albumen appears to be lessened by it in *albuminuria*. The disorders, however, in which the oxygen treatment appears to possess real merit, are *post-scarlatinal nephritis*, and in *chlorotic dyspepsia*. Oxygen water (water charged with oxygen gas) may be given by mouth, and the pure gas inhaled from the rubber bag in which it is usually stored. This bag should be furnished with a tube supplied with valves and a stop-cock. Ozone has similar uses, and is particularly lauded in *anemia*.

Ozone.—ACTIVE OXYGEN. Formula: O_3. Molecular Weight: 47.88. Ozone was observed as early as 1785 by Van Marum, who passed an electric spark through oxygen and noticed the peculiar smell of the gas and its property of tarnishing a bright surface of mercury. In 1840 Schönbein made a detailed study of ozone, and gave it its name, from a Greek verb, meaning "to smell." Ozone is produced by slow oxidation of phosphorus, or by the passage of a silent electrical discharge through oxygen gas. Electrical discharges during thunder showers produce ozone in the atmosphere, although the fact must not be overlooked that the higher oxides of nitrogen are also formed, and behave toward potassium iodide starch paper in the same manner as ozone. Ozone is also generated when manganese dioxide is heated in a current of oxygen or with potassium chlorate (O. Brunk, see *Oxygen*). 1.55 per cent cent of ozone was produced when the proportion of manganese dioxide and potassium chlorate was 25 to 1. Ozone has not been obtained in the pure state; it is always diluted with oxygen. In recent years the manufacture of ozone by electric discharges is being very greatly perfected.

Ozone is quite soluble in many essential oils, *e. g.*, oil of turpentine, oil of cinnamon, etc., and is sparingly soluble in water. It is a powerful oxidizer, decolorizes indigo and blood, and destroys albumen and even caoutchouc and gutta-percha, tarnishes bright metallic surfaces, *e. g.*, silver or mercury, and converts alcohol (C_2H_6O) into aldehyde (C_2H_4O). From potassium iodide it liberates iodine; thus the most delicate test for ozone (which distinguishes it from hydrogen peroxide) is the blue coloration imparted to a paper saturated with a solution of potassium iodide in starch water. It colors alcoholic tincture of guaiac blue (see *Guaiacum*). Ozone is a colorless gas, but may be liquefied by pressure to an indigo-blue liquid (Hautefeuille and Chappuis). Liquid ozone boils at —119° C. (—182.2° F.), at atmospheric pressure (L. Troost, *Chem. Zeitung*, 1898, p. 543).

The researches of Andrews and Tait (1860) have shown that ozone is an allotropic modification of oxygen, *i. e.*, consisting of the same substance, but possessing different properties. The formation of ozone from oxygen is attended by a condensation of 3 volumes (or molecules) of oxygen to 2 volumes (or molecules) of ozone, according to the equation: $3O_2 = 2O_3$; hence the molecule of ozone must be regarded as consisting of 3 atoms of oxygen, and has been aptly called *peroxide of oxygen* (O_2O). Vice versa, 2 volumes of ozone, when heated to about 300° C. (572° F.), yield again 3 volumes of ordinary oxygen. In its chemical reactions, only one-third of the oxygen is available. Thus, for example, when ozone acts upon potassium iodide solution only one-third of its oxygen liberates iodine, while ordinary oxygen is formed as follows: $O_3+IK+H_2O=O_2+2KOH+I$. The resultant volume of oxygen is the same as the original volume of ozone, because one-third of the latter, being in combined form, has disappeared as a gas. The medicinal uses of ozone are the same as those of oxygen.

OXYMEL.—OXYMEL.

SYNONYMS: *Oxymel simplex, Mel acetatum.*

Preparation.—This is prepared according to the *British Pharmacopœia* (1898), by heating to liquefaction 40 ounces (Imp.), or 800 grammes, of clarified honey, and mixing with it 5 fluid ounces each, or 100 cubic centimeters each, of acetic acid and distilled water, the finished product to have the specific gravity 1.320. The *German Pharmacopœia* (1872) directed a simple mixture of acetic acid, sp. gr. 1.040 (1 part), with clarified honey (40 parts). The *French Codex* orders virgin honey, 4 parts, and white wine vinegar, 1 part. Concentrate and clarify with paper pulp.

Action and Medical Uses.—This represents a popular gargle for *sore throat.* It is also used as a vehicle for expectorant preparations, such as ipecacuanha, squill, etc., and in fever-drinks.

OXYMEL SCILLÆ.—OXYMEL OF SQUILL.

Preparation.—Mix 2 pounds (av.) of clarified honey, with 1 pint (Imp.) of vinegar of squill. Evaporate, by means of water-bath, until the product when cold, has a specific gravity of 1.32. This accords with the *Br. Pharm.*, 1885 and 1898. Honey (2 parts), vinegar of squill (1 part). Evaporate to 2 parts and strain (*Ger. Pharm.*, 3d ed.). Honey (4 parts), vinegar of squill (1 part). Clarify with pulp of paper and evaporate to specific gravity 1.26 (*French Codex*).

The *National Formulary* directs: "Vinegar of squill (*U. S. P.*), fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; honey, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Mix them in a tared porcelain capsule or enameled iron vessel, and apply the heat of a water-bath until the mixture has been reduced to the weight of one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Then strain, allow it to cool, and transfer it to bottles, which should be well corked"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—Used for the same purposes for which squill is employed (see *Scilla*). Dose, as an expectorant, for infants, 1 to 15 drops; for an adult, 20 to 60 drops.

PÆONIA.—PEONY.

The root of *Pæonia officinalis*, Linné.

Nat. Ord.—Ranunculaceæ.

COMMON NAMES: *Peony, Piney.*

Botanical Source.—Peony has many thick, long-spreading, perennial roots, running deep into the ground, with an erect, herbaceous, large, green, and branching stem, 2 or 3 feet high. The leaves are large; the lower ones bipinnately divided; the leaflets ovate-lanceolate, smooth, and variously incised. The flowers are large, red, terminal, and solitary; the sepals 5, and unequal. Petals red, cordiform; stamens numerous, mostly changed to petals by cultivation. Carpels 3; stigmas double and persistent; follicles fleshy, and many-seeded; seeds black, numerous, dry, and round (W.—R.).

History and Description.—This plant is indigenous to southern Europe, and is cultivated in gardens in the United States and elsewhere, on account of the elegance of its large flowers, which appear from May to August. The root is the medicinal part; it consists of a root-stalk, from ½ to 1 inch in diameter, from which proceed fusiform tubers, gradually terminating in delicate fibers. These, together with the seeds, have, when recent, a strong, rather unpleasant odor, and a sweetish, mawkish taste, succeeded by a sub-acrid bitterishness and slight astringency; drying nearly removes these properties. The recent flowers have a similar, but feebler, odor, and a more herbaceous taste. They all yield their virtues to diluted spirits.

Chemical Composition.—The fresh root has the odor of bitter almonds, and contains starch, fat, sugar, a small quantity of tannin, oxalates, malates, and phosphates (Morin). Wiggers (*Handbuch der Pharmacognosie*, 1864) obtained, by distillation of the fresh root with water, a distillate possessing the odor of bitter almonds. Ether removed therefrom a small quantity of an oil having the same odor, and producing, in aqueous or alcoholic solution, a blood-red color with ferric chloride. Dragendorff found in the seeds of *Pæonia officinalis* tannin and *peonia-fluorescin* (see *Related Species*).

Action, Medical Uses, and Dosage.—Peony is antispasmodic and tonic. It is asserted to have been successfully employed in *chorea, epilepsy, spasms*, and various *nervous affections.* In combination with white snakeroot, or black cohosh, it has proved valuable in *pertussis.* An infusion may be made by adding 1 ounce of the root, in coarse powder, to 1 pint of a boiling liquid, composed of 1 part of good gin, and 2 parts of water, which may be sweetened. Dose, 2 or 3 fluid ounces, 3 or 4 times a day. Dose, of the expressed juice of the recent root, 1 or 2 drachms; of the powdered root, 1 drachm, 3 or 4 times a day; of the powdered seeds, from

30 to 40 grains. The seeds, taken night and morning, have been successfully used in removing *nightmare* attendant upon dropsical persons. They are also reputed emetic, cathartic, and antispasmodic. It undoubtedly relieves *nervous irritation*, and should be restudied. A tincture of the fresh root (℥viii to alcohol, 76 per cent, Oj) may be given in doses of 1 to 30 drops.

Related Species.—*Pæonia Moutan*, Simson; *Botan-root.* Japan. The root of this plant yielded Jagi (1878), by extraction with ether, a crystallizable body, *peonol*, melting at 45° C. (113° F.), said to be closely related to caprinic acid. It is readily dissolved by alcohol and ether, and believed to be a ketone.

Pæonia peregrina, Miller.—The root of this species, according to analysis of Mandelin and Johannson (*Archiv der Pharm.*, 1879, p. 535), contains starch (14.25 per cent), moisture (15.5 per cent), sugar, gum, resins, tannin, fat, ash, and a small quantity of an alkaloid. The seeds, according to Dragendorff and Stahre (*ibid.*, 1879, pp. 412 and 531), contain fatty oil (23.6 per cent), *peonia-resinic acid*, with indifferent *peonia-resin* (1.13 per cent), *tannic acid* (less than 1 per cent), the coloring matters, *peonia-fluorescin* and *peonia-brown* (a phlobaphene) (of each about 4 per cent), *legumin*, sugar, mucilage, and an alkaloid.

PANAX.—GINSENG.

The root of *Aralia quinquefolia*, Decaisne and Planchon (*Panax quinquefolium*, Linné; *Ginseng quinquefolia*, Wood).

Nat. Ord.—Araliaceæ.

Common Name: *Ginseng.*

Illustration: Johnson, *Med. Bot. of N. A.*, Fig. 132.

Botanical Source.—Ginseng has a perennial, fusiform, whitish, thick, and fleshy root, transversely wrinkled, and terminating in fibers; its upper portion slender and marked with the scars of the former shoots. The stem is round, smooth, green, often with a tinge of red, about 1 foot high, regularly divided at top into 3 petioles, with a flower-stalk in their center. The petiole is round, smooth, and swelling at the base. Leaves 3, ternate, quinate, or septentate. Leaflets pedicellate, obovate, sharply serrate, acuminate, smooth on both sides, with scattered bristles on the veins above. Flowers small, greenish, in a simple umbel, supported by a round, slender peduncle, which rises from the top of the stem, in the center of the petioles. The involucre is composed of a multitude of short, subulate bracts, interspersed among the flower-stalks, which are so short as to give the appearance of a head rather than an umbel. Calyx with 5 small, acute teeth. Petals 5, oval, reflexed, and deciduous. Stamens 5, with oblong anthers. Styles 2, reflexed and persistent. Ovary large, inferior, ovate-cordate, and compressed. The berries are kidney-shaped, retuse at both ends, compressed, of a bright-scarlet color, crowned with a calyx and styles, and contain 2 and sometimes 3 semicircular seeds. The outermost florets ripen first, and their berries often obtain their full size before the central ones are expanded; the central florets are frequently abortive (L.—W.).

Fig. 189.

Aralia quinquefolia.

History and Description.—Ginseng is a native of most of the middle and northern states, and extends on the mountains far south, growing in rich soil and in shaded situations, and flowering in July. C. S. Rafinesque (*Med. Flora of the U. S.*, Vol. II, 1830, p. 53) states that the Jesuits, knowing the plant from their sojourns in Tartary, found it afterward, toward 1718, in Canada, and instituted the trade in this root with China. The root is somewhat fusiform, 2 or 3 inches in length, and about ½ an inch in diameter, and sends off a few delicate fibers. When dried, it consists of a soft, yellowish-white, corrugated bark, inclosing a central, woody substance. It has a faint smell, and its taste is sweetish, somewhat bitter, mucilaginous, and feebly aromatic. Water or alcohol takes up its properties. Large quantities of it are now gathered and sent to China, where it commands an enormous price, as the Chinese ascribe wonderful medicinal virtues to it. The American drug is cheapest (about $1.86 per pound), next ranks Corea ginseng ($16.50 per pound), and highest in price is the genuine Chinese ginseng. The latter is seldom found in the stores, and the finest qualities command the price of from $60 to $100 for a weight of about 580 grains. In Corea, the cultivation and trade in ginseng is a government monopoly (*Amer. Jour. Pharm.*, 1887, p. 597; 1897, p. 551, and 1898, p. 251). Ginseng is also grown in Japan, but is considered inferior to Corea ginseng. The genuine *Chinese ginseng* is the root of *Aralia Ginseng*, A. Meyer (*Panax Ginseng*, Nees), an east Asia plant. Altogether, 5 commercial grades of ginseng are distinguished in China. It is often adulterated by mixing it with the root of some species of Convolvulus and other roots. (On the cultivation of ginseng in America, see *Amer. Jour. Pharm.*, 1891, p. 411.) Ginseng is becoming very scarce and, unless a method of cultivation becomes practical, bids fair to be exterminated. The price now is from $4.00 to $7.50 per pound and advancing.

Chemical Composition.—Rafinesque (*loc. cit.*) states that the roots have a pleasant, camphorated smell, and that they owe their active properties to a peculiar substance similar to camphor, which he calls *panacine*—white, pungent, soluble in alcohol and water, more fixed than camphor. The roots also contain a volatile oil, sugar, mucilage, resin, etc. S. S. Garrigues (*Amer. Jour. Pharm.*, 1854, p. 511) obtained from an aqueous infusion a sweetish-bitter, amorphous yellow principle, which he calls *panaquilon*. It is soluble in ether and alcohol, insoluble in water. Concentrated sulphuric acid dissolves it with purple-red color. If the solution is poured into water, a white precipitate (*panacon*) results (see Davydow, *Amer. Jour. Pharm.*, 1890, p. 338).

Action, Medical Uses, and Dosage.—A mild tonic and stimulant. Useful in *loss of appetite*, *slight nervous debility*, and *weak stomach*. Continued for some length of time, for its temporary administration gives but little benefit, it is a very important remedy in *nervous dyspepsia*, and in *mental exhaustion from overwork*. It gives fairly good results in *nervous prostration*, and in *cerebral anemia*. By some, it is considered useful in *asthma*, *gravel*, *convulsions*, *paralysis*, to invigorate the virile powers, etc. It gives fairly good results in *atonic laryngitis*, *bronchitis*, and some relief in *phthisis*, being a secondary remedy for these complaints. Dose, of the powder, from 10 to 60 grains; of the infusion, from 2 to 4 fluid ounces; specific panax, 5 to 60 drops.

Specific Indications and Uses.—Nervous dyspepsia; mental and other forms of nervous exhanstion from overwork.

PANCREATINUM (U. S. P.)—PANCREATIN.

"A mixture of the enzymes naturally existing in the pancreas of warm-blooded animals, usually obtained from the fresh pancreas of the hog (*Sus scrofa*, Linné [*Class:* Mammalia. *Order:* Pachydermata])"—(*U. S. P.*).

Source.—The *pancreas* (meaning *all flesh*) is a long, flat, conglomerate gland, analogous in its structure to the salivary glands, and which is situated transversely across the posterior wall of the abdomen, behind the epigastric and the two hypochondriac regions. It secretes a fluid termed the *pancreatic juice*, which is injected into the duodenum, and there mixing with the bile from the liver, and the chyme from the stomach, it helps to convert the latter pulpy substance into *chyle*. The pancreatic juice is a colorless, odorless, strongly alkaline, viscid liquid (specific gravity 1.008 or 1.009), containing from 1.5 to 2.5 per cent of soluble albuminous matters (*enzymes*), resembling ptyalin in action. They may be precipitated from aqueous solution by alcohol, and still be soluble again in water (difference from albumen). Pancreatic juice has the power to emulsify fats, also to dissociate them into glycerin and fatty acids, to convert starchy matters into dextrin and sugar, and to dissolve albumen and fibrin (see below).

Pancreatin is the name given to the purified dried juice of the pancreas, or to the precipitated albuminoids of this juice.

Preparation.—The *National Formulary* (1st ed., 1888) directs as follows: "Take pancreas of the hog, fresh, water, alcohol, each, a sufficient quantity. Reduce the fresh pancreas of the hog, freed as much as possible from fat and membranes, to a fine paste by means of a suitable chopping machine. Mix it with half its weight of cold water, and knead it thoroughly and frequently during 1 hour, then transfer the mass to a strainer of canton flannel, and add to the filtrate an equal volume of alcohol. Collect the precipitate, drain it, and free it by pressure from as much of the adherent liquid as possible. Then spread it on shallow trays, and dry it by exposure to warm air, at a temperature not exceeding 40° C. (104° F.). Triturate the dry product, in a mortar, with 4 times its weight of pure benzin; transfer the mass to a dry filter, and when the liquid has passed below the surface of the powder, follow it with enough fresh benzin to displace the retained portion. Lastly, dry the powder between bibulous paper. *Note.*—If larger quantities of pancreas are operated upon, and there is risk of its decomposition in presence of the water, it is advisable to saturate the latter with chloroform, which will retard decomposition for a long time. * * * In place of pancreatin, prepared by the formula above given, any other commercial preparation of the pancreas may be used, provided it reaches the standard of peptonizing power prescribed for the former"—(*Nat. Form.*, 1st ed.). (See also note to *Pulvis Pancreaticus Compositus.*)

For R. V. Mattison's process of preparing *saccharated pancreatin*, based on the precipitation of pancreatin by sodium chloride solution, see *Amer. Jour. Pharm.*, 1873, p. 532. Pancreatin possesses the power of emulsifying a very large amount of fat or oil.

Description and Tests.—The *U. S. P.* describes pancreatin as "a yellowish, yellowish-white, or grayish, amorphous powder, odorless, or having a faint, peculiar, not unpleasant odor, and a somewhat meat-like taste. Slowly and almost completely soluble in water, insoluble in alcohol. Pancreatin digests albuminoids, and converts starch into sugar; prolonged contact with mineral acids renders it inert. If there be added to 100 Cc. of tepid water, contained in a flask, 0.28 Gm. of pancreatin and 1.5 Gm. of sodium bicarbonate, and, afterward, 400 Cc. of fresh cow's milk, previously heated to 38° C. (100.4° F.), and if this mixture be maintained at the same temperature for 30 minutes, the milk should be so completely peptonized, that, if a small portion of it be transferred to a test-tube and mixed with some nitric acid, no coagulation should occur. Peptonized milk, prepared in the manner just described, or even when the process is allowed to go on to the development of a very distinct, bitter flavor, should not have an odor suggestive of rancidity"—(*U. S. P.*).

Pancreatin absorbs moisture from the atmosphere and deteriorates when exposed to air for a long time; it becomes inert when heated to temperatures higher than 50° C. (122° F.).

Chemical Composition.—Pancreatin is a proteid substance containing soluble ferments (*enzymes*). The pancreatic juice holds at least 4 ferments, as follows: (1) *Trypsin* (of Kühne), which digests albuminoids, changing them to peptones, *leucin*, *tyrosin*, etc., and acting best in neutral or alkaline media, unlike pepsin, which requires an acid medium. It also acts in feebly acid solution, but stronger acids and the gastric juice render it wholly inert. The most favorable temperature for its action is at about 38° C. (100.4° F.) (see above *test*). (2) *Amylopsin* digests carbohydrates and acts upon starch with greater energy than ptyalin, which it resembles, producing maltose and dextro-glucose. It also closely resembles diastase. (3) *Steapsin*, the digester of fats, is probably the chief emulsifying agent, and resolves fats into fatty acids and glycerin and esters—*e. g.*, *salol*—into their component alcohol and acid—in this case, phenol and salicylic acid (see *Amer. Jour. Pharm.*, 1892, p. 404). (4) A *milk-coagulating* or *rennet-like ferment*, probably the same as that contained in the fourth stomach of the calf.

Action, Medical Uses, and Dosage.—Pancreatin has been recommended in *atonic dyspepsia*, due either to impaired secretion or defective composition of the juices secreted; in *acid dyspepsia*, the result of the abnormal transformation of the food in the stomach, from morbid conditions of the gastric juice; in *flatulent dyspepsia*, and in the *dyspepsia of children*, who are fed chiefly upon milk and amylaceous diet, and who often suffer therefrom, with emaciation and diarrhœa. It may be employed where there is *chylous* or *fatty diarrhœa*, with abdominal uneasiness, and in *intestinal dyspepsia*. *Infantile dyspepsia*, *jaundice*, with imperfect digestion of fats, *scrofula*, *diabetes*, *rickets*, *anemia*, *leukæmia*, *chlorosis*, *incipient tuberculosis*, and *dyspepsia*, with nausea, vomiting, diarrhœa, flatulence, and abdominal pain, are cases in which it has been administered by stomach. In *organic diseases of the œsophagus and stomach*, and in *nervous vomiting* and *vomiting of pregnancy*, a pancreatic enema has been administered with the effect of being absorbed and sustaining the life of the patient. Luebe's enema consists of about equal parts of lean meat, grated to a fine pulp, and chopped pancreas, beaten in a mortar or bowl, gradually adding luke-warm water until a pap-like mixture results. If fat is needed, it may be added in proportion of one-sixth of the quantity of meat employed. From 5 to 10 ounces may be used as an enema, and should be injected per rectum with a large-mouthed syringe and retained as long as possible.

As nature has furnished the pancreatic juice to effect the conversion of chyme into chyle, in the duodenum, and probably with the aid of the presence of bile; and as the pancreatin must certainly undergo some change from the action of the juices of the stomach previous to its entrance into the duodenum, it is somewhat puzzling to clearly understand the utility of pancreatin in the stomach, at least until the food has been wholly converted into chyme; besides, when digestion is sluggish or becomes difficult, this is not entirely owing to the deficiency of the gastric, pancreatic, or intestinal juices, but generally to a more radical change in the secretion and composition of these juices, dependent upon an abnormal condition of the organ secreting them. However, pancreatin is an inoffensive agent, and may be conveniently tested in the cases in which it has been advised; and if, after 10 or 12 days, no benefit is derived from it, its use should be suspended. It should be remembered that it gives temporary aid only, and that it has failed to fulfil all the demands for which it was introduced. Its dose is 3 or 4 grains, about an hour after meals. It may be made into pills of 3 grains each, with a sufficient amount of honey; or 1 drachm of it may be mixed with 15 grains of phosphate of calcium, and the mixture be divided into 10 doses. Chopped pancreas may be given in desertspoonful doses with the food. The latter should not be hot. It is frequently given with sodium bicarbonate.

Trypsin is a reputed solvent for *diphtheritic membranes*, a spray of 30 grains of trypsin and 10 grains of sodium bicarbonate in 1 fluid ounce of water, being employed for this purpose. An injection of it has been proposed to dissolve blood-clots in the bladder (Webster).

Specific Indications. and Uses.—Intestinal indigestion, with diarrhœa of fatty or chylous feces, and with flatulence, abdominal pain, nausea, and vomiting; in diseases of mesenteric glands. For temporary effects only.

Preparations.—LIQUOR PANCREATICUS (N. F.), *Pancreatic solution.* "Pancreatin (*U. S. P.*), seventeen and one-half grammes (17.5 Gm.) [270 grs.]; sodium bicarbonate, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; glycerin, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; compound spirit of cardamom (F. 347), thirty-five cubic centimeters (35 Cc.) [1 fl℥, 88 ♏]; alcohol, thirty-five cubic centimeters (35 Cc.) [1 fl℥, 88 ♏]; purified talcum (F. 395), fifteen grammes (15 Gm.) [231 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the pancreatin and the sodium bicarbonate gradually with six hundred and fifty cubic centimeters (650 Cc.) [21 fl℥, 470 ♏] of water, add the alcohol, compound spirit of cardamom and purified talcum; mix them thoroughly by shaking, and pour the mixture upon a wetted filter, returning the first portions of the filtrate, until it runs off clear. Wash the filter with enough water to obtain seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of filtrate. To this add the glycerin. Each fluid drachm represents 1 grain of pancreatin (*U. S. P.*)"—(*Nat. Form.*).

PULVIS PANCREATICUS COMPOSITUS (N. F.), *Compound pancreatic powder, Peptonizing powder.*—"Pancreatin (*U. S. P.*), twenty grammes (20 Gm.) [309 grs.]; sodium bicarbonate, eighty grammes (80 Gm.) [2 ozs. av., 360 grs.]. Mix them by trituration. *Note.*—If pancreatin of proper strength is not available, any other commercial preparation of pancreas, as, for instance, the extract, may be used in place of it, provided it attains the required standard. Twenty-five (25) grains of this powder are sufficient to peptonize 1 pint of fresh cow's milk, by proceeding in the following manner: Add the compound pancreatic powder to 4 fluid ounces of tepid water contained in a suitable flask, and, afterward, add 1 pint of fresh cow's milk, previously heated to 38° C. (100.4° F.). Maintain the mixture at this temperature during 30 minutes, then transfer the flask to a cold place. Milk thus peptonized should not be used when it has been kept over 24 hours, or when it has developed a bitter taste"—(*Nat. Form.*).

EXTRACTUM PANCREATIS presents the digestive ferments of the pancreas in the form of a dry, whitish powder. It contains these principles in such a degree of activity, that their action upon various food substances can be quickly demonstrated—viz., the action of trypsin upon albumen, of diastase upon starch, of the emulsive ferment upon fats and oils, and the milk-curdling ferment. Extractum pancreatis is a specialty of Fairchild Bros. & Foster, New York, who also offer *Trypsalin*, a preparation which presents the ferment, trypsin, in a form especially designed for application to the throat and mucous membrane.

ENZYMOL.—A purified solution of the proteolytic enzyme obtained by direct solution from the gastric glands in sterilized and aromatized menstruum. It is practically an artificial gastric juice, intended for external use only, being a painless solvent for all dead tissues and septic matter, and a corrector of offensive odors. It may be used, diluted with an equal bulk of water and applied by a spray, compress, or injection, upon all *ulcers*, *wounds*, or in *abscess cavities*. A specialty of Fairchild Bros. & Foster, New York City.

Panopepton.—This is a predigested, albuminous, and farinaceous artificial food-product, prepared from bread and beef peptones, and preserved in agreeable solution in sherry wine. It is specially adapted as a food for delicate individuals, convalescents, and infants with faulty digestion. It is very readily retained by the most irritable of stomachs. It is a specialty of Fairchild Bros. & Foster, New York City.

PAPAVERIS CAPSULÆ.—POPPY CAPSULES.

The nearly ripe capsules of *Papaver somniferum*, Linne.

Nat. Ord.—Papaveraceæ.

Synonyms: *Papaver* (*U. S. P.*, 1870), *Fructus papaveris*, *Poppy-heads*.

Illustration: Bentley and Trimen, *Med. Plants*, 18.

Botanical Source and History.—The poppy is an annual plant with a tapering and white root. The stem is round, erect, smooth, with occasionally a few hairs on its upper part, glaucous, branched, leafy, and from 2 to 4 or 5 feet in height. The leaves are alternate, 4 to 8 inches in length, 2 or 3 inches broad, amplexicaul, slashed, repand, with rather blunt teeth, sessile, ovate-oblong, and glaucous beneath. The flowers are large, brilliantly white or silvery gray, double by cultivation, on long, terminal, leafless peduncles, with bristly hairs. The calyx consists of 2 smooth, convex, deciduous sepals. The corolla is composed of 4 petals, very large, sometimes with a deep purple spot at the base. Stamens numerous; anthers oblong and compressed; style, 1; stigmas, 4 to 20, radiating, and sessile upon the crown of the nearly globular ovary. The capsules are obovate or globose, smooth, about the size of a middling apple, rather hard and brittle, 1-celled, opening by pores beneath the lobes of the stigma, and filled with numerous parietal placentæ. Placentæ many-seeded. The seeds are reniform, oily, white, or gray, sweet, and edible (L.—W.).

Formerly, distinction was made between the *black* and the *white* variety of poppy, based on the color of the seeds, and to some extent on that of the petals, those of the latter variety being white, of the former violet or red. Cultivation has produced grades intermediate between these varieties sometimes difficult to distinguish. Boissier (1867) established three well-marked varieties, viz: (1) *Papaver somniferum*, Linné, var. *setigerum* (*Papaver setigerum* of De Candolle). This is the wild variety of poppy, beset with long, stiff bristles; leaves acutely toothed; 7 to 8 stigmas. This variety occurs in the Peloponnesus, Corsica, Cyprus, and the Hières Islands; (2) *P. somniferum*, var. *glabrum*, smooth, with subglobular capsule and from 10 to 12 stigmas, cultivated in Asia Minor and Egypt (see *Opium*); and (3) *P. somniferum*, var. *album* (*Papaver officinale* of Gmelin), with more or less egg-shaped capsules devoid of apertures; it is cultivated in Persia (see *Pharmacographia*).

The white poppy is considered the official variety; it is probably a native of Persia, but is also extensively cultivated in many of the warmer parts of the world. In Asia the flowering season is in February; in this country and Europe it is during the months of June, July, and August; the official parts of the plant are the capsules, and opium, or the concrete juice from the capsules (see *Opium*); the seeds are employed for obtaining their fatty oil (see page 1434).

Description.—Papaveris Capsulæ. The capsules of the poppy, or *poppy-heads*, should always be gathered before they have ripened; at this time they abound in the juice from which opium is formed, and which becomes greatly diminished when the capsule has fully matured. When dried, the unripe capsules possess the peculiar bitterness and narcotic qualities of opium, which are hardly observable in those that are allowed to ripen. The dried capsules are of various sizes, from that of a small egg to that of a large orange; they are of an ovate or globular form, flattened underneath, and surmounted by the persistent stigma. The capsules of the *white* poppy are larger than those of the *black*. They owe their virtues entirely to the opium contained in them. The *white* capsules are usually devoid of apertures (indehiscent) under the crowning circular disk generally oblong, though sometimes so depressed as to be broader than long. Some varieties have the lower end narrowed and prolonged. Where the fruit joins the stalk there is a tumid ring. The stigmas are peltate and sessile, from 8 to 20 in number, constituting sharp, angular ridges agreeing in number with the carpels. The placentæ are also of the same number, projecting into the 1-celled interior so as to form incomplete partitions. On their faces and edges are borne the minute kidney-shaped seeds in immense numbers.

The *black* capsules are smaller, globular-ovate, broadest below, usually about 1½ inches in diameter, and exhibit underneath the circular disc of stigmas, the apertures (dehiscences) which allow the seeds to be shaken out.

SEMINA PAPAVERIS.—*Poppy-seeds* or *Maw-seeds* are very numerous, a single capsule containing many thousands. They are reniform, white, bluish, grayish, or blackish, finely net-veined, oleaginous and emulsive, and yield by expression nearly 50 per cent of a yellowish fixed oil (*Oleum Papaveris, Oil of poppy-seeds*). Sacc, in 1849, obtained about 55 per cent of oil from the seeds, with 23 per cent of mucilage and 12.6 per cent of protein matter. The oil is odorless, has a pleasant, mucilaginous, bland taste, is pale-yellow and transparent, and destitute of narcotic properties. It has a specific gravity of 0.925, and becomes solid at —18° C. (0° F.). It is soluble in 25 parts of cold and 6 parts of boiling alcohol, and in ether. Upon saponification it yields 9½ per cent of glycerin. Upon exposure to the air for some time it easily dries, forming a varnish; it is therefore used by painters, also for culinary and for burning purposes, and as an adulterant of higher-priced oils, as olive oil. Its chief constituent, according to Hazura and Friedrich (1887), is the glyceride of *cannabinoleic acid* ($C_{18}H_{32}O_2$).

Chemical Composition.—The largest quantity of opium alkaloids is formed in the plant at the time when the seeds begin to accumulate oil and albuminous matter. The alkaloids are distributed over all parts of the plant, except the seeds, which, when clean from adhering particles of the capsule, are absolutely free from alkaloids. Young plants do not contain them (Clautrian, *Jahresb. der Pharm.*, 1889, p. 80). The unripe capsules contain the constituents of opium, only in a more diluted form; thus morphine is present to the extent of 1 to 2 per cent, and narcotine, codeine, rhœadine, narceïne, and meconic acid in correspondingly less quantities. The capsules also contain ammonium salts, tartaric and citric acids, mineral acids, mucilage and wax (Deschamps d'Avallon, 1864). Ripe capsules dried at 100° C. (212° F.) yielded Flückiger 14.28 per cent of ash, chiefly consisting of chlorides and sulphates of alkali metals.

Action and Medical Uses.—Poppy-heads are occasionally used externally in fomentations, though both for topical and internal use they have been supplanted by opium and its preparations, which are now prepared of definite strengths.

PARALDEHYDUM (U. S. P.)—PARALDEHYDE.

FORMULA: $C_6H_{12}O_3$. MOLECULAR WEIGHT: 131.7

"A polymeric form of ethylic aldehyde (C_2H_4O=43.9). Paraldehyde should be kept in well-stoppered, dark, amber-colored bottles, in a cool place"—(*U. S. P.*).

Preparation.—When hydrochloric acid, zinc chloride, sulphur dioxide, or carbonyl chloride ($COCl_2$) is allowed to act upon ethylic aldehyde at ordinary temperature, the liquid becomes heated and paraldehyde is formed by a process of polymerization. The new product is an agglomeration of 3 molecules of ethylic (acetic) aldehyde, whereby contraction of volume takes place. It is generally prepared by acting upon aldehyde with hydrochloric acid gas, or with a small amount of concentrated sulphuric acid, until the liquid no longer dissolves in an equal bulk of water. The product thus obtained is purified by alternate crystallization in the cold and subsequent distillation.

Description and Tests.—Paraldehyde is officially described as "a colorless, transparent liquid, having a strong, characteristic, but not unpleasant or pungent odor, and a burning and cooling taste. Soluble in 8.5 parts of water at 15° C. (59° F.), and in 16.5 parts of boiling water; miscible, in all proportions, with alcohol, ether, and fixed or volatile oils. When cooled to near 0° C. (32° F.), paraldehyde solidifies to a crystalline mass, which becomes liquid again at 10.5° C. (51° F.). It boils at 123° to 125° C. (253.4° to 257° F.), giving off inflammable vapors. Paraldehyde is neutral, or slightly acid, to litmus paper. When distilled with a small portion of sulphuric acid, paraldehyde is converted into ordinary aldehyde, boiling at about 21° C. (70° F.). On warming some silver ammonium nitrate T.S. saturated with paraldehyde, in a test-tube, a silver mirror will form on standing. On heating some paraldehyde on a water-bath, it should completely volatilize without leaving any disagreeable odor (absence of aldehyde derived from fusel oil). One Cc. of paraldehyde should form, with 10 Cc. of water, a clear solution, free from oily drops (absence of amylic alcohol, etc.), and this solution, when acidulated with nitric acid, should not be affected by silver nitrate T.S. (absence of hydrochloric acid), or barium chloride T.S. (absence of sulphuric acid). A mixture of 8 Cc. of paraldehyde and 8 Cc. of alcohol with 1 drop of phenolphtalein T.S. should acquire a pink color upon the addition of 0.5 Cc. of normal potassium hydrate T.S. (limit of free acid)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Paraldehyde is soporific rather than anodyne, acting better when wakefulness is pronounced than when a person enjoys the customary sleep. The sleep produced is peaceful and approaches a natural slumber, the individual upon awakening experiencing no headache nor tired sensations. The appetite is not disturbed by it, but the functions of circulation and respiration are slowed and the bodily heat lowered. It is eliminated chiefly by the breathing organs, and to some extent by the kidneys, imparting to both the urine and the breath the characteristic odor of one in drunkenness. It very much resembles chloral in action, though it is less depressing. Pain interferes somewhat with its action, for it is less anodyne than soporific. Its long-continued use may produce fatty changes in the liver and heart, and in disorders of the latter with feebleness, and especially cardiac dilatation accompanying emphysema, it is contraindicated. Like chloral, it produces disturbances of nutrition, resulting in obstinate nasal ulcerations, scarlatinoid, desquamative eruptions, ocular, faucial, and rectal irritation, and ulcers about the nails. Respiratory paralysis is the cause of death from toxic doses. Paraldehyde has been chiefly used as a hypnotic, being for this purpose comparatively safe, though it is not adapted to bring sleep when pain or fever exists. It is nauseous and apt to disturb the stomach, though the appetite generally remains unaffected. It has been successfully used to calm and produce sleep in *acute mania*, *melancholia*, and other forms of *insanity*, *mental exhaustion*, and *delirium tremens*. It is said to be suited to all forms of insanity, and all ages, but appears best adapted to acute cases, exhibiting maniacal excitement and *insomnia with great agitation*. It is generally contraindicated in cases lacking this excitement. It has been especially used in violent forms of *chronic insanity*, *dementia*, etc. The ordinary dose ranges from 5 to 60 grains, in water (sweetened), or flavored whiskey, brandy, or other alcoholic fluid, or masked in some tincture of a bitter drug. An elixir is often prescribed. One after Wearn is prepared as follows: "Take of paraldehyde 3 parts, alcohol 10 parts. Solve. Add orange-flower water 4 parts, simple syrup 10 parts, and enough distilled water to make 32 parts. Color with 5 minims of burnt sugar.

Related Preparations.—ALDEHYDE, *Acetic aldehyde*, *Acetaldehyde* ($C_2H_4O=CH_3.CHO$). Molecular weight: 44. Aldehyde is an oxidation product of alcohol, and was isolated and its relation to alcohol shown by Liebig, in 1835, who gave it its present name (*alcohol dehydrogenatum*, from 2 atoms of hydrogen being oxidized away). It was previously observed by Scheele in 1774. Acetic aldehyde may be formed in various ways. On a large scale it is obtained in the manufacture of alcohol, being found in those fractions distilling at lowest temperatures. In the laboratory, acetic aldehyde may be prepared by the dry distillation of a mixture of calcium acetate and formiate, as follows: $(CH_3.COO)_2Ca + (H.COO)_2Ca = 2CH_3.CHO + 2CaCO_3$, or more frequently in the wet way, by carefully distilling alcohol with an oxidizing mixture, *e. g.*, sulphuric acid and potassium bichromate. Alcohol, aldehyde, ether, and other products pass over. The distillate is rectified by cautious redistillation with calcium chloride, and pure aldehyde is obtained by converting it, in ethereal solution, into a crystallizable ammonium compound by means of dry ammonia gas, decomposable into its constituents by distillation with diluted sulphuric acid. (For details of these operations, see Roscoe and Schorlemmer's *Chemistry*, Vol. III, Part I, 1882, p. 475.)

Aldehyde is a clear, colorless liquid, of a peculiar and powerful ethereal odor, of specific gravity 0.79 at 18° C. (65° F.), and boiling at 21° C. (70° F.). It is neutral, inflammable, and mixes in all proportions with water, alcohol, and ether. It rapidly absorbs oxygen, being oxidized to acetic acid as follows: $CH_3.CHO + O = CH_3.COOH$. Aldehyde also has the property of reducing metallic silver from its ammoniated nitrate solution; the silver firmly adheres to the glass wherein it is reduced, and forms a mirror upon it. Silver mirrors may be made in this manner. Acetic aldehyde combines with ammonia gas, forming a crystallizable compound, *aldehyde-ammonia*, as follows: $CH_3CHO+NH_3=CH_3CHOH.NH_2$. When heated with caustic potash, aldehyde is rapidly converted into *resin of aldehyde*, which swims on the surface of the liquid in the retort in the shape of a brownish, plastic substance, which, when heated to boiling, evolves a disagreeable odor.

Aldehyde inhaled, even in small amounts, asphyxiates, but when mixed with air it acts as an anæsthetic, though its irritant action upon the tissues has led to the abandonment of the idea of ever again using it as such on man. Taken into the stomach it irritates, and has produced dangerous results. It quickly and deeply intoxicates, and it is to the presence of aldehyde that the first distillate of inferior grades of spirits owe their rapid and dangerous action. The heart's action is but little interfered with by its inhalation, but even small doses quicken respiration, and larger doses may induce respiratory paralysis. Aldehyde possesses greater anti-putrefactive qualities than alcohol, a very dilute solution of it perfectly preserving meat from decay.

METALDEHYDE ($C_{12}H_{24}O_6$), a reputed hypnotic sometimes used like aldehyde, is occasionally deposited in the form of crystals from aldehyde at ordinary temperature. Liebig found it to have the same percentage composition as aldehyde, and to be a polymerized form of the latter. It is produced by acting upon acetic aldehyde with polymerizing agents, such as acids, carbonyl chloride, etc., at the freezing point of water, or with calcium chloride at ordinary temperatures. It crystallizes in white needles, is not soluble in water, but dissolves easily in ether or alcohol. It sublimes without fusing at 100° C. (212° F.), but when heated in a closed tube to a higher temperature, it is converted into ordinary acetaldehyde.

PAREIRA (U. S. P.)—PAREIRA.

"The root of *Chondodendron tomentosum*, Ruiz et Pavon"—(*U. S. P.*). (*Cocculus Chondodendron*, De Candolle; *Cissampelos Abutua*, Vellozo; *Botryopsis platyphylla*, Miers.)

Nat. Ord.—Menispermaceæ.

COMMON NAMES: *Pareira brava*, *Pareira root.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 11.

Botanical Source.—This plant is "a lofty climbing shrub, with long, woody stems, and leaves as much as a foot in length. The latter are of variable form, but mostly broadly-ovate, rounded or pointed at the extremity, slightly cordate at the base, and having long petioles. They are smooth on the upper side; on the under, covered between the veins with a fine, close tomentum of ashy hue. The flowers are unisexual, racemose, minute, produced either from the young shoots or from the woody stems. The fruits are ¾ of an inch long, oval, black, and much resembling grapes in form and arrangement" (Hanbury, *Pharmacographia*).

History and Description.—This plant was introduced into Europe by the Portuguese in the second half of the seventeenth century. Its true origin was made known by Hanbury, in 1873, after it having been believed, for more than a hundred years, to be the product of *Cissampelos Pareira*, Linné (see D. Hanbury, *Amer. Jour. Pharm.*, 1873, p. 449). It is a woody, climbing vine of Brazil and Peru, being plentiful in the neighborhood of Rio Janeiro. In Brazil it is called *abutua*. It is much subject to adulteration, one of the most frequent substitutions at one time having been the worthless stem for the root (see E. R. Squibb, *Amer. Jour. Pharm.*, 1872, p. 107; and John Moss, *ibid.*, 1874, p. 335). Occasionally, substitutes of unknown origin turn up (see Ringer and Brooke, on "True and Commercial Pareira, *Amer. Jour. Pharm.*, 1892, p. 255). Spurious drugs may be known by their non-conformity to the pharmacopœial requirements.

True pareira brava is officially described as follows: "In subcylindrical, somewhat tortuous pieces, about 10 to 15 Cm. (4 to 6 inches) long, varying in thickness from 2 to 10 Cm. (⅘ to 4 inches); externally dark brownish-gray, with transverse ridges and fissures and longitudinal furrows; internally pale brown, and, when freshly cut, having a waxy lustre; bark thin; wood porous, in 2 or more somewhat irregularly concentric circles, with rather large medullary rays, and no distinct central pith; inodorous; taste bitter. Pieces having a bright-yellow color, or the woody portion of which is grayish, hard, and nearly tasteless, should be rejected"—(*U. S. P.*).

Chemical Composition.—F. A. Ringer and E. Brooke (*Amer. Jour. Pharm.*, 1892, p. 255) made a comparative analysis of true pareira and a spurious variety from Bahia, of unknown botanical origin. The distinguishing feature was the petroleum-ether extract (fats and fatty acids), which amounted in the true root to

8.67 per cent; in the false to only 0.28 per cent. Both drugs also contained starch, gum, tannin (1.26 per cent in the true), phlobaphene (0.52 per cent), and an alkaloid (0.819 per cent). The spurious drug contained only 0.143 per cent of the latter. Both alkaloids were insoluble in water, but soluble in alcohol and ether.

Charles Morrison (*Amer. Jour. Pharm.*, 1878, p. 430) records the presence of two alkaloids in a specimen of false pareira brava, having a bright-yellow wood; one of the alkaloids was similar to, but not quite identical with berberine. Wiggers, in 1839, named an amorphous, white alkaloid, which he found in a probably undetermined species of pareira brava, *pelosine;* it was insoluble in water, soluble in alcohol and acids, and of an intensely bitter taste. *Pelosine* was subsequently found by Flückiger (*Neues Jahrbuch der Pharmacie*, 1869, pp. 257–276) in notoriously genuine *Cissampelos Pareira*, associated with an indifferent body, *deyamittin*. Pelosine was proven by Flückiger to be identical with the alkaloids *beberine* and *buxine* (which see).

Action, Medical Uses, and Dosage.—Tonic, diuretic, and aperient. To the kidneys it is a decided stimulant and tonic, relieving irritation of the urinary tract, being indicated by abdominal uneasiness, with desire to pass urine frequently. Used in *chronic inflammation of the bladder, pyelitis,* and various disorders of the urinary organs. Also recommended in *calculous affections, leucorrhœa, dropsy, rheumatism,* and *jaundice.* Dose, of the infusion, from 1 to 4 fluid ounces; of the extract, from 10 to 20 grains. A strong tincture (bark, ℥viii to alcohol, 76 per cent, Oj) may be administered in doses of from 1 to 10 drops for specific purposes.

Specific Indications and Uses.—Chronic cystitis and pyelitis; irritation of urinary tract, with abdominal uneasiness; frequent desire to urinate, which act is accomplished with pain in urethra and glans penis.

Other Drugs Known as Pareira Brava.—ROOTS AND STEMS OF:

I. CISSAMPELOS PAREIRA, Linné (*C. microcarpa*, De Candolle); illustration in Bentley and Trimen's *Med. Plants*, 15.—This was thought originally to be the source of pareira brava. It is also termed *Velvet-leaf* and *Ice vine*, and is a shrub with a round, ligneous root, stems either smooth, or with close-pressed down, and climbing over trees. Leaves large, nearly orbicular, peltate, aristate at the point, when full grown smooth above, underneath covered with silky pubescence, but not truly downy. Flowers diœcious, hispid, in racemes; sepals 8, 4 inner united into a cup, with usually an entire margin; peduncles solitary or in pairs, branching from the base, as long as the petiole, or longer, racemose corymbose, with divaricating, downy ramifications. Racemes, in the female plant, longer than the leaves, bearing the flowers in spiked fascicles. Bracts sessile, somewhat orbicular, scarcely mucronate. Ovary solitary, and surmounted with 3 stigmas. Berries scarlet, round, reniform, compressed, shriveled, thinned to the edge, all over hispid with long hairs (L.). This plant is a native of the West India Islands and the Spanish Main. The root and stem seldom attain the diameter of 1 inch, and are more often the size of a quill. No concentric rings are shown on cross-section. It is very bitter, not sweetish nor astringent. This variety is made up chiefly of stems with some sections of root.

II. COMMON FALSE PAREIRA BRAVA.—This is derived from undetermined plants of the natural order *Menispermaceæ*, and is the drug that yielded *pelosine* to Wiggers, in 1839. According to Hanbury, "the drug consists of a ponderous, woody, tortuous stem and root, occurring in pieces from a few inches to a foot or more in length, and from 1 to 4 inches in thickness, coated with a thin, hard, dark-brown bark. The pieces are cylindrical, 4-sided, or more or less flattened, sometimes even to the extent of becoming ribbon-like. In transverse section, their structure appears very remarkable. Supposing a piece to be *stem*, a well-defined pith will be found to occupy the center of the first-formed wood, which is a column about ¼ of an inch in diameter. This is succeeded by 10 or 15 or more concentric, or oftener eccentric, zones, $\frac{1}{10}$ to $\frac{1}{20}$ of an inch wide, each separated from its neighbor by a layer of parenchyme, the outermost being coated with true bark. In pieces of the *true root*, the pith is reduced to a mere point. Sometimes the development of the zones has been so irregular that they have formed themselves entirely on one side of the primitive column, the other being coated with bark. The zones, including the layer around the pith (if pith is present), are crossed by numerous small medullary rays. These do not run from the center to the circumference, but traverse only their respective zones, on the outside of which they are arched together. The drug, when of good quality, has its wood firm, compact, and of a dusky, yellowish-brown hue, and a well-marked, bitter taste. It exhibits, under the knife, nothing of the close, waxy texture seen in the root of *Chondodendron*, but cuts as a tough, fibrous wood"—*Pharmacographia*. This root is unaffected by iodine. This kind possesses medicinal value, but has been largely superseded by an inert drug, devoid of bitterness, in cylindrical sticks of light weight, dull color, splitting readily, and having two easily detached layers of bark. D. Hanbury advocates returning to the use of the original pareira brava, which gave the drug its reputation.

III. STEMS OF CHONDODENDRON TOMENTOSUM (By far less efficient than the root (see P. R. Squibb, *Amer. Jour. Pharm.*, 1872, p. 107). It is also known as *Pa*[illegible].

IV. White Pareira Brava.—Stems and roots of *Abuta rufescens*, Aublet. A tasteless and odorless drug, not found in commerce, whose decoction turns strongly blue when treated with iodine. The root, on transverse section, shows white, amylaceous, concentric zones, marked with handsome, dark, wedge-shaped medullary rays.

V. Yellow Pareira Brava.—Probably derived from *Abuta amara*, Aublet, of Guiana. Internally, it is bright-yellow, and has eccentric zones. It is probably the specimen analyzed by Morrison (see above).

PARTHENIUM.—FEVERFEW

The flowering herb of *Pyrethrum Parthenium*, Smith (*Matricaria Pyrethrum*, Linné; *Chrysanthemum Parthenium*, Persoon; *Tanacetum Pyrethrum* Schultz).

Nat. Ord.—Compositæ.

Common Names: *Feverfew, Featherfew.*

Botanical Source.—Feverfew is a perennial, herbaceous plant, with a tapering root, and an erect, branched, leafy, round, furrowed stem, about 2 feet high. The leaves are alternate, petiolate, flat, bipinnate, or tripinnate, hoary green, the segments or leaflets inclining to ovate, decurrent, gashed, and dentate. The flowers are white and compound. The panicle is corymbose, sometimes compound; peduncles long-naked, single-flowered, and swelling upward. Flower-heads erect, about ½ inch broad, with a convex, yellow disk, and numerous short, broad, abrupt, 2-ribbed, white rays; often wanting; sometimes multiplied, and the disk being obliterated, constitutes a double flower. The involucre is hemispherical, imbricate, pubescent, with the scales scarious at the edge; the receptacle flat or convex, and naked; the achenia wingless, angular, uniform, crowned by a coronetted pappus, which is usually toothed, and occasionally auriculate (L.—W.).

History.—This is a European plant, and is common to the United States; found occasionally in a wild state, but is generally cultivated in gardens, and flowers in June and July. It imparts its virtues to water, but much better to alcohol. Bees are said to dislike this plant very much, and a handful of the flower-heads will cause them to keep at a distance.

Chemical Composition.—J. Chautard, in 1863, obtained from this plant, by distillation with water, an oil which deposits upon standing in the cold, a lævorotatory camphor, *pyrethrum-camphor* ($C_{10}H_{16}O$), distinguished from ordinary camphor by its opposite optical rotation. Besides, the volatile oil contains an oxygenated liquid, and possibly a terpene hydrocarbon.

Action, Medical Uses, and Dosage.—Tonic, carminative, emmenagogue, vermifuge, and stimulant. This agent is one of the pleasantest of the tonics, influencing the whole intestinal tract, increasing the appetite, improving digestion, and promoting secretion, besides having a decided action upon the renal and cutaneous functions. The warm infusion is an excellent remedy in *recent colds*, *flatulency*, *worms*, *atonic dyspepsia*, *irregular menstruation*, *nervous debility*, *hysteria*, *suppression of the urine*, and in some *febrile diseases*. In *hysteria* or *flatulency*, 1 teaspoonful of the compound spirits of lavender forms a valuable addition to the dose of the infusion, which is from 2 to 4 fluid ounces. The cold infusion or extract makes a valuable tonic. The leaves in poultice are an excellent local application in *severe pain* or *swelling of the bowels*, etc.

Related Species.—*Parthenium integrifolium*, Linné; *Cutting almond*. This plant, also known by the name of *Nephritic plant*, is indigenous and perennial, with an erect, striate, pubescent stem, from 3 to 6 feet in height. Leaves alternate, lance-ovate, hispid-scabrous, coarsely dentate-crenate, coriaceous, lower ones petiolate, upper sessile, sometimes clasping, 4 to 12 inches long, about half as wide. Radical petioles a foot long. Heads many-flowered, tomentose, corymbed; ray-flowers 5, somewhat ligulate, fertile; disk-flowers tubular, sterile. Involucre hemispherical, 5-leaved; scales in 2 series, outer ovate, dilated, inner orbicular; receptacle minute, conical, chaffy; achenia 5, obovate, compressed, cohering with 2 contiguous paleæ. It is sometimes known as *Prairie dock* (W.). This plant grows in the middle and western states, in dry soils, flowering from July to September. The root is the part used. Its growth is singular; it issues from a head or caudex, at first small, but gradually increases in size, and terminates very abruptly, giving off other roots of a similar form, each being a distinct root, about the size and shape of a radish, but growing horizontally, and sending up stems from near the large ends of the principal roots, which are blackish outside, and bluish-gray within. According to analysis by Frank B. Meyer (*Amer. Jour. Pharm.*, 1881, p. 490), the bitterness of the drug is due to a crystallizable substance obtained by abstracting the powdered drug first with petroleum benzin, which removes a dark-green wax; then with ether, and taking up the ethereal extract with boiling water. The crystals turn deep-red with ferric chloride, and do not reduce Fehling's solution. The liquid preparations of the drug possess an agreeable orange-like odor. Diuretic. A cold infusion of the root, in wineglassful doses, 3 or 4 times a day, will be found very beneficial in *heat of the urine*, *strangury*, *dysuria*, *gonorrhœa*, *gravel*, and *diseases of the kidneys and bladder* generally. It is highly recommended by some practitioners in these diseases. Likewise said to be an aromatic bitter and stimulant. The flowering tops have been used as an antiperiodic. Two fluid ounces of their infusion have no unpleasant influence on the nervous system, and are said to be equal to 20 grains of sulphate of quinine (Houlton).

Parthenium Hysterophorus, Linné, is employed like feverfew. It resembles cutting almond, and is indigenous to Louisiana, Florida, and the West Indian Islands. It is a common weed in Jamaica. Dr. José R. Tovar, of Cuba, employed *parthenin* obtained from this plant in cases of *facial neuralgia* with much success (*Therap. Gazette*, 1885, p. 359). M. Guyet (*Proc. Amer. Pharm. Assoc.*, 1886, p. 416) points out the complex composition of this active constituent, which he states is not a definite body. Dr. Carlos Ulrici (see *Amer. Jour. Pharm.*, 1886, p. 451, and Merck's *Bulletin*, Oct., 1888, p. 53) found in the drug five alkaloids, *parthenine* being the active, bitter and crystallizable principle, quite readily soluble in hot water. Uncrystallizable *parthenic acid* is likewise present. Dr. Harry V. Arny observed that the plant is richest in the active bitter principle in the months of June and July, when about 1 per cent may be obtained therefrom in large crystals. It is not a glucosid as was first supposed, nor an alkaloid. A volatile oil containing a camphor was obtained by distillation with steam (*Amer. Jour. Pharm.*, 1897, p. 169). Small doses (3 grains) of the total active principle quicken, and larger doses (15 grains) retard cardiac movements. Large doses (50 grains) slow the respiration, reduce arterial tension, and bring down the temperature.

PASSIFLORA.—PASSION FLOWER.

The root and stem-base of *Passiflora incarnata*, Linne.

Nat. Ord.—Passifloraceæ.

Common Names: *Passion flower*, *May pops*.

Botanical Source.—A pubescent, climbing shrub, reaching a height of from 20 to 30 feet, and supporting 3 to 5-cleft leaves, the lobes being serrated, and the petiole bearing above 2 glands. The involucre is 3-parted. The flowers are large, wonderful, and handsome, being about 2 inches broad, and of a nearly white color, the crown being triple and of a purplish and flesh-colored or roseate hue. The fruit is the size of a hen's egg, oval, and orange-yellow. It is a perennial herb (G.—W.).

Botanical History.—The genus *Passiflora* inhabits mainly the tropical portions of America. They are climbing herbs or shrubs, usually with tendrils having alternate, generally palmately divided (some undivided) leaves, with stipules. The flowers are perfect; the calyx is of 5 sepals united at the base to form a cup, and usually have the color of the petals at least on their inner surface. The 5 petals are inserted on the calyx throat, which is a complex, double or triple filamentous crown. The filaments of the 5 stamens are united to form a tubular sheath for the long-stalked ovary, upon which are the 3 club-shaped styles. The anthers are large and fixed by their middle. The many-seeded, 1-celled berry-like fruit is often edible. The seeds are invested by a pulpy substance (Gray).

Two species of this genus have been used to some extent in this country, *P. incarnata* and *P. lutea*. The former has now become an important remedy. This species is found within our borders, thriving in dry soils from Virginia to Florida, and from thence westward to Missouri and Arkansas. The common name in our southern states for the fruit is *May-pops*. The generic name *Passiflora* is, according to Gray, "an adaptation of *flos passionis*, a translation of *fior della passione*, the popular Italian name early applied to the flower from a fancied resemblance of its parts to the implements of the crucifixion." The fruit is orange-colored, about the size of a hen's egg, and filled with a sweetish-yellow pulp. The juice of the leaves of this species, together with those of *Passiflora pallida* and *Passiflora maliformis*, were long ago used by the Brazilians for intermittent fevers. The entire plant is used in medicine. Prof. Goss, who introduced it to the Eclectic profession, employed the root and its preparations. We know of physicians who prefer the tincture of the leaves, and others still, who desire the root with a few inches of the stem attached. Passiflora contains small amounts (often traces only) of an alkaloid. Its constituents seem not to possess any decided chemical characteristics.

Passiflora was introduced into medicine in 1839 or 1840 by Dr. L. Phares, of Mississippi, who, in the *New Orleans Medical Journal*, records some trials of the drug made by Dr. W. B. Lindsay, of Bayou Gros Tete, La. The use of the remedy has been revived within recent years, Prof. I. J. M. Goss, M. D., of Georgia, having introduced it into Eclectic practice.

Action, Medical Uses, and Dosage.—The physiological action of passiflora has not been well-studied. Medicinal doses produce no special physiological impressions, but we have observed even small doses to occasionally provoke emesis, Some individuals appear to be very susceptible to this effect. Moderate doses act as an antispasmodic and are somewhat narcotic. Dr. Phares, who introduced the drug, stated that he was satisfied that it possessed no narcotic properties. It is, at least, hypnotic. Excessive doses are said to have produced in animals both spasms and paralysis.

The clinical application of passiflora has been with most observers satisfactory. Its force is exerted chiefly upon the nervous system, the remedy finding a wide application in *spasmodic disorders* and as a rest-producing agent. It is best adapted to debility and does not act so well in sthenic conditions, although not contraindicated in such. It is specially useful to allay *restlessness* and overcome *wakefulness*, when these are the result of exhaustion, or the nervous excitement of debility. It proves specially useful in the *insomnia* of infants and old people. It gives sleep to those who are laboring under the effects of mental worry or from mental overwork. It relieves the nervous symptoms due to reflex sexual or menstrual disturbances, and the *nervous irritability* resulting from prolonged illness. We have employed it with good results to allay the restlessness of *typhoid fever*, although its action appears to be slow, but sure. The sleep induced by passiflora is a peaceful, restful slumber, and the patient awakens quiet and refreshed. A further study of the drug will undoubtedly give us a better guide to its adaptation as a nerve sedative and hypnotic. An atonic condition appears to be the keynote to its selection.

Passiflora is a remedy for *convulsive movements*. One of its first successful applications in medicine was for the relief of *tetanus*, both in man and the horse. If given in full doses in *epilepsy* when the aura gives warning of an approaching attack, the remedy is said to be of considerable value, but after the convulsions have begun it has little or no effect. Some, however, have reported success in all stages of the disease. Passiflora is praised for its control over the *spasms of childhood*, whether from dentition, *worms*, or undigested aliment; it has also been successfully employed in *trismus nascentium*. Spasms, dependent upon *meningeal inflammation*, have been controlled with it. It appears not to be contraindicated in any form of spasm. Dr. Holmes (*Ec. Med. Jour.*, 1896, p. 55) reports a case of *post-partum puerperal eclampsia* relieved after but two convulsions by the hypodermatic use of 2 drachms of passiflora. The remedy has given good results in *chorea*, especially in girls approaching the menstrual age. When *whooping-cough* is associated with convulsions, passiflora has given relief, and in *hysteria* with spasmodic movements it is reputed equally successful.

Passiflora is a remedy for *pain*, particularly of the neuralgic type. Thus it has relieved *neuralgic* and *spasmodic dysmenorrhœa*, *rectal pain*, *cardiac pain*, facial and other forms of *neuralgia*, many *reflex painful conditions* incident to *pregnancy* and the menopause, and other forms of pain accompanied or not with spasmodic action. *Sick* or *nervous headache*, the *headache of debility*, or from cerebral fullness are often relieved by passiflora. All such cases show marked atony of some part or function.

Passiflora has been employed to relieve many of the nervous phenomena attending *la grippe*, and both internally and externally has been given to mitigate the ravages of *erysipelas* (particularly when facial) and *syphilis*. Prof. Scudder long ago characterized passiflora as a remedy to relieve irritation of the nerve centers, and to improve sympathetic innervation, improving the circulation and nutrition, and stated that it might be used "in *torpidity of the liver* with hemorrhoids, and in *congestion of ovaries and uterus*." He employed for the latter purpose fractional doses of the drug (*Spec. Med.*, *p.* 197). It has been used to check *diarrhœa* and *dysentery*. An aqueous extract has been lauded as an application to recent *burns* and *scalds*, and to *hemorrhoids;* also to *ulcerating carcinomata*, *painful ulcers*.

chancres and *chancroids*. A pledget of cotton saturated with passiflora and introduced into a carious tooth has promptly allayed violent *toothache*. The dose of specific passiflora is from a fraction of a drop to 2 fluid drachms.

Specific Indications and Uses.—Irritation of brain and nervous system with atony; sleeplessness from overwork, worry, or from febrile excitement, and in the young and aged; neuralgic pains with debility; exhaustion from cerebral fullness, or from excitement; convulsive movements; infantile nervous irritation; nervous headache; tetanus; hysteria; oppressed breathing; cardiac palpitation from excitement or shock.

Related Species.—*Passiflora lutea*, Linné. Smooth and slender; summit of the leaves obtusely 3-lobed and lobes entire; glandless petioles and greenish-yellow flowers an inch broad. Damp thickets from Pennsylvania to Florida, and west to Illinois, Missouri and Louisiana. The fruits are acidulous and edible. Used by Dr. Phares, of Mississippi, like *Passiflora incarnata*.

Passiflora cærulea, Linné. Leaves 5-lobed and entire; flowers fringed and greenish, bluish, purplish, or white; fruit, orange-yellow. A native of Brazil, and often cultivated in warm countries for ornamental coverings for walls, houses, and arbors. The fruit is not eaten.

Fig. 190.

Passiflora cærulea.

Passiflora lyræfolia, Tussac.—Leaves unequally 3-cleft at top; flowers red; fruit like a cherry.

Passiflora rubra, Linné.—Leaves, 2-lobed; flowers whitish and light red; scarlet berries. Reputed narcotic by inhabitants of Jamaica and the Caribbee Islands.

Passiflora edulis.—Fruit large, orange-purple externally, orange-colored within. Has an acidulous, orange-flavored taste. Edible.

Passiflora alata.—An extract of the leaves with aloes was reputed beneficial in atrophy of various parts.

Passiflora capsularis.—Reputed emmenagogue.

Passiflora fetida, Cavanilles.—Leaves 3-lobed; flowers whitish, with purple crown; odor fetid. Said to be antispasmodic, emmenagogue, and expectorant. Used in poultices.

Passiflora laurifolia, Laurel-leaved granadilla.—West Indies. Known also as *Water lemon* and *Honey-suckle* by the English, *Pomme de Liane* by the French, and in South America as *Granadilla* and *Murucuja*. Fruit about the size of a hen's egg. Yellow and dotted with white; the pulp is whitish and watery, and the juice, which is peculiarly flavored and agreeably acid, is sucked by Europeans and natives through an opening made in the tough, thin rind. "It is said that it quenches thirst, allays heat, induces an appetite, and elevates the spirits" (Hogg). The leaves are bitter, and considered anthelmintic and moderately astringent.

Passiflora maliformis, Linné, *Apple-fruited granadilla*, or *Sweet calabash.*—Flowers white and fringed with blue. Fruit is dull yellow and resembles an apple in size and shape. Pulp gelatinous, pale yellow, very agreeably acid, and usually eaten with wine and sugar. Juice of the leaves used in Brazil in *intermittent fevers* (Hogg).

Passiflora contrayerva.—Root sweetish, pungent and fragrant. Reputed "counter-poison, deobstruent and cordial."

Passiflora quadrangularis, Linné.—Branches 4 angled and winged. Fruit large as a goose egg, and of a greenish-yellowish color. Native of Jamaica and South America and known as the *Common granadilla*, or *Granadilla vine*. The sweet, acidulous, purple-colored pulp is the edible portion. The root is reputed very poisonous, causing emesis, convulsions, paralysis and death. Small doses of the root are said to act as an anthelmintic. An active principle, somewhat like morphine, has been isolated from the root and named *passiflorine*.

Murucuja ocelatta.—West Indies. "Anthelmintic, diaphoretic and antihysteric" (Hogg). An infusion and syrup are used in Jamaica, like laudanum. A vinous or spirituous tincture of the flowers is employed under the name of *Bull-hoof* or *Dutchman's laudanum*, as an efficient and easy narcotic.

Modecca palmetta.—Reputed tonic and pectoral, and *Modecca integrifolia*, beaten with butter, is said to "heal *hemorrhoids*."

Adenia venenata.—Africa. A climber known as *Passion flower* in its habitat. Lauded as a vesicant by Schweinfurth.

PENTHORUM.—PENTHORUM.

The whole herb of *Penthorum sedoides*, Linné.

Nat. Ord.—Crassulaceæ.

COMMON NAMES: *Virginia stone-crop, Ditch stone-crop.*

Botanical Source. This is an erect, perennial herb, about a foot high, found growing in creeks and wet situations throughout the United States and Canada. The stem is smooth, round at the base, but angular above, and often branched.

It has numerous scattered, thin leaves, from 2 to 3 inches long, about ⅓ as wide, and attached to the stem at an acute angle. They are lanceolate, smooth, finely and sharply serrate, tapering regularly to an acute apex, and at the base to a very short leaf-stalk. The flowers are small, inconspicuous, and arranged in terminal naked cymes, consisting of from 2 to 4 slender, simple, 1-sided branches, which unroll as the flowers expand. The flowers are supported on short peduncles about ¼ of an inch long, and consist, each, of a 5-parted calyx, 10 stamens, and 5 pistils, which are united at the base. The petals are generally wanting. The fruit consists of 5 dry, 1-celled capsules, beaked with the persistent style, and united at the base. They open, when ripe, at the summit, and are filled with numerous minute seeds. The genus Penthorum, which differs from its allies of the Crassulaceæ in not having fleshy stems, consists of only 2 species—the one described above, indigenous to North America, the other found only in China.

Fig. 191.

Penthorum sedoides,

History and Chemical Composition.—Penthorum sedoides was mentioned by some of the older authorities, but its more recent introduction into medicine may be ascribed to Dr. F. H. Briggs (*Ec. Med. Jour.*, 1875, p. 479). The fresh herb has an astringent, slightly acid taste, and, when bruised, an herb-like odor. The properties of the fresh plant are best extracted by alcohol, and seem chiefly to depend upon a form of tannin which, in alcoholic solution with ferrous sulphate, first turns blue and then precipitates black. With ferric sulphate, it forms a deep-green solution. Neither the tincture, nor the tincture freed from tannin, shows the slightest indication of an alkaloid with the ordinary reagents. When the herb is distilled with water, the distillate is free from volatile oil.

Action, Medical Uses, and Dosage.—Dr. Briggs states that "the older authorities gave this agent as a demulcent and laxative, and it does not seem to exert the astringent action common to agents containing tannic acid. The impression upon the mouth is that of an astringent, but, on examining the mucous membrane, it does not seem corrugated, but very fresh and rosy, and it would undoubtedly prove a valuable tooth and mouth wash." The fluid extract and specific medicine have been employed successfully in the treatment of *cholera infantum*, *diarrhœa*, and *hemorrhoids*. Prof. J. M. Scudder observes that mucous membranes, especially when they have suffered from inflammatory action, are peculiarly influenced by this agent, which gradually removes irritation, promotes normal functional activity, and restores the tissues to their normal condition. He found it not only an excellent remedy in *diarrhœa*, but likewise in *chronic nasal catarrh*, in *chronic pharyngitis*, in *chronic bronchitis*, with increased secretion, and in *chronic vaginitis*, with or without leucorrhœal discharge. He employs it internally and locally, when this can be effected, in spray; also as a topical application to *chronic ulcers*. It is not, as a rule, as well adapted to acute as to chronic disorders, and must be used for a length of time to obtain its best effects. As a reliever of irritation of mucous surfaces, its best results have been obtained in *chronic affections of the posterior nares, pharyngeal vault*, and *Eustachian tubes*. It may be used both internally and by atomization. It has been of benefit in *indigestion* and *nervous dyspepsia*. Its effects upon the gastric membranes have been compared to those of small doses of ipecac. The dose of the fluid extract is from 10 to 60 minims, repeated every 3 or 4 hours; of the specific penthorum, 1 to 30 minims, in a teaspoonful of water. Penthorum is a remedy of undoubted power, and deserves a more careful study than has been hitherto bestowed upon it. It is best adapted to chronic conditions, being of little service in acute phases.

Specific Indications and Uses.—Pharyngeal and nasal disorders of a chronic type, with fullness, dryness, and irritation, with a purplish, congested appearance; catarrhal inflammations, with profuse secretions; catarrhal gastric disorders; catarrhal diarrhœa; spongy gums.

PEPO (U. S. P.)—PUMPKIN SEED.

"The seed of *Cucurbita Pepo*, Linné"—(*U. S. P.*).

Nat. Ord.—Cucurbitaceæ.

COMMON NAME: *Pumpkin seed.*

Botanical Source.—Cucurbita Pepo is an annual plant, hispid and scabrous, with a procumbent stem and branching tendrils. Its leaves are large, cordate, palmately 5-lobed, or angled and denticulate. The flowers are yellow, large, axillary, and the males long-pedunculate. Corolla campanulate; the petals united and coherent with the calyx. The calyx of the male flowers is 5-toothed; of the female the same, the upper part being deciduous after flowering; the stigmas are 3, thick, and 2-lobed; the pepo, or fruit, subligneous, very large, roundish, or oblong, smooth, yellow when ripe, furrowed and torulose, containing yellowish seeds, somewhat resembling those of the watermelon in form (W.).

History.—The pumpkin flowers in July, and matures its fruit in September and October. It is a native of the Levant, and is extensively cultivated as a kitchen vegetable, and for cattle. The seeds of this plant are used in medicine, and have long been popular with the laity as a remedy for worms. An oil may be obtained from the pumpkin seeds by expression. The West India seeds are more active as an anthelmintic than our own.

Description.—The seeds are "about 2 Cm. (⅘ inch) long, broadly-ovate, flat, white or whitish, nearly smooth, with a shallow groove parallel to the edge; containing a short, conical radicle, and 2 flat cotyledons; inodorous; taste bland and oily"—(*U. S. P.*).

Chemical Composition.—Pumpkin seeds are composed of 25 per cent of husks and 75 per cent of kernels, and contain upward of 33 per cent of a reddish fixed oil, which, according to Kopylow (*Amer. Jour. Pharm.*, 1877, p. 23), consists of the glycerides of palmitic, myristic, and oleic acids. These also occur partly in the free state. No alkaloid was found in the seeds, nor the glucosid, *cucurbitin*, of Dorner and Wolkowitsch (1870). According to Dr. L. Wolff (*Amer. Jour. Pharm.*, 1882, p. 382), the active (tænifuge) principle is a greenish-brown, acrid, bitter resin (Heckel, 1875) not contained in the petroleum-benzin extract of the seeds, but in the extract obtained with ether. It is also soluble in alcohol and chloroform. Its dose, as a tænifuge, is 15 grains, in pill form. The fatty oil is soluble in absolute, but not in 95 per cent alcohol (W. E. Miller, *ibid.*, 1891, p. 385). Air-dried pumpkin seeds contain about 3.7 per cent of ash. The juice of pumpkin pulp contains 1.6 per cent of dextrose and 0.9 per cent of cane sugar (Mr. Both, in Dragendorff's *Heilpflanzen*, 1899, p. 650). The coloring matter of the pumpkin is due to *carotin* (*Jahresb. der Pharm.*, 1896, p. 84).

Action, Medical Uses, and Dosage.—Mucilaginous, tænicide, and diuretic, and of service in *strangury* and *urinary affections*, also in *gastritis*, *enteritis*, and *febrile diseases*. The infusion may be drank freely. The expressed oil of the pumpkin seeds, in doses of 6 to 12 drops, several times a day, is said to be a most certain and efficient diuretic, giving quick relief in *scalding of urine*, *spasmodic affections of the urinary passages*, and has cured *gonorrhœa*. Half a fluid ounce of oil of pumpkin seeds, taken upon a fasting stomach, repeated in 2 hours, and in another 2 hours followed by a dose of castor oil containing ½ fluid ounce of the pumpkin-seed oil, has been effectual in removing *tapeworm*. The following mixture has been found efficient in the removal of tapeworm: Take of the ethereal oil of pumpkin seeds, 1 fluid ounce; ethereal extract of male fern, 1 fluid drachm; sugar, 2 drachms; water, 4 fluid ounces; rub the oil with the sugar, then the extract, and finally add, gradually, the water. One-fourth of this is a dose, to be repeated every hour. An infusion of the seeds has also been found effectual in removing tapeworm. The method now chiefly pursued is to have the patient fast for a day and take a saline cathartic to wash the intestinal mucus, etc., from the worm. Then, the patient being kept in bed to prevent emesis, administer to him 3 doses of ⅓ of a pint each, every 2 hours, of an emulsion prepared from the fresh seeds beaten with pulverized sugar and diluted with milk or water. After a few hours, a purgative, like castor oil, may be administered to aid in the expulsion of the worm. This is also effectual in removing the *roundworm*. It was formerly believed that the tænifuge properties resided in the external covering of the seeds, but later investigations do not confirm this view.

Specific Indications and Uses.—Tapeworm; roundworm; ardor urinæ.

Related Species.—*Citrullus vulgaris*, Schrader (*Cucurbita Citrullus*, Linné; *Cucumis Citrullus* of Seringe); *Watermelon*. This is a native of Africa and southern Asia, and is cultivated in this country for its large and delicious fruit, which is usually ripened in August, the flowers appearing in June and July. The fruit contains many obovate, smooth, compressed seeds, thickened at the margin, and of a black or yellowish-white color (W.). The fleshy, juicy pulp of the watermelon is diuretic, and forms a grateful article of diet for febrile patients, when not contraindicated. Watermelon seeds possess properties similar to pepo, and, as a diuretic (infusion of bruised seeds) is one of the mildest and best we possess. Acetate of potassium added to it, increases its efficiency and augments the excretion of the solid constituents of the urine. F. Popow (*Jahresb. der Pharm.*, 1888, p. 51) found the edible portion of the watermelon to consist of water (94.96 per cent) and dry substance (5.04 per cent); the latter was composed of nitrogenous matter (0.67 per cent), dextrose (3.67 per cent), lævulose (0.46 per cent), mucilage (0.05 per cent), fat (0.06 per cent), cellulose (0.10 per cent), and mineral matter (0.28 per cent). The seeds contain resin (2.3 per cent), albumen (6 per cent), and dextrose (3 per cent) (Dragendorff's *Heilpflanzen*, 1899, p. 650).

Lagenaria vulgaris, Seringe (*Cucurbita Lagenaria*, Linné); *Gourd*, or *Calabash*.—Pulp is occasionally bitter and purgative (A. De Candolle, 1882).

Cucumis sativus, Linné; *Cucumber*.—This plant is too well known to require description. Both the fruit and seeds are employed. The latter contain, besides mucilage, a bland, fixed oil, of a pale-yellow color, to the amount of about 32 per cent. Prof. Procter proposed, in 1853, a *cucumber ointment*, prepared as follows: Take green cucumbers, 7 pounds; suet, 15 ounces; lard, 24 ounces. Grate the fruit and express the juice. Then melt together the lard and suet, and, when sufficiently cooled so as to form a semisolid mass, gradually incorporate with it the cucumber juice, adding about one-third of it each time. After some time, melt the whole mixture, strain, and keep in glass containers, covering the ointment with rose-water. Close the jar securely. When needed, take out a portion, and mix it to a white, creamy paste by triturating it with a small amount of rose-water. Cucumber seeds have been used for diuretic purposes like other seeds of this class. The ointment is emollient, and may be applied to *cuts, abrasions*, etc. Dr. J. M. Scudder (*Spec. Med.*, p. 119) advised a tincture of green cucumber, prepared with 98 per cent alcohol for "irritation of the urinary passages, sharp pain in the loins, and rheumatic pains in the shoulders." Cramp-like pains in the shoulder and loins, with inability to urinate, are the indications given by Dr. O. H. Rohde (*Trans. of N. Y. Ec. Med. Assoc.*, Vol. XVII, p. 165).

Momordica balsamina, Linné; *Balsam-apple*.—This long-ovate fruit, tapering at each extremity, has been used considerably as a vulnerary. It is verrucose, orange or bright-red, rather angular and spontaneously divides laterally, displaying an interior containing oval, flat, brown seeds, somewhat rugose, and imbedded in a fleshy arillus of a red color. The root and fruit are both purgative. Two drachms of balsam-apple are said to have killed a dog. A preparation of the fruit (without the seeds), infused in almond or olive oil, has been employed considerably in *prolapsus ani, hemorrhoids, burns, scalds, chapped hands*, and *old ulcerations*. An extract of it has been praised for its curative effects in *dropsy*. Balsam-apple, infused in whiskey, is quite largely employed by the German population of this country as a vulnerary. It is often applied to *chilblains*. Internally, an alcoholic tincture and a jelly have been employed for the relief of pain in the chest from *acute colds*, and in *pulmonary congestion*. Proper doses relieve gastro-intestinal irritation, and give relief in gastro-intestinal pains, particularly in *colic*.

Cucurbita Melopepo, Linné; *Squash*.

Cucumis Melo, Linné; *Muskmelon*.—The seeds of this and the foregoing species possess similar properties to those of pepo, but in a milder degree. The seeds contain 39 per cent of fatty oil. From the root an emetic principle, *melon-emetine*, was isolated, in 1887 (*Pharm. Centralhalle*, p. 600), by Heberger and Jorosiewicz.

Cucurbita maxima, Duchesne.—Improperly called *Gourd*. Seeds contain sugar, gum, an aromatic body, a soluble organic acid, yellow, bland fixed oil (25 per cent), and emulsin, but no alkaloid nor a glucosid (Cadenberg, 1881). The seeds give, on rubbing with water, a bland, white emulsion.

PEPSINUM (U. S. P.)—PEPSIN.

"A proteolytic ferment or enzyme obtained from the glandular layer of fresh stomachs from healthy pigs, and capable of digesting not less than 3000 times its own weight of freshly coagulated and disintegrated egg albumen, when tested by the process given below. If it be desired to use a diluent for reducing pepsin of a higher digestive power to that required by the Pharmacopœia, sugar of milk should be employed for this purpose"—(*U. S. P.*).

Source, History, and Preparation.—Pepsin is a peculiar, probably non-albuminous principle, occurring in the gastric juice, and possessing the power, in the presence of hydrochloric or other acids, to dissolve coagulated albumen and muscular fiber, converting them into the modified proteids known as *peptones*. The name *pepsin* was first used about 1836, by Schwann, who obtained the "digestive principle" by macerating cleaned stomachs in acid water, precipitating the liquid with mercuric chloride, and separating the mercury with sulphide of hydrogen. Commercial pepsin was first prepared by drying the granular layer of the stomach of the pig or calf, at low temperatures, and powdering the product. Pepsin is not known in the absolutely pure state. Besides being soluble in water, it is also soluble in glycerin; according to Wittichs, it may be extracted from the mucous membrane of the stomach by means of glycerin acidulated with 0.1 per cent of hydrochloric acid and then precipitated by alcohol. By the process of the *British Pharmacopœia* (1885), the washed mucous lining of the fresh stomach of a sheep, calf, or pig, is scraped with a blunt instrument, the viscid pulp is immediately spread in a thin layer on glass plates or glazed earthenware, and dried at a temperature not to exceed 37.8° C. (100° F.). This product is sparingly soluble in water, because it naturally contains much inert animal matter. A more active pepsin may be obtained by this method if the inner coating of the stomach wherein the pepsin glands are imbedded, be utilized, *i. e.*, washed, dried, and powdered. (For Scheffer's process, based upon the precipitation of pepsin by sodium chloride solution, see *Pepsinum Saccharatum;* see also an interesting article on the manufacture of pepsin, in *Amer. Jour. Pharm.*, 1893, p. 140, from *Pharm. Jour. Trans.*, and *ibid.*, 1892, p. 562.)

Description and Chemical Properties.—"A fine, white, or yellowish-white, amorphous powder, or thin, pale-yellow or yellowish, transparent or translucent grains or scales, free from any offensive odor, and having a mildly acidulous or slightly saline taste, usually followed by a suggestion of bitterness. It slowly attracts moisture when exposed to the air. Soluble, or for the most part soluble, in about 100 parts of water, with more or less opalescence; more soluble in water acidulated with hydrochloric acid; insoluble in alcohol, ether, or chloroform. On heating a solution of pepsin in acidulated water to 100° C. (212° F.), it becomes milky, or yields a light, flocculent precipitate, and loses all proteolytic power. In a dry state it can bear this temperature without injury. Pepsin usually has a slightly acid reaction. It may be neutral, but should never be alkaline"—(*U. S. P.*). Pepsin having a foul odor should be rejected. Aqueous solution of pepsin will to a slight extent dissolve coagulated albumen, but the addition of a few drops of hydrochloric acid (about 0.1 to 0.3 per cent) renders it at once an active solvent; while pancreatin is active only in alkaline media. Pepsin is not destroyed by the process of digestion. After it has ceased to act, the addition of another supply of acid apparently regenerates it, and renders it capable of again performing the part of a digestive agent. Pepsin curdles 80,000 parts of milk (*Amer. Jour. Pharm.*, 1872, p. 49). Neutralization suspends the action of pepsin; alkalies and alcohol injure it; boiling destroys it. Precipitated dry pepsin, obtained according to Mr. Scheffer's method, resembles parchment paper, or "sole leather," the color ranging from light-straw to brown. Pepsin, after having been dried, swells in water, dissolves slowly, but in small proportion. When freshly precipitated, it is very soluble. Solution of pepsin is almost neutral, yields a transparent, gelatinous precipitate with alcohol without losing its peptonizing power, and coagulates on boiling. Bichloride of mercury and nitrate of lead give white precipitates with it.

Valuation of Pepsin.—"Prepare, first, the following three solutions: *A.* To 294 Cc. of water add 6 Cc. of diluted hydrochloric acid. *B.* In 100 Cc. of solution *A* dissolve 0.067 Gm. of the pepsin to be tested. *C.* To 95 Cc. of solution *A*, brought to a temperature of 40° C. (104° F,), add 5 Cc. of solution *B*. The resulting 100 Cc. of the liquid will contain 2 Cc. of diluted hydrochloric acid, 0.00335 Gm. of the pepsin to be tested, and 98 Cc. of water. Immerse and keep a fresh hen's egg during 15 minutes in boiling water; then remove it and place it in cold water. When it is cold, separate the white, coagulated albumen, and rub it through a clean sieve having 30 meshes to the linear inch. Reject the first portion passing through the sieve. Weigh off 10 Gm. of the second cleaner portion, place it in a flask of the capacity of about 200 Cc., then add one-half of solution *C*, and shake well, so as to distribute the coherent albumen evenly throughout the liquid. Then add the second half of solution *C*, and shake again, guarding against loss. Place the flask in a water-bath, or thermostat, kept at a temperature of 38° to 40° C. (100.4° to 104° F.), for 6 hours, and shake it gently every 15 minutes. At the expiration of this time the albumen should have disappeared, leaving at most only a few, thin, insoluble flakes. (Trustworthy results, particularly in comparative trials, will be obtained only if the temperature be strictly maintained between the prescribed limits, and if the contents of the flasks be agitated uniformly, and in equal intervals of time.) The relative proteolytic power of pepsin stronger or weaker than that described above may be determined by ascertaining, through repeated trials, how much of solution *B* made up to 100 Cc. with solution *A* will be required exactly to dissolve 10 Gm. of coagulated and disintegrated albumen under the conditions given above"—(*U. S. P*).

The *National Formulary* (1st ed.) made less strict requirements, demanding only that pepsin should be capable of dissolving not less than 500 times its own weight of hard-boiled egg-albumen, giving explicit directions for its valuation. (For the results of the valuation of 15 commercial samples of pepsin by the *U. S. P.* assay method, see *Proc. Amer. Pharm. Assoc.*, 1895, p. 244.)

Action, Medical Uses, and Dosage.—Previous to the introduction of pepsin, it was a common course among several nations, and in domestic practice, to collect the gizzards of chickens, ducks, turkeys, pigeons, and other birds, remove their inner mucous membranes, dry them, and then reduce them to powder; and this powder, now called *ingluvin*, either alone or in combination with other substances, was administered in derangements of the digestive organs. Pepsin, properly prepared, answers a much better purpose, but to be of efficacy, it must not be united with starch, bismuth, wine, alcohol, or other substances that impair or destroy its peculiar properties. The articles with which it may be combined without injury are, in the form of powder, sugar of milk, or silica, and in fluid form, glycerin, or acidulated water and glycerin, which will preserve it for a considerable period. Pepsin, while aiding or correcting digestion, exerts no influence upon the various lesions upon which the impaired digestive process depends; though it may, in certain cases, afford such relief to this process as to permit the natural recuperative energies of the system to effect recovery. It frequently affords relief in various forms of *indigestion*, or of *dyspepsia*. Infants of delicate constitution, suffering from gastric derangements either previous to or during the period of *dentition*, as manifested by tumid abdomen, emaciation, diarrhœa, and often a tendency to vomit, will derive much benefit from its use, during the administration of which these symptoms will disappear, and the sufferings from dentition will be greatly mitigated. Among those infants raised artificially upon cow's milk, and with whom this fluid does not readily digest, pepsin has likewise been recommended; it may be serviceable in some instances of this kind, though it appears to me that liquid rennet would answer a much better purpose (J. King). It should be remembered that its continued use tends to enfeeble gastric digestion, and thus defeats the purposes for which it is given.

In cases of *sick headache* due to *gastric acidity*, large doses of pepsin, taken shortly after meals, will tend greatly to postpone or prevent the cephalalgic attack. It will also be of value in the feeble or tardy digestion attending convalescence from exhausting *febrile* or *inflammatory disorders*, and that present during long-standing *chronic diseases*. According to M. Liebreich, pepsin is contraindicated in carcinoma, and ulceration of the stomach, in which its administration would tend to hasten the process of thinning the diseased portion of the gastric walls. M. Castro (1868) has successfully used hypodermatic injections of an acid solution of pepsin for the removal or diminution of *tumors*, passing the injection directly into their substance. Pepsin, to be of service, must be pure and reliable, and the more recent its preparation the more satisfactory will be its effects. The dose of saccharated pepsin is from 10 to 60 grains, taken shortly after each meal; it may be taken alone, washed down with a draught of water, or it may be mixed in equal parts of water and pure glycerin; of pure pepsin, from 2 to 10 grains; of liquid pepsin, from 2 fluid drachms to 2 fluid ounces.

Related Preparations.—See *Pepsinum Saccharatum* [*U. S. P.*], and *Vinum Pepsini* (N. F.).

LIQUID PEPSIN (Scheffer).—"Take of saccharated pepsin, 64 grains; water, 5 fluid ounces; hydrochloric acid, 1 fluid drachm; after solution, add glycerin, 3 fluid ounces, then mix and filter. One fluid ounce dissolves 90 grains of coagulated albumen"—(*Nat. Form.*).

Pepsinum Aromaticum (N. F., *Aromatic pepsin.*—"Saccharated pepsin (*U. S. P.*), ninety-seven grammes (97 Gm.) [3 ozs. av., 184 grs,]; aromatic fluid extract (*U. S. P.*), six cubic centimeters (6 Cc.) [97 ♏]; tartaric acid, one and one-half grammes (1.5 Gm.) [23 grs.]; sodium chloride, one and one-half grammes (1.5 Gm.) [23 grs.]. Mix the ingredients by trituration, dry the product by exposure to warm air, and keep it in well-stoppered bottles"—(*Nat. Form.*).

Pulvis Pepsini Compositus (N. F.), *Compound powder of pepsin, Pulvis digestivus.*—"Saccharated pepsin (*U. S. P.*), fifteen grammes (15 Gm.) [231 grs.]; pancreatin (*U. S. P.*), fifteen grammes (15 Gm.) [231 grs.]; diastase, one gramme (1 Gm.) [15 grs.]; lactic acid (*U. S. P.*), one cubic centimeter (1 Cc.) [16 ♏]; hydrochloric acid (*U. S. P.*), two cubic centimeters (2 Cc.) [32 ♏]; sugar of milk, sixty-six grammes (66 Gm. [2 ozs. av., 143 grs.]. Add the acids gradually to the sugar of milk, and triturate until they are thoroughly mixed. Mix the pepsin, pancreatin, and diastase, and then incorporate this mixture, by trituration, with the sugar of milk. Finally, rub the mixture through a hair-sieve, and preserve the powder in bottles. *Note.*—The best commercial variety of diastase, capable of converting the largest comparative amount of starch into dextrin and glucose, should be used for this preparation"—(*Nat. Form.*).

Glyceritum Pepsini (N. F., 1st ed.), *Glycerite of pepsin.*—Pepsin, 640 grs.; hydrochloric acid, 80 ♏; purified talcum, 120 grs.; glycerin, 8 fl℥; water, enough to make 16 fluid ounces. Mix the pepsin with 7 fluid ounces of water and the hydrochloric acid, and agitate until solution has been effected. Then incorporate the purified talcum with the liquid, filter, returning the first portions of the filtrate until it runs through clear, and pass enough water through the filter to make the filtrate measure 8 fluid ounces. To this add the glycerin, and mix. Each fluid drachm represents 5 grains of pepsin (N. F.). *Note.*—For filtering the aqueous solution of pepsin first obtained by the above formula, as well as for filtering other liquids of a viscid character, a filter paper of loose texture (preferably that known as 'Textile Filtering Paper'), or a layer of absorbent cotton placed in a funnel, or percolator, should be employed"—(*Nat. Form.*, 1st ed.).

PEPSINUM SACCHARATUM (U. S. P.)—SACCHARATED PEPSIN.

Preparation and History.—"Pepsin, ten grammes (10 Gm.) [154 grs.]; sugar of milk recently dried, and in No. 30 powder, ninety grammes (90 Gm.) [3 ozs. av., 76 grs.]. To make 100 grammes (100 Gm.) [3 ozs. av., 231 grs.]. Triturate the pepsin with the sugar of milk to a fine, uniform powder. Keep the product in well-stoppered bottles. Saccharated pepsin, when tested by the process given under Pepsin (see *Pepsinum*), with the modification that 0.67 Gm. of it are to be taken in preparing solution *B*, should digest 300 times its own weight of freshly coagulately and disintegrated egg albumen."—(*U. S. P.*).

In 1872 (*Amer. Jour. Pharm.*, 1872, p. 49), Prof. E. Scheffer, of Louisville, announced the formula for making saccharated pepsin now generally used by manufacturers, a process that is easy and practical. It is carried out as follows: Dissect the mucous membrane from well-cleaned hogs' stomachs, chop it fine, and macerate it for several days, in water acidulated with hydrochloric acid; strain the resulting liquid, and mix it with its bulk of saturated solution of chloride of sodium. The pepsin now separates, will rise to the surface, and must be skimmed off, drained upon a muslin strainer, and submitted to strong pressure to rid it of salt; then, while still moist, it is to be mixed with milk sugar, in such proportion that ten grains dissolved in one fluid ounce of water acidulated with hydrochloric acid, will dissolve one hundred and twenty grains of coagulated albumen, at about 38° C. (100° F.), in from 4 to 6 hours.

Action, Medical Uses, and Dosage.—Those of Pepsin. (See *Pepsinum.*)

Related Preparations.—The following preparations and plant are employed as aids to digestion:

Liquor Pepsini (*U. S. P.*) (N. F.), *Solution of pepsin.*—"Saccharated pepsin (*U. S. P.*), forty grammes (40 Gm. [1 oz. av., 180 grs.]; hydrochloric acid (*U. S. P.*), twelve grains (12 Gm. [185 grs.]; glycerin, three hundred and twenty-five cubic centimeters (325 Cc. [10 fl℥, 475 ♏]; water, six hundred and fifty cubic centimeters (650 Cc.) [21 fl℥, 470 ♏]. Dissolve the saccharated pepsin in the water, previously mixed with the hydrochloric acid, add the glycerin, let the mixture stand 24 hours, and filter"—(*Nat. Form.*).

Liquor Pepsini Aromaticus (N. F.), *Aromatic solution of pepsin.*—"Pepsin (*U. S. P.*), seventeen and one-half grammes (17.5 Gm.) [270 grs.]; oil of cinnamon, four (4) drops; oil of pimenta, four (4) drops; oil of cloves, eight (8) drops; purified talcum (F. 395), fifteen grammes (15 Gm.) [231 grs.]; alcohol, thirty-five cubic centimeters (35 Cc.) [1 fl℥, 88 ♏]; hydrochloric acid (*U. S. P.*), ten cubic centimeters (10 Cc. [162 ♏]; glycerin, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the pepsin with five hundred cubic centimeters (500 Cc. [16 fl℥, 435 ♏] of water and the hydrochloric acid, and shake the mixture frequently until the pepsin is dissolved. Then add the purified talcum and the oils, previously dissolved in the alcohol; mix the whole thoroughly, by agitation, and filter it through a wetted filter, returning the first portions of the liquid until it runs through clear. Pass enough water through the filter to make the filtrate measure seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏]. To this add the glycerin. Each fluid drachm represents 1 grain of pepsin (U. S. P.)"—*Nat. Form.*).

Liquor Seriparus (N. F.), *Liquid rennet.*—"Calves' rennet, fresh, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; sodium chloride, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; alcohol, two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏]; water, eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏]. Dissolve the sodium chloride in the water, add the alcohol, and macerate in this mixture the rennet (or the washed mucous membrane of the fresh stomach of a suckling calf), during 3 days, under frequent agitation, then filter. *Note.*—If this liquid is to be used merely for curdling the milk, without separating the whey as a distinct layer, it should be added to the milk, previously warmed to a temperature of about 35° C. (95° F.), and the mixture should then be set aside undisturbed, until it coagulates. If the whey is to be separated, the liquid rennet should be added to the milk while cold, and the mixture heated to about 35° C. (95° F.), but not exceeding 40° C. (104° F.) One part of the liquid should coagulate between 200 and 300 parts of cow's milk"—(*Nat. Form.*).

Ingluvin.—This is the essential digestive principle of the domestic chicken, introduced to physicians by Wm. R. Warner & Co., of Philadelphia and New York. It is said to depend upon a bitter principle for its therapeutic effects. Ingluvin has, for a number of years, been sucessfully used as a gastric tonic and digestant, in *indigestion* and *flatulent dyspepsia*, and is one of the few agents which have been found most successful in controlling the *vomiting of pregnancy*. It has superseded pepsin, to some extent, in the treatment of *indigestion*. Dose, 5 to 20 grains.

Ananassa sativa, Schult.; *Pineapple.*—This well-known fruit has been proven an active digestant of albuminous material (Marcano, Chittenden). Its active ferment, to which the name *bromelin* (from *Bromelia*, the name given the plant by Linné), is said to resemble trypsin more nearly than it does pepsin. Fresh pineapple juice is a quick digestant, acting best in neutral solution, though still active in acid or alkaline media. Between 50° and 60° C. (122° and 140° F.), it shows greatest digestive power, and at 70° C. (158° F.), its effects are arrested. It has been considerably employed in *gastric debility*, and to dissolve the *diphtheritic membrane*.

PETROLATUM.—PETROLATUM.

Source and History.—Three varieties of petrolatum are now official, as follows:

I. Petrolatum Liquidum (*U. S. P.*), *Liquid petrolatum.*—"A mixture of hydrocarbons, chiefly of the marsh-gas series, obtained by distilling off the lighter and more volatile portions from petroleum, and purifying the residue when it has the desired consistence"—(*U. S. P.*).

II. Petrolatum Molle (*U. S. P.*), *Soft petrolatum* (*Petrolatum, Pharm.*, 1880), *Soft petroleum ointment.*—"A mixture of hydrocarbons, chiefly of the marsh-gas series, obtained by distilling off the lighter and more volatile portions from petroleum, and purifying the residue when it has the desired melting point. When petrolatum is prescribed or ordered without further specification, soft petrolatum (*Petrolatum Molle*) is to be dispensed"—(*U. S. P.*).

III. Petrolatum Spissum (*U. S. P.*), *Hard petrolatum* (*Petrolatum, Pharm.*, 1880), *Hard petroleum ointment.*—"A mixture of hydrocarbons, chiefly of the marsh-gas series, obtained by distilling off the lighter and more volatile portions from petroleum and purifying the residue when it has the desired melting point"—(*U. S. P.*).

These forms of petrolatum are obtained by distilling off the more volatile, lighter portions from petroleum, either in a vacuum or by means of superheated steam. The residual oil is termed *reduced oils*, and is purified by passing it through long columns of granular, well-dried animal charcoal while being warmed to from 40° to 55° C. (104° to 131° F.). At first a colorless portion passes, subsequently followed by colored products. Or, petrolatum may be obtained from deposits sometimes formed in crude petroleum. Commercial varieties of petrolatum are known as *vaseline*, *cosmoline*, etc. (For a detailed account of the manner of obtaining petrolatum, see S. P. Sadtler's *Handbook of Indust. Org. Chem.*, 2d ed., 1895.)

Description and Tests.—I. Petrolatum Liquidum (*U. S. P.*), *Liquid petrolatum* (*Liquid paraffin, Ger. Pharm.*): "A colorless or more or less yellowish, oily, transparent liquid, without odor or taste, or giving off when heated, a faint odor of petroleum. Specific gravity, about 0.875 to 0.945 at 15° C. (59° F.). Insoluble in water, scarcely soluble in cold or hot alcohol, or in cold absolute alcohol; but soluble in boiling absolute alcohol, and readily soluble in ether, chloroform, carbon disulphide, oil of turpentine, benzin, benzol, and fixed or volatile oils. When heated on platinum, liquid petrolatum is completely volatilized, without emitting any acrid vapors. The alcoholic solution of liquid petrolatum is neutral to litmus paper. If 5 Gm. of liquid petrolatum be digested, for half an hour with 5 Gm. of sodium hydrate and 25 Cc. of water, the aqueous layer separated, and supersaturated with sulphuric acid, no oily substance should separate (absence of fixed oils or fats of animal or vegetable origin, or of resin). If 2 volumes of concentrated sulphuric acid be added to 1 volume of liquid petrolatum, in a test-tube, placed in hot water, and the contents occasionally agitated during 15 minutes, the acid should not acquire a deeper tint than brown, nor lose its transparency (limit of readily carbonizable, organic impurities)"—(*U. S. P.*). Mr. G. M. Beringer (*Amer. Jour. Pharm.*, 1894, p 15) points out that liquid petrolatum is nearly insoluble in castor oil. The analogous preparation of the *British Pharmacopœia* (1898) is *Paraffinum Liquidum*, a non-fluorescent liquid of specific gravity 0.885 to 0.890, boiling at a temperature not below 360° C. (680° F.). "A mixture of 4 Cc. with 2 Cc. of absolute alcohol, and 2 drops of a clear saturated solution of lead oxide in solution of sodium hydroxide, should remain colorless when kept at 70° C. (158° F.) for 10 minutes (absence of sulphur compounds)"—(*Br. Pharm.*, 1898).

II. PETROLATUM MOLLE (*U. S. P.*), *Soft petrolatum* (*Petrolatum, U. S. P.*, 1880), *Soft petroleum ointment*, *Adeps petrolei*, *Paraffinum unguinosum*, *Paraffinum molle*, *Soft paraffin*, *Paraffin jelly*.—"A fat-like mass, of about the consistence of an ointment, varying from white to yellowish, or yellow, more or less fluorescent when yellow, especially after being melted, transparent in thin layers, completely amorphous, and without odor or taste, or giving off, when heated, a faint odor of petroleum. If a portion of soft petrolatum be liquefied and brought to a temperature of 60° C. (140° F.), it will have a specific gravity of about 0.820 to 0.840. The melting point of soft petrolatum ranges between about 40° and 45° C. (104° and 113° F.). In other respects soft petrolatum has the characteristics of, and should respond to the tests given under liquid petrolatum (see *Petrolatum Liquidum*)"—(*U. S. P.*). None of nine samples of commercial Petrolatum Molle analyzed by Mr. L. F. Kebler (*Amer. Jour. Pharm.*, 1895, p. 142), contained any saponifiable matter, while the melting points conformed more nearly to the requirements of the *U. S. P.* (1880) (40° to 51° C. or 104° to 125° F.) than to those of the present Pharmacopœia. *Paraffinum Molle* of the *British Pharmacopœia* (1898), melts at 35.5° to 38.9° C. (96° to 102° F.), and has a specific gravity of 0.840 to 0.870 at the melting-point.

III. PETROLATUM SPISSUM (*U. S. P.*), *Hard petrolatum* (*Petrolatum*, (*U. S. P.*, 1880), *Hard petroleum ointment*.—"A fat-like mass, of about the consistence of a cerate, varying from white to yellowish or yellow, more or less fluorescent when yellow, especially after being melted, transparent, in thin layers, completely amorphous, and without odor or taste, or giving off, when heated, a faint odor of petroleum. If a portion of hard petrolatum be liquefied, and brought to a temperature of 60° C. (142° F.), it will have a specific gravity of about 0.820 to 0.850. The melting point of hard petrolatum ranges between about 45° and 51° C. (113° and 125° F.). In other respects hard petrolatum has the characteristics of, and should respond to the tests given under liquid petrolatum (see *Petrolatum Liquidum*)"—(*U. S. P.*). (For the *Paraffinum Durum* of the *British Pharmacopœia*, 1898, see *Paraffin*, under *Petroleum*.)

Action, Medical Uses, and Dosage.—Petrolatum is employed chiefly as a non-irritating ointment base, for which it is admirably adapted. It does not turn rancid like fats. It may be employed wherever an oily protective is demanded, and also for lubricating purposes. A semisolid, crude form, known as "*rod wax*," that which concretes on the casings of the oil wells, has been administered in 3 grain pills, in *chronic bronchial affections* and in *phthisis*. Vaseline, cosmoline, etc., are slightly laxative, and are said to allay gastro-intestinal irritation, and even inflammation. Used with a spray apparatus, liquid petrolatum is employed locally to allay *inflammatory conditions of the nasal*, *pharyngeal*, *laryngeal*, and *bronchial mucous surfaces*. Soft petrolatum is an excellent agent to prevent *falling of the hair*, and for that dry condition of the scalp which allows the formation of *dandruff*. For this purpose it is not sufficient that it be merely applied to the hair as a pomade, but it should be rubbed in upon the scalp, at the roots of the hair, taking small areas that it may be well applied. It should be used about once a week.

PETROLEUM.—PETROLEUM.

A bituminous, combustible fluid issuing from the earth.

SYNONYMS: *Oleum petræ*, *Rock oil*, *Naphtha*.

History and Source.—This fluid now so universally used, has come into prominence only since the boring of the first oil well in the Pennsylvania oil fields, at Titusville, in 1859, although oil had previously been observed in the United States to exude with salt springs. Bituminous exudations from the earth have been known, moreover, from early historical times. Pliny and Dioscorides report on the use of petroleum in certain parts of Sicily for lighting purposes. It occurs in the earth in all strata, from the lower silurian to the tertiary period, in limestone and sandstone formations, mostly collected in large subterranean cavities. When freshly struck, the oil sometimes gushes forth to a considerable height. American oil fields are those in western Pennsylvania and New York (Seneca Lake); in Ohio, near Lima; in West Virginia, Kentucky, Tennessee, and California, and the Canadian province of Ontario, near Euniskillen. The Russian petroleum district of Baku, on the Caspian Sea, began to be exploited in 1866, and now ranks second in importance to the Pennsylvania fields. Petroleum is also obtained in large quantities in Galicia, and is found in Hannover, Alsatia, in Italy, Persia, Java, Burmah (Rangoon), Japan. and the West Indies.

The geological origin of petroleum is not known with certainty. Some claim that it is formed by the dry distillation of beds of coal, which is disputed by others. Advocates of the chemical theory believe it to be formed by chemical processes, *e. g.*, the interaction of water and iron carbide at a white heat (Mendelejeff), while others assume it to be formed by the decomposition of organic bodies. Thus C. Engler, in 1888 and 1889, showed that by destructive distillation of fish-oils under pressure, a distillate is formed possessing all the qualities of petroleum; accordingly, he believes that petroleum is formed under similar conditions from huge fish-like animals. This theory should be enlarged so as to include the possible formation of petroleum from vegetable oils. Prof. S. P. Sadtler (*Amer. Jour. Pharm.*, 1896, p. 466) observed in the destructive distillation of linseed oil some 40 per cent of a neutral hydrocarbon oil of greenish fluorescence, from which paraffin oil and paraffin could be isolated. Prof. Edward Orton (*Pharm. Jour. Trans.*,Vol. XXII, 1891–92, p. 1066) believes the Lima and California oils, which contain nitrogen and sulphur, to be of animal, the Pennsylvania oil of vegetable origin, *i. e.*, indirectly derived from the resinous spores of marine vegetations. Quite recently, G. Kraemer (*Chemiker Zeitung*, No. 80, 1899, p. 843) shows the formation of petroleum and paraffin by the vegetative action of diatoms. Petroleum is now extensively used in the manufacture of illuminating and lubricating oils and paraffin.

Description and Chemical Composition.—Crude petroleum is an oily liquid varying from the thinness of water to the consistency of butter, and has all shades of color from light to dark-red and black. It often has a blue fluorescence. The specific gravity of the oil varies from 0.78 to 0.91. The Russian and German oils have a higher specific gravity than the Pennsylvania oil. The American petroleum is also chemically different from the Russian oil. It consists chiefly of hydrocarbons of the paraffin series ($C_nH_{2n}+_2$), which vary from the gaseous methane (CH_4), to the solid paraffin ($C_{30}H_{62}$). Besides, hydrocarbons of the unsaturated series (olefines, C_nH_{2n}) are present. Petroleum, when exposed to the air, loses its volatile constituents; the residue, by partial oxidation, thickens, and is converted into *asphaltum* (see below). The oil obtained near Lima, Ohio, has a peculiar unpleasant smell, and contains sulphur compounds, on account of which special methods for purification are required. The Russian petroleum contains 10 per cent of benzol hydrocarbons and 90 per cent of peculiar hydrocarbons (C_nH_{2n}) called *naphtenes* (Markownikoff). (See detailed paper on these naphtenes by Dr. R. Wischin, Baku, in *Chemiker Zeitung*, 1899, pp. 916–926.)

Action, Medical Uses, and Dosage.—Petroleum, or rock oil, is not an active poison, unless it contains sulphur, which is the case with crude petroleum from Canada and Lima, Ohio. Even with children, the fatal dose must be very large. death being due to its secondary gastro-intestinal effects, rather than to any results of absorption of the hydrocarbons (Taylor, *Med. Jurisp.*). The toxic effects are vomiting, dizziness, a sense of fullness, pain and constriction in the head, thirst, burning in fauces and stomach, cardiac palpitation, faintness, pallor and coldness of surface, cold sweats, weak pulse and symptoms of collapse, occasionally followed by somnolence. Sometimes tetanic convulsions take place, and, as a rule, diarrhœa does not occur. Often vomiting does not ensue. The vapor of the various products included under the name petroleum intoxicate, and various cases of intoxication have lately been recorded from the intentional inhalation of gasoline. The local application of coal oil must be guarded, for, if air be excluded extensive and dangerous blistering and ulceration may result (Felter, *Ec. Med. Jour.*, 1897, p. 110).

Therapeutically, petroleum appears to possess stimulating properties, and has been recommended as a remedy in various diseases. It is decidedly antiseptic, and somewhat antispasmodic, expectorant, and diuretic. A mixture, composed of 16 drops of petroleum and 24 drops of tincture of asafœtida, to be taken at 1 dose, and repeated 3 times a day, has been advised in the treatment of *tapeworm*. Petroleum has also been recommended in various *diseases of the lungs and air-tubes*, when not accompanied with inflammatory symptoms. Internally, it has been advised in *bronchitis*, and in other conditions attended with increased secretion of mucus. For internal use, the crude oil is preferred to the purified, and has been used for the relief of *whooping-cough* and *croup*. Its dose is from 10 to 30 drops, in wine, milk, syrup, etc. Externally, it has been employed as a stimulating embrocation in *lepra*, *psoriasis*, and other *scaly diseases of the skin*, *atonic chronic rheumatism*, *chilblains*, *sprains*, *synovitis*, *tumors*, *burns*, *stiffness and contraction of the joints*, *local paralysis*, etc. It is asserted to dissolve the *diphtheritic membrane*. It destroys the *itch insect* and *pediculi*.

British oil is composed of 4 fluid ounces, each, of oil of turpentine and oil of linseed; 2 fluid ounces, each, of oil of amber and oil of juniper; 1½ fluid ounces of Barbadoes petroleum, and ½ fluid ounce of American petroleum or Seneca oil.

Coal oil (*Kerosene*, see *Derivatives*, below) is reputed to drive away crickets, cockroaches, bedbugs, rats, mice, etc., if sprinkled around their haunts. It is considerably used as a popular local remedy for *piles*, *itch*, *rheumatism*, *painful affections*, *sprains*, etc., and has been recommended internally in several diseases.

Mecca oil, a mineral oil from a place named Mecca, Ohio, is said to be useful in *bronchial*, *laryngeal*, and *pulmonary affections*, and was formerly sold at most extravagant prices for such purpose. The dose varies from 5 to 30 drops, repeated 2 or 3 times a day.

Dr. Andreosky asserts to have used *petroleum naphtha*, in doses of 10 to 20 drops, in 2 or 3 fluid ounces of wine or mint-water, with benefit in *Asiatic cholera*.

Derivatives of Petroleum.—Crude petroleum, by rectification, is differentiated into several constituents of commercial importance. The most valuable constituent is the burning oil fraction, which formerly, in American oil, amounted to from 35 to 55 per cent, while from 20 to 30 per cent of lubricating oil was obtained. By means of a peculiar process, whereby the vapors are allowed to become superheated (*cracking*), the yield of burning oil is increased at the expense of the lubricating fraction. Thus the yield is now 75 to 80 per cent of the former and about 6 per cent of the latter (Prof. S. P. Sadtler, *Handbook of Indust. Org. Chem.*, 2d ed., 1895, p. 19). The principal fractions of the crude oil are the *benzine distillate*, *burning oil distillate*, and *residuum*; the latter is redistilled in so-called tar-stills, and yields *block paraffin*, *lubricating oil*, yellow wax and coke. In Baku, distillation is continuous, and is not carried to coking; the residual mass is used in the same process as fuel.

Benzine Distillate amounts to 12 per cent of the crude oil, and is separated into a great number of commercially important fractions—*e. g.*, (1) *Cymogene*, boiling at 0° C. (32° F.), hence a gas at ordinary temperature. It is used in the making of artificial ice. (2) *Rhigolene*, boiling at 18.3° C. (65° F.), hence an exceedingly volatile and inflammable liquid, having a specific gravity of 0.60. As it reduces the temperature to −28.3° C. (−19° F.), by evaporation, it is recommended in the form of a spray by Dr. H. J. Bigelow (*Amer. Jour. Pharm.* 1866, p. 363), as a substitute for ether as a local freezing anæsthetic. It has not come into general use. (3) *Petroleum ether* (*Sherwood oil*), boiling from 40° to 70° C. (104° to 158° F.). It is used as a solvent, especially for caoutchouc and fats, and to propel gas motors. (4) *Gasoline* (*canadol*), boiling from 70° to 90° C. (158° to 194° F.). It is used as a solvent for oil from seeds, and was suggested as an effective and cheap agent to free the cutaneous surfaces and subjacent tissues. (5) *Petroleum naphtha* boils from 80° to 110° C. (176° to 230° F.), and has a specific gravity of 0.69 to 0.70. It dissolves wax, caoutchouc, oils, pitch, etc., and is used in the manufacture of oil-cloth and of varnishes. (6) *Ligroine* boils from 80° to 120° C. (176° to 248° F.), has a specific gravity of 0.71 to 0.73, and is chiefly used as a solvent

Burning Oil Fraction (*Kerosene, Coal oil*).—The commercial illuminating and burning oils occur under varied and often fanciful names. They are distinguished mainly by their color and their fire test. In order to remove color and empyreumatic odor from the crude fractions, they must be purified by shaking with 1½ to 2 per cent of sulphuric acid, washing with water and with solution of caustic soda. The most important test for burning oils is that which ascertains the degree of safety in burning; it is known as the fire-test, and includes the determination of the *flashing point* and the *burning point* of the oil. The flashing point is that temperature at which the oil gives off vapors which, when mixed with air, will explode in the presence of an open light—*e. g.*, a spark—yet without igniting the oil; at a somewhat higher temperature—the burning point—the oil will be ignited by the explosion. Many methods have been devised to determine the flashing point of petroleum with greatest possible accuracy, for which see details in Prof. S. P. Sadtler's *Handbook of Indust. Org. Chem.*, 2d ed., 1895, p. 34. The official apparatus used in England and Germany is that devised by Sir Frederick Abel, and the operation is known as the Abel test; in this a closed oil-cup is used. In the United States, a modified, open-cup test is used; this gives results somewhat too high as compared with the other test. It is stated that the oils going to the continent of Europe, to China and Japan, have a flashing point of 43.3° C. (110° F.); the "head-light," used in America, a flashing point of 65.5° C. (150° F.). It is a matter of regret that the official standard in Germany and England and other countries is as low as 21° C. (69.8° F. by the Abel test. In this connection, see an exceedingly interesting article on the flashing point of petroleum, by Lobry de Bruyn, in *Chemiker Zeitung*, 1896, pp. 251–265 and 623–626, wherein it is earnestly advocated to raise the official flashing point to 40° C. (104° F.) by the Abel test.

Paraffin is a solid mixture of hydrocarbons of the paraffin series (C_nH_{2n-2}), occurring chiefly in crude petroleum, especially the thick variety, from which it is often deposited upon standing. It was discovered, in 1830, by Reichenbach in the tar resulting from the destructive distillation of beech wood; it is also formed by the dry distillation of peat, bituminous shales, and coals—*e. g.*, cannel coal, boghead coal—and occurs in nature in the form of the "minerals" *ozokerite* or *earth wax*, in Galizia, and *neft-gil*, in Persia; of the former it constitutes about 50 per cent, and, when obtained from it, resembles wax, and is called *ceresine*. Paraffin also occurs native in Utah and Texas. On a commercial scale, it is obtained either from petroleum, by fractionally distilling the burning oil residue in tar stills, purifying the distillate, and separating the solid paraffin from the liquid paraffin oil by chilling and pressing, or, as is done in Germany and in Scotland, by the dry distillation of bituminous shales at low temperatures, whereby benzene, naphtha (*photogene*), and burning oil (*solar oil*) are likewise obtained (see details in Prof. Sadtler's *Handbook*, 2d ed., pp. 21, 25, and 27). The preparation of petrolatum (*U. S. P.*), from petroleum, is considered under *Petrolatum*.

Paraffin is a white, microcrystalline mass, resembling wax or spermaceti, inodorous and tasteless, and slightly greasy to the touch. The melting point of paraffin varies considerably, according to its origin. The *Br. Pharm.* (1898) demands for *Paraffinum Durum* (*Hard paraffin*) a melting point of 54.4° to 57.2° C. (130° to 135° F.), while the *Ger. Pharm.* (1890) requires for *Paraffinum Solidum* the unusually high melting point of 74° to 80° C. (165.2° to 176° F.). Paraffin varies in specific gravity from 0.82 to 0.94 (*Br. Pharm.*). It is insoluble in water, slightly soluble in absolute alcohol, almost entirely soluble in ether. It is also soluble in oil of turpentine, ether, benzol, and hot olive oil; does not dissolve camphor, naphtalin, or pitch, when fused with them, but may be readily mixed with stearin, spermaceti, beeswax, and common resin. Lard and suet separate from it on cooling. Sulphide of carbon dissolves its weight of paraffin, and chloroform about one-fifth its weight. It is a good insulator of electricity. When ignited, it burns with a bright flame, leaving no residue. When heated to temperatures above 300° C. (572° F.), it may be distilled without being decomposed. The *Ger. Pharm.* directs that, if 3 Gm. of paraffin be heated, on the water-bath, with 3 Cc. of concentrated sulphuric acid for 10 minutes, with repeated shaking, the acid should but slightly turn brown, and the paraffin should not be altered. One part of alcohol, boiled with 1 part of paraffin, should not redden blue litmus paper. Paraffin is indifferent toward acids and alkalies at ordinary temperatures, hence its name, from *parum affinis*, meaning of little affinity. Bromine, however, readily evolves hydrobromic acid upon warming with paraffin, chlorine also acts upon this substance at a higher temperature. Paraffin is used in the manufacture of paraffin candles and Swedish matches; in the manufacture of sugar, to prevent the syrup from foaming and boiling over, to produce gloss on paper and fabrics, to prevent surfaces of vessels from being attacked by corrosive liquids, and for many other purposes.

Asphaltum, *Asphalt*, also known as *Mineral pitch*, *Pitch of Judea*, is a bituminous product, resulting from petroleum by evaporation of the lighter hydrocarbons and partial oxidation of the residue. In liquid form (*maltha*) it is found in Alsatia, in California, Utah, Kentucky, Tennessee, and Texas. Solid asphalt is chiefly obtained from the asphalt lake of Trinidad, in the West Indies, which supplies most of the asphalt used in the United States, and from Venezuela, South America (Bermudez asphalt). Other deposits of solid asphalt are in Cuba, Switzerland, Hannover, and the Dead Sea in Palestine. Asphalt has the appearance of pitch, and is brownish-black in color. Its bituminous part is insoluble in acids, alkalies, water, and alcohol, and soluble in fatty oils, oil of turpentine, petroleum, carbon disulphide, chloroform, acetone, and ether. The total quantity of bitumen is determined by extraction with carbon disulphide. That part of the extracted bitumen, soluble in petroleum naphtha, called [illegible], is tough and elastic, and, for paving purposes, is the only valuable part; the rest is brittle *asphaltene*. Trinidad asphalt contains about 39.8 per cent of bitumen, and 34 per cent of mineral matter, while Bermudez asphalt contains over 90 per cent of bitumen and only 2.6 per cent of mineral matters (S. P. Sadtler, *loc. cit.*, p. 17). For paving purposes, asphalt is mixed with limestone and sand. This addition prevents the mass from being inflammable, and, when properly prepared, permits expansion and contraction, in hot or cold weather, without cracking. Asphalt is also used in the making of varnishes.

PETROSELINUM.—PARSLEY.

The root of *Petroselinum sativum*, Hoffmann (*Apium Petroselinum*, Linné).

Nat. Ord.—Umbelliferæ.

COMMON NAME: *Parsely, Common parsley.*

Botanical Source.—Parsley is a biennial plant with a fleshy, spindle-shaped root, and a round, striated, erect, smooth, branching stem. The radical leaves are biternate, bright-green, and borne on long, channeled petioles; the leaflets are rhomboidal-ovate, wedge-shaped at the base, deeply incised, the segments mucronate and sometimes rounded. The upper leaves gradually become more entire and narrower, till the uppermost are simply ternate with linear segments. Umbels terminal and axillary, pedunculated, with 5 to 8 rays. General involucre none, or 1 or 2 subulate, minute bracts; partial involucre with 6 or 8 setaceous bracts, much shorter than the pedicels, erect, forming a perfect whorl. The flowers are white or greenish; the petals rounded, incurved, and scarcely emarginate; the calyx with the limb obsolete; the disk short, conical, and somewhat crenulate; the styles diverging. The fruit is ovate, about a line long, compressed, pale greenish-brown, the back occupied by three elevated, pale primary ridges, the two others quite on the margin at the side. The stamens are longer than the corolla (L.).

History.—Parsley is a European plant, and was known as early as the first century. It is now cultivated in nearly all moderate climates as a culinary vegetable. The plant has a grateful aroma. The seeds, herb, and root, are the medicinal parts; the root has rather an agreeable odor, and a saccharine, slightly spicy taste, and should be used while fresh. The root and herb contain small quantities of a volatile oil; larger quantities are contained in the seeds.

Chemical Composition.—The root, besides sugar, starch, mucilage, and 0.08 per cent of essential oil, contains a peculiar body, named by Braconnot (1843) *apiin*. The essential oil from the root has a specific gravity of 1.049, and upon standing, deposits crystals, probably of *apiol* (see below). Parsley seeds contain fatty oil (about 22 per cent, Rump, 1836), volatile oil containing the well-defined crystallizable body *apiol*, tannin, gelatinous *apiin* (of Braconnot), and an oily substance *apiol* (Joret and Homolle, *Jour. Pharm. Chim.*, 1855, p. 212). Parsley seeds yield, upon distillation with water about 2.8 per cent (4.27 per cent, H. C. Whitney, 1880) of an essential oil (*oil of parsley*), part of which is heavier than water. Crystals of *apiol* (formerly called *parsley camphor*) are formed by exposing the oil to a low temperature. Some oils are semisolid, owing to the presence of large quantities of apiol. *Apiol* ($C_{12}H_{14}O_4$) melts at 30° C. (86° F.), and boils at 294° C. (561.2° F.), hence is not easily volatilized with the vapors of boiling water. It has the characteristic taste, but only a faint odor of parsley. Its chemical composition was cleared up, by Ciamician and Silber (1888 and 1890). It is soluble in alcohol and ether; almost insoluble in water. Oil of parsley also contains *lævopinene* (v. Gerichten, 1876).

APIOL, of Joret and Homolle, is an oily liquid which has the odor and taste of parsley; it is not miscible with water, has a specific gravity of 1.078, and was introduced as a febrifuge capable of supplanting quinine. It is probably not a uniform body, and is prepared by abstracting an alcoholic extract of the seeds, with chloroform or ether, removing fat by triturating the evaporated residue with lead oxide, and after 48 hours filtering through charcoal. The oil thus obtained is probably identical with the heavy part of the volatile oil from the seeds. Also see paper on this subject by H. C. Whitney (*New Remedies*, 1880, p. 7).

APIIN may be isolated from the seeds by extracting them with alcohol and removing apiol from the alcoholic extract by means of ether. The residue is purified by repeated solution in alcohol and precipitation with water. Similarly, apiin may be obtained from the herb, wherein it was first discovered. It is a white, tasteless, microcrystalline powder, soluble in warm alcohol and boiling water. Upon cooling it falls out, forming a jelly in as dilute a solution as 1 in

1500. It is soluble in alkalies, and is precipitated therefrom by acids. Aqueous solutions of apiin produce a deep blood-red coloration with ferric chloride (Braconnot). It is a glucosid, and is decomposed by the action of diluted acids into dextrose and *apigenin* (Lindenborn, 1867; v. Gerichten, 1876).

Action, Medical Uses, and Dosage.—Parsley. Diuretic, relieving urinary irritation. Very useful in *dropsy*, especially that following *scarlatina*, and other *exanthematous diseases*. Also used in *retention of urine*, *strangury*, and *gonorrhœa*. Parsley seeds have a powerful odor, somewhat like that of turpentine, and a spicy, pungent taste, and have been used as a carminative, and for the same purpose as the root—they are said to be very poisonous to the parrot. The seeds as well as the leaves, sprinkled on the hair, in powder, or in the form of an ointment, will effectually destroy vermin; the leaves, applied as a fomentation, will, it is asserted, cure the *bites* or *stings of insects*. The leaves, bruised, are a good application to *contusions*, *swelled breasts*, and *enlarged glands*—reputed to "dry up the milk" of wet-nurses. The oil is efficient as a diuretic, in doses of 3 or 4 drops a day; dose of the infusion, 2 to 4 fluid ounces, 3 or 4 times a day.

Apiol.—In doses of from 7 to 15 grains apiol occasions a cerebral excitement similar to that caused by coffee, a sensation of vigor and composure, and warmth about the stomach; in doses of from 30 to 60 grains it causes intoxication, giddiness, flashes of light, vertigo and ringing in the ears, etc. It is highly recommended as a substitute for quinine in *intermittent fevers*, and has proved very efficient. It has likewise been found valuable in *menstrual derangements*; as *fetid menstruation*, *neuralgic dysmenorrhœa*, *neuralgic uterine colic*, *amenorrhœa*, etc.; also in the *night-sweats of consumption*. The dose is 3 to 6 grains, several times a day, beginning a couple of days prior to menstruation, given in gelatin capsules, or formed into pills with medicinal amygdalin soap, and magnesia, gum, or yellow of egg.

Related Species.—*Apium graveolens*, Linné; *Celery*. This well-known garden plant is indigenous to European countries, where it is found growing wild in meadows and ditches. The fruit is used under the name *fructus apii* or *celery-seed*. The leaves and root contain mannit; the whole plant contains mucilage, fat, sugar, and essential oil. The latter has the characteristic odor of celery, a specific gravity of 0.870 to 0.895, and contains 90 per cent of hydrocarbons, among these *dextro-limonene* but no pinene. The odor of celery oil is due to *sedanolid* ($C_{12}H_{18}O_2$), and the *anhydride of sedanonic acid* ($C_{12}H_{16}O_2$) (Ciamician and Silber, 1897). Both substances are volatilized with difficulty, and the greater part of them may often be obtained from the residue of distillation (see Gildemeister and Hoffmann, *Die Ätherischen Öle*, 1899, p. 713). An infusion of the roots or herbs has been employed for *rheumatic complaints*, *chronic bronchial affections* and in *intermittents*. The seeds and plant are reputed nerve tonics, and are used for about the same purposes as parsley. The seeds enter into the formation of many medicines intended as nerve tonics. Locally, the infusion or the bruised plants have been employed as a stimulant, anodyne poultice.

Conioselinum canadense (*Selinum canadense*, B. and H.). Wet woods of northern United States. Used, under the name *Hemlock parsley*, in *dysentery*.

PHELLANDRIUM.—WATER FENNEL.

The fruit of *Œnanthe Phellandrium*, Lamarck (*Phellandrium aquaticum*, Linne). *Nat. Ord.*—Umbelliferæ.

Common Names: *Water fennel*, *Fine-leaved water hemlock*, *Water dropwort*.

Botanical Source.—This plant is a biennial or perennial, umbelliferous herb, having a thick, spindle-shaped root, with many whorled fibers. The stem is hollow, furrowed, half immersed in the water, very bushy, with numerous spreading, leafy branches, and from 2 to 4 feet in height. The leaves are petioled, spreading, repeatedly pinnate, cut, with innumerable fine, expanded, dark-green, shining, acute segments. The umbels are opposite to the leaves, on shortish stalks, about 5-rayed, without any general bracts. Partial umbels are very dense, of numerous short rays, accompanied by many narrow, taper-pointed bracts. The flowers are white, numerous, all fertile, outer ones largest and most irregular; innermost more certainly prolific. Styles long, filiform, spreading, and capitate. Fruit ovate, rather compressed, purplish, smooth, oblong, crowned with the minute spreading calyx, and rather short, permanent, slightly spreading styles; the dorsal ridges distinct, but little elevated, the lateral ones much broader and thicker; all confluent below the calyx. The pedicels are shorter than the fruit (L.).

History and Description.—This plant is common to Europe, growing in ditches and wet places, and its leaves are reputed harmful to cattle, causing a species of palsy after eating it. It is poisonous, but not so dangerously so as the *Œnanthe Crocata* (*Dead-tongue*, or *Hemlock dropwort; see Related Species*), which is considered the most energetic poison of the narcotico-acrid Umbelliferæ. By desiccation, they lose much of their poisonous properties. The *Œ. Phellandrium* is occasionally found in this country. The seeds are the parts used. They are about $\frac{1}{12}$ inch long, of a yellowish-green color, elliptical, slightly curved, flat on one side and gibbous on the other, striated with 10 filiform ribs, and terminate in small, 5-toothed heads, the remains of the calyx and styles. They have a peculiar, strong odor, somewhat resembling *angelica*, and an acrid, spicy taste, owing to a volatile oil, which they contain in abundance.

Chemical Composition.—The seeds contain about 1.5 per cent of volatile oil and 19.5 per cent of fatty oil. Indications of an alkaloid have been variously observed (see Flückiger, *Pharmacognosie*, 3d ed., 1891, p. 953). It is probably the poisonous *phellandrin* of earlier chemists. The volatile oil has a penetrating, aromatic odor, a specific gravity of about 0.87, and contains 80 per cent of the terpene hydrocarbon *phellandrene*. It was discovered by Pesci (1883) in the seeds of this plant, from which it was named. It is present as *dextro-phellandrene*, which also occurs in other oils, while *lævo-phellandrene* is the chief constituent of certain Eucalyptus and other oils—*e. g.*, *Eucalyptus amygdalina*. Phellandrene forms a characteristic nitrite, melting at 103° C. (217.4° F.). It is an unstable terpene, capable of polymerization into solid *diphellandrene*, or of being converted into the optically inactive isomer, *dipentene*.

Action, Medical Uses, and Dosage.—Water fennel is a mild narcotic stimulant, expectorant, alterative, and diuretic. In large doses, it produces dizziness, inebriation, and dull pains in the head. The seeds have been most successfully used in chronic affections of the air-passages, as *laryngitis*, *asthma*, *hemoptysis*, *catarrh*, etc.; also in *periodical febrile diseases*, *dyspeptic affections*, and in *indolent ulcerations*. They are given in powder, commencing with 4 or 5 grains, every 1 or 2 hours throughout the day, cautiously increasing the dose to 8 or 10 grains. Two parts each of powdered gum Arabic and sugar of milk may be mixed with 1 part of the powdered seeds, and divided into doses of 25 grains each, which may be repeated every 2 or 3 hours. Dr. Turnbull, of Liverpool, used the following tincture and extract: Take of well-bruised seeds of phellandrium, 16 ounces; alcohol, a sufficient quantity to displace by percolation 32 fluid ounces. The dose is from $\frac{1}{2}$ to 1 fluid drachm. For the alcoholic extract, take of the seeds of phellandrium, bruised, 16 ounces; alcohol, 3 parts; displace by percolation, distill off $2\frac{1}{2}$ pints of alcohol, and evaporate the remainder to the consistence of an extract. The dose is from 3 to 5 grains, in pill. He recommended it highly in *consumption* and *bronchitis*, to relieve troublesome cough, render expectoration less and easier, and produce sleep at night. He believed the above preparations to contain all the beneficial properties of the seeds, and to act with more certainty and power.

Related Species.—*Œnanthe Crocata*, Linné (*Œnanthe apiifolia*), *Nat. Ord.*—Umbelliferæ; *Water hemlock*, *Water lovage*, *Water dropwort*, *Hemlock dropwort*, *Dead-tongue*. Indigenous to England, France, Spain, and Sweden, thriving in swamps and moist situations. The root of this species is medicinal. This is an exceedingly poisonous plant. The active poisonous principle is a resinous matter, soluble in ether and alcohol, insoluble in water. An alkaloid could not be isolated (A. Vincent, *Jour. Pharm. Chim.*, 1864, p. 140; also see microscopical investigation by H. W. Jones, *Pharm. Jour. Trans.*, Vol. XVI, 1885, p. 357). The plant produces severe gastro-intestinal disturbances and convulsions. A number of cases of poisoning, some fatal, are recorded in Hale's *New Remedies—Therapeutics*. Small doses of the tincture have been advised in *epilepsy* by several writers in the *Eclectic Medical Journal*, *Eclectic Medical Gleaner*, and other journals. Doses of even 5 drops sometimes produce violent headache and other unpleasant symptoms, in which case the dose will have to be lessened.

PHENACETINUM.—PHENACETIN.

FORMULA: $C_6H_4.OC_2H_5.NHC_2H_3O$. MOLECULAR WEIGHT: 178.63.

SYNONYMS: *Para-acetphenetidin*, *Para-ethoxy-acetanilid*, *Phenacetine*.

History and Preparation.—This compound was introduced to the profession by Kast and Hinsberg, in 1887. It is produced by a series of chemical processes, by which its molecule is gradually built up. The successive steps are as follows: Phenol (carbolic acid, $C_6H_5.OH$) is converted into para-nitro-phenol ($C_6H_4.OH.NO_2$) by means of nitric acid; of this compound the sodium salt ($C_6H_4.ONa.NO_2$) is prepared, and converted by double decomposition with ethyl-iodide (C_2H_5I) into para-nitro-phenetol ($C_6H_4.OC_2H_5.NO_2$), which yields, upon reduction of the nitro-group by means of nascent hydrogen, *para-amido-phenetol*, or *paraethoxy-aniline* ($C_6H_4.OC_2H_5.NH_2$). Upon boiling this compound with glacial acetic acid ($CH_3CO.OH$), the amido-group is acetylized, and phenacetin ($C_6H_4.OC_2H_5.NH.CH_3CO$) results.

Description and Tests.—Phenacetin consists of white, tasteless, inodorous, glistening, scaly crystals, neutral to litmus. It dissolves in boiling alcohol (1 in 2), cold alcohol (1 in 6), boiling water (1 in 70), and very sparingly in cold water (1 in 1400); melting point 135° C. (275° F.). When heated on platinum foil, it should volatilize without leaving a residue. It dissolves without color in sulphuric acid. When 0.1 Gm. of phenacetin is boiled with 2 Cc. of hydrochloric acid for half a minute, the liquid diluted with 20 Cc. of water, cooled and filtered, the filtrate assumes a deep-red coloration upon the addition of solution of chromic acid (*Br. Pharm.*, 1898). In this reaction, phenacetin is hydrolyzed into acetic acid and *para-phenetidin* ($C_6H_4.OC_2H_5.NH_2$), which yields red color-reactions with oxidizers. This test, slightly modified, is also official in the *German Pharmacopœia*. To establish the absence of para-phenetidin, the *British Pharmacopœia* gives the following test: "A mixture of 0.3 Gm. of phenacetin with 1 Cc. of alcohol (90 per cent), should not acquire a red tint when diluted with 3 times its volume of water, and boiled with 1 drop of volumetric solution of iodine (absence of para-phenetidin)"—(*Br. Pharm.*, 1898). The *German Pharmacopœia* tests for *acetanilid* as follows: Dissolve 0.1 Gm. of phenacetin in 10 Cc. of hot water, allow to cool, filter, and add to the filtrate bromine water, until the solution is yellow. The absence of turbidity, which would consist of para-brom-acetanilid, will indicate the absence of acetanilid. The latter is more readily soluble in water than phenacetin.

Action, Medical Uses, and Dosage.—Phenacetin is probably the best of the coal-tar products which have been introduced and so wonderfully multiplied in the last few years. However, while ordinarily safe in proper doses, in large amounts, and sometimes even with the regulation doses, it is capable of producing serious symptoms, if not death. Among the toxic symptoms are vomiting, chills, profuse sweating, quickened respiration, sleepiness, marked reduction of the temperature, and almost stoppage of the heart's action. Cyanosis is marked. After the internal administration of phenacetin, the urine contains a substance reducing Fehling's solution.

Therapeutically, it is analgesic, diaphoretic, and antipyretic. In *local congestions* and *inflammation*, it has a tendency to reduce the swelling in proportion as it controls the pain. The sweating produced is not as severe as that caused by antipyrin, nor is it so apt to produce the cutaneous eruptions and aural symptoms that sometimes follow the use of the latter and other antipyretics. It is of of some value in *fevers*, and gives comfort in, but does not in the least shorten the duration of *typhoid fever*. Here the smaller doses should be employed. In 2-grain doses, it controls the high-temperature of *phthisical patients*, without producing excessive diaphoresis. One of its most important uses with us is to produce that moistened condition of the skin and tongue necessary to render the patient capable of being benefited by the action of quinine. A dry skin and tongue and an irritable nervous system are, with us, contraindications for the latter drug. But in *malaria* and other disorders, in which quinine, when properly administered, does good service, phenacetin readily puts the patient in condition for the kindly reception of the antiperiodic. Its use, however, as a primary antipyretic is not favored by the Eclectic profession.

Phenacetin promptly controls *pain*, acting best when independent of structural change. It is adapted to either acute or chronic conditions. It is one of the popular remedies for *headaches*, particularly of the nervo-congestive and catarrhal forms. As an antirheumatic, its action in relieving pain is pronounced, and for the property of controlling muscular pain, it has been extensively employed in *la grippe*, *ague*, *tonsillitis*, and *febrile* and *inflammatory diseases*. It controls the pains of *dysmenorrhœa*, *articular rheumatism*, *neuralgia*, *pleurisy*, and *acute nephritis*, but should be used with care. *Muscular spasm* is relaxed by it, and it lessens the irritability of the congested larynx in *pertussis* and *laryngitis*, and is claimed of value in *hysteria*, *asthma*, and *epilepsy*, acting as an antispasmodic. As an antithermic, the dose is from 1 to 5 grains; as an analgesic, 3 to 20 grains, beginning always with the smaller dose. It may be given in powder upon the tongue, or floating upon water, or preferably, in capsules. If given in powder, in water, it should be first moistened with a few drops of some alcoholic fluid to prevent its adherence to the glass or spoon. Owing to its sparing solubility phenacetin is somewhat unmanageable (Murrell). Contraindicated by debility.

Specific Indications and Uses.—Sthenic conditions; severe muscular pain; pain from congestion; neuralgic pains; nervo-congestive or catarrhal headache; high temperature; preparator for quinine administration.

Related Compounds and Derivatives.—METHACETIN ($C_6H_4.OCH_3.NHC_2H_3O$), *Para-acetanisidin*, *Para-methoxy-acetanilid*. This compound is analogous to phenacetin, the ethyl group of the latter being replaced by the methyl group. Hence it is produced exactly in the same manner as phenacetin, excepting that methyl iodide (or chloride) is substituted for ethyl iodide (or chloride). It forms colorless or faintly reddish, odorless, lustrous scales, fusing at 127° C. (260.6° F.), and vaporizing unchanged at a greater heat. It dissolves readily in boiling water (1 in 12), but sparingly in cold water (1 in 526). Alcohol, chloroform, acetone, glycerin, and the fixed oils dissolve it readily. If heated with less water than is required to dissolve it, it melts to an oily liquid, which becomes solid again when cooled. This serves to distinguish it from phenacetin, which falls out in the form of crystals. Methacetin is reputed antipyretic, antiseptic, and analgesic. It is an unsafe remedy, however, for it powerfully reduces the temperature and pulse-rate in febrile conditions, frequently producing excessive sweating, cyanosis, and dangerous collapse. It has been employed in *phthisis*, *articular rheumatism*, *neuralgia*, and *typhoid fever*, with rather unfavorable results. It should never be given to debilitated individuals. The dose for one day is from 7 to 15 grains.

LACTOPHENIN is an antipyretic, analgesic, and antineuralgic agent, the specialty of C. F. Boehringer & Soehne, New York City. It is a derivative of phenetidin, containing a lactic acid constituent in place of the acetic acid constituent of phenacetine. Chemically it is lactyl-paraphenetidin ($C_6H_4OC_2H_5.NH.CO.CH[OH]CH_3$). It is a crystalline powder, slightly bitter, and soluble in about 300 parts of water; acids and alkalies decompose it. Therapeutically, it acts as an *antipyretic*, reducing temperature gradually, with no effect on the heart; and as an *analgesic*, and as a mild *hypnotic*. Its range of application is indicated by these properties; according to clinical reports it has been used with marked success in *typhoid fever*, *articular rheumatism*, *neuralgia*, *headache*, *migraine*, *influenza*, etc.; reports of its safety and desirability in children's practice have been frequent. The dose for adults is from 4 to 15 grains, with daily maximum of 30 to 45 grains.

PHENOCOLL HYDROCHLORIDE, *Glycocoll paraphenetedin hydrochloride*, *Phenocoll hydrochlorate* ($C_6H_4.OC_2H_5.NH.COCH_2.NH_2.HCl$).—Phenocoll results from the interaction of glycocoll (amido-acetic acid) and phenetidin (para-amidophenetol) (see *Phenacetin*). Its hydrochloride forms a very fine white, crystalline powder soluble in cold water (1 in 20) with neutral reaction. Alcohol and hot water dissolve it more freely. From hot water it crystallizes in cubical crystals; from boiling alcohol in acicular crystals. It is practically insoluble in benzol, chloroform, and ether. Volatile and fixed alkalies and their carbonates precipitate the base phenocoll from solutions of phenocoll hydrochloride. When anhydrous the base fuses at 100.5° C. (213° F.); the hydrated compound (with 1 molecule of water) at 95° C. (203° F.). Acetate (soluble in water, 1 in 4), carbonate, and salicylate of phenocoll have also been produced. This compound has been employed as an antipyretic and analgesic. It is said to be a fairly safe remedy for *rheumatic* and *neuralgic conditions*, allaying pain, reducing the temperature, and promoting sleep. The urine becomes dark-colored under its administration. It is apt to produce excessive sweating. Its use in *influenza*, *malarial intermittents*, *phthisis*, and *typhoid fevers* is hardly justified by results. From 5 to 15 grains, administered in powder, capsules, or in water, from 3 to 5 times a day, is the usual dose.

IODOPHENIN, *Iodophenine*, *Iodo-phenacetin*. This product, which contains about 50 per cent of iodine, is closely related to phenacetin, probably being an iodine addition-compound of the latter (3 atoms of iodine to 2 molecules of phenacetin). It is prepared by adding an aqueous potassium-iodide solution of iodine to a mixture of aqueous solution of phenacetin (cold and saturated) and hydrochloric acid. The presence of the latter is essential. This gives a chocolate-colored precipitate composed of fine crystals. Warm glacial acetic acid is substituted for water as a better solvent for phenacetin; in this case, steel-blue crystals result. Iodophenin has a burning, sharp taste, a faint iodine odor, and fuses under decomposition at 130° C. (266° F.). It imparts a yellow stain to the skin. Water does not dissolve it. The compound is readily soluble in alcohol, boiling hydrochloric acid, and glacial acetic acid, little soluble in chloroform and benzol. This agent is antiseptic and a topical irritant. It is not of much value in medicine. It is used locally only. When internally administered iodine is liberated in the intestines, resulting in iodine poisoning. Iodine is readily split off upon boiling with water or upon treatment with sodium thiosulphate or caustic soda (*Pharm. Centralhalle*, 1891, p. 312; also compare *ibid.*, p. 406).

Hydracetin, *Acetylphenylhydrazine* ($C_6H_5HN—NHC_2H_3O$).—To prepare this compound, acetic anhydride and phenylhydrazine are heated together, the product is dissolved in boiling water, and allowed to crystallize. It forms nearly tasteless, odorless, colorless, prismatic crystals, melting between 128° and 129° C. (262.4° and 264.2° F.). Boiling with concentrated acid decomposes it into its constituents, phenylhydrazine and acetic acid. The commercial compound known as *pyrodin* or *pyrodine*, is impure hydracetin. It is soluble in alcohol, cold water (1 in 50), and in boiling water (1 in 8 or 10). Sulphuric acid dissolves it colorless, but the solution becomes blood-red when a drop of nitric acid is added to it (difference from methacetin and phenacetin). Like phenylhydrazine, hydracetin reduces Fehling's solution. It is a cumulative poison, destroying the blood-corpuscles. It has nevertheless been employed for a brief period in ¾-grain doses, twice a day, as an antipyretic and antirheumatic agent. Even externally applied, as has been recommended for *psoriasis* (5 to 15 per cent lanolin ointment of hydracetin), it has produced deleterious effects. It should have no place in medicine.

Phenylhydrazine ($C_6H_4.NH.NH_2$).—This is an oily, colorless fluid obtainable by various methods, *e. g.*, by reduction of diazobenzene chloride ($C_6H_5.N:N.Cl$), with stannous chloride and hydrochloric acid. The following reaction takes place: $C_6H_5N:N.Cl+2SnCl_2+4HCl=C_6H_5NH.NH_2.HCl$ (phenylhydrazine hydrochloride) $+2SnCl_4$. Phenylhydrazine boils at 233° C. (451.4° F.). At a low temperature it solidifies in the form of tabular crystals, which fuse at 23° C. (73.4° F.). Alcohol and ether easily dissolve it, while it is soluble with difficulty in water. It is a basic substance, forming salts with acids. It has the characteristic property of entering into combination with aldehydes and ketones and their derivatives, notably with members of the sugar group. The remarkable achievements in the chemistry of the sugar group by Prof. Emil Fischer are due to the discovery of the characteristic behavior of phenylhydrazine toward the sugars. With dextrose it forms a characteristic crystallizable yellow compound called *phenyl-glucosazone*, and is recommended accordingly as a delicate test for sugar in urine. Phenylhydrazine enters into the manufacture of antipyrine and allied substances. This body is too poisonous for use in medicine.

PHOSPHORUS (U. S. P.)—PHOSPHORUS.

Symbol: P. Atomic Weight: 30.96.

A non-metallic element, obtained from calcium phosphate by reduction with charcoal.

"Phosphorus should be carefully kept under water, in strong, well-closed vessels, in a secure and moderately cool place, protected from the light"—(*U. S. P.*).

Source and History.—Phosphorus was accidentally discovered in 1669, by Brandt, of Hamburg, as he was attempting to extract from human urine a liquid capable of converting silver into gold. In the year 1769, Gahn discovered it in bones, and very soon after, Scheele devised a process for obtaining it from them, which is essentially the process now pursued. It is a constituent also of nerves, brain, etc.; it is also found in the form of phosphates in various plants, combined with calcium, potassium, or iron, etc., and in this form is also met with in the mineral kingdom.

Preparation.—Take animal bones, calcine them in an open fire till all the charcoal is burned out and they become white. In this state they contain from 75 to 80 per cent of phosphate of calcium $(PO_4)_2Ca_3$. Reduce the calcined bones to a fine powder, and to 10 parts of this powder add 30 or 40 parts of water, and gradually stir in 6 parts of concentrated sulphuric acid. After 24 hours, 50 or 60 parts of water are added to the mixture, and the whole well stirred and digested for 1 or 2 days. The liquid is then strained and evaporated to the consistence of thick syrup, and then contains acid phosphate of calcium, which is formed according to the following equation: ($[PO_4]_2Ca_3+2H_2SO_4=2CaSO_4+[PO_4]_2H_4Ca$). The syrup is now mixed with one-fourth of its weight of powdered charcoal, placed in an iron pot, and dried by exposure to a dull red heat, which converts the acid phosphate into calcium metaphosphate $(PO_3)_2Ca$. This dried mass is then placed in a stoneware or iron retort, the neck of which ends in a wide bent tube which dips a little under water, in a bottle or receiver, and is gradually heated to whiteness. Two-thirds of the phosphoric acid in the mass is reduced by the charcoal, and phosphorus is set free, which distills over and condenses under the water. The reduction takes place as follows: $3(PO_3)_2Ca+10C=10CO+(PO_4)_2Ca_3+4P$). This equation also shows that carbonic oxide gas (CO) is disengaged in large quantity. Owing to the presence of water in the mass, part of the phosphorus is liable to be disengaged in combination with hydrogen, forming a spontaneously combustible gas. Care must, therefore, be taken to avoid explosions. The phosphorus first obtained is usually of a reddish-brown color, owing to the presence of phosphide of carbon, formed during the process; to purify it, it is melted under water, and while liquid, squeezed through chamois leather, which separates impurities. It is lastly melted under water and molded into sticks by running it under water into glass tubes and allowing to cool. To make the process more economical, the organic matter of the bones is previously utilized (see *Gelatin*); or the bones are first subjected to dry distillation whereby *bone-black* (*animal charcoal*) is yielded, which is used on a large scale in sugar refineries; after it has become useless for this purpose, it may be completely incinerated and used in the manufacture of phosphorus as described.

Wöhler obtained phosphorus by distilling 2 parts of bone-black with 1 of quartz sand at a white heat. The silicic acid of the sand decomposed the phosphate of calcium contained in the bone-black, and disengaged the phosphoric acid which was reduced by the carbon. A. Rossel (1893) prepares phosphorus by reducing glacial phosphoric acid or sodium- or calcium-metaphosphate with aluminum or zinc. This requires a much lower heat for the liberation of phosphorus than the older method. In recent years, phosphorus is obtained by distilling a mixture of calcium phosphate and coke in an electrical furnace (*Amer. Jour. Pharm.*, 1898, p. 595, from *Scient. Amer.*).

Description.—Phosphorus exists in three allotropic modifications—namely, as the ordinary, octohedral, poisonous; the red, amorphous, non-poisonous; and the metallic, or rhombohedral phosphorus.

Ordinary, or yellow phosphorus is produced in the form of cylindrical sticks of a light-amber color, and a crystalline structure. The *U. S. P.* describes it as a "translucent, nearly colorless solid, of a waxy lustre, having, at ordinary temperatures, about the consistence of beeswax. By long keeping, the surface becomes red, and occasionally black. It has a distinctive and disagreeable odor and taste (*but should not be tasted, except in a state of great dilution*). When exposed to the air, it emits white fumes, which are luminous in the dark, and have an odor somewhat resembling that of garlic. On long exposure to the air, it takes fire spontaneously. Specific gravity 1.830, at 10° C. (50° F.). Melting point, 44° C. (111.2° F.). Phosphorus is insoluble or nearly so in water, to which, however, it imparts its characteristic, disagreeable odor and taste. Soluble in 350 parts of absolute alcohol at 15° C. (59° F.), in 240 parts of boiling absolute alcohol, in 80 parts of absolute ether, in about 50 parts of any fatty oil, and very soluble in chloroform, or in carbon disulphide, the latter yielding a solution which must be handled with the greatest of care to prevent danger from fire"—(*U. S. P.*). From solutions in the latter two solvents phosphorus may be obtained in the form of well-developed crystals of the regular system.

Phosphorus is somewhat flexible at ordinary temperatures, and may be easily cut with a knife, but is brittle at 0° C. (32° F.). The presence of 0.3 per cent of sulphur, or even much less, renders it brittle at ordinary temperatures. Friction will cause phosphorus to ignite. When the atmosphere is excluded, phosphorus boils when heated to 290° C. (554° F.), but evaporates and sublimes at a much lower temperature (about 104° C., or 219.2° F.). Phosphorus combines with chlorine, bromine, and iodine, spontaneous combustion taking place in the reaction. The luminosity of phosphorus, when exposed to moist air, is due to slow oxidation, whereby phosphorous acid (H_3PO_3) is formed. It is strange, however, that phosphorus is not in the least oxidized when in contact with pure oxygen even for months. The luminosity produced by phosphorus is destroyed by alkalies, alcohol, carbolic acid, etc. Phosphorus also imparts luminosity to the vapors of water, with which it is distilled, and may thus be identified. Heated in oxygen, phosphorus burns with a dazzling light. The heavy, white cloud which forms when phosphorus burns in the air, consists of *phosphorus pentoxide* (P_2O_5), the anhydride of *phosphoric acid* ($P_2O_5+3H_2O=2PO_4H_3$) (also see *Acidum Phosphoricum*). Upon slow oxidation of phosphorus, the volatile, white *tri-oxide* (P_2O_3) is formed, which is the anhydride of *phosphorous acid* ($P_2O_3+3H_2O=2PO_3H_3$). The anhydride of *hypophosphorous acid* (PO_2H_3) (see *Acidum Hypophosphorosum*), which would have the formula (P_2O), does not exist.

Yellow phosphorus is a very dangerous substance to handle, and occasions painful and slow-healing sores when in contact with the skin. When small pieces are dried between filtering paper, they soon ignite. Phosphorus should be preserved under water in well-stoppered vessels, and kept in a dark place.

Phosphorus is used as a poison for rats and vermin, and finds extensive application in the manufacture of matches. In the laboratory, it is employed for many chemical processes, *e. g.*, the preparation of pure phosphoric acid and other pharmaceutical compounds.

Impurities and Tests.—Phosphorus sometimes contains arsenic or sulphur or both. "To test for arsenic and sulphur, proceed as follows: Add 3 Gm. of phosphorus to 15 Cc. of nitric acid diluted with 15 Cc. of distilled water in a flask having the capacity of 50 Cc., and digest the mixture at a gentle heat on a water-bath, until the phosphorus is dissolved. Transfer the solution to a capsule, and evaporate it until no more nitrous vapors are given off, and then dilute the solution to 30 Cc. with distilled water. Heat 20 Cc. of the diluted solution to about 70° C. (158° F.) for half an hour, passing hydrogen sulphide through it during the half-hour's heating, and then until the liquid has become cold. If the liquid be now allowed to stand at rest during 24 hours, not more than a very small quantity of lemon-yellow precipitate should be visible (limit of arsenic). On adding barium chloride T.S. to the remainder of the liquid, not more than a slight opalescence should be produced (limit of sulphur)"—(*U. S. P.*).

Allotropic Modifications.—Amorphous, or Red Phosphorus. Ordinary, or yellow phosphorus, exposed to sunlight or violet light, turns into red phosphorus. Exposure to temperatures between 240° and 250° C. (464° and 482° F.) accomplishes the same result, while a heat above 260° C. (500° F.) revives ordinary phosphorus. The best method to obtain the red modification is to heat ordinary phosphorus in a closed vessel above its boiling point, *i. e.*, to 300° C. (572° F.). It forms a deep-reddish powder or mass, having a metallic lustre, is absolutely stable in the atmosphere, does not ignite when rubbed, is insoluble in the solvents for ordinary phosphorus, has a higher specific gravity (2.106), and is non-poisonous, because it is not absorbed by the system. It is not fusible, but vaporizes at 260° C. (500° F.). When heated in the presence of nitrogen to 450° C. (842° F.), it is converted into vitreous (ordinary) phosphorus. Commercial red phosphorus is liable to contain traces of ordinary phosphorus, which should be removed by boiling with caustic soda. The crude article should, therefore, be kept under water.

Metallic, or Rhombohedric Phosphorus, is obtained by exposing phosphorus with metallic lead in closed vessels to a red heat for 40 hours, allowing to cool, and dissolving out the lead with diluted nitric acid. It forms lustrous, dark scales, or microscopic rhombohedra, has a specific gravity of 2.34, and is converted into ordinary phosphorus again by heating it to 358° C. (676.4° F.).

Black Phosphorus.—The so-called black phosphorus of Thénard, obtained by rapidly cooling melted phosphorus, is due to the probable formation of metallic phosphides. Another variety of "black phosphorus" obtainable by the action of ammonia and heat upon ordinary powdered phosphorus, was shown by Flückiger (1892) to be *arsenic* originating from the sulphuric acid employed, and held dissolved in the phosphorus.

Action and Toxicology.—In minute doses, and properly diluted, phosphorus becomes absorbed and acts as a stimulant and tonic to the nervous, vascular, and secreting organs. It excites the mental faculties and the sexual feelings, raises the temperature of the skin, increases the frequency and volume of the pulse, and promotes the secretions. Cell growth, particularly of the skin, is quickened by it. In large doses, it operates as a poison, causing gastro-enteritis, becomes absorbed, and produces tissue changes and convulsions, insensibility, and death. Tardieu and Roussin state that phosphorus is poisonous of itself, and acts only on the economy in a state of isolation and purity. Fatty degeneration of the liver and heart, are chief among its results. According to Mialhe, the absorption of phosphorus (and also of sulphur) is due, not to the chemical action of the alkalies present in the intestinal juices, but to the fatty matters contained in the alimentary substances, which, after effecting its solution, serve as the vehicle for its introduction into the economy. The phosphorus so absorbed may remain several days within the body without undergoing any sensible change, as its union with the fatty matters enables it to almost completely escape the action of the chemical agents with which it comes in contact, and to diffuse itself throughout the system in the same manner as poisons soluble in water. Hence, the reason for the phosphoresence, and the garlicky odor observed at the autopsy of persons who have been poisoned by phosphorus. Phosphoretted hydrogen acts similarly, as when introduced into the blood, it gives rise to the production of water, and to a precipitate of phosphorus in a state of minute division eminently suited for the development of its deleterious action.

As a poison, phosphorus acts both locally (as an irritant) and specifically. The symptoms of acute poisoning from the ingestion of phosphorus are as follows: Within a few minutes, or, more generally, after a few hours, the victim experiences a disagreeable, alliaceous, or garlicky taste, and the breath is observed to be alliaceous. Burning pain (not intense) in the stomach, with a sense of oppression in that organ follows, and there is general malaise and eructations of garlicky vapors of the drug. The vapors may show luminosity if the room be dark. Vomiting of luminous, coffee-colored, yellowish, or bilious material is common, and often violent and frequent. The abdomen is hot, distended, and tender upon palpation. Purging is not a common occurrence (constipation at first being the rule), but when taking place the stools are loose, dark, or sanguineous, and painful. The stools are often phosphorescent in the dark. When death occurs early, the symptoms rapidly intensify until collapse, followed by death, takes place. Should death be delayed, however, for several days, as is frequently the case, and particularly when active symptoms are late in developing, jaundice supervenes and becomes rapidly progressive. The irritant symptoms usually subside, forming an apparent intermission for the better, but the danger is as great as ever. The pulse and temperature, which are at first above normal, soon become subnormal, great prostration ensues, the pulse becomes feeble and rapid, and sometimes the radial pulse is almost imperceptible, the skin is cold, the urine scanty, albuminous, and contains tube-casts. At this stage the stools are usually abundant and dark-greenish or bloody. The skin may show hemorrhagic areas and petechial spots, and wounds or sores upon the surface bleed freely and easily. The nervous symptoms follow the establishment of jaundice. Coma ensues, associated with jactitation or convulsive muscular movements, and death occurs usually about 5 or 6 days after the ingestion of the poison.

When phosphorus vapors come in direct contact with bone, necrosis of the part generally results. Formerly, it was quite common for those manufacturing lucifer matches to be thus affected (particular the jaw bones), but improved methods have largely overcome the danger from this source. This necrosed condition is now believed to be rare, unless the phosphorus can come into direct contact with the bare bone, as through carious teeth, or ulcers of the mouth. However, it has been known to produce caries of the teeth, with abscesses, and thus become extended to the alveolar processes. The foregoing bone effects and the following symptoms constitute *chronic phosphorus poisoning:* Nauseous eructations, vomiting, purging, burning pain in the stomach, hypersensitiveness to cold, stiffness, numbness, and pain in the limbs and joints, wasting, dyspepsia, straw-colored or grayish skin, and hectic fever, with respiratory irritation and cough. The patient may die of the effects of the phosphorus direct, or he may die of dyspepsia or phthisis. The chief post-mortem changes from phosphorus poisoning are fatty degeneration of the liver, heart, kidneys, and other organs, as well as of the voluntary muscles; some surface disorganization of tissue may be observed, chiefly in the stomach. The blood is thick and dark-colored. The liver is deep-yellow, interspersed with reddish patches, and altogether closely resembles the effects of yellow atrophy of the liver, which disease poisoning by phosphorus most nearly resembles. The whole interior of the body is phosphorescent, and the luminosity may persist for months. (For further post-mortem appearances, consult Taylor's *Medical Jurisprudence*.)

In phosphorus poisoning, death does not usually take place until several days have elapsed. The shortest period on record is one-half hour (Habershon, in Taylor's *Med. Jurisp.*). Less than 1 grain ($\frac{1}{8}$ grain, Wormley) has caused death. Only white or ordinary phosphorus is poisonous, red or amorphous phosphorus being non-toxic. Locally, phosphorus produces dangerous burns quite difficult to heal. The pregnant woman invariably aborts when poisoned by phosphorus.

In poisoning by phosphorus the stomach should be evacuated as speedily as possible. For this purpose sulphate of copper, which is itself one of its best chemical antidotes (forming the black phosphide of copper), may be given in 2 or 3-grain doses, every 5 minutes, until vomiting ensues. Apomorphine hydrochlorate may be used subcutaneously if desired, to induce emesis. After vomiting has freely occurred, small doses of the copper sulphate (2 grains) should be continued every half hour, so that any free phosphorus may be converted into the black phosphide, at the same time endeavoring to prevent further vomiting by means of ice or of small doses of morphine sulphate. After full emesis by copper sulphate, copper carbonate followed by vinegar, has been successfully used as an antidote. Following the use of the copper sulphate, administer French oil of turpentine, 2 fluid drachms of which may be given in mucilage of acacia every 15 minutes until 1 ounce has been taken. Old (ozonized) oil should be preferred. Ordinary turpentine is not effective unless old or ozonized. (For Dr. P. E. Andant's use of turpentine, see previous editions of this *Dispensatory*.) The use of magnesia (Pareira, X. Landerer) has been advised, as has a draught of calcined magnesia, 4 grains; chlorine water, 16 grains, and distilled water, 224 grains. The alkalies, however, are but feebly effective. In phosphorus poisoning no albuminous or oily bodies (except French oil of turpentine) should be given, lest by their attenuation of the poison they favor its toxic action. Oxygenated water and the inhalation of oxygen have been advised as true antidotes, as has also potassium chlorate. M. Mialhe advised, in cases of poisoning by phosphorus, to expel this agent as rapidly as possible from the system by means of acidulated laxative drinks, with abstinence, or, at all events, a prohibition of any kind of food containing fatty matter. He considered the solution of phosphorus in ether or chloroform as more apt to act dangerously than the solution in oil. After the use of the antidote free purgation should be produced by means of magnesium sulphate, magnesium citrate, or Rochelle salts. No remedy is effective as an antidote after degeneration of tissue has begun. The best preventives of chronic phosphorus poisoning among those engaged in the manufacture of lucifer matches are a wetted sponge over the mouth, good ventilation of the factory, and personal cleanliness.

Medical Uses and Dosage.—Though accredited with various therapeutical properties, phosphorus may be said to be chiefly a remedy for nerve exhaustion with prostration of the vital powers. Though a powerful nerve stimulant, it is still a question whether its action is temporary, tiding the patient over a critical period, or whether it primarily produces a permanent tonic effect. That its effects are but temporary is the view held by most observers, and tonic effects follow this reassertion of nerve power. The cases for phosphorus are those of atony, adynamia, debility, low nerve force, or nerve exhaustion. The phosphorus patient is weak, digestion and blood-making are imperfect, the glandular secretions and the excretions are defective, there is languor, lassitude, sexual debility in the adult, brain-fag, and general apathy. Sympathetic innervation is below par, the skin is dull and inactive, the tongue lifeless in appearance, and the whole system shows a lack of activity and evidence of imperfect elaboration of the blood, and defective nutrition of the nerve centers. In such conditions, through its primary stimulating power, it may prove tonic and restorative. Prof. Locke says of phosphorus that "it bears the same relation to the nervous system that iron does to the blood."

Bearing in mind the indications above given, phosphorus becomes an important remedy in many *nervous diseases*. It was early employed as a stimulant in *convulsive* and *old paralytic cases*, and for *progressive locomotor ataxia*. In all such cases inflammation should be absent. When *paralysis of spinal origin* is functional, it is often more serviceable than strychnine (Locke). It frequently proves the best remedy for long-standing, obstinate *neuralgia*, particularly in the aged. In such cases nerve exhaustion is a marked symptom. It occasionally benefits in *epilepsy* with the same nerve debility, or when due to sexual excesses, or abuse. Ordinarily, however, it is of little value in this disease. In *neurasthenia*, due to debility or to physical or mental overwork, or to sexual weaknesses, and in *degenerative nerve-changes* due to senility, it often proves a good remedy. When *insomnia* is due to cerebral anemia, phosphorus frequently gives rest and sleep, and it occasionally proves useful in the *debility* due to acute and chronic alcoholism, the morphine habit, and in *melancholia*, *dementia*, and *hysteria*. For *mental failure*, *mental aberrations*, *paralysis agitans* due to imperfect nutrition or to degenerative changes, and in *atheroma of the cerebral vessels*, the remedy has been highly endorsed. Though not an analgesic proper, it relieves *pain* of a neuralgic and rheumatic character, particularly *rheumatic headache*, when due to great debility, and when the pain suddenly subsides in some other part of the body and quickly attacks the head. It is a good remedy for *intercostal neuralgia* in the debilitated, and a good agent for the relief of *nervous headache* in similar subjects.

The sexual and urinary apparatus are impressed by phosphorus. Its effects in sexual weakness are probably not due so much to a special affinity for these parts as to its general stimulating effects upon the body at large. However, it appears to improve the circulation and innervation of the genito-urinary tract, and it is a good remedy to improve *vesical*, *prostatic*, and *testicular irritation*, whether arising from or associated with sexual excesses (Scudder). It has given good results in "*chronic cystitis*, *chronic prostatitis*, *enlarged and pendulous testes*, *gleet*, *chronic ovaritis*, and *vaginitis*" (Scudder). To these we may add *chronic irritation of the kidneys and ovaries*, and *atonic dysmenorrhœa;* also *chronic nephritis*, with atony and the voiding of milky urine. "In the treatment of disease from sexual abuse, as in *involuntary seminal emissions* with marked atony and morbid irritability, it is the very best remedy known" (Locke, *Syllab. of Mat. Med.*, p. 199). It has long been used as a remedy for *impotency* due to excesses or to debility of sexual organs or of the whole system.

Phosphorus in minute doses (gtt. iij to v in aqua ℥iv; teaspoonful every hour) is a valuable agent in low grades of *pneumonia* and *bronchitis*. It is a better agent in the second stage of pneumonia than aconite. It is an agent of great power in *lung hepatization*. In *chronic pneumonia* with secretion of muco-pus and expectoration of blood—the patient hastening on to consumption—this remedy or the hypophosphites will be found of great value. In the extreme debility of *typhoid pneumonia*, no agent is more efficient than phosphorus. Rust-colored sputa is one of the strongest indications for phosphorus; hacking, dry cough in the early stage of *phthisis* is also an indication for this drug. *Chronic bronchitis*, with bloody and muco-purulent expectoration and *chronic laryngitis*, with marked dryness and sense of heat in the throat, and associated with nervous depression, call for small doses of phosphorus. *Pleurisy*, in some subjects, and especially in the chronic form, may require phosphorus to assist in the absorption of the effusion. In such cases the patient is extremely weak, the pulse feeble, tongue pasty, and appetite and digestion much impaired.

Phosphorus has been used as a stimulant to the nervous centers in *low fevers* with low, muttering delirium, unconsciousness, and involuntary passage of the fecal and urinary discharges. It is also useful as a cutaneous stimulant in some *exanthematous diseases* in which the eruption has receded from the skin. It has also been advised, chiefly in conjunction with arsenic, for *boils*, *carbuncles*, *scrofulous abscesses*, *acne*, *herpes zoster*, *scald-head*, *lepra*, *lupus*, *psoriasis*, *fistulæ*, *osseous caries*, and *enlarged glands*. In the so-called *scrofulous diathesis* it is sometimes useful, and in such a state it relieves *amenorrhœa*, *dysmenorrhœa*, *leucorrhœa*, *chlorosis*, *nasal catarrh*, *colliquative sweating* and other debilitating discharges in *phthisis*, especially the *diarrhœa of phthisis*. Ten or 20 minims of specific phosphorus, added to 4 fluid ounces of water, and given in teaspoonful doses every 2, 3, or 4 hours, have been found by Prof. J. M. Scudder, M. D., very useful in *cholera infantum*, where there was nervous exhaustion, the discharges from the bowels being slimy and frothy, with tympanites. Phosphorus has been endorsed as a remedy for *pernicious anemia*, but often fails. Prof. Locke advises minute doses of phosphorus for "*muscular weakness*, as in children who are slow in learning to walk." In *fatty degenerations of the brain*, *spinal cord*, *heart*, *liver*, and *kidneys*, it has been with some physicians a favorite remedy. In *fatty hepatic degeneration* with a pale, waxy countenance, and in *malignant jaundice*, with delirium and marked prostration, it is a serviceable remedy. In fatty degenerations the dose must be minute. It is a remedy for *osteomalacia* and *rickets*, and has been advised in *proctitis* and in *diabetes mellitus*.

In ocular and aural therapeutics, phosphorus is sometimes useful. Thus, in *functional inner ear disorders*, associated with general neurasthenia, it sometimes benefits, and *tinnitis aurium*, is occasionally overcome by it. The dose is about $\frac{1}{100}$ grain, 4 times a day (Foltz). In eye affections it frequently aids in a cure, particularly if there be a scrofulous or tubercular taint. It quickly relieves *retinal hyperemia* and *retinitis*. It has also benefited *disseminated choroiditis* and *retinochoroiditis*. Foltz (*Dynam. Therap.*) declares that it will rapidly increase visual acuity in *functional* or *reflex amblyopia*, provided no morbid process is present, and that it is the best remedy for *insufficiency of the internal recti* and *paralysis of the ocular muscles*. The dose for this purpose is from $\frac{1}{200}$ to $\frac{1}{100}$ grain. Others have pronounced it a good remedy for *asthenic amaurosis* of functional character.

Phosphorus may be given in solution in alcohol, ether, olive, almond, or cod-liver oil, chloroform, glycerin, or in pill. An elixir of phosphorus and phosphorated oil are now official. The dose of phosphorus ranges from $\frac{1}{250}$ grain, cautiously and gradually increased to $\frac{1}{16}$ grain, from $\frac{1}{100}$ to $\frac{1}{60}$ grain being the usual range of dosage. Elixir of phosphorus, 15 minims to fl℥j=($\frac{1}{260}$ to $\frac{1}{65}$ grain); phosphorated oil (1 per cent phosphorus) 1 to 10 minims; specific phosphorus is the form usually employed in Eclectic practice, the most common prescription reading: R Specific phosphorus gtt. v to xx, aqua fl℥iv. Dose, 1 teaspoonful, every 2 to 4 hours. One minim of specific phosphorus represents $\frac{1}{240}$ grain of white phosphorus. As phosphorus appears to accumulate in the system, its action should be carefully watched, and as soon as vomiting, diarrhœa, or other symptoms of derangement of the digestive organs appear, the use of the remedy should be temporarily ceased, and, after 2 or 3 days, be again commenced with the smallest dose, as before. Indeed, when no symptoms whatever manifest themselves, it will be prudent to cease its administration every 15 or 20 days, recommencing its use in 4 or 5 days, and so on.

Specific Indications and Uses.—Nervous exhaustion; atony: vesical and prostatic irritation, with mucoid discharges; sense of fullness and dragging in the perineum; sense of weariness in lower extremities; mucoid rectal discharges; low muttering delirium in low fevers, with involuntary discharges; chronic bronchial and pulmonic affections, with heat, dryness, hacking cough, and difficult expectoration of muco-purulent or sanguineous sputa; rusty sputa; pulmonary hyperemia; pinkish countenance with staring eyes; expressionless pasty tongue; insufficiency of the internal recti muscle of the eye; sexual debility.

Preparations of Phosphorus.—Aqua Phosphorica, *Phosphorus water*. M. Stanislas Martin, has suggested the internal use of aqua phosphorica, the water which is kept standing over phosphorus. I have derived benefit from it in cases of *impotency*, *premature seminal emissions*, and in some *nervous affections*. It may be taken in doses of from 5 to 10 minims, repeated 3 times a day, in some syrup of the hypophosphites (J. King).

Pil. Aphrodisiaca, or *Pil. damiana cum phosphoro et nuce vomicæ*.—This pill is a specialty of Eli Lilly & Co., Indianapolis, Ind., and contains extract of damiana, extract of nux vomica, and phosphorus. It is extensively prescribed as an aphrodisiac and nerve tonic in *impotency*, *sexual debility*, *nervousness*, and *mental overwork*.

Phosphorus Paste.—Phosphorus is very useful for destroying rats, mice, cockroaches, bugs, and other vermin; the following paste is considered the best for this purpose, as it does not ferment on keeping: Triturate to liquefaction 6 parts of phosphorus and 1 part of pure sulphur, with 6 parts of cold water, that is added in portions; afterward add 2 parts of mustard flour, 10 parts of cold water, 8 parts of sugar, and 12 parts of rye flour. Stir it to the consistence of a soft paste, and keep it in pots closely covered (*Amer. Jour. Pharm.*, Vol. XXVII, p. 473).

PHYSALIS.—GROUND CHERRY.

The berries of *Physalis viscosa*, Linné.

Nat. Ord.—Solanaceæ.

Common Names: *Ground cherry*, *Yellow henbane*.

Botanical Source.—This plant is indigenous, perennial and pubescent, having an herbaceous, decumbent stem, about a foot high, and which is often viscid as well as the whole plant. The branches are somewhat dichotomous and angular. The leaves are very variable, even in the same plant, solitary or in pairs, ovate or lanceolate-ovate, cordate or acute at base, often obtuse at the apex, repand-toothed or entire, petiolate, from 1 to 4 inches in length, and ½ or ⅔ as broad, or even of equal breadth; when they occur in pairs, one of them is much smaller. The flowers are solitary, axillary, and pendulous; the corolla campanulate-rotate, twice as long as the calyx, tube very short, limb obscurely 5-lobed, greenish-yellow, with 5 brownish spots at the base inside. Calyx 5-cleft, persistent, enlarged, inflated, and angular; stamens 5, connivent; anthers opening lengthwise. The fruit is a yellow or orange-colored berry, inclosed in the calyx. There are many varieties of this plant, some of which have been unnecessarily divided into species, as *P. obscura*, *P. pubescens*, *P. pennsylvanica*, and *P. philadelphia* (W.—G.).

History.—This plant is common in many parts of the country, and is found growing in dry fields, hillsides, and roadsides, flowering in July and August. Its root is fusiform, white, and bitter, and will probably act as a bitter tonic. The fruit or berries are slightly acid and edible, with a faint bitterness. Water or proof-spirit extract their properties.

Action, Medical Uses, and Dosage.—Tonic, laxative, and diuretic, said also to be sedative. The juice of the berries, or a strong infusion, is reputed very beneficial in *gravel*, *difficult urination*, and several *urinary disorders*. Dose, of the juice of the berries, 1 or 2 fluid ounces. It will be found very useful in *febrile* and *inflammatory diseases*, attended with considerable vascular excitement, high-colored or scanty urine, restlessness or wakefulness, and torpor of the bowels.

Related Species.—*Nicandra physaloides*, Gaertner, is known as *Apple of Peru*.

Withania coagulans, Dunal, of India.—Sometimes confused with alkekengi. It contains a powerful coagulating principle, and is used by the natives, in place of rennet, to coagulate milk. For medical uses in India, see Dymock, *Materia Medica of Western India*.)

Physalis Alkekengi, *Alkekengi*, or *Winter cherry*, of Europe, has the stem somewhat branching below, the leaves in pairs, entire, acute; flowers white; calyx of the fruit red or reddish, with acid and somewhat bitter berries. It grows about a foot high, and possesses similar properties to physalis, and is recommended as a febrifuge (W.). It is naturalized and sometimes cultivated in the United States, being known as *Strawberry tomato*. Dessaignes and Chautard, in 1852, obtained the bitter principle of *Physalis Alkekengi*, which they call *physalin* ($C_{14}H_{16}O_5$), and which has been employed with success in *intermittent fever*. Pure *physalin* is a white, amorphous powder, with a faint tinge of yellow; its taste is at first faintly, afterward permanently bitter. It is sparingly soluble in cold water, more soluble in hot water, chloroform, and alcohol, and sparingly soluble in ether and acids. It is dissolved without chemical alteration by ammonia, but is precipitated from alcoholic solution by an ammonical solution of acetate of lead. The fruit of Physalis Alkekengi contains citric acid and sugar.

PHYSOSTIGMA (U. S. P.)—PHYSOSTIGMA.

"The seed of *Physostigma venenosum*, Balfour"—(*U. S. P.*).

Nat. Ord.—Leguminosæ.

COMMON NAMES: *Calabar bean* (*Faba calabarica*), *Ordeal bean of Calabar*.

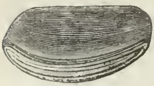
Botanical Source.—This is a large, herbaceous, climbing perennial, with the stem woody at the base, about 2 inches in diameter, twining, and sometimes 50 feet long. The leaves are large and pinnately-trifoliate; and the leaflets ample, ovate, and acuminate, with stipels. The flowers are large, about an inch long, in pendulous, fascicled racemes, on axillary peduncles, pale-pink or purplish, and beautifully veined. The bracts generally fall early, and the flower-stalk or rachis is covered with tuber-like knots. Corolla crescentiform, papilionaceous; vexillum round-ovate, recurved; apex bilobed, base angustate, margins auriculate; alæ oblong-obovate, free, incurved; keel obovate and produced into a twisted beak. The calyx is campanulate, quadrifid, 5-toothed, short, broad, the two upper nearly united. Upper stamens free; anthers all alike. Ovary raised on a stipe, 2 or 3-ovuled. Style thickened within the beak of the keel, and twisted with it, bearded along the inner side, and bearing a hood-like appendage at the apex covering the stigma. The legume is broad-linear, flattened, but convex on both sides, 2-valved, and slightly constricted between the seeds, which are oblong, with a long, linear hilum.

Fig. 192.

Physostigma venenosum.

History.—This plant, the Ordeal bean of Calabar, is a native of Calabar, in the Gulf of Guinea, on the western coast of Africa, and, according to Dr. Mery, around the sources of the river Coma, near Gabon. It is the only known species of the genus, unless we include the *Mucuna cylindrosperma*, Welwitsch, by some called *Physostigma cylindrospermum*, whose seeds were found with the commercial drug by Holmes, in 1879. It grows along the banks of rivers, climbing upon the adjacent trees and shrubs, and when the seeds become ripe they frequently fall into the rivers, are carried down the stream, and collected by the natives residing on the borders. The Calabar negroes call the seed *eséré*, and use it as an *ordeal* for the purpose of deciding the guilt or innocence of persons accused of crimes. It has been a very difficult matter to procure these beans, as the natives were averse to giving them to foreigners, hence their high price. In this connection, see a more detailed account of the Calabar bean and its uses, by J. U. Lloyd, in the *Western Druggist*, 1897, p. 249. Calabar bean is a violent poison, but did not attract attention on the part of the medical profession until its power of contracting the pupil of the eye was discovered. The first important notice on the subject was made by Dr. Christison before the Royal Society of Edinburgh, February 5, 1855, and which is published in their proceedings. Dr. Thomas R. Fraser was the first to discover, in 1862, its peculiar property of contracting the pupil, and subsequently Dr. Argyll Robinson made a more complete analysis of its ophthalmic properties. The present botanical name of the plant was given to it by Dr. Balfour, of Edinburgh. The powder, the tincture, specific physostigma, eserine, and the extract of Calabar bean (see *Extractum Physostigmatis*) are employed for internal use.

Fig. 193.



Calabar bean: fruit of Physostigma venenosum.

Description.—The bean or seed is the part used, and is officially described as "about 25 to 30 Mm. (1 to 1¼ inches) long, 15 to 20 Mm. (⅗ to ¾ inch) broad, and 10 to 15 Mm. (⅖ to ⅗ inch) thick; oblong, and somewhat reniform; testa granular, chocolate-brown, with a broad, black groove extending over the entire length of the convex edge; embryo with a short, curved radicle, and 2 large, white, concavo-convex cotyledons; inodorous; taste bean-like. On moistening the embryo with potassium hydrate T.S., it becomes pale-yellow"—(*U. S. P.*). The latter test serves to distinguish this bean from that of *Physostigma cylindrospermum*, which produces with the alkali an almost orange color, turning to greenish (see E. M. Holmes, *Pharm. Jour. Trans.*, Vol. IX, 1879, p. 913). The average weight of the seed is about 4.1 grammes (63 grains). Alcohol takes up its virtues entirely, water but partially. The kernel is brittle and constitutes the most poisonous part of the seed, the episperm being nearly inert; but it is exceedingly difficult to completely separate the latter.

Chemical Composition.—Calabar bean contains starch (48 per cent), mucilage, albumen (23 per cent), fatty oil (2.5 per cent), and salts, mainly potassium phosphate. The chief active principle of physostigma is the alkaloid *physostigmine*, discovered, in 1864, by Jobst and Hesse. Vée and Leven (1865) claimed to have obtained it in crystallized form, and named it *eserine*, from ésére, the African term for the ordeal bean. Jobst and Hesse prepared it by treating an alcoholic extract of the seeds with solution of sodium bicarbonate, and shaking out the alkaloid with ether, abstracting it with diluted sulphuric acid and again treating this solution with sodium bicarbonate and ether. The *French Codex* uses the name *eserine* exclusively.

PHYSOSTIGMINE ($C_{15}H_{21}N_3O_2$) (*Eserine*) forms colorless, hygroscopic, thin plates, slightly soluble in water, easily soluble in alcohol, ether, chloroform, benzol and carbon disulphide. It is strongly basic, and forms salts with acids, some of which are crystallizable. Physostigmine is an unstable body when exposed to light and air, and especially at a higher temperature (100° C. or 212° F.), it turns red, and is converted into Duquesnel's *rubreserine* ($C_{13}H_{16}N_2O_2$, Ehrenberg, 1894), a deep-red substance insoluble in ether, but soluble in chloroform. Free alkali and ammonia favor this change, while sodium bicarbonate hardly affects the alkaloid. The salts of physostigmine yield precipitates with alkaloidal reagents (see color reactions under *Physostigminæ Sulphas* and *Salicylas*). This alkaloid is too poisonous for general use. It may cause death when absorbed by the conjunctiva; the $\frac{1}{65}$

of a grain injected hypodermatically, or $\frac{1}{16}$ of a grain introduced into the stomach, will, with the adult, cause symptoms of intolerance; a larger dose will produce graver symptoms. It is not a counter-poison to strychnine. It merely changes the symptoms of the poisoning and the results of the autopsy without retarding the death.

A second alkaloid, *calabarine*, was discovered in Calabar bean, in 1876, by Harnack and Witkowski, distinguished from eserine principally by its being insoluble in ether. It is soluble in alcohol and water, and its toxic power is about one-sixth that of eserine. It resembles strychnine in its physiological action more nearly than physostigmine, producing tetanic movements in animals of the lower order. Ehrenberg (*Chem. Centralblatt*, 1894, p. 439) believes that calabarine is a decomposition product of physostigma alkaloids. Eber, in 1888, found in the Calabar bean an alkaloid, *eseridine* ($C_{15}H_{23}N_3O_3$), distinguished by its property of liberating iodine from iodic acid. Ehrenberg (*loc. cit.*) finally isolated the crystallizable alkaloid, *eseramine* ($C_{16}H_{25}N_4O_3$), which is physiologically inactive. By extracting Calabar bean with petroleum ether, Hesse (1878) obtained *phytosterin*, a substance closely related to the alcohol cholesterin in animal fats.

Action, Medical Uses, and Dosage.—Calabar bean, when administered in poisonous doses to animals, appears to produce a depressing influence, as manifested by a slight tremor, followed by paralysis of the limbs, slow and irregular respiration, with stertor, muscular twitchings, more or less complete loss of sensation, contraction of the pupils, frothy mucus escapes from the mouth, and finally there is only a gasping inspiration previous to death. Consciousness is preserved during the whole time, until the power of expression is lost. Reflex action can not be produced by either pricking or pinching the skin. Immediately after death the pupils dilate. With 45 children who were accidentally poisoned by the Calabar bean and taken to the Southern Hospital of Liverpool, the more prominent symptoms were loss of mobility, extreme prostration, slowness and feebleness of pulse, profuse sweats, coldness of the extremities, vomitings, and with some, severe diarrhœa. One of the children died, with whom there was neither nausea nor vomiting. These symptoms, with most of the children, disappeared in the course of 6 or 7 hours. Some look upon Calabar bean as a respiratory poison causing asphyxia; others, as interfering with contractions of the heart and producing syncope. Calabar bean appears to be a spinal paralyzer, lessening excitability of the peripheral extremities of the motor nerves, destroying excitability of the muscles, and directly diminishing reflex action. Its action on blood-vessels is, firstly, to contract them; secondly, to dilate them. It diminishes the pulsations of the heart (Fraser). Retention of the urine is sometimes produced owing to the sphincter contraction induced by the drug.

There is no known antidote to poisoning by Calabar bean except atropine, which should be injected in $\frac{1}{80}$ grain doses; one indispensable condition is an evacuation of the poison; for, when used as an ordeal among the Calabar negroes, those who vomit do not die; so it was with the children above referred to. As to other measures, they must be based upon general principles according to the symptoms presenting, such as artificial respiration, electricity, coffee, stimulants, etc.

Calabar bean was introduced into medical practice as a valuable local agent in certain conditions of the eyes, since which it has been successfully employed internally in certain nervous disorders. The alcoholic extract of the bean was the preparation formerly used in ophthalmic practice as a local application to the eye, while at the present day the alkaloid eserine has largely supplanted the use of the extract; when brought into contact with the conjunctiva, physostigmine causes lachrymation, and in about 5 minutes later contraction of the pupil, followed by contraction of the ciliary muscles; this contraction reaches its height in half an hour, and continues for about 12 hours (sometimes less pronounced for days), without, however, producing complete immobility of the pupil. It counteracts the effect of atropine, and also acts if there is paralysis of the pupil. The contraction of the pupil and ciliary muscle thus produced, generally causes pain, which may be very severe and continue for hours. If the eye be used, or efforts at accommodation be made, the pain increases. It appears, according to the views of some observers, to act by depressing the functions of the spinal cord, and thus preventing the transmission of nervous impulses through the cord to and from the iris; others, however, believe that it does not primarily affect the spinal axis, but acts directly upon the muscles and their controlling nerves. The pupillary contraction is thought to be due to dilatation of the blood vessels supplying the iris. The effects of physostigmine may be confined to the eye to which it is applied. It has been successfully employed as a local application in *mydriasis*, from atropine or other cause, in *iritis* and inflammations of neighboring structures, when desirable to produce alternate contraction and dilatation of the pupils, thus preventing adhesions; *paralysis of the ciliary muscle*, *retinitis* with photophobia, *photophobia* with *strumous ophthalmia*, *granular and irritable lids*, *ulceration of the margin of the cornea*, *prolapsus of the iris*, and in all cases where pupillary contraction is indicated, or where it is desired to improve the accommodative power of the eye for distant vision. *Glaucoma* is palliated by the use of physostigmine, especially if it be induced by the use of atropine. It is a remedy for *episcleritis*. In *corneal ulcerations* with feeble recuperative powers, in *indolent*, *non-vascular*, *corneal ulcers*, and in *hypopyon ulcers*, it is extremely valuable.

Physostigmine is the agent to be selected to control excessive ocular tension after *traumatisms*. It subdues *neuralgic pains in the eyeball*, sometimes relieves *convergent strabismus*, and is often employed to overcome *spasm of the muscles of accommodation* when persistent. Gelatin discs of physostigmine (*Lamellæ Physostigminæ*) containing about $\frac{1}{1000}$ grain of the alkaloid are occasionally used, and readily dissolve when placed upon the conjunctiva of the lower lids. The local effect ceases in from 12 to 24 hours. Generally, the solution (1 in 1000) is employed. A glycerin solution (1 part in 5) of the extract was formerly, and is still used to some extent.

The internal administration of the extract has also been found useful in *chorea*, *centric* or *eccentric tetanus*, *epilepsy*, *reflex neuralgia*, *reflex paralysis*, etc. However, its therapeutical effects in these diseases, are not fully decided. It is, however, a useful remedy in *diseases of the brain and spinal cord*, when administered in minute doses, the usual prescription being: ℞ Specific physostigma gtt. v, aqua ℥iv. Mix. Dose, a teaspoonful every 2 to 4 hours. The indications for its use here are a cool surface, cold extremities, feeble, tremulous pulse, and contracted pupils. Occasionally the dilated pupil will lead to its use if the associate symptom is a rapid, small, tense pulse. Dullness of intellect, pupillary contraction, and the small, weak pulse are the symptoms of *cerebro-spinal meningitis*, which call for its exhibition. The same state of the pulse with a forcible upturning of the eyes, points to its use in *puerperal convulsions*, which it sometimes relieves. Larger doses than for the above-named nervous conditions are required in *tetanus*. As large a dose as 5 drops of specific physostigma may be repeated every 1 or 2 hours in this complaint.

In one case of *traumatic tetanus*, Watson gave 2 grains every hour. Fraser does not think the powder advisable in tetanus, the functions of the stomach being considerably impaired in this disease. The ordinary tincture is an uncertain preparation, and should not be used. The alcoholic extract must be administered with great care; its commencing dose should not exceed $\frac{3}{8}$ of a grain in 24 hours, and at no time should its dose exceed 2 grains in 24 hours. It may be given in pill form, or dissolved in diluted alcohol, spirit, wine, or glycerin. Watson advises a preparation made by dissolving 8 grains of the alcoholic extract in $\frac{1}{2}$ fluid ounce of boiling water, then gradually adding $1\frac{1}{2}$ fluid ounces of alcohol, and filtering; 10 minims of this contain $\frac{1}{12}$ of a grain of the extract, which is a good dose to begin with in an adult. When used in subcutaneous injection the extract may be rubbed up in water, and a little chloride of sodium or a few drops of liquor potassæ be added. In a severe case of traumatic tetanus, Ashdown made use of a subcutaneous injection of $\frac{1}{3}$ of a grain of the extract in 18 minims of water; repeating the injection every 2 hours. But great care is required in determining the amount of extract necessary in any given case; when *physostigmine* is employed for this purpose, a solution of 1 part to 1000 is amply sufficient, of which a few drops only should be injected, repeating the operation according to the effects produced.

Physostigmine has also been proposed as an antagonist to *poisoning by belladonna* or *atropine*. I have found its internal use decidedly successful in several cases of *impotence*, the result of masturbation, also in cases of imperfect erection with premature seminal discharge on attempting coition; in which affections I am not aware its use has been heretofore tested. The dose of the powder is usually about 4 or 5 grains, during the 24 hours, in water, emulsion, or pill form (J. King). Extract of physostigmine ($\frac{1}{10}$ grain) and eserine ($\frac{1}{60}$ grain) have been successfully employed in *excessive sweating*, while the internal use of the former has been suggested in *cholera, diarrhœa, fecal accumulation* due to *intestinal dilatation*, and in *gastralgia, chronic constipation, intestinal, renal*, and *cystic catarrh, phthisical night sweats, dyspnœa, emphysema, bronchial dilatation*, and *asthma*. Commencing dose of the extract, $\frac{1}{10}$ grain; of the powder, 1 grain; for specific uses in nervous diseases, a fraction of a drop of specific physostigma; for other purposes a fraction of a drop to 5 drops; of eserine, $\frac{1}{100}$ grain, carried as high as $\frac{1}{25}$ grain; for local ocular purposes, a few drops of a solution of eserine (1 in 1000); for hypodermatic use, a solution of eserine (1 in 1000).

Specific Indications and Uses.—Eserine: Locally to induce contraction of the pupil in mydriasis or injuries to the eye; iritis, corneal ulcers, iridal prolapse, and ocular inflammations. Physostigma: Pulse feeble and tremulous, surface cool, extremities cold, and pupils contracted; or pupils dilated with small, rapid, tensive pulse; mental torpor in cerebro-spinal meningitis; breathing difficult with sense of constriction.

Related Drugs and Substitutions.—ANTIARIS, *Upas antiar*. A gummy-resinous exudate from *Antiaris toxicaria*, Leschenault (*Nat. Ord.*—Urticaceæ). The tree furnishing this poison is one of the large forest trees of Java, Celebes, and the islands near by. It is well known on account of the term *Deadly upas* applied to it, for it is said to exhale, like the poisonous species of Rhus, a volatile matter which affects some individuals, causing swellings and eruptions upon the skin. The milk-white or yellowish exudate flows when the tree is wounded; this upon exposure becomes brownish in color. It forms the bulk of the *Upas antiar* or so-called *Javanese arrow-poison*, and is identical with the *Ipoh poison* of the Malays (see *Nux Vomica*). Upas antiar is a waxy, reddish-brown body having an acrid, and excessively bitter taste. Alcohol and ether partially dissolve it; with water it forms an emulsion. It contains besides albumen, wax, and gum, the following peculiar principles: (1) The toxic, crystallizable, glucosid, *antiarin* ($C_{27}H_{42}H_{10}+4H_2O$, Kiliani, 1896), discovered in 1824 by Pelletier and Caventou; it is soluble in 27.4 parts of boiling alcohol, in 254 parts of water at 22.5° C. (72.5° F.), and in 2792 parts of ether (Mulder). It has a high melting point (225° C. or 437° F., Kiliani). When heated with diluted hydrochloric acid, it is decomposed into *antiarigenin* and *antiarose*, isomeric with rhamnose (Kiliani). (2) *Antiarol* ($C_9H_{12}O_4$, Kiliani), soluble in warm water, melting at 146° C. (294.8° F.). (3) *Antiaresin* ($C_{24}H_{36}O$, Kiliani), crystallizing from hot alcoholic solution in long needles, melting at 173.5° C. (344.3° F.) (see *Jahresb. der Pharm.*, 1896, p. 46).

The effects of upas antiar and antiarin are decidedly different from those produced by other bodies also known as *upas*. Thus the *Upas Tieuté* (which see) gives the tetanizing effects of strychnine, which it contains. Upas antiar does not appear to act upon the brain or spinal axis, but upon voluntary and involuntary muscles and the larger nerve trunks. It does not produce convulsions or tetanize, but all voluntary movements are impaired or wholly suspended by it according to the amount of the poison absorbed. Even small doses act upon the vasomotor centers, producing increased arterial tension, while large doses paralyze the heart muscle, death taking place from this effect. In effects it more closely resembles physostigma than any other agent, but has not yet been applied therapeutically.

CANJOURA.—The seeds of a creeper of Salvador, from which the inhabitants prepare a paste, said to act violently upon the nervous system. A state of delirium lasting a week or more is said to have been induced by it.

CALI NUTS, or CALI BEANS.—These are worthless substitutes for Calabar beans, mostly derived from certain papilionaceous plants of the genus *Entada, e. g., E. scandens* (see article with illustration by W. B. Hay, in the *Western Druggist*, 1898, p. 101). They bear no resemblance to Calabar beans (see articles on Cali beans in *Chem. Zeitung*, 1887, p. 633; 1890, p. 34; 1891, p. 825).

PHYSOSTIGMINÆ SALICYLAS (U. S. P.)—PHYSOSTIGMINE SALICYLATE.

FORMULA: $C_{15}H_{21}N_3O_2C_7H_6O_3$. MOLECULAR WEIGHT: 412.17.

"The salicylate of an alkaloid obtained from physostigma. It should be kept in small, dark, amber-colored and well-stoppered vials"—(*U. S. P.*).

SYNONYM: *Eserine salicylate*.

Preparation.—This salt may be prepared, according to Hager, by dissolving in boiling distilled water (35 parts) pure salicylic acid (1 part) and physostigmine (2 parts). Strain the solution, if necessary, and allow the salt to crystallize.

Description and Tests.—This salt is officially described as "colorless or faintly yellowish, shining, acicular, or short, columnar crystals, odorless, and having a bitter taste. It acquires a reddish tint when long exposed to light and air. Soluble, at 15° C. (59° F.), in 150 parts of water, and in 12 parts of alcohol; in 30 parts of boiling water, and very soluble in boiling alcohol. When heated to about 179° C. (354.2° F.), the salt melts. Upon ignition, it is consumed, leaving no residue. The salt usually has a faintly acid reaction on litmus paper. On adding a small portion of the salt to colorless, concentrated sulphuric acid, the latter assumes a tint not deeper than yellow. If a minute portion of the salt be added to a few cubic centimeters of ammonia water, in a small capsule, the liquid will acquire a yellowish-red color. On evaporating the liquid on a water-bath, a blue residue will be left which yields, with alcohol, a blue solution, becoming violet-red upon supersaturation with acetic acid, and exhibiting a strong, reddish fluorescence. The aqueous solution of the salt, when mixed with ferric chloride T.S., assumes a deep-violet color"—(*U. S. P.*). The solutions of this compound, both alcoholic and aqueous, exposed to light, turn reddish more quickly than the dry salt. This compound has the advantage over the sulphate, particularly in not being deliquescent. The blue color formed in the above test is known as *physostigmine blue*.

Action, Medical Uses, and Dosage.—This agent is designed for hypodermatic use, but as it does not readily dissolve in water, and is apt to decompose when exposed to light, its utility is doubtful. *Diarrhœa* and *dysentery* have been treated with it. Its other uses are those of physostigma. The dose should not be more than $\frac{1}{75}$ grain, though as high as $\frac{1}{12}$ grain has been recommended; for local use upon the eye, a solution of from $\frac{1}{2}$ grain to 2 grains to the ounce of distilled water may be employed.

Other Physostigmine Salts.—PHYSOSTIGMINÆ HYDROBROMAS. *Physostigmine hydrobromate.* This salt is used like the preceding. It is less stable than the salicylate, but more permanent than the sulphate. It is crystalline.

Physostigmine tartrate and *P. hydrochlorate* have uses and doses similar to those of the salicylate.

PHYSOSTIGMINÆ SULPHAS (U. S. P.)—PHYSOSTIGMINE SULPHATE.

FORMULA: $(C_{15}H_{21}N_3O_2)_2H_2SO_4$. MOLECULAR WEIGHT: 646.82.

"The sulphate of an alkaloid obtained from physostigma. It should be kept in small, dark, amber-colored and well-stoppered vials"—(*U. S. P.*).

SYNONYM: *Eserine sulphate.*

Description and Tests.—This salt is more soluble than the salicylate, but on exposure it deliquesces and assumes the consistence of an extract, therefore it is not so convenient to dispense as the latter salt. The *U. S. P.* describes physostigmine sulphate as "a white or yellowish-white, micro-crystalline powder; odorless, and having a bitter taste. It is very deliquescent when exposed to moist air, and gradually turns reddish by exposure to air and light. Very soluble in water and in alcohol, at 15° C. (59° F.), and still more so at the boiling temperature of these liquids. At 105° C. (221° F.), the salt melts, and upon ignition it is consumed, leaving no residue. The salt is neutral to litmus paper. On adding a small portion of the salt to colorless, concentrated sulphuric acid, the latter should not assume a tint deeper than yellow. If a minute portion of the salt be added to a few cubic centimeters of ammonia water, in a small capsule, the liquid will acquire a yellowish-red color. On evaporating this liquid on a water-bath, a blue or bluish-gray residue will be left which yields, with alcohol, a blue solution becoming violet-red upon supersaturation with acetic acid, and exhibiting a strong reddish fluorescence. The aqueous solution of the salt yields, with barium chloride T.S., a white precipitate, insoluble in hydrochloric acid"—(*U. S. P.*). It is distinguished from the salicylate by not producing a violet coloration with ferric chloride.

Action, Medical Uses, and Dosage.—Used like the salicylate of physostigmine, and in the same doses.

PHYTOLACCA.—PHYTOLACCA.

The root, leaves, and berries of *Phytolacca decandra*, Linné.

Nat. Ord.—Phytolaccaceæ.

Common Names: *Poke*, etc. (see below).

Botanical Source.—Phytolacca is a handsome plant growing from 3 to 9 feet high. It is indigenous, with a perennial root of large size, frequently exceeding a man's leg in diameter, usually branched, fleshy, fibrous, whitish within, easily cut or broken, and covered with a very thin brownish bark or cuticle. When young the stem is green, but as the plant matures it becomes more or less purple. The stem is annual, about 1 inch in diameter, much branched, smooth, stout, and hollow. The leaves are opposite, scattered, ovate, entire, 5 inches long by 2 or 3 wide, smooth on both sides, with ribs underneath. The flowers are numerous, arranged in long racemes opposite the leaves. There are no petals, but 5 rounded, incurved, petaloid sepals, whitish, or greenish-white in color. Stamens 10, shorter than the sepals. Styles 10, recurved. Ovary of 10 carpels, green, and united in a ring. The fruit is a handsome, flattened, black, or blackish-purple berry, 10-seeded, and contains a beautiful crimson juice.

Fig. 194.

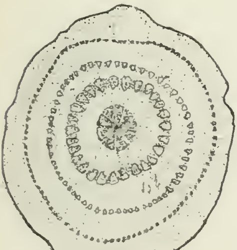
Phytolacca decandra.

Official Parts. Phytolaccæ Fructus (*U. S. P.*), *Phytolacca fruit* (*Phytolaccæ bacca*, *Pharm.*, 1880; *Poke-berry*). "The fruit of *Phytolacca decandra*, Linné (*Nat. Ord.*—Phytolaccaceæ")—(*U. S. P.*).

Phytolaccæ Radix (*U. S. P.*), *Phytolacca root*, *Poke-root*.—"The root of *Phytolacca decandra*, Linné (*Nat. Ord.*—Phytolaccaceæ)"—(*U. S. P.*).

History.—Phytolacca is the North American representative of a small family of plants—the *Phytolaccaceæ*. The plant also grows in North Africa, China, southern Europe, the Azores, and in the Sandwich Islands. Phytolacca is known by many common names, as Poke, Poke-weed, Poke-root, Virginian poke, Garget, Garget-weed, Scoke, Scoke-weed, Coacum, Coakum, Cocum, Mechoacan, Pigeon-berry, Cancer-root, Jalap cancer-root, Red nightshade, American nightshade, Red-weed, and Scoke jalap. The name *Phytolacca* is derived from the Greek *phyton*—a plant—and the modified Latin *lacca*, or French *lac*, meaning lake, having reference to the crimson color of the juice of the berries. Poke is common in the United States, growing in hedges, and along the borders of fields and clearings, along roadsides and in uncultivated fields and moist grounds. Its root is very tenacious of life. In this country it is regarded only as a weed, but in Europe is valued as an ornamental garden plant. The plant flowers from July to September, and the berries ripen in autumn. The young, green shoots, as they start in the spring and before the leaves have developed, are used as a table vegetable, being considered the best substitute for asparagus. They become cathartic as they advance to maturity. E. Preston (1884) calls attention to the peculiar and little-known property of phytolacca leaves to emit, in autumn, a phosphorescent light in the dark. Prof. E. Schär found the phenomenon to be due to an oxydizing enzyme,

Fig. 195.



Poke-root.

Fig. 196.

Section of Poke-root.

which he succeeded in isolating (see *Jahresb. der Pharm.*, 1896, p. 534). The official parts of this plant are the root and berries. The *root*, which is more commonly employed, should be gathered in the latter weeks of autumn, cleansed from dirt and impurities, sliced transversely, and carefully dried. The *leaves*, if they are to be used medicinally, should be gathered just previous to the ripening of the berries. The *berries* must be gathered when they are fully matured; they have a disagreeable, mawkish taste with a faint degree of acrimony, and are nearly inodorous. They contain an abundance of a beautiful dark-purple juice, which is turned yellow by an alkali, while an acid reinstates its purple color; the latter is of a very fugitive nature. The juice is said to have been used by the Turks for tinting sweetmeats (Landerer). The berries, though poisonous, lose their toxic qualities somewhat when cooked, and some have gone so far as to make pies of the fruit—a practice which, however, should be condemned. Severe purging has followed the eating of the flesh of pigeons which had fed upon the berries. Poke has long been used in domestic practice, principally as a poultice to discuss tumors. The berries steeped in gin have long been popular as a remedy for chronic rheumatism. The American Indians made use of this plant, but it must not be confounded with the plant known as *Indian poke*, which is the *Veratrum viride*. It is much used for the inflammatory condition of cow's udders, known as "garget," hence one of the names for this plant. Phytolacca yields its virtue to water and alcohol. The leaves and berries possess some medicinal activity, but the root is the part principally used. This root loses its medicinal properties with age, consequently only recent material should be used for making the fluid preparations. According to E. H. Cressler (*Amer. Jour. Pharm.*, 1875, p. 196), the inhalation of the powdered root produces soreness of the throat and chest, severe coughing and inflammation of the eyes.

Description.—I. PHYTOLACCÆ FRUCTUS (*U. S. P.*), *Poke-berries.* "A depressed-globular, dark-purple, compound berry, about 8 Mm. (⅓ inch) in diameter, composed of 10 carpels, each containing 1 lenticular black seed; juice purplish-red; inodorous; taste sweet, slightly acrid"—(*U. S. P.*).

II. PHYTOLACCÆ RADIX (*U. S. P.*), *Poke-root.*—"Large, conical, branched and fleshy; mostly in transverse or longitudinal slices, wrinkled, grayish, hard; fracture fibrous, the wood-bundles in several distinct, concentric circles; inodorous; taste sweetish and acrid"—(*U. S. P.*).

Chemical Composition.—The *berries*, according to Terreil (*Comptes Rendus*, 1880), contain *phytolaccic acid*, which is gummy, non-deliquescent, soluble in water and alcohol with acid reaction, hardly soluble in ether. Haverland (*Dissert.*, 1892) likewise obtained it, with small quantities of acetic, citric, and tartaric acids. W. Cramer (*Amer. Jour. Pharm.*, 1881, p. 598) found the juice of the berries to contain gum, sugar, malic acid, and coloring matter. The *coloring matter* was isolated in comparatively pure form by Herman Harms (*Amer. Jour. Pharm.*, 1893, p. 1) as a purplish-red powder, insoluble in absolute alcohol, ether, and chloroform, but readily soluble in water. It is destroyed by ferric chloride, chlorine water, hydrogen sulphide, etc. It reduces Fehling's solution direct. Alkalies dissolve it with yellow color which is turned red by acids. *Phytolaccin* is an indifferent crystallizable principle isolated by Edo Claassen (*New Remedies*, 1879, p. 326) from the seeds of phytolacca berries; it is soluble in chloroform and alcohol, slightly soluble in water. It was also obtained by Harms (*loc. cit.*) and analyzed by Haverland (1892), who found it to be free from nitrogen and related to the tannins.

The *root* of phytolacca is remarkable for the great amount of potassium it contains. A splinter of the root imparts to the Bunsen flame a violet coloration. G. B. Frankforter (*Amer. Jour. Pharm.*, 1897, p. 134) found in the dried root 13.38 per cent of ash, of which 41.6 per cent, or 5.56 per cent of the dried root, are potassium oxide. Part of the latter exists in the form of potassium nitrate (Pape, *Amer. Jour. Pharm.*, 1881, p. 597). A quantitative analysis of poke-root by G. F. Frankforter (*ibid.*, p. 281), showed it to have the following percentage composition: Fatty oil and wax 0.6, bitter resin 1, non-reducing sugar 9.46, reducing sugar 0.4, proteids 1.94, amido compounds 1.6, probably free formic acid 0.36, potassium formate 1.9, starch 11.68, calcium oxalate 6.2, nitrates 2.4, cellulose 16.4, lignin 3.2, gum coloring matter, ash, moisture 42.75. The absence of acetic, citric, malic, tartaric, benzoic, and salicylic acids are affirmed, likewise the absence of tannin and of chlorides. *Phytolaccic acid* is possibly present, but no alkaloid or glucosid could be isolated, although reactions were obtained with *some* alkaloidal reagents. Edmond Preston (*Amer. Jour. Pharm.*, 1884, p. 567) had obtained an alkaloid from the root, which he named *phytolaccine*, while N. Coscera (*Chem. Centralbl.*, 1887) found a glucosid. The root contains a substance probably closely allied to *saponin* (see H. Trimble, *Amer. Jour. Pharm.*, 1893, p. 273).

Action, Medical Uses, and Dosage. Physiologically, phytolacca acts upon the skin, the glandular structures, especially those of the buccal cavity, throat, sexual system, and very markedly upon the mammary glands. It further acts upon the fibrous and serous tissues, and mucous membranes of the digestive and urinary tracts. The drug is principally eliminated by the kidneys. Applied to the skin, either in the form of juice, strong decoction, or poultice of the root, it produces an erythematous, sometimes pustular, eruption. The powdered root when inhaled is very irritating to the respiratory passages, and often produces a severe coryza, with headache and prostration, pain in chest, back, and abdomen, conjunctival injection and ocular irritation, and occasionally causes violent emeto-catharsis. Phytolacca slows the heart's action, reduces the force of the pulse, and lessens the respiratory movements. It is a paralyzer of the spinal cord, acting principally on the medulla. In poisoning by this agent tetanic convulsions may ensue. Death results from carbonic acid poisoning, the result of respiratory paralysis. Upon the gastro-intestinal tract doses of from 10 to 30 grains of it act as an emetic and drastic cathartic, producing nausea which comes on slowly, amounting almost to anguish, finally after an hour or so, resulting in emesis. It then continues to act upon the bowels, the purging being prolonged for a considerable length of time. It is seldom used for emeto-cathartic purposes, on account of its tardy action, which, when established, continues for some time. It rarely causes cramps or pain. Large doses produce powerful emeto-catharsis, with loss of muscular power—occasionally spasmodic action takes place, and frequently a tingling or prickling sensation over the whole surface. Dimness of vision, diplopia, vertigo, and drowsiness are occasioned by large doses not sufficient to produce death.

Therapeutically, phytolacca is emetic, cathartic, narcotic, and alterative. In certain conditions of the system which might come under the head of *dycrasia*, it proves a most valuable alterative. *Scrofulous*, *syphilitic*, and *rheumatic conditions* are invariably benefited by it. It is best suited to *chronic rheumatism*, and *syphilitic* and *rheumatic joint affections*. As an antirheumatic quite large doses are necessary. The specific phytolacca may be used, or a saturated gin tincture of the berries. Preparations of the root are excellent for the removal of those severe *pains attending mercurio-syphilitic affections* (*osteocopus*), often being more beneficial than opium.

Phytolacca plays an important part in dermatological practice. It destroys the "*itch*" *insect*, consequently it is of value in *scabies*. The condition which calls for it is one of indolent action of the skin, usually associated with vitiated blood. There is a glandular difficulty—a scrofulous condition. There may be *scaly*, *vesicular*, *pustular*, or *tuberculous eruptions*, and *lymphatic enlargements with pain*. The skin may be inflamed, but does not itch because there is not activity enough in the part. It is often indicated in *chronic eczema*, *syphilitic eruptions*, *psoriasis*, *tinea capitis*, *favus*, and *varicose* and *other ulcers of the leg*. Associated with iris, it is a valuable agent in *acute sycosis*, *fissures*, *fistulæ*, *boils*, *carbuncles*, *dermal abscesses*, and all *ulcerations of the outlets of the body*. It relieves the pain of *burns* and promotes rapid healing. For skin diseases it should be employed internally and locally. ℞ Specific phytolacca ʒss, aqua ℥iv. Sig. Teaspoonful every 3 hours. Locally: ℞ Specific phytolacca ʒij, glycerin ℥j. Mix. Apply.

In *diseases of the mouth and throat* it is highly esteemed. It is useful in acute and chronic mucous affections, as, in *tracheitis*, *laryngitis*, *influenza*, *catarrh*, and especially in those affections where there is a tendency to the formation of false membrane, as *diphtheria*. There is a pallid, somewhat leaden-colored tongue, with but little coating, being a slick, glutinous coat, if covered at all. The mucous membranes present whitish erosions, or vesicular patches. With these conditions it may be employed in *tonsillitis*, *follicular pharyngitis*, *stomatitis*, *aphthæ*, *nursing sore mouth*, or *ordinary sore mouth*, and *syphilitic faucial ulcerations*. It should be taken internally and used locally as a gargle. It is one of our most valuable agents in *non-malignant diphtheria.* It is indicated by diphtheritic deposits. It stimulates the mucous surfaces, promotes glandular activity, and removes the diphtheritic membrane. It is a good remedy in *chronic tonsillar hypertrophy.* It is beneficial in difficult respiration produced by *bronchocele* (iris is useful here also) and associated with baptisia, does good service as a local wash in *ozena* and other forms of *nasal catarrh.* *Cough* resulting from inflamed or irritated sore throat is cured by it when the other indications for the drug are present.

In diseases of the glandular apparatus phytolacca and iris are our best drugs. Unlike iris, though, the former is best suited to hard, lymphatic enlargements. It is not the remedy for suppurative conditions of the glands. In such cases iris with baptisia renders the best service. No other remedy equals phytolacca in *acute mastitis.* If employed early it prevents suppuration, yet it acts kindly even when the abscess has to be opened, and the diluted specific phytolacca may be injected into the cavity. The remedy should be administered internally, alternated with specific aconite. Locally, specific phytolacca and glycerin may be applied when suppuration has not begun. Or the powdered root may be employed, moistened with water. *Parotitis* is almost always cured with phytolacca and aconite. *Metastasis of mumps* to the testes, as well as *orchitis*, from other causes, indicate this drug. *Sore nipples* and *mammary tenderness*, or morbid sensitiveness of the breasts during the menstrual period call for phytolacca. It is a good remedy for *ovaritis.* *Lymphoma* has been cured by it. *Subinvolution of the uterus*, *uterine* and *vaginal leucorrhœa*, and some cases of *membranous dysmenorrhœa* are cured by this agent. Applied as a poultice it has been greatly beneficial in the treatment of *felons*, and internally administered has cured *bronchocele* when iodine has failed.

Ulceration of the mucous crypts of the stomach and of *Peyer's patches* call for phytolacca. *Nasal catarrh*, *ozena*, and other ulcerated conditions of the nasal membranes are benefited by phytolacca associated with specific baptisia. It has been used with success in *gonorrhœa* and copious *nocturnal urination.* It relieves *conjunctival inflammations*, and *gonorrhœal* and *syphilitic sore eyes.* In *granular conjunctivitis* I have derived much advantage by bathing the eyes daily with a decoction of the root, applying it to the affected conjunctiva by means of a camel's hair pencil, at the same time administering the tincture of the recent root internally (J. King). It has been used for the cure of *piles*, *hydrophobia*, and *angina pectoris*, but we possess better agents for these conditions. *Headache*, whether rheumatic, nervous, syphilitic, or sympathetic (as, *sick headache* from gastric acidity and debility), is much benefited by it. It is also one of our most useful remedies in *asthenic hyperemia of the uterus*, *spleen*, *liver*, and other organs. Good results have followed its internal administration in *albuminuria*, and in those *dropsies* attended with albumen in the urine. The root, roasted in hot ashes until soft, and then mashed and applied as a poultice, is unrivaled in *felons* and *tumors* of various kinds. It discusses them rapidly, or, if too far advanced, hastens their suppuration. Associated with iris it may be employed in *mesenteric* and *splenic tuberculosis.* Several years ago it was noticed that birds lost their adipose tissue when feeding upon poke-berries. Recently, this agent, in the form of an extract of the berries, has been employed to reduce *obesity.* Reports for and against its virtues in this line are now appearing in journals, but its action is still doubtful. Some, believing that it does act in this way, have suggested its use in *fatty degeneration of the heart.* Probably it would be more clearly indicated if associated with a rheumatic diathesis. The root or leaves finely powdered, and added to lard to form an ointment, in the proportion of 60 grains to 1 ounce of lard, is very efficient in *scald-head*, and many other obstinate skin diseases, occasionally causing a slight degree of irritation when applied.

An infusion of the leaves taken internally is slightly cathartic; when bruised and applied locally, they are beneficial in *indolent ulcers.* A strong decoction of the leaves is of much benefit in *hemorrhoids;* if injected into the rectum 2 or 3 times a day, and a fomentation of the leaves applied to the part, it will almost always give relief, and eventually effect a cure. A fluid drachm or two may be taken internally at the same time, and repeated 2 or 3 times a day; should any narcotic effects be produced, its use may be omitted for 1 or 2 days, and then commenced in smaller doses. The inspissated juice of the leaves has been recommended in *indolent ulcers*, and as a remedy in *cancer;* in this last disease, Dr. Bone combined it with gunpowder. Quite recently, the inspissated juice of the leaves has been lauded as a new local remedy for the removal of *carcinoma*. The treatment, however, is not new, having been referred to by American medical writers early in the present century (see Felter, *Ec. Med. Jour.*, 1896, p. 335). The usual prescription for specific uses is: R Specific phytolacca gtt. x to xxx, aqua ℥iv. Mix. Sig. Teaspoonful every 1, 2, or 3 hours. As a glycerole: R Specific phytolacca ʒii, glycerin ℥i. Mix. Apply in chronic skin diseases. The dose of specific phytolacca ranges from 1 to 10 drops.

Specific Indications and Uses.—Pallid mucous membranes with ulceration; sore mouth with small blisters on tongue and mucous membrane of cheeks; sore lips, blanched, with separation of the epidermis; hard, painful, enlarged glands; mastitis; orchitis; parotitis; aphthæ; soreness of mammary glands, with impaired respiration; faucial, tonsillar, or pharyngeal ulceration; pallid sore throat, with cough or respiratory difficulty; secretions of mouth give a white glaze to surface of mouth, especially in children; white pultaceous sloughs at corners of mouth or in the cheek; and diphtheritic deposits.

Related Species and Pharmacal Preparations.—*Phytolacca dioica*, Linné (*Pircunia dioica*, Moquin-Tandon). A tree about 25 feet high and from 6 to 10 feet in circumference; native of Brazil or Mexico, and naturalized in Algeria. The wood is spongy. The berries grow in racemes, are yellowish-green, 12 to 15-celled, each cell containing a flattened seed. According to Balland (*Jour. Pharm. Chim.*, 1881, p. 232), the berries are sweet and edible, and yield by expression 74 per cent of a juice which contains resin, volatile oil, dextrose (3.20 per cent), saccharose (11.2 per cent), an undetermined organic acid (perhaps *phytolaccic acid*) (2.6 per cent), gum (4.4 per cent), etc. The resin is soluble in ether, and very acrid, but exists only in minute quantity. Also see *Amer. Jour. Pharm.*, 1882, p. 13.)

Phytolacca acinosa.—This plant is said to be violently toxic. The Japanese use it as a diuretic. A non-crystalline resin, *phytolaccotoxin* ($C_{24}H_{38}O_8$), has been isolated from it by Dr. Kashimura. It produces spinal convulsions and is reputed to impress the vasomotor system, acting thereby as a stimulant to the circulatory apparatus.

ARTHROSIA.—This specialty of Wm. R. Warner & Co. (Philadelphia and New York) is a combination in pilular form of salicylic acid, extracts of colchicum and phytolacca, resin of podophyllum, quinine, and capsicum. It is antirheumatic, antilithic, tonic, and alterative, and is prescribed in *acute and chronic gout*, *rheumatism*, *neuralgia*, *sciatica*, *rheumatic headache*, and in some *renal* and *hepatic affections*. Dose, 2 pills, 3 times a day, an hour before meals.

SUCCUS ALTERANS is a combination of vegetable alteratives prepared after the formula of Dr. George W. McDade, by Eli Lilly & Co., of Indianapolis, Ind. It is very extensively used as an alterative in *syphilis*, *scrofula*, *anemia*, *eczema*, and other diseased conditions the result of impoverishment of the blood. It contains in combination, the juices of Stillingia sylvatica, Smilax Sarsaparilla, Phytolacca decandra, Lappa minor, and Xanthoxylum carolinianum.

PICROTOXINUM (U. S. P.)—PICROTOXIN.

FORMULA: $C_{30}H_{34}O_{13}$. MOLECULAR WEIGHT: 600.58.

"A neutral principle obtained from the seed of *Anamirta paniculata*, Colebrooke"—(*U. S. P.*). (*Anamirta Cocculus*, Wight and Arnott; *Menispermum Cocculus*, Linné; *Coccus suberosus*, De Candolle.)

Nat. Ord.—Menispermaceæ.

Botanical Source and History.—The seeds furnishing this body are known as *Cocculus indicus* (*Fructus cocculi*), *Fishberries* or *Indian berries*. The plant furnishing them is a strong, climbing shrub, with a corky, ash-colored bark, with deep cracks or fissures. The leaves are dense, smooth, shining, coriaceous, roundish, acute, very slightly cordate, if at all, sometimes truncate at the base, with 5 digitate ribs, about 6 inches long, and as many broad. The stalks are a little shorter than the leaves, tumid at both ends, especially the lower. Flowers diœcious; the female flowers being in lateral compound racemes. The calyx is composed of 6 sepals in a double series, with 2 closely-pressed bractioles. The stamens are united into a central column dilated at the apex. Anthers numerous, covering the whole globose apex of the column. The drupes, from 1 to 3 in number, are globose, 1-celled and 1-seeded. The seed is globose and deeply excavated at the hilum. Albumen fleshy. Cotyledons very thin, linear-oblong, distant, diverging, and very membranous (L.—W.—A.).

Cocculus indicus inhabits Malabar, the Eastern Islands, etc., of India. Other plants, especially the *Coccus lacunosus* of Celebes and the Molucca Isles, and a Malabar species, *Cocculus plunkenetii*, are stated by some authors to furnish a portion of commercial fishberries.

Fig. 197.

Anamirta paniculata.

The Fruit (*Fructus cocculi*).—The fruit, as met with in commerce, consists of a dry, light, roundish nut, nearly ½ inch in diameter, of a grayish-black color, wrinkled, inodorous, subreniform, and composed of an external, slightly bitter shell or layer, beneath which is a white, thin, ligneous endocarp, containing an oleaginous, whitish-yellow, odorless, but intensely bitter nucleus or seed of a semilunar form, within which arises a central placenta contracted at the base, but enlarged and divided into two cells superiorly.

Fig. 198.

Cocculus indicus: fruit of Anamirta paniculata

Preparation of Picrotoxin.—According to Prof. E. Schmidt (1883), the grains, coarsely powdered, are deprived of most of their fatty oil by warm pressure, boiled out with water, the solution precipitated with lead acetate, filtered, the lead removed from the filtrate by means of hydrogen sulphide, the liquid again filtered and evaporated to crystallization. The crude picrotoxin is recrystallized from water and strong alcohol. Picrotoxin may also be extracted by means of alcohol or petroleum ether. (For Wittstein's process, see details in this *Dispensatory*, preceding editions. The yield, according to this process is 1 ounce or 1½ ounces from 8 pounds of berries, or about 1.2 per cent.)

Chemical Composition.—The *husk* of cocculus grains contains two isomeric, non-poisonous, non-bitter, crystallizable alkaloids—*menispermine* and *para-menispermine* ($C_{18}H_{24}N_2O_2$, Pelletier and Couerbe, 1834). The former is soluble in ether, the latter insoluble. Both are insoluble in water, but soluble in warm alcohol. Menispermine is also soluble in diluted acids, forming well-crystallizable salts; it melts at 120° C. (248° F.). The husk also contains a yellow resin, fat, wax, chlorophyll, and the problematical *hypo-picrotoxic acid* of Pelletier and Couerbe, insoluble in boiling water and ether, readily soluble in alkalies with brown color.

The *seeds*, or nuclei, of cocculus grains contain resin, gum, starch, and large amounts of fat (23.6 per cent, Römer, 1882), of which more than one-third consists of free fatty acid, principally stearic acid. The seeds also contain the very poisonous, bitter principle, *picrotoxin* ($C_{30}H_{34}O_{13}$, Schmidt and Loewenhardt; Paterno and Oglialoro, 1881; *picrotoxic acid* of Pelletier and Couerbe), which was first isolated by P. Boullay (1812). It is accompanied by the crystallizable, tasteless *cocculin* or *anamirtin* ($C_{19}H_{26}O_{10}$, E. Schmidt and E. Loewenhardt, 1884), crystallizable from hot water, insoluble in alcohol and ether.

The chemical composition of picrotoxin agrees best with the formula $C_{30}H_{34}O_{13}$. Barth and Kretschy (1884) asserted that picrotoxin is not a uniform body, being a mixture of the poisonous *picrotoxinin* ($C_{15}H_{16}O_6$) and the bitter, non-poisonous *picrotin*, separation being effected by boiling with benzol, in which picrotoxinin is soluble, picrotin very little soluble. Schmidt and Loewenhardt (*Jahresb. der Pharm.*, 1883–84, p. 774), on the other hand, maintained that picrotoxin is a definite body, being decomposed by boiling benzol into the constituents named, as follows: $C_{30}H_{34}O_{13}$ (picrotoxin) $= C_{15}H_{16}O_6$ (picrotoxinin) $+ C_{15}H_{18}O_7$ (picrotin). Quite recently, Richard Joseph Meyer succeeded in obtaining picrotoxin, with all its characteristics synthetically, by the mere crystallization of a mixture of 2 molecules of picrotoxinin and 1 molecule of picrotin, and concludes that picrotoxin is a mixture of *picrotoxinin* ($C_{15}H_{16}O_6+H_2O$) and *picrotin* ($C_{15}H_{18}O_7$) in the approximate proportion of 2 molecules of the former and 1 molecule of the latter (*Berichte der Deutsch. Pharm. Ges.*, 1897, p. 16). He has also shown that the molecular weight of picrotoxin, as determined by the kryoscopic method, is only one-third of that represented by the formula $C_{30}H_{34}O_{13}$; that the above decomposition is not equimolecular, but picrotin invariably forms only one-third of the picrotoxin employed.

Description and Tests.—Picrotoxin is officially described as forming "colorless, flexible, shining, prismatic crystals, or a micro-crystalline powder; odorless, and having a very bitter taste; permanent in the air. Soluble, at 15° C. (59° F.), in 240 parts of water, and in 9 parts of alcohol; in 25 parts of boiling water, and in 3 parts of boiling alcohol; also soluble in solutions of the alkalies, and in acids. Very slightly soluble in ether or chloroform"—(*U. S. P.*). It is also soluble in amyl alcohol and glacial acetic acid. "Picrotoxin is neutral to litmus paper. When heated to 200° C. (392° F.), picrotoxin melts, forming a yellow liquid, and upon ignition it is consumed, leaving no residue. Concentrated sulphuric acid dissolves picrotoxin with a golden-yellow color, very gradually changing to reddish-brown, and showing a brown fluorescence. On mixing about 0.2 Gm. of powdered sodium nitrate with 3 or 4 drops of sulphuric acid, in a small, flat-bottomed capsule, sprinkling a minute quantity of picrotoxin over it, and then adding, from a pipette, concentrated solution (1 in 4) of sodium hydrate, drop by drop, until it is in excess, the particles of picrotoxin will acquire a brick-red to deep-red color, which fades after some hours. On diluting 2 Cc. of alkaline cupric tartrate V.S. with 10 Cc. of water, and adding a small portion of picrotoxin, red cuprous oxide will be separated within half an hour at ordinary temperatures, and much more rapidly upon the application of heat. The aqueous solution of picrotoxin should remain unaffected by mercuric or platinic chloride T.S., tannic acid T.S., mercuric potassium iodide T.S., or other reagents for alkaloids (absence of alkaloids)"—(*U. S. P.*).

The fact that picrotoxin may be shaken out from acidulated aqueous liquids by means of ether or amyl alcohol, facilitates its detection in certain articles of food, *e. g.*, beer, to which it has been fraudulently added in order to impart bitterness to it. Flückiger (*Pharmacognosie*, 3d ed., 1891, p. 790) recommends evaporating the sample to dryness with calcined magnesia, extracting with alcohol, dissolving the evaporated alcoholic extract with hot distilled water, acidulating with sulphuric acid, and shaking out with ether; recrystallize from water, and apply the tests for picrotoxin as given above.

Action, Medical Uses, and Dosage.—Cocculus indicus is occasionally given internally, though very poisonous. Given to animals it acts on the cerebro-spinal system, causing giddiness, staggering, tetanic convulsions, and coma. It also produces gastric irritation. The powder, or an ointment, has been applied in *barber's itch*, *scald-head*, *itch*, and other unyielding diseases of the skin, as well as to kill lice. Given to fish, it poisons them, depriving them of sensibility, and has been used for the purpose of catching them. Extraordinary claims have been made by Planat for cocculus, as an agent in *spasmodic disorders*, including *epilepsy*, *infantile convulsions*, *chorea*, etc. Others, however, claim that it aggravates, at least in epilepsy. It has likewise been employed in *paralysis of the sphincters and limbs*. By some physicians, cocculus and picrotoxin, in minute doses, are recommended in disorders for which strychnine and nux vomica are employed. It is also an antagonist to these drugs, and may be used in cases of poisoning by them. *Nervous debility*, *paresis*, mild forms of *paralysis*, *facial paralysis*, *paralysis agitans*, and *alcoholic tremor* are conditions in which minute doses have rendered good service. *Spasms of the muscles of locomotion*, with cold skin and deficient capillary circulation, are said to be benefited by cocculus. It has also been advised in *gastric atony* and *intestinal dyspepsia*, with torpor of the parts involved. Dr. John Fearn recommends 2-grain doses of the 3 x trituration as a certain remedy for *profuse sweating*. It has been endorsed by others as exceedingly efficient in *night-sweats*, the above doses being given every 2 hours, in the evening, for 3 or 4 days. An attenuation of cocculus, as employed by Homœopaths, is an efficient remedy to prevent the nausea and sickness incident to travel by rail and upon water (*sea-sickness*). The dose of picrotoxin ranges from $\frac{1}{150}$ to $\frac{1}{64}$ grain.

PILOCARPINÆ HYDROCHLORAS (U. S. P.)—PILOCARPINE HYDROCHLORATE.

FORMULA: $C_{11}H_{16}N_2O_2HCl$. MOLECULAR WEIGHT: 243.98.

"The hydrochlorate of an alkaloid obtained from pilocarpus. It should be kept in small, well-stoppered vials"—(*U. S. P.*).

Preparation.—The free alkaloid is first prepared, *e. g.*, by Petit's process. The coarsely-powdered leaves are percolated with alcohol of 80 per cent, containing about 0.8 per cent of hydrochloric acid. The alcohol is distilled off under reduced pressure, the aqueous hydrochloride solution separated from the fatty layer, the solution rendered alkaline with aqua ammoniæ, and shaken out with chloroform. The crude bases thus obtained are converted into the nitrates by carefully adding diluted nitric acid to very slight excess, and evaporating the solution to dryness. The crude nitrate is then repeatedly crystallized from alcohol, whereby *jaborine*, which forms no crystallizable nitrate, and the small quantities of *pilocarpidine* present remain in solution. Pilocarpine is then liberated from the purified salt, dissolved in slight excess of hydrochloric acid, and the solution evaporated to crystallization.

Description and Tests.—"Small, white crystals, odorless, and having a faintly bitter taste; deliquescent on exposure to damp air. Very soluble in water and in alcohol; almost insoluble in ether or chloroform. When heated to 197° C. (386.6° F.), the salt melts, and upon ignition it is consumed, leaving no residue. The aqueous solution (1 in 100) of the salt is neutral, or has a faintly acid reaction upon litmus paper"—(*U. S. P.*). It is practically insoluble in carbon disulphide and in benzol. It is soluble in 1½ parts of water, both cold and boiling, the solution remains clear, even after having been kept for some length of time. But 7 parts of cold alcohol and ⅖ part of boiling alcohol are required to dissolve it (Schuchardt). "Concentrated sulphuric acid dissolves the salt to a colorless liquid, with evolution of hydrochloric acid vapor. If a small fragment of potassium dichromate be added to a few drops of this solution, on a white porcelain surface, the dichromate will gradually dissolve with a vivid, dark-green color. Fuming nitric acid dissolves the salt with a faintly greenish tint. The aqueous solution (1 in 100) of the salt is precipitated by iodine T.S., bromine water, mercuric chloride T.S., and most other reagents for alkaloids. If the aqueous solution be slightly acidulated, the subsequent addition of ammonia water will produce no precipitate. Sodium hydrate T.S. produces a precipitate only in a concentrated solution of the salt. The aqueous solution yields with silver nitrate T.S. a white precipitate insoluble in nitric acid"—(*U. S. P.*). (Regarding the melting point of the hydrochloride, see paper by Paul and Cownley, *Amer. Jour. Pharm.*, 1897, p. 108.)

Action, Medical Uses, and Dosage.—(See *Pilocarpus.*) Dose, ⅕ to ¾ grain; hypodermically, ⅛ to ¼ grain.

Related Compound.—PILOCARPINÆ NITRAS ($C_{11}H_{16}N_2O_2HNO_3$). This salt is official in the *British Pharmacopœia*. According to the *British Pharmacopœia* (1885), it is prepared from extract of jaborandi by agitating the latter with chloroform and an alkali, evaporating the chloroform solution, neutralizing the residue with nitric acid, and recrystallizing. It forms a crystalline, white powder or needles. Nitrate of pilocarpine is soluble in 8 or 9 parts of water, at 15° C. (59° F.), freely soluble in boiling alcohol, but slightly soluble in cold alcohol. The solution of this salt is precipitated by chloride of gold, in fine needles, and by chloride of platinum, in prismatic crystals. It should leave no ash when burned with free access of air. A diluted solution applied to the eye, causes contraction of the pupil. Uses and doses, same as for Pilocarpine hydrochlorate.

PILOCARPUS (U. S. P.)—PILOCARPUS.

"The leaflets of *Pilocarpus Selloanus*, Engler (Rio Janeiro Jaborandi), and of *Pilocarpus Jaborandi*, Holmes (Pernambuco Jaborandi)"—(*U. S. P.*).

Nat. Ord.—Rutaceæ.

COMMON NAME: *Jaborandi.*

ILLUSTRATIONS: *Pilocarpus Jaborandi*—*Pharm. Jour. Trans.*, 3d series, Vol. V, 1874–75, p. 582; and H. Geiger, *Berichte der Deutsch. Pharm. Ges.*, 1897, p. 424, Plates. *P. Selloanus* and *P. pennatifolius*—*Pharm. Jour. Trans.*, 4th series, Vol. I, p. 521.

Botanical Source and History.—The jaborandi shrub is a native of Brazil, and grows to the height of from 6 to 10 feet. The genus is represented by about 19 described species, for an enumeration of which, see *Pharm. Jour. Trans.*, Vol. I, 1895, p. 541. They are natives of South America and the West Indies. Jaborandi was introduced to the medical profession by Dr. S. Coutinho, of Pernambuco, in 1874. The leaves were examined by Prof. Baillon, and the plant referred to the *Pilocarpus pennatifolius* of Lemaire, described by him, in 1852. Engler (1874) states that its leaves are pilose (hairy) beneath, while E. M. Holmes (1875) calls attention to the fact that commercial leaves are glabrous (devoid of hair). However, not much importance can be attached to this distinction, because Planchon (1875) has observed that the leaves of *Pilocarpus pennatifolius*, grown in Paris, may occur partly in the glabrous, partly in the pilose form. In 1875 (*Pharm. Jour. Trans.*, Vol. V, pp. 581 and 641), Mr. E. M. Holmes referred one of the two grades then in commerce (Rio Janeiro jaborandi) to *Pilocarpus Selloanus*, Engler, and, in 1893 (*ibid.*, Vol. XXIII, p. 1008; also, *ibid.*, Vol. I, 1895, p. 520) established for the other (Pernambuco jaborandi) a new species, *Pilocarpus Jaborandi*, Holmes, which he described from a specimen grown in the Cambridge Botanical Garden.

Engler's botanical description of *P. Selloanus*, as communicated by E. M. Holmes, is as follows: The stem is covered with thin, purple bark, and leafy toward the apex. The leaves are imparipinnate. The petiole of the leaf is semiterete, flattened a little above, quite glabrous. The leaflets are trijugate, oblong, distinct, nearly equal, obtuse, margin reflexed, membranaceous or subcoriaceous, grayish-green, quite glabrous on both sides, pellucid-punctate; mid-rib sulcate above, very prominent beneath; lateral nerves rather prominent beneath; petiole of leaflets short. The raceme is terminal, nearly three times longer than the leaves, terete, purple, quite glabrous, with slender pedicels, horizontally patent and slightly hairy, six times longer than the buds, and furnished at the middle and base with 2-minute, ciliolate bracts. The calyx is very short, with broad, rounded lobes, which are ciliolate. The petals are coriaceous, lanceolate, acute, furnished with a prominent mid-rib, inflexed at the upper margin and at the apiculus. The stamens are shorter than the petals. The ovary is depressed, globose, very smooth, half included in the disk, and crowned with a short, rather thick style (*Pharm. Jour. Trans.*, Vol. V, 1875, p. 641).

The new species, *P. Jaborandi*, Holmes, differs from *P. Selloanus*, to which it is most nearly allied, in having 4 pairs of leaflets; in the elliptic-oblong shape of the leaflets and their more fleshy consistence; in the veinlets being more prominent on the upper surface; in the slender, glabrous pedicels, only three times longer than the leaf-buds; in the minute bracts, being situated near the apex of the pedicel; in the rose color of the ovate petals, pedicels, and upper part of rachis; and in the rugose-crenate disc. The calyx is pentagonal, not lobed (*Pharm. Jour. Trans.*, Vol. XXII, 1892, p. 875).

The subsequent investigations of E. M. Holmes (*ibid.*, 1895, pp. 520 and 539), and, more lately, those of H. Geiger (*Berichte der Deutsch. Pharm. Ges.*, 1897, pp. 356 and 425), have shown that commercial jaborandi leaves, at present in the market, are to be referred to the following 5 species: (1) *P. Jaborandi*, Holmes (Pernambuco jaborandi), identical with *P. officinalis* (Poehl, 1879); (2) *P. pennatifolius*, Lemaire (Paraguay jaborandi), which, according to Geiger, is identical with *P. Selloanus*, Engler; (3) *P. trachylophus*, Holmes (Ceara jaborandi); (4) *P. microphyllus*, Stapf (Maranham, or Small jaborandi); and (5) *P. spicatus*, Saint-Hilaire (Aracati jaborandi). In 1896, a spurious jaborandi was referred, by Holmes, to a hitherto unknown plant, *Swartzia decipiens*. The nomenclature, according to the places of export, as adopted by Holmes, is abandoned by Geiger, because the commercial bales rarely even contain leaves of a single species.

Description.—Official jaborandi is thus described by the *U. S. P.*: "About 10 to 15 Cm. (4 to 6 inches) long, and 4 to 6 Cm. (1⅔ to 2¼ inches) broad, short-stalked, oval or ovate-oblong, entire, and slightly revolute at the margin, obtuse and emarginate, unequal at the base; dull-green, coriaceous, pellucid-punctate, mostly smooth; when bruised slightly aromatic; taste somewhat bitter and pungent"—(*U. S. P.*). Commercial jaborandi is usually mixed with leaf-stalks, twigs, and bark. The leaflets are almost odorless when entire; have a slightly aromatic taste, followed by a persistent acridity. (For a comparative histological study of jaborandi leaves, see Albert Schneider, *Journal of Pharmacology*, 1897, p. 141.)

Fig. 199.

Leaf of Jaborandi

Chemical Composition.—The active principle of jaborandi leaves is the alkaloid *pilocarpine*, which was discovered almost simultaneously by E. Hardy, in France, and A. W. Gerrard, in England, in 1875. Several other active principles were subsequently isolated from the mother liquors of pilocarpine—namely, the alkaloids *jaborine* (Hardy, 1875; Harnack and Meyer, 1880), *pilocarpidine* (Merck, 1885), *jaboridine* (Harnack, 1885), and volatile *jabonine* ($C_9H_{14}N_2$, Hardy and Calmels, 1887), as well as *jaboric* and *pilocarpic acids;* but it is somewhat doubtful whether these derivatives of pilocarpine preexist in the leaves. Other constituents are a volatile oil (0.56 per cent, Hardy), an acrid resin, tannin, and a volatile acid, forming large crystals.

Pilocarpine ($C_{11}H_{16}N_2O_2$, Harnack and Meyer, 1880) may be obtained as described under pilocarpine hydrochlorate (which see). It forms a viscid liquid, optically dextro-rotatory, soluble in water and alcohol, slightly soluble in cold ether or chloroform, and in acids, forming a series of salts, of which the acetate is soluble in ether. The nitrate crystallizes well; the hydrochloride is very deliquescent. Pilocarpine, boiled with water, is decomposed into *trimethylamine* ($N[CH_3]_3$) and *beta-pyridine-alpha-lactic acid* ($C_5H_4N.C[OH.CH_3].COOH$). Its synthesis was effected by Hardy and Calmels, in 1887 (see graphic formula in *Pharm. Jour. Trans.*, Vol. XVIII, p. 89). These observers, as well as Merck (1885), consider it to be *methyl-pilocarpidine* (see below). According to J. van de Moer (1895), pilocarpine also stands in close connection with the alkaloid *cytisine* (see *Baptisia*).

Jaborine ($C_{22}H_{32}N_4O_4$, Hardy and Calmels, 1887) is a strongly basic, amorphous alkaloid, indicated by Hardy (1875), and shown by Harnack and Meyer (*Chem. Centralblatt*, 1880) to correspond in its physiological action with atropine, while pilocarpine in this respect resembles nicotine. It is formed when alcoholic or acid solutions of pilocarpine are concentrated by evaporation, and is not contained originally in the fluid extract of jaborandi. Its formation explains the lack of uniformity of the physiological action of pilocarpine as first obtained. When pilocarpine is rapidly heated to 175° C. (347° F.), and kept at this temperature for half an hour, it is decomposed into ether-soluble *jaborine* and water-soluble *pilocarpidine* and *jaboric acid* ($C_{19}H_{25}N_3O_5$, Hardy and Calmels. *Pharm. Jour. Trans.*, Vol. XVII, 1887, p. 550). Jaborine is a brittle mass, insoluble in water, soluble in alcohol, ether, and a solution of jaboric acid. Its salts are uncrystallizable. Boiling with aqueous solution of caustic potash, converts it into pilocarpidine.

Pilocarpidine ($C_{10}H_{14}N_2O_2$, Harnack, 1885) was discovered by Merck (1885), and was considered by him and others to be the lower homologue of pilocarpine. This simple relation, however, does not seem to exist between these two bases (E. Merck, *Archiv der Pharm.*, 1898, p. 141), nor are they isomers, as was asserted by Petit and Polonowsky (*Pharm. Jour. Trans.*, Vol. V, 1897, p. 83). The aqueous solution of its salts is not precipitated by chloride of gold (difference from pilocarpine). It is a syrupy liquid, forming a well-crystallizable nitrate. The formula of *nicotine* being $C_{10}H_{14}N_2$, pilocarpidine may be regarded as dioxy-nicotine. It has been obtained synthetically as an intermediary product in the synthesis of pilocarpine (see above). It is easily converted into *jaboridine* ($C_{10}H_{12}N_2O_3$, Harnack, *Chem. Centralblatt*, 1885), which is probably identical with *jaborandine* of Parodi (1875) from *Piper Jaborandi*. It may also be formed from pilocarpine by treatment with fuming nitric acid (Chastaing, 1882). The chemistry of pilocarpine and derivatives is held by Petit and Polonowsky (1897) to be still doubtful.

The following table states the yield of total alkaloid and nitrate, as recorded by several observers:

Analyst.	Source of Jaborandi.	Per cent Pilocarpine.	Per cent crystallizable nitrate. Melting point.	Per cent recrystallizable nitrate Melting point.	
A. Poehl, 1879	Hairy	1.97			
	Non-hairy	0.19			
F. Budee, 1880	I. Hairy	....	1.26	0.77	Am. J. Pharm., 1880, p. 25.
	Non-hairy	1.00	0.56		
	New lot	1.01	0.609		
	Stems	0.066			

Analyst.	Source of Jaborandi.	Per cent Pilocarpine.	Per cent crystallizable nitrate. Melting point.	Per cent recrystallizable nitrate. Melting point.	
F. Budee, 1880	II. Non-hairy	0.35	0.198		
	III. Mostly non-hairy	0.67	0.34		
F. Miller, 1880	Hairy	1.21 1.265	....	....	*Ibid.*
	Non-hairy	0.87 0.93			
A. Dohme, 1893	*P. pennatifolius*	0.33	....	....	*Proc. A. P. Assoc.,* 1895, p. 266.
1894	*P. pennatifolius*	0.18			
1895	*P. pennatifolius*	0.19			
1894	*P. microphyllus*	0.16			
1895	*P. microphyllus*	0.19			
Paul & Cownley, 1894	*P. Jaborandi*	....	0.5 to 0.8 pil. nitrate	....	*Phr. Jr. Trans.,* Vol. I, 1895, p. 542.
	P. pennatifolius	....	0.18, 0.19; 0.38 pil. nitrate		
	P. microphyllus	....	0.16 to 0.19 pil. nitrate		
	P. microphyllus	....	Up to 0.8 alk. nitrate		
	P. trachylophus	0.02 (new alkaloid)			
Paul & Cownley, 1896	*P. spicatus*	0.16	....	0.03 at 151.5° C. 0.04 at 130.5° C.	*Ibid.*, Vol. III, 1896, p. 1.
	P. trachylophus	0.4	0.02		
	P. Jaborandi	0.72	0.67 at 161° C.	0.37 at 162.7° C. 0.30 at 158.3° C.	
	P. microphyllus	0.84	0.45 at 160° C.	0.23 at 162.7° C. 0.22 at 147.7° C.	

Action, Medical Uses, and Dosage.—Jaborandi acts upon the glandular system, increasing the secretory action of the glands; however, its influence is more especially exerted upon the sudoriferous and salivary glands. A drachm or two of the powdered leaves and smaller branches infused in a cupful of boiling water, and the whole taken at a draught, will, in about 10 or 20 minutes afterward, occasion a tingling sensation with redness of the cutaneous surface; this sensation is at first experienced in the face, but soon extends over the whole surface, and is quickly followed by an abundant perspiration, which is apt to continue for 4 or 5 hours. Almost simultaneously with the sweating, the secretion of saliva increases to such an extent as to greatly embarrass speech, the person being often obliged to assume an inclined position that the escape of the saliva may be facilitated. During its salivary action 1 or 2 pints of saliva, and even more, may be secreted, and, not infrequently, there will be, in addition, an augmentation of the bronchial and lachrymal secretions. At times the mucous glands of the intestines will be so influenced as to occasion a diarrhœa, and it is not a rare circumstance that the submaxillary glands enlarge. After the administration of jaborandi, patients are often attacked with nausea, vomiting, vertigo, hiccough, heaviness of the head, and contraction of the pupils. According to S. Ringer and A. Gould, the temperature of the body becomes greatly lessened during the sweating, falling 1.4° F.; on the other hand, Green, Rabuteau, Gubler, Robin, Ambrosoli, and Riegel, state that it becomes considerably elevated. As the rule, at the termination of the diaphoresis, the temperature becomes the same as it was at the time the jaborandi was administered; in a few cases it has been slightly lower, but returned to the normal degree in the course of from 12 to 24 hours. From the commencement of the perspiration, the face becomes pale, the pulse fuller, and more frequent; the pulsations of the heart become irregular, and, with persons laboring under some cardiac affection, a kind of asystolia is observed. The effects of this agent have been found to occur more readily with adults than with children. In the exhibition of this article as a diaphoretic, the use of warm drinks, and other aids toward facilitating the sweating, are not required.

During the sudorific action of jaborandi, the quantity of urine is lessened, to a greater or lesser extent, and micturition frequently proves painful. As urea exists to a large extent in the saliva and sweat caused by jaborandi (no uric acid being found), a diminution of it occurs in the urine voided; but, after sweating, it gradually returns to its normal figure in the urine, and from this it would appear that the drug does not increase the combustions of the economy. Experiments with the sphygmograph, made at various periods during the action of the drug, have shown an almost complete asystolia with a very considerable diminution of vascular tension. M. Robin is led to believe that jaborandi has an especial action upon the vasomotors, which it paralyzes; from whence results the cardiac asystolia and the copious secretions of sweat and saliva. M. Gubler, while admitting this paralyzing action upon the vasomotors, maintains that it has, in addition, a special irritating influence upon the sudoriferous and salivary glands, and upon the renal glomerules, which stimulates their functional activity. Dryness of the mouth and throat, with a sense of fatigue and depression, most usually follow the cessation of its active effects. Administered in divided doses, jaborandi, instead of acting as a diaphoretic and sialagogue, becomes an active diuretic. When given in cases where there is a diminished secretion of milk, contrary to what might be anticipated, it increases the quantity of this mammary secretion. Martindale dissolved extract of jaborandi in glycerin, and applied it around the eye; a marked contraction of the pupil ensued. A similar result, with impaired vision, is apt to follow its internal administration in large doses, but this disappears on the cessation of the medicine. Pilocarpine is the active principle of jaborandi, having an action nearly identical; however, it causes less salivation, less vomiting, and is more certain in its effects—the hydrochlorate and the nitrate of this alkaloid are used; they may be employed internally, or by subcutaneous injections.

Therapeutically, jaborandi has been found of value in the removal of serous effusions, as in *hydrothorax*, *anasarca*, *ascites*, *chronic pleurisy*, etc., whether these be due to disorders of the heart, liver, kidneys, to chronic inflammatory conditions, to albuminuria, or exist as a sequence of exanthematous affections, etc. While in certain of these effusions it acts as a curative agent, in others it will prove useful as affording temporary relief, from time to time, until other indicated remedial agents have been enabled to overcome or to modify the abnormal conditions giving rise to such effusions. In *cardiac diseases*, from its tendency to diminish the contractility of the heart and arteries, and to favor their dilatation (diastole), thus conducing to dyspnœa and even to asphyxia; if used at all, great care and prudence should be observed. In those disorders, in which its employment from time to time is followed by persistent debility, it is contraindicated.

Jaborandi has been used with more or less success in the following diseases: *Asthma*, *bronchitis* (with or without emphysema), *albuminous diabetes*, *dropsies*, in cases of poisoning and diseases due to miasms or morbid poisons (*puerperal septicemia?*) *eruptive fevers* impeded in their evolution, etc. (Gubler); in *metastatic orchitis* (Czernicki); in *polyuria* (Laycock); in *chronic rheumatism*, *syphilitic rheumatism*, and in *acute articular rheumatism*, but in which the endocarditis was aggravated (Fereol)—this author has also observed an attack of gout, and an increase of the intensity of hemicrania, in cases where it was administered; in the albuminuria of pregnancy its use was followed with hematuria (Langlet); in *acute albuminous nephritis* (Bloch)—this author likewise states that jaborandi will be found efficient in *chronic parenchymatous nephritis*, especially when the renal lesions are not of long standing; that the existence of uræmic phenomena is not an absolute contraindication of the drug; that it is seldom of service in *interstitial nephritis;* and that it should be employed with the greatest caution when cardiac lesions are present. Petithau advises its employment in all *subacute* or *chronic catarrhal* or *rheumatic affections;* in *dropsies*, when there is no morbid change of the kidneys, and anemia is but slight; in *pernicious intermittent fevers:* in *psoriasis* and other dry forms of *cutaneous diseases:* in *chronic syphilitic affections*, etc.

According to M. Rabuteau, coffee is an antagonist of jaborandi: when given concurrently with it, it will prevent the nausea and vomiting, and likewise appears to diminish the perspiration as well as the excretion of the urea. The effects of jaborandi upon the human system are also counteracted by subcutaneous injections of solution of atropine; while those of belladonna or atropine are overcome by subcutaneous injections of pilocarpine. But this antagonism does not invariably appear, as the symptoms following the administration of one of these substances, are not always counteracted by the employment of the other; besides while the dose of jaborandi or pilocarpine may always be readily determined, that of belladonna, and especially of atropine, is so difficult to regulate, that extreme circumspection is required (J. King). Where depressing effects are produced by jaborandi, as sometimes occurs where there are valvular disease or fatty degeneration of the heart, or morbid pulmonic circulation, strychnine hypodermatically may sustain the heart-action. Digitalis, cactus, caffeine, or strophanthus may also be used. The profuse sweating may be checked by atropine. When pilocarpine acts like atropine, such effects are probably due to contaminating jaborine.

Since the foregoing uses, as recorded by the earlier investigators of jaborandi, were established, the drug has come into prominence in Eclectic practice chiefly through the writings of Webster, Ketchum, and Foltz. Added to its diuretic and sudorific qualities, jaborandi is sedative and antispasmodic, many preferring it to veratrum for the former purpose, and to lobelia or gelsemium for the latter. The indications for this drug, specifically considered, may be summed up as follows: It is a remedy for sthenic conditions, and must be avoided, or its use carefully guarded, in weakened conditions of the heart. Jaborandi is efficient in disorders exhibiting a dry, hot skin, with febrile reaction, especially when accompanied by acute suppression of the secretions, dry, parched mouth, full, strong, hard, and sharp pulse, deficient renal activity with deep-red urine, scanty in quantity and of high specific gravity; restlessness, and, with any of these symptoms, pain. Jaborandi is claimed by Prof. Webster to be adapted to almost any febrile or inflammatory condition, sthenic or asthenic, with or without a dry skin. Most observers however, prefer to limit its use to sthenic conditions only. As a remedy for pain and inflammation it has been highly endorsed in *mammitis*, with dry skin and suppressed lacteal secretion, in *acute articular inflammation* and *acute articular rheumatism*, the joint being extremely painful and swollen. In *erysipelas* with dry skin and elevation of temperature, it has rendered good service, and is particularly of value when locally applied. Webster declares that in *cerebro-spinal meningitis*, it has no equal. In *rheumatic complaints* its value is enhanced by its power to eliminate urea and uric acid from the system. Jaborandi is indicated by stiffness, soreness, and swelling of the joints, whether the parts show redness or pallor. One of its chief indications in such disorders is *puffiness of the tissues*. For *acute* (preferably) or *chronic muscular pain*, *pleurodynia*, *lumbago*, *muscular spasm*, *cardiac rheumatism* and *angina pectoris*, few remedies are more efficient. The specific indications, must, of course, be observed.

Jaborandi is recommended for *cough* when the throat is very dry and secretion checked. It is well recommended in *bronchial asthma* and *whooping-cough* with dryness of the respiratory passages. Small doses relieve "*winter cough*," and the cough of *chronic bronchitis* with lack of secretion, and dry, irritable, hoarse cough. In the early stage of *bronchitis*, and in the congestive stage of *pneumonia*, it rapidly relieves the local inflammation, and reduces the fever if it be given in diaphoretic doses. In respiratory troubles it does best service when associated with other indicated remedies, as bryonia, asclepias, lobelia, etc. In *acute tonsillitis* with secretion of tenacious pharyngeal mucus, it serves an excellent purpose. Foltz values it highly in *pharyngitis sicca* (*Eclectic Med. Gleaner*, Vol. V, p. 193). When exudation has taken place in *pleurisy*, jaborandi is one of the best agents to effect the removal of the fluid and promote resolution. It finds also, a place in the treatment of dry *croup*, *laryngismus stridulus*, *laryngeal diphtheria*, and so-called *membranous croup*. In the latter two affections, if the child is strong, jaborandi may be administered in doses sufficient to increase the secretions of the throat, and thus loosen the false membranes. Jaborandi has given good service in *metastatic* and *gonorrhœal orchitis*, *ovaritis*, and *metritis*, the specific indications for it being present. Jaborandi is one of the most useful of agents in properly selected cases of *la grippe* or *epidemic influenza*, and of *catarrhal fever*. In fact the drug acts admirably as a non-stimulating diaphoretic and sedative in many inflammatory and febrile conditions, provided the stomach is not too irritable to retain the medicine.

In *diseases of the kidneys,* jaborandi does effective work in throwing a part of the burden of elimination upon the skin. In this way the kidneys are relieved of excess of watery secretion, and of the elimination of a portion of urea. For this reason it has been employed in various forms of *nephritis*, particularly in *acute albuminuria*, and in so-called *Bright's disease.* It is undoubtedly the best remedy (using pilocarpine preferably) we possess for *uræmic poisoning*, but the full diaphoretic action must be obtained if good results are to be expected. Diaphoretic doses also benefit the *albuminuria of pregnancy.* It has been successfully employed in conjunction with ergot to control the excessive secretion of urine in *diabetes insipidus.*

Acting upon the theory that the act of parturition is favored by free diaphoresis, jaborandi and its alkaloid have been successfully used in cases of *tedious labor* due to a rigid, hard os uteri. In these cases the pains are severe yet ineffectual, the skin dry, pulse full, sharp, and hard, and there is some febrile reaction. These conditions are rectified by diaphoretic doses of the drug. A full dose or a couple of broken doses of jaborandi is accredited with the cure of *puerperal eclampsia.* In such cases it may be advantageously combined with other indicated agents.

Jaborandi has proved a useful drug in *exanthematous diseases* with tardy appearance or tendency to recession of the eruption, and by this action has been thought to avert the danger of post-scarlatinal dropsy. Many *skin disorders* of a dry character appear to be benefited by the internal and external use of jaborandi. Among these disorders are *eczema*, *pruritis*, particularly when occurring in a jaundiced skin, *prurigo*, *hyperhydrosis pedum*, *psoriasis*, and *rhus poisoning.* In the latter affection grindelia has been employed locally with jaborandi. This drug is accredited with the rather singular effect of causing the hair to become darker in color; and it is likewise said to be useful in *alopecia* to promote the growth of the hair. For this purpose pilocarpine may be employed, with or without cantharides, and mixed with lanolin. Copious and annoying *night-sweats* are said to be relieved by minute doses of jaborandi. Locally, the drug has given relief in *burns* and *scalds*, and internally and locally is of considerable value in *parotitis.* In small doses it has been lauded as an effective agent in *ptyalism* and *aphthous stomatitis.* In *local* and *general dropsies* the drug is sometimes useful, but as cautioned by Ellingwood, it should be used discretely, particularly in *hydrocephalus*, lest harm be done to the patient.

Pilocarpus and its alkaloidal salts have been used to counteract the *poisonous effects of belladonna, atropine, stramonium, daturine*, and *poisonous bites* or *stings*, and in *ptomaine poisoning* from canned fish and meats. In the latter instances it has no antidotal power, but favors elimination of the offending material. While often failing to counteract the toxic effects of atropine, it nearly always relieves the unpleasant dryness of tissue following the use of that alkaloid or of belladonna.

Prof. Foltz is an enthusiastic advocate of the use of jaborandi in *eye, ear, nose,* and *throat disorders*, particularly where there is a lack of the natural secretions of these parts. Full doses of jaborandi contract the pupils, impair accommodation, diminish intraocular tension, and increase secretion. Locally applied, the action is similar, the effects upon the pupil, however, being much less pronounced when the drug is internally administered. Dr. Foltz praises it in *rheumatic iritis*, and for the absorption of "*non-organized vitreous opacities.*" In *iritis* he always uses it, and believes that it shortens the duration of the disease, and if adhesions are present, assists in their absorption. *Optic neuritis, retinal detachment, choroiditis, episcleritis, tobacco* and *alcoholic amblyopia*, and *atrophy of the optic nerve* are also conditions in which he advises its use. After *traumatism*, with increased ocular tension, the latter as well as the pain, will be relieved by the local use of pilocarpine hydrochlorate. Instilled in the eye the same is useful in *keratitis* and *phlyctenular conjunctivitis*, both in the early stage. For ocular affections Foltz advises as a dose from 3 to 10 drops of specific jaborandi, every 2 or 3 hours; and as a collyrium, 1 to 2 grains of pilocarpine hydrochlorate to 2 fluid ounces of water In *ear disorders* jaborandi improves by increasing the secretions of the aural cavities and canals. *[illegible]* is frequently restored to its natural condition by the continued use of jaborandi. Jaborandi is the best remedy in *non-suppurative inflammation of the middle ear*, of the proliferous type (Foltz), and it proves a good drug for *nervous deafness, deafness following scarlet fever* and *diphtheria*, and with appropriate adjunct treatment, in *inner ear diseases of syphilitic origin* (Foltz). The alkaloidal salts (⅓ to ⅙ grain subcutaneously) have been employed in these disorders, but the parent drug is to be preferred in doses of 3 to 10 drops every 3 or 4 hours.

Pilocarpine.—The alkaloid pilocarpine has been used in the forms of hydrochlorate and nitrate in the same diseases as the infusion and alcoholic preparations of the leaves. The effects of the alkaloid are said to be more certain than when the leaves are used, and the tendency to nausea and vomiting is greatly diminished. Pilocarpine may be used in many of the aforementioned disorders, although jaborandi is preferred by the Eclectic profession. Outside of the special mentions of the use of the alkaloids given above, they may be used in the following conditions: For *uræmic convulsions* and in *puerperal convulsions* it is preferred by many to jaborandi. *Œdema of the larynx* is said to be promptly relieved by pilocarpine.

Beranger considers the hydrochlorate of pilocarpine of great value, therapeutically, in certain eye diseases; he uses it in instillations, and in subcutaneous injections, two very distinct effects being obtained, according to the methods employed. By injections, profuse discharges follow, accompanied with a diminution of ocular tension, and a more rapid renovation of the media of the eye; this form of use he considers indicated in *acute* and *chronic glaucoma, iritis, floating bodies in the vitreous humor*, certain *opacities of the cornea*, and in *poisonings*. Sometimes complete recovery will ensue; at others, great relief follows. His solution was made by dissolving 3 grains of the hydrochlorate of pilocarpine in 75 minims of cherry-laurel water, of which solution from 10 to 15 drops were injected at a time. It must be remembered, however, that pilocarpine injected into a tumor of the eye, has produced great weakness and emaciation, without in the least affecting the size of the growth (see Armaingaud, in previous editions of this *Dispensatory*). By instillations, he employs it as a powerful myotic in *mydriasis*, and prefers it to eserine, as it is accompanied with no irritation. He likewise prefers it in instillation, to eserine, in disturbances of vision associated with *secondary paralysis* and characterized by *asthenopia*, with *feebleness of the intrinsic muscles of the eye*, and also in certain cases of *presbyopia* which is not constant but returns at different periods. Dr. Landesberg, of Philadelphia, found both the fluid extract of jaborandi, internally, and the hydrochlorate of pilocarpine, by subcutaneous injection, more effective and reliable than any other known remedy, in *intraocular hemorrhages*, and in *opacities of the vitreous* and *aqueous fluids;* but he prefers eserine to pilocarpine, as a myotic, on account of the increased action of the lachrymal and salivary glands occasioned by the latter, when absorbed. Gillet de Grandmont, of France, has used the nitrate of pilocarpine, by subcutaneous injection, in the forearm, of from ¼ to ½ grain, in solution; and has found surprisingly good results to follow in *specific* or *rheumatic iritis*, either simple, or complicated with alterations of the cornea, in the *keratitis of Hutchinson*, in *dimness and hemorrhage of the vitreous body*, in *glaucoma*, in *atrophy of the choroid*, in *hemorrhages* and *plastic exudations of the retina*, and in *commencing atrophy of the optic nerve*. In all the above-named affections, the agent produced its usual results, as sweating, increase of the cardiac pulsations, etc.

The dose of jaborandi in infusion (45 grains to 2 fluid ounces of water) is 1 fluid ounce, which may, if necessary, be repeated every 10 or 15 minutes; of the fluid extract, from 10 drops to 1 drachm; of specific jaborandi, 1 to 30 drops; of pilocarpine or its salts, internally, from ¼ to ¾ grain; by subcutaneous injection, $\frac{1}{20}$ to ¼ grain, in solution. In cases where the internal exhibition of jaborandi by mouth, occasions nausea or vomiting, this may be avoided in giving the dose by rectal enema.

Specific Indications and Uses.—Deficient secretion; marked dryness and heat of skin and mucous tissues; pulse full, hard, sharp, and strong; muscular pain; muscular spasm; urine suppressed, of deep color and high specific gravity; elevated temperature with deficient secretion; puffiness of tissues; rigid, hard os-uteri; marked restlessness; dry, harsh cough; tenacious sputum; œdema; uræmic poisoning and convulsions; increased ocular tension; itching, with jaundice. Adapted chiefly to sthenic cases. Minute doses relieve colliquative sweating.

PILULÆ.—PILLS.

Preparation and History.—Eclectic physicians prefer liquid remedies when practicable, objecting to any form of pill, tablet, or confectionary, especially of galenicals. "The points demanded to prepare a proper pill mass are, to obtain sufficient consistency that the particles may cohere together, and to have them firm enough to retain a globular form; their component parts should be such as to prevent any tendency to moldiness, or any absorption of moisture when exposed to the atmosphere. Medicines which are deliquescent should never enter into a pill mass, and efflorescent salts should be previously exposed to heat so as to fall to powder, by the removal of their water. Ingredients which have a chemical reaction upon each other should not be added together in a pill mass, unless it be desired to secure the influence of the resulting compound.

"Gum-resins and inspissated extracts are sometimes soft enough to be made into pills without addition; where any moisture is requisite, a few drops of alcohol is more proper than syrups or conserves, as it unites more readily with them, without sensibly increasing their bulk. In some instances, where alcohol will not act upon the mass, water may be substituted" (Coxe).

Substances which do not admit of being made into a pill mass by themselves, must have certain inert matters added to them, called *excipients*, and such excipients only should be employed as will give the proper degree of consistence and tenacity to the mass, without interfering in any way with the action of its medicinal agents or rendering the pills too large or hard. Excipients vary much in their character, according to the nature of the articles to be made into pill form; the most common are syrup, glycerin, mucilage, soap, bread-crumb, conserve of roses, water, spirit, gum, sugar, magnesia, starch, molasses, etc. The dry excipients are used to give the required firmness to extracts, confections, oils, and other fluid or soft substances, while the moist excipients are intended for dry medicines, or agents which are insoluble, and among these molasses, syrup, and conserve of roses are the most esteemed, especially when the pills are to be kept for a length of time.

The addition of too much gum Arabic or tragacanth to the pill mass, is objectionable, as it often causes the pill to become so hard as to materially modify its operation, or perhaps cause it to pass through the intestines without being dissolved. Whenever the excipient is named by the physician in his prescription, the apothecary should adopt it if practicable; but, if it be not practicable, then he must follow his own judgment. Indeed, it would always be better in prescribing extemporaneous preparations of pills, if the physician would omit the excipient, and leave it to the more practical knowledge of the apothecary to supply the appropriate excipient.

The best excipients for dry powders, as jalap, rhubarb, ipecacuanha, ginger, digitalis, conium, etc., are molasses or conserve of roses; those for resinous extracts, resins and gum-resins, are soap, proof-spirit, alkaline solutions, and sometimes mucilage; and those for the volatile oils and oleoresins, are soap, magnesia, white wax, etc. The proper selection of these, however, depends entirely upon the peculiar nature of the medicines ordered, and requires a considerable degree of practical knowledge, not expected to be possessed by the practicing physician.

The medicinal ingredients of the pill mass should be perfectly mixed and incorporated, usually combining together the active ingredients first, and afterward the excipient, and the mass should be worked in the hand, on a pill slab, or in a mortar, until it is thoroughly homogeneous. If the mass be too hard, it may not be dissolved in the juices of the stomach; if too soft, there will be difficulty in forming it into pills. The pill mass being properly formed, is now to be divided into pills; certain portions of it are, by means of a spatula, or by the pill-machine, made into long, round, slender rolls, of the desired thickness, which are then divided into pills. If the pill-machine be used, the pills are accurately divided and made globular at the same time; if the spatula be used, the pills are to be rounded by the fingers. Most apothecaries are furnished with the pill-machines, which serve to expedite the process, as well as to secure a greater degree of accuracy.

Pills containing vegetable drugs usually weigh from 1 to 5 grains; containing heavy mineral preparations, 5 to 10 grains. A larger pill than these is denominated a *bolus;* a very small, sugar-coated pill, a *granule.*

PILL-COATING.—In order to cover the taste and odor of pills many plans have been devised; formerly they were covered with gold or silver leaf, but this is a very objectionable method, as pills thus prepared frequently pass through the bowels without being dissolved. Another mode is to dip each pill in a melted solution of pure glue, but this plan is tedious and requires considerable time for the drying of the pills. Collodion has been recommended as an agent for covering pills, but as the collodion will not readily dissolve in the stomach, its employment would be improper. Sugar is frequently used, combined with gum Arabic, and sometimes starch is likewise added, the proportions of each article being the same; the pills to be dipped in a thin syrup, and then rolled in the mixture. This process is most applicable to disagreeably odorous substances, as castor, asafœtida, valerian, etc., which are completely masked by it. When the gelatin is previously colored with carmine, the pills resemble hawthorn berries.

M. Calloud treats of the subject of enveloping medicinal substances in a covering to prevent unpleasant taste, in *Jour. de Pharm.*, Vol. XXIII, p. 301. He had recourse to the dried mucilage of flaxseed prepared with sugar. His method is: Take of flaxseed, 1 part; white sugar, 3 parts; spring water, a sufficient quantity. A thick mucilage is obtained by carefully boiling the seeds, the sugar is added, and the whole of the moisture evaporated by careful desiccation. The mixture is but slightly hygroscopic, may be reduced to fine powder, and employed for covering pills. This operation is effected extemporaneously with great facility. The pills, slightly moistened, are rolled in the mucilaginous powder, by which they are coated with a layer of the compound.

M. Calloud suggests another process, applicable in certain cases, which is the use of butter of cacao as a covering for pills, where, owing to gastric irritation, the unmasked pills will cause disagreeable symptoms. The process is very simple; the prepared pills are thrown into melted butter of cacao, then removed with a perforated skimmer, and finally rolled in finely-powdered sugar, or what is better, sugar of milk. He also prepares a powder, in which the pills, previously dampened externally with water, are agitated until sufficiently coated; it is prepared by mixing a clear mucilage of tragacanth (made of tragacanth, 1 part; water, 2 parts) with sugar of milk, 20 parts; spreading this thinly upon plates, and, when thoroughly dried, pulverizing it.

Blanchard's method, as improved by Baildon, consists of using a solution of balsam of tolu, 1 drachm, in chloroform, 3 drachms. Some of this is placed in a suitable box, the pills agitated in it, then turned upon a slab, and so arranged that they do not touch each other. In about 20 minutes they are dry and non-adhesive, and present a finished appearance. It not only conceals any unpleasant taste or smell, but it prevents the pills from becoming too hard (*Amer. Jour. Pharm.*, Vol. XXIX, p. 350).

The foregoing remarks are largely historical, and record the method of pill-coating in the apothecary shops, and may be useful still when it is desirable to coat a few pills extemporaneously. But, at present, the coating of pills is done on a large scale by manufacturing pharmacists, who supply not only simples, but compounds of every description capable of being made into pills. Two forms of pill-coating are used—sugar and gelatin—of which we prefer the latter. Sometimes admixtures of foreign bodies are employed, such as chalk or starch, and, in some cases, the pills are given a coating of shellac or rosin previous to the sugar. This is to prevent coloring of the sugar-coat, and is to be objected to because of its insoluble nature. The methods of each manufacturer are in part peculiar to himself, and are derived from his experience and skill, but all are an outgrowth of the hand-coating processes mentioned in this article.

Mr. H. C. Archibald describes the method pursued by manufacturers in sugar-coating pills and granules, in *Amer. Jour. Pharm.*, 1867, p. 199; and, in the same journal, 1867, p. 12, Prof. E. Parrish makes known a new process for preparing sugar-coated pills, but which is only practicable on a large scale. (For other *excipients* and *coatings*, see following pill formulæ.)

Pill-dusting.—Several substances are used for covering pills to prevent them from adhering to each other, as powdered elm-bark, powdered orris or liquorice roots, lycopodium, carbonate of magnesium, starch, etc., and these powders are also used during the formation of the pill to prevent them from sticking to the fingers or to the apparatus on which they are made. The powders ordinarily used are liquorice, lycopodium, and elm. Carbonate of magnesium can only be used in those instances where it occasions no decomposition with one or more active constituents of the pill.

Compressed Pills.—This class of preparations is usually prepared by means of a proper instrument, by compression of the desired material, in powder, without the addition of an excipient. Powders which are not deliquescent, yet easily soluble in water, are best adapted for compressed pills. Occasionally, for the sake of rendering the substance more easily compressible, or to facilitate the removal of the pills from the mold or instrument employed, very dry materials are combined with a very little of petrolatum, sugar, cacao butter, or alcohol. These pills are generally of lenticular shape. (See Remington's and Coblentz's *Prac. of Pharm.*)

Preservation.—Pills are much better preserved in small, loosely-stoppered glass bottles than in the common wood or pasteboard boxes, and should be dispensed in glass vials by the apothecary. As it is not always convenient to make a large amount of pill mass into pills at one time, the balance may be kept in a bladder, which should be moistened occasionally with some of the same kind of liquid the mass was made up with, or with some aromatic oil.

Tablet Triturates.—These are made by compressing mixtures of powders or of simple substances in powder form into discs of variable size and shape They are open to many objections as medicinal representatives of drugs, and cannot carry the values of substances which either disintegrate or evaporate on drying. For this reason, they can not correctly represent a large class of natural drugs. Tablets are easily made, and their manufacture, on a large scale, might properly become a part of the confectioner's art. In our opinion, for all plant preparations, such as extracts, gelatin-coated pills are preferable and fully as elegant. For such simples as chemicals, that do not alter by action of the air, tablets are suitable, providing they are not stamped so hard as to prevent them from dissolving. Great discrimination should be employed in the use of tablets, and if the physician is not qualified to judge of the remedy's nature, he should be very cautious concerning its use in tablet form. Sugar and other inert substances are employed in the making of tablets to give bulk to energetic bodies. In our opinion, much injury has been done by the indiscrete attempt of tablet makers to put into tablet form remedies that deteriorate or are destroyed by drying. These general remarks on tablets are offered in this place because of the fact that we have no special department for them.

Pilulæ (N. F.), *Pills*.—"In giving the formulas for pills, the quantities of the several ingredients required for one hundred (100) pills are given in metric weights in the first column, while the quantities required for each single pill are given in apothecaries' weight in the second column. When it is desirable to prepare a number of pills by the proportion given for the single pill, it is recommended that, upon multiplying by the number of pills required, the nearest whole number, or nearest convenient fraction, in each case, be chosen" (*Nat. Form.*).

This arrangement has been altered in this work so that the figures representing the amount in each pill follow the general formula. This is done to save space

PILULÆ ACONITI COMPOSITÆ.—COMPOUND PILLS OF ACONITE.

Preparation.—Take of extract of aconite, ½ drachm; extract of stramonium, 4 grains; valerianate of quinine, 20 grains. Mix thoroughly, form a pill mass, and divide into 60 pills.

Action, Medical Uses, and Dosage.—These pills are very efficient in *febrile* and *inflammatory complaints*, where *nervous irritability*, restlessness, or wakefulness is present; also in *nervous headache*, and other nervous affections. They are but little used at the present time. The dose is 1 pill every 2, 3, or 4 hours, according to the urgency of the symptoms, and the effect caused by the use of the pills (J. King).

PILULÆ ALOES (U. S. P.)—PILLS OF ALOES.

Synonym: *Pills of Socotrine aloes.*

Preparation.—"Purified aloes, in fine powder, thirteen grammes (13 Gm.) [201 grs.]; soap, in fine powder, thirteen grammes (13 Gm.) [201 grs.]; water, a sufficient quantity to make 100 pills. Beat the powders together with water, so as to form a mass, and divide it into 100 pills"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—(See *Aloes*.) Dose, from 1 to 3 pills.

PILULÆ ALOES COMPOSITÆ.—COMPOUND PILLS OF ALOES.

Synonym: *Anti-dyspeptic pills.*

Preparation.—Take of extracts of boneset, mandrake, and ginseng, each, 2 drachms; aloes, in powder, 8 drachms; gamboge, castile soap, of each, in powder, 4 drachms; capsicum and lobelia seed, of each, in powder, 1 drachm; oil of cloves, 2 minims. Mix the extracts together, then add the soap, beating it well in a mortar, and finally thoroughly beat and work in the powders, and when the whole is well incorporated, add the oil of cloves. Divide the mass into pills of 4 grains each (T. V. Morrow, M. D.).

This pill is by many considered superior to the one originally given in Beach's *Amer. Prac.*, of which the following is the formula: Take of Socotrine aloes, in powder, 4 ounces; castile soap, colocynth, gamboge, of each, 2 ounces; extract of gentian, 4 ounces; oil of cloves, 2 drachms. Mix as above. Dose, same as above.

Action, Medical Uses, and Dosage.—This pill is cathartic in doses of from 2 to 4 pills. It has been found very useful in *dyspepsia*, *constipation*, *jaundice*, *amenorrhœa*, and in all ordinary cases where cathartics are required.

PILULÆ ALOES ET ASAFŒTIDÆ (U. S. P.)—PILLS OF ALOES AND ASAFETIDA.

Preparation.—"Purified aloes, in fine powder, nine grammes (9 Gm.) [139 grs.]; asafetida, nine grammes (9 Gm.) [139 grs.]; soap, in fine powder, nine grammes (9 Gm.) [139 grs.]; water, a sufficient quantity to make 100 pills. Beat the solids together with water, so as to form a mass, and divide it into 100 pills"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This pill is applicable in *constipation* in nervous and hysterical individuals who suffer from *gastric debility* and *flatulence*. Dose, 2 to 5 pills.

PILULÆ ALOES ET FERRI (U. S. P.)—PILLS OF ALOES AND IRON.

Preparation.—"Purified aloes, in fine powder, seven grammes (7 Gm.) [108 grs.]; dried ferrous sulphate, seven grammes (7 Gm.) [108 grs.]; aromatic powder, seven grammes (7 Gm.) [108 grs.]; confection of rose, a sufficient quantity to make 100 pills. Beat the powders together with confection of rose, so as to form a mass, and divide it into 100 pills"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This pill is employed in treating *amenorrhœa*, accompanied by *constipation*, in debilitated and anemic women. Dose, 1 to 3 pills. Small doses should be administered for some little time previous to the menstrual periods.

PILULÆ ALOES ET MASTICHES (U. S. P.)—PILLS OF ALOES AND MASTIC.

Preparation.—"Purified aloes, in fine powder, thirteen grammes (13 Gm.) [201 grs.]; mastic, in fine powder, four grammes (4 Gm.) [62 grs.]; red rose, in fine powder, three grammes (3 Gm.) [46 grs.]; water, a sufficient quantity to make 100 pills. Beat the powders together with water, so as to form a mass, and divide it into 100 pills"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This is a modification of *Lady Webster's Dinner Pills.* The mastiche retards the solubility of the pill so that its chief action is exerted on the large intestine, hastening rectal evacuation. Used for *constipation* and *gastro-intestinal torpor.* Dose, 1 pill (each pill contains about 2 grains of aloes) at dinner or at bedtime.

Related Pills.—ANDERSON'S SCOTS PILLS. Take Barbadoes aloes, 12 ounces; colocynth, $\frac{1}{2}$ ounce; gamboge, $\frac{1}{2}$ ounce. All in very fine powder. Beat them with soap, 2 ounces, a little water, and oil of anise, fl℥ii. Divide into 3-grain pills.

HOOPER'S FEMALE PILLS.—Take aloes, 40 parts; ferrous sulphate (crystallized), 20 parts; myrrh, extract of black hellebore, and soap, āā, 10 parts; ginger and canella, both in powder, āā, 5 parts. Beat into a mass with water. Divide into $2\frac{1}{2}$-grain pills. Cathartic and emmenagogue.

PILULÆ AD PRANDIUM (N. F.), *Dinner pills.*—"I. When 'dinner pills,' under this or some other equivalent name, are prescribed without further specification, it is recommended that the *Pilulæ Aloes et Mastiches* of the *U. S. P.*, also called Lady Webster's Dinner Pills, be dispensed. *Note.*—Of other combinations bearing similar names, or used for similar purposes, the following appear to be those most commonly in use: II. *Chapman's Dinner Pills.*—"Purified aloes (*U. S. P.*), nine and seven-tenths grammes (9.7 Gm.) [150 grs.]; mastic, nine and seven-tenths grammes (9.7 Gm.) [150 grs.]; ipecac, in fine powder, six and one-half grammes (6.5 Gm.) [100 grs.]; oil of fennel, one and one-half cubic centimeters (1.5 Cc.) [25 ♏]. To make 100 pills. Each pill contains $1\frac{1}{2}$ grains of aloes, $1\frac{1}{2}$ grains of mastic, 1 grain of ipecac and about $\frac{1}{4}$ minim of oil of fennel" (see *Pilulæ*, N. F.). III. *Cole's Dinner Pills.*—"Purified aloes (*U. S. P.*), seven and eight-tenths grammes (7.8 Gm.) [120 grs.]; mass of mercury (*U. S. P.*), seven and eight-tenths grammes (7.8 Gm.) [120 grs.]; jalap, in fine powder, seven and eight-tenths grammes (7.8 Gm.) [120 grs.]; antimony and potassium tartrate, thirteen centigrammes (0.13 Gm.) [2 grs.]. To make 100 pills. Each pill contains $1\frac{1}{5}$ grains of aloes, $1\frac{1}{5}$ grains of blue mass, $1\frac{1}{5}$ grains of jalap, and $\frac{1}{50}$ grain of tartar emetic" (see *Pilulæ*, N. F.). IV. *Hall's Dinner Pills.*—"Purified aloes (*U. S. P.*), six and one-half grammes (6.5 Gm.) [100 grs.]; extract of glycyrrhiza, six and one half grammes (6.5 Gm.) [100 grs.]; soap, in powder, six and one-half grammes (6.5 Gm.) [100 grs.]; molasses, six and one-half grammes (6.5 Gm.) [100 grs.]. To make 100 pills. Each pill contains 1 grain of aloes, 1 grain of extract of liquorice, 1 grain of soap, and 1 grain of molasses" (see *Pilulæ*, N. F.). Adapted from *Nat. Form.*

PILULÆ ALOES ET PODOPHYLLI COMPOSITÆ (N. F.), *Compound pills of aloes and podophyllum, Janeway's pills.*—"Purified aloes (*U. S. P.*), six and one-half grammes (6.5 Gm.) [100 grs.]; resin of podophyllum (*U. S. P.*), three and one-fourth grammes (3.25 Gm.) [50 grs.]; alcoholic extract of belladonna leaves (*U. S. P.*), one and six-tenths grammes (1.6 Gm.) [25 grs.]; extract of nux vomica (*U. S. P.*), one and six-tenths grammes (1.6 Gm.) [25 grs.]. To make 100 pills. Each pill contains 1 grain of aloes, $\frac{1}{2}$ grain of resin of podophyllum, $\frac{1}{4}$ grain of extract of belladonna leaves, and $\frac{1}{4}$ grain of extract of nux vomica" (see *Pilulæ*, N. F.). Adapted from *Nat. Form.*

PILULÆ TRIPLICES (N. F.), *Triplex pills, Pilula triplex.*—I. "Purified aloes (*U. S. P.*), thirteen grammes (13 Gm.) [200 grs.]; mass of mercury (*U. S. P.*), six and one-half grammes (6.5 Gm.) [100 grs.]; resin of podophyllum (*U. S. P.*), one and six-tenths grammes (1.6 Gm.) [25 grs.]. To make 100 pills. Each pill contains 2 grains of aloes, 1 grain of blue mass, and $\frac{1}{4}$ grain of resin of podophyllum (see *Pilulæ*, N. F.). *Note.*—When *Pilula triplex*, under this name or some equivalent, is prescribed without further specification, it is recommended that the above preparation be dispensed. A formula devised by Dr. John W. Francis is also in use: II. *Francis' triplex pills.*—Purified aloes (*U. S. P.*), five and one-half grammes (5.5 Gm.) [85 grs.]; scammony, five and one-half grammes (5.5 Gm.) [85 grs.]; mass of mercury (*U. S. P.*), five and one-half grammes (5.5 Gm.) [85 grs.]; croton oil, thirty-two one-hundredths cubic centimeter (0.32 Cc.) [5 ♏]; oil of caraway, one and six-tenths cubic centimeters (1.6 Cc.) [25 ♏]; tincture of aloes and myrrh (*U. S. P.*), a sufficient quantity to make 100 pills. Each pill contains $\frac{5}{6}$ grain of aloes, $\frac{5}{6}$ grain of scammony, $\frac{5}{6}$ grain of blue mass, $\frac{1}{20}$ minim of croton oil, $\frac{1}{4}$ minim of caraway oil, and a sufficient quantity of tincture of aloes and myrrh" (see *Pilulæ*, N. F.). Adapted from *Nat. Form.*

PILULÆ QUADRUPLICES (N. F.), *Quadruplex pills, Quatuor pills, Pilulæ ferri et quininæ compositæ.*—"Dried sulphate of iron, six and one-half grammes (6.5 Gm.) [100 grs.]; quinine sulphate, six and one-half grammes (6.5 Gm.) [100 grs.]; purified aloes (*U. S. P.*), six and one-half grammes (6.5 Gm.) [100 grs.]; extract of nux vomica (*U. S. P.*), one and six-tenths grammes (1.6 Gm.) [25 grs.]; extract of gentian (*U. S. P.*), a sufficient quantity to make 100 pills. Each pill contains 1 grain of sulphate of iron, 1 grain of quinine sulphate, 1 grain of aloes, $\frac{1}{4}$ grain of extract of nux vomica, and a sufficient quantity of extract of gentian" (see *Pilulæ*, N. F.). Adapted from *Nat. Form.*

PILULÆ ALOES ET MYRRHÆ (U. S. P.)—PILLS OF ALOES AND MYRRH.

SYNONYM: *Rufus' pills.*

Preparation.—"Purified aloes, in fine powder, thirteen grammes (13 Gm.) [201 grs.]; myrrh, in fine powder, six grammes (6 Gm.) [93 grs.]; aromatic powder, four grammes (4 Gm.) [62 grs.]; syrup, a sufficient quantity to make 100 pills. Beat the powders together with syrup, so as to form a mass, and divide it into 100 pills"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—As a laxative, 1 to 2 pills; purgative, 2 to 6 pills. Also employed in *uterine disorders* marked by *constipation* and *torpor.*

Related Pill.—PILULÆ FERRI COMPOSITÆ (N. F.), *Compound pills of iron* (*U. S. P.*, 1880). "Myrrh, nine and three-fourths grammes (9.75 Gm.) [150 grs.]; sodium carbonate, four grammes and eighty-five centigrammes (4.85 Gm.) [75 grs.]; sulphate of iron, 4 grammes and eighty-five centigrammes (4.85 Gm.) [75 grs.]; syrup, a sufficient quantity. To make 100 pills. Each pill contains $1\frac{1}{2}$ grains of myrrh, $\frac{3}{4}$ grain of sodium carbonate, and $\frac{3}{4}$ grain of sulphate of iron" (see *Pilulæ*, N. F.). Adapted from *Nat. Form.*

PILULÆ ALOINI, STRYCHNINÆ, ET BELLADONNÆ (N. F.) PILLS OF ALOIN, STRYCHNINE, AND BELLADONNA.

Preparation.—"Aloin, one and three-tenths grammes (1.3 Gm.) [20 grs.]; strychnine, alkaloid, five centigrammes (0.05 Gm.) [$\frac{5}{6}$ gr.]; alcoholic extract of belladonna leaves (*U. S. P.*), eight decigrammes (0.8 Gm.) [12.5 grs.]. To make 100 pills. Each pill contains $\frac{1}{5}$ grain of aloin, $\frac{1}{120}$ grain of strychnine, and $\frac{1}{8}$ grain of extract of belladonna leaves (see *Pilulæ*, N. F.). *Note.*—These pills are also prepared with double the amount of strychnine. It is recommended that the stronger pills be dispensed only when specially demanded." Adapted from *Nat. Form.*

Action, Medical Uses, and Dosage.—These pills are very popular with physicians at the present day for the treatment of *habitual constipation*. Dose, 1 to 2 pills a day.

Related Pills.—PILULÆ ALOINI, STRYCHNINÆ ET BELLADONNÆ COMPOSITÆ (N. F.), *Compound pills of aloin, strychnine, and belladonnæ.* "Aloin, one and three-tenths grammes (1.3 Gm.) [20 grs.]; strychnine, alkaloid, five centigrammes (0.05 Gm.) [$\frac{5}{6}$ gr.]; alcoholic extract of belladonna leaves (*U. S. P.*), eight decigrammes (0.8 Gm.) [12.5 grs.]; extract of rhamnus purshiana, three and one-fourth grammes (3.25 Gm.) [50 grs.]. To make 100 pills. Each pill contains $\frac{1}{5}$ grain of aloin, $\frac{1}{120}$ grain of strychnine, $\frac{1}{8}$ grain of extract of belladonna leaves, and $\frac{1}{2}$ grain of extract of rhamnus (see *Pilulæ*, N. F.). *Note.*—If extract of rhamnus purshiana is not available, take fluid extract of rhamnus purshiana (*U. S. P.*), and evaporate it on a water-bath, to a pilular consistence. These pills are also prepared with double the amount of strychnine. It is recommended that the stronger pills be dispensed only when specially demanded." Adapted from *Nat. Form.*

PILULÆ ALOINI COMPOSITÆ (N. F.), *Compound pills of aloin.*—"Aloin, three and one-fourth grammes (3.25 Gm.) [50 grs.]; resin of podophyllum (*U. S. P.*), eight decigrammes (0.8 Gm.) [12.5 grs.]; alcoholic extract of belladonna leaves (*U. S. P.*), one and six-tenths grammes (1.6 Gm.) [25 grs.]. To make 100 pills. Each pill contains $\frac{1}{2}$ grain of aloin, $\frac{1}{8}$ grain of resin of podophyllum, and $\frac{1}{4}$ grain of extract of belladonna leaves" (see *Pilulæ*, N. F.). Adapted from *Nat. Form.*

PILULÆ ANTIDYSPEPTICÆ (N. F.), *Antidyspeptic pills.*—"Strychnine, alkaloid, sixteen centigrammes (0.16 Gm.) [$2\frac{1}{2}$ grs.]; ipecac, in fine powder, sixty-five centigrammes (0.65 Gm.) [10 grs.]; alcoholic extract of belladonna leaves (*U. S. P.*), sixty-five centigrammes (0.65 Gm.) [10 grs.]; mass of mercury (*U. S. P.*), thirteen grammes (13 Gm.) [200 grs.]; compound extract of colocynth (*U. S. P.*), thirteen grammes (13 Gm.) [200 grs.]. To make 100 pills. Each pill contains $\frac{1}{40}$ grain of strychnine, $\frac{1}{10}$ grain of ipecac, $\frac{1}{10}$ grain of extract of belladonna leaves, 2 grains of blue mass, and 2 grains of extract of colocynth" (see *Pilulæ*, N. F.). Adapted from *Nat. Form.*

PILULÆ ASAFŒTIDÆ (U. S. P.)—PILLS OF ASAFETIDA.

Preparation.—"Asafetida, twenty grammes (20 Gm.) [309 grs.]; soap, in fine powder, six grammes (6 Gm.) [92 grs.]; water, a sufficient quantity to make 100 pills. Beat the solids together with water, so as to form a mass, and divide it into 100 pills"—(*U. S. P.*). This pill should be coated with sugar. Each pill contains 3 grains of asafœtida.

Action, Medical Uses, and Dosage.—Same as *Asafœtida.* Dose, 1 to 3 pills.

PILULÆ ASAFŒTIDÆ COMPOSITÆ (ECLECTIC).—COMPOUND PILLS OF ASAFETIDA.

Preparation.—Take of asafœtida, opium, carbonate of ammonium, each, 1 drachm. Mix the asafœtida and opium together by aid of a gentle heat, and, while soft, add the ammonium carbonate. Divide the mass into 75 pills.

Medical Uses and Dosage.—This pill is useful in many *nervous* and *hysterical disorders*. Each pill contains $\frac{4}{5}$ of a grain of opium. The dose is 1 or 2 pills, according to the severity of the case.

PILULÆ BAPTISIÆ COMPOSITÆ.—COMPOUND PILLS OF WILD INDIGO.

Preparation.—Take of extract of leptandra, 4 grains; resin of podophyllum, 8 grains; sanguinarine, 1 grain; alcoholic extract of wild indigo root, a sufficient quantity to form a pill mass. Mix thoroughly together, and divide into 16 pills.

Action, Medical Uses, and Dosage.—These pills are cholagogue, laxative, and antiseptic; they were formerly considered especially useful in *typhoid fevers*, and in all *typhoid conditions*, where it was required to keep the bowels regular. The dose is 1 pill, to be repeated every 2, 3, or 4 hours until a mild operation is produced; to be given daily, or every other day (J. King).

PILULÆ CAMBOGIÆ COMPOSITÆ.—COMPOUND PILLS OF GAMBOGE.

Preparation.—Take of gamboge and scammony, each, in powder, 12 grains; elaterium, 2 grains; croton oil, 8 minims; extract of hyoscyamus, a sufficient quantity. Mix together, and divide into 12 pills.

Action, Medical Uses, and Dosage.—This is a quick and certain cathartic, useful in *dropsy*, *obstinate constipation*, etc. The dose is 1 pill, repeated every 1 or 2 hours, until it operates. It is contraindicated when inflammation of any of the abdominal viscera is present.

PILULÆ CAMPHORÆ COMPOSITÆ.—COMPOUND PILLS OF CAMPHOR.

SYNONYM: *Cholera pill.*

Preparation.—Take of camphor, opium, kino, of each, in powder, 30 grains; capsicum, 5 grains; conserve of roses, a sufficient quantity. Mix together, and form a pill mass, and divide into 30 pills.

Action, Medical Uses, and Dosage.—These pills were much employed in *Asiatic cholera*, as a stimulant, antispasmodic, anodyne, and astringent, and with much success. One pill to be given after each discharge from the bowels, or oftener, if the urgency of the case requires it. When powders are preferred, the conserve of roses may be omitted, and the mixture be given in powder.

Related Pills.—PILULÆ OPII ET CAMPHORÆ (N. F.), *Pills of opium and camphor.* "Powdered opium, six and one-half grammes (6.5 Gm.) [100 grs.]; camphor, thirteen grammes [illegible] Gm.) [200 grs.]. To make 100 pills. Each pill contains 1 grain of opium and 2 grains of camphor" (see *Pilulæ*, N. F.). Adapted from *Nat. Form.* Uses, similar to those of *Dover's powder.* Dose, 1 to 2 pills.

PILULÆ ANTINEURALGICÆ (N. F.), *Antineuralgic pills.*—I. *Gross' antineuralgic pills.* "Quinine sulphate, thirteen grammes (13 Gm.) [200 grs.]; morphin sulphate, thirty-two centigrammes (0.32 Gm.) [5 grs.]; strychnine, alkaloid, twenty-two centigrammes (0.22 Gm.) [3.3 grs.]; arsenous acid, thirty-two centigrammes (0.32 Gm.) [5 grs.]; extract of aconite leaves (U. S. P. 1870), three and two-tenths grammes (3.2 Gm.) [50 grs.]. To make 100 pills. Each pill contains 2 grains of quinine sulphate, $\frac{1}{20}$ grain of morphine sulphate, $\frac{1}{30}$ grain of strychnine, $\frac{1}{20}$ grain of arsenous acid, and $\frac{1}{2}$ grain of extract of aconite leaves (see *Pilulæ*, N. F.). *Note.* When 'antineuralgic pills,' or 'neuralgia pills,' without other specification, are prescribed, it is recommended that the above preparation be dispensed. Sometimes the morphine sulphate is directed to be omitted. II. *Brown-Séquard's antineuralgic* or *neuralgia pills*.—Extract of hyoscyamus (*U. S. P.*), four and one-half grammes (4.5 Gm.) [67 grs.]; extract of conium (*U. S. P.*), four and one-half grammes (4.5 Gm.) [67 grs.]; extract of ignatia (*U. S. P.*), three and two-tenths grammes (3.2 Gm.) [50 grs.]; extract of opium (*U. S. P.*), three and two-tenths grammes (3.2 Gm.) [50 grs.]; extract of aconite leaves (*U. S. P.*, 1870), two and two-tenths grammes (2.2 Gm.) [33 grs.]; extract of Indian cannabis (*U. S. P.*), one and six-tenths grammes (1.6 Gm.) [25 grs.]; extract of stramonium (*U. S. P.*), one and three-tenths grammes (1.3 Gm.) [20 grs.]; alcoholic extract of belladonna leaves (*U. S. P.*), one and one-tenth grammes (1.1 Gm.) [17 grs.]. To make 100 pills. Each pill contains ⅔ grain of extract of hyoscyamus, ⅔ grain of extract of conium, ½ grain of extract of ignatia, ½ grain of extract of opium, ⅓ grain of extract of aconite leaves, ¼ grain of extract of cannabis, ⅕ grain of extract of stramonium, and ⅙ grain of extract of belladonna leaves" (see *Pilulæ*, N. F.). Adapted from *Nat. Form.*

PILULÆ CATHARTICÆ COMPOSITÆ (ECLECTIC).—COMPOUND CATHARTIC PILLS.

Preparation.—Take of extract of leptandra, gamboge, scammony, each, in powder, 1 drachm; resin of podophyllum, castile soap, each, ½ drachm. Triturate the powders thoroughly together, then add the soap; mix and beat the whole together till they are thoroughly incorporated. Divide the mass into 100 pills (J. King).

Action, Medical Uses, and Dosage.—This is a valuable pill in all cases where a cathartic is required, as in *constipation*, *torpor of the biliary apparatus*, *hepatic disease*, *intermittent* and *remittent fevers*, *jaundice*, etc. One pill will generally be found sufficient for a dose, rarely 2 pills will be required.

PILULÆ CATHARTICÆ VEGETABILES (U. S. P.)—VEGETABLE CATHARTIC PILLS.

Preparation.—"Compound extract of colocynth, sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; extract of hyoscyamus, thirty grammes (30 Gm.) [1 oz. av., 25 grs.]; extract of jalap, thirty grammes (30 Gm.) [1 oz. av., 25 grs.]; extract of leptandra, fifteen grammes (15 Gm.) [231 grs.]; resin of podophyllum, fifteen grammes (15 Gm.) [231 grs.]; oil of peppermint, eight cubic centimeters (8 Cc.) [130 ♏]; water, a sufficient quantity to make 1000 pills. Mix the compound extract of colocynth intimately with the resin of podophyllum and incorporate the oil of peppermint. Rub the extracts of hyoscyamus, jalap, and leptandra with enough water to render them plastic, then beat them together with the mixture first prepared, using a sufficient quantity of water to form a mass, to be divided into 1000 pills"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—As the name indicates, this is a vegetable cathartic. Dose, as a laxative, 1 pill; as a cathartic, 2 to 3 pills.

Related Pills.—PILULÆ CATHARTICÆ COMPOSITÆ (*U. S. P.*), *Compound cathartic pills*, *Antibilious pills*. "Compound extract of colocynth, eighty grammes (80 Gm.) [2 ozs. av., 360 grs.]; mild mercurous chloride, sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; extract of jalap, thirty grammes (30 Gm.) [1 oz. av., 25 grs.]; gamboge, in fine powder, fifteen grammes (15 Gm.) [231 grs.]; water, a sufficient quantity to make 1000 pills. Mix the powders intimately, then gradually incorporate them with the extract of jalap and a sufficient quantity of water to form a mass, to be divided into 1000 pills"—(*U. S. P.*). Often repeated, this pill will salivate. Dose, as a laxative, 1 pill (about 3 grains); as a brisk cathartic, 3 pills. Extensively used by members of the old school of practice as a laxative and cathartic. It is not employed in Eclectic medicine.

PILULÆ ANTIMONII COMPOSITÆ (*U. S. P.*), *Compound pills of antimony*, *Plummer's pills*, *Compound pills of subchloride of mercury*, *Compound calomel pills*.—"Sulphurated antimony, four grammes (4 Gm.) [62 grs.]; mild mercurous chloride, four grammes (4 Gm.) [62 grs.]; guaiac, in fine powder, eight grammes (8 Gm.) [123 grs.]; castor oil, a sufficient quantity to make 100 pills. Beat the powders together with castor oil, added a few drops at a time, so as to form a mass, and divide it into 100 pills"—(*U. S. P.*). This pill is not employed by the Eclectic profession. It is used in old school practice for *rheumatic* and *cutaneous disorders of syphilitic origin*. Dose, 1 to 4 pills a day

PILULÆ CIMICIFUGÆ COMPOSITÆ.—COMPOUND PILLS OF BLACK COHOSH.

Preparation.—Take of the alcoholic extracts of black cohosh and scutellaria, each, 1 drachm; valerianate of quinine, $\frac{1}{2}$ drachm. Mix thoroughly together, form into a pill mass, and divide into 60 pills.

Action, Medical Uses, and Dosage.—These pills will be found very useful in *chorea* and other derangements of the nervous system, also in *fevers* or other diseases, attended with much *restlessness* or *wakefulness*, and in several *uterine affections*. The dose is 1 pill every 1, 2, or 3 hours, daily, according to the urgency of the symptoms (J. King).

PILULÆ COLOCYNTHIDIS COMPOSITÆ (N. F.)—COMPOUND PILLS OF COLOCYNTH.

SYNONYMS: *Pilulæ cocciæ*, *Cochia pills*.

Preparation.—"Extract of colocynth (*U. S. P.*), one and one-tenth grammes (1.1 Gm.) [17 grs.]; purified aloes (*U. S. P.*), thirteen grammes (13 Gm.) [200 grs.]; resin of scammony (*U. S. P.*), thirteen grammes (13 Gm.) [200 grs.]; oil of cloves, one and one-half cubic centimeters (1.5 Cc.) [25 ♏]. To make 100 pills. Each pill contains $\frac{1}{6}$ grain of extract of colocynth, 2 grains of aloes, 2 grains of scammony, and $\frac{1}{4}$ minim of oil of cloves (see *Pilulæ*, N. F.). *Note.*—The *Pilula Colocynthidis Composita* of the *British Pharmacopœia*, for which the above is an equivalent, is prepared with colocynth pulp, and contains potassium sulphate, which was originally added as an aid to reduce the ingredients to powder. With the use of extract of colocynth this becomes unnecessary. The *British Pharmacopœia* directs the above to be kept as a pill mass, to be made into pills of such weight as may be prescribed. When such specification is omitted, it is recommended to dispense pills containing the quantities above directed." Adapted from *Nat. Form.*

Action, Medical Uses, and Dosage.—This pill is employed as a purgative. Dose, 1 to 2 pills.

Related Pills.—PILULÆ COLOCYNTHIDIS ET HYOSCYAMI (N. F.), *Pills of colocynth and hyoscyamus*. "Extract of colocynth (*U. S. P.*), sixty-five centigrammes (0.65 Gm.) [10 grs.]; purified aloes (*U. S. P.*), nine and seven-tenths grammes (9.7 Gm.) [150 grs.]; resin of scammony (*U. S. P.*), nine and seven-tenths grammes (9.7 Gm.) [150 grs.]; oil of cloves, one cubic centimeter (1 Cc.) [17 ♏]; extract of hyoscyamus (*U. S. P.*), nine and seven-tenths grammes (9.7 Gm.) [150 grs.]. To make 100 pills. Each pill contains $\frac{1}{10}$ grain of extract of colocynth, $1\frac{1}{2}$ grains of aloes, $1\frac{1}{2}$ grains of scammony, $\frac{1}{6}$ minim of oil of cloves, and $1\frac{1}{2}$ grains of extract of hyoscyamus (see *Pilulæ*, N. F.). *Note.*—The *Pilula Colocynthidis et Hyoscyami* of the *British Pharmacopœia* is directed to be made by mixing 2 parts of compound pill of colocynth (F. 298), with 1 part of extract of hyoscyamus, and is directed to be kept as a pill mass, to be made into pills of such weight as may be directed. When such specification is omitted, it is recommended to dispense pills containing the quantities above directed." Adapted from *Nat. Form.*

PILULÆ COLOCYNTHIDIS ET PODOPHYLLI (N. F.), *Pills of colocynth and podophyllum.*—"Compound extract of colocynth (*U. S. P.*), sixteen and two-tenths grammes (16.2 Gm.) [250 grs.]; resin of podophyllum (*U. S. P.*), one and six-tenths grammes (1.6 Gm.) [25 grs.]. To make 100 pills. Each pill contains $2\frac{1}{2}$ grains of extract of colocynth, and $\frac{1}{4}$ grain of resin of podophyllum" (see *Pilulæ*, N. F.). Adapted from *Nat. Form.*

PILULÆ COPAIBÆ.—PILLS OF COPAIBA.

Preparation.—Take of copaiba and white wax, of each, 1 drachm. Melt the wax, mix in the copaiba, and divide into 30 pills (compare *Massa Copaibæ*). These pills are frequently combined in other proportions, and with the addition of cubebs. Thus: take of copaiba 1 part; white wax, $1\frac{1}{2}$ parts; cubebs, in powder, 2 parts. Melt the wax, add the copaiba and cubebs, and divide into 4-grain pills. This combination is suitable to warm climates. Another combination is: take of copaiba, 1 part; white wax, 2 parts; cubebs, in powder, 3 parts. Prepare as above, and divide into 4-grain pills.

Copaiba is usually solidified into a pill mass by the use of the recently calcined magnesia. The magnesia absorbs the oil of copaiba, and at the same time forms with the acid of the copaiba a copaivate of magnesium. The time required to effect the solidification of the copaiba will be several hours, and the quantity of magnesia required will depend upon the amount of copaivic acid present. Ordinarily, 16 parts of magnesia to 1 of copaiba will effect the solidification; and the mass should not be allowed to harden too much before it is divided into pills. The addition of the magnesia does not materially increase the size of the pill.

Action, Medical Uses, and Dosage.—These pills are useful in *gonorrhœa*, and other affections where the medicinal agents are indicated. The dose is 2 to 4 pills, 3 times a day.

PILULÆ COPAIBÆ COMPOSITÆ.—COMPOUND PILLS OF COPAIBA.

Preparation.—Take of solidified copaiba, 1 drachm; ethereal extract of cubebs, ½ drachm; resin of podophyllum, 9 grains; gum myrrh, 1 drachm; alcoholic extract of nux vomica, 15 grains. Mix thoroughly, and divide into 3-grain pills.

Action, Medical Uses, and Dosage.—These pills are useful in *gonorrhœa, gleet, stricture*, and *chronic inflammation of the prostate*. The dose is from 2 to 4 pills, twice a day. For ordinary cases, the following preparation will be found beneficial: Take of solidified copaiba, 2 drachms; ethereal extract of cubebs, 1 drachm; oil of juniper, a sufficient quantity, not to impair the pilular consistency of the mass. Mix, and divide into pills of 4 grains each. The dose is the same as above.

PILULÆ FERRI CARBONATIS (U. S. P.)—PILLS OF FERROUS CARBONATE.

SYNONYMS: *Ferruginous pills, Chalybeate pills, Blaud's Pills, Pills of iron, Griffith's pills.*

Preparation.—"Ferrous sulphate, in clear crystals, sixteen grammes (16 Gm.) [247 grs.]; potassium carbonate, eight grammes (8 Gm.) [123 grs.]; sugar, four grammes (4 Gm.) [62 grs.]; tragacanth, in fine powder, one gramme (1 Gm.) [15 grs.]; althæa, in No. 60 powder, one gramme (1 Gm.) [15 grs.]; glycerin water, each, a sufficient quantity to make 100 pills. Rub the potassium carbonate, in a mortar, with a sufficient quantity (about 10 drops each) of glycerin and water, then add the ferrous sulphate and sugar, previously triturated together to a uniform powder, and beat the mass thoroughly, until it assumes a greenish color. When the reaction appears to have terminated, incorporate the tragacanth and althæa, and, if necessary, add a little more water, so as to obtain a mass of a pilular consistence. Divide this into 100 pills. These pills should be freshly prepared, when wanted"—(*U. S. P.*).

History.—This pill is the modified Blaud's pill, and has the official name formerly given to Vallet's mass (*Pilulæ Ferri Carbonatis*), and also differs much from the pill of similar name directed by the *British Pharmacopœia*. Hence, a confusion of names and the pills they represent will be likely to occur among physicians.

Action, Medical Uses, and Dosage.—Its uses are those of compound mixture of iron (see *Mistura Ferri Composita*). This pill is a ferruginous tonic, and may be employed in all cases where iron is required. It is especially valuable in *anæmia, atonic amenorrhœa, chlorosis*, and *hysterical affections;* also in the *hectic fever of phthisis* and *chronic mucous catarrhs*. It appears to have the usual effects of iron on the blood, increasing its coloring particles and rendering it of a more scarlet color. It may be divided into 3 or 5-grain pills, of which from 2 to 6 may be given 3 times a day, and continued for several weeks, particularly if their use is followed by an amelioration of the symptoms of disease.

Related Pills.—PILULÆ FERRI CARBONATIS (N. F.), *Pills of carbonate of iron, Ferruginous pills, Blaud's pills, Chalybeate pills*. "Sulphate of iron, in clear crystals, 240 grains; carbonate of potassium, 140 grains; sugar, 48 grains; tragacanth, in fine powder, 16 grains; glycerin, 10 minims; water, a sufficient quantity. Triturate the sulphate of iron with the sugar to a uniform powder. In another mortar triturate the carbonate of potassium with the glycerin and 10 minims of water. Add to this mixture the previously prepared powder, and beat the mass thoroughly until it assumes a greenish color. When the reaction appears to have terminated, incorporate the tragacanth, and, if necessary, add a little more water, so as to obtain a mass of a pilular consistence. Divide this into 96 pills. Each pill represents about 1 grain of carbonate of iron (ferrous). *Note.*—Sometimes so-called '3-grain' Blaud's pills (*Pilulæ Blaudii Minores*) are prescribed or demanded. These may be prepared by using the quantities given in the above formula, and dividing the mass into 168 pills"—(*Nat. Form.*, 1st ed.).

Pilulæ Metallorum (N. F.), *Metallic Pills, Pilulæ metallorum amaræ, Bitter metallic pills.*—"Reduced iron, six and one-half grammes (6.5 Gm.) [100 grs.]; quinine sulphate, six and one-half grammes (6.5 Gm.) [100 grs.]; strychnine, alkaloid, thirty-two centigrammes (0.32 Gm.) [5 grs.]; arsenous acid, thirty-two centigrammes (0.32 Gm.) [5 grs.]. To make 100 pills. Each pill contains 1 grain of reduced iron, 1 grain of quinine sulphate, $\frac{1}{20}$ grain of strychnine, and $\frac{1}{20}$ grain of arsenous acid (see *Pilulæ*, N. F.). *Note.*—A similar combination is known under the name of *Aitken's tonic pills:* "Reduced iron, four and one-half grammes (4.5 Gm.) [67 grs.]; quinine sulphate, six and one-half grammes (6.5 Gm.) [100 grs.]; strychnine, alkaloid, thirteen centigrammes (0.13 Gm.) [2 grs.]; arsenous acid, thirteen centigrammes (0.13 Gm.) [2 grs.]. To make 100 pills. Each pill contains $\frac{2}{3}$ grain of reduced iron, 1 grain of quinine sulphate, $\frac{1}{50}$ grain of strychnine, $\frac{1}{50}$ grain of arsenous acid" (see *Pilulæ*, N. F.). Adapted from *Nat. Form.*

PILULÆ FERRI COMPOSITÆ.—COMPOUND PILLS OF IRON.

Synonym: *Emmenagogue pills.*

Preparation.—Take of Vallet's carbonate of iron, 1 drachm; resin of podophyllum, 15 grains; white turpentine, ½ drachm. Mix well together, and divide into 30 pills. This pill should not be confounded with *Pilulæ Ferri Compositæ* of the *U. S. P.* of 1880 (which see under *Pilulæ Aloes et Myrrhæ*).

Action, Medical Uses, and Dosage.—This pill is used chiefly as an emmenagogue. The dose is 1 pill every 3 or 4 hours.

PILULÆ FERRI FERROCYANIDI COMPOSITÆ.—COMPOUND PILLS OF FERROCYANIDE OF IRON.

Preparation.—Take of ferrocyanide of iron, sulphate of quinine, and alcoholic extract of black cohosh, each, 40 grains. Mix, and divide into 40 pills.

Action, Medical Uses, and Dosage.—These pills are tonic, alterative, and antiperiodic, and may be used in all diseases attended with periodicity, as *intermittent fever*, *chorea*, *epilepsy*, etc. They will be found an excellent remedial agent. The dose is 1 pill, 3 or 4 times a day, or oftener if required (J. King).

PILULÆ FERRI IODIDI (U. S. P.)—PILLS OF FERROUS IODIDE.

Synonym: *Pills of iodide of iron.*

Preparation.—"Reduced iron, four grammes (4 Gm.) [62 grs.]; iodine, five grammes (5 Gm.) [77 grs.]; glycyrrhiza, in No. 60 powder, four grammes (4 Gm.) [62 grs.]; sugar, in fine powder, four grammes (4 Gm.) [62 grs.]; extract of glycyrrhiza, in fine powder, one gramme (1 Gm.) [15.5 grs.]; acacia, in fine powder, one gramme (1 Gm.) [15.5 grs.]; water, balsam of tolu, ether, each, a sufficient quantity to make 100 pills. To the reduced iron, contained in a small mortar, add six cubic centimeters (6 Cc.) [97 ♏] of water, and then, gradually, the iodine, constantly triturating, until the mixture ceases to have a reddish tint. Then add the remaining powders, previously well mixed together, and mix the whole thoroughly. Transfer the mass to a porcelain capsule, and evaporate the excess of moisture, on a water-bath, with constant stirring, until the mass has acquired a pilular consistence. Then divide it into 100 pills. Dissolve ten grammes (10 Gm.) [154 grs.] of balsam of tolu in fifteen cubic centimeters (15 Cc.) [243 ♏] of ether, shake the pills with a sufficient quantity of this solution until they are uniformly coated, and put them on a plate to dry, occasionally rolling them about until the drying is completed. Keep the pills in a well-stoppered bottle"—(*U. S. P.*).

Tests.—"Pills of ferrous iodide should be devoid of the smell of iodine. If a few of the pills be triturated with water, the filtrate should not assume more than a light-blue tint on the addition of starch T.S. (absence of more than traces of free iodine)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This pill possesses the same medicinal properties as the solution of iodide of iron, and may be given in the same diseases. About 1½ grains of the iodide of iron enters into each pill, 1 of which may be given for a dose, and repeated 2 or 3 times a day. The *U. S. P.* pill contains about 1 grain of ferrous iodide.

PILULÆ GALBANI COMPOSITÆ (N. F.)—COMPOUND PILLS OF GALBANUM.

Preparation.—"Galbanum, nine and three-fourths grammes (9.75 Gm.) [150 grs.]; myrrh, nine and three-fourths grammes (9.75 Gm.) [150 grs.]; asafœtida, three and one-fourth grammes (3.25 Gm.) [50 grs.]; syrup, a sufficient quantity to make 100 pills. Each pill contains 1½ grains of galbanum, 1½ grains of myrrh, and ½ grain of asafœtida" (see *Pilulæ*, N.F.). Adapted from *Nat. Form.* This agrees with the *U. S. P.* (1880) formula.

Action, Medical Uses, and Dosage.—Formerly much employed in *hysterical manifestations*, and as a stimulant in *mucous profluvia*. Dose, 2 to 5 pills.

PILULÆ GLONOINI (N. F.)—PILLS OF GLONOIN.

SYNONYM: *Pills of nitroglycerin.*

Preparation.—"Spirit of glonoin (*U. S. P.*), six and one-half grammes (6.5 Gm.) [100 grs.]; althæa, in fine powder, six and one-half grammes (6.5 Gm.) [100 grs.]; confection of rose (*U. S. P.*), a sufficient quantity. Mix the spirit of glonoin intimately with the powdered althæa, expose the mixture for a short time to the air, so that the alcohol may evaporate, then make a pill mass by means of confection of rose, and divide it into 100 pills. Each pill contains $\frac{1}{100}$ grain of glonoin (nitroglycerin)"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—(See *Spiritus Glonoini.*)

PILULÆ HYOSCYAMI COMPOSITÆ.—COMPOUND PILLS OF HYOSCYAMUS.

Preparation.—Take of extract of hyoscyamus, extract of valerian, each, 2 drachms; extract of aconite, sulphate of quinine, of each, 1 drachm. Mix thoroughly together, and divide into pills of 3 grains each.

Action, Medical Uses, and Dosage.—These pills will be found advantageous in *neuralgia*, *rheumatism*, *chorea*, *dysmenorrhœa*, and many affections of a similar character. The dose is 1 pill every 2, 3, or 4 hours, according to circumstances. As the virtue of valerian resides in its oil, it is probable the extract is nearly useless, and one-half the quantity of the oil of valerian, or of valerianic acid, should be substituted for the extract, and forms a much more efficient pill (J. King).

PILULÆ LEONURI COMPOSITÆ.—COMPOUND PILLS OF MOTHERWORT.

Preparation.—Take of the alcoholic extracts of motherwort and unicorn-root, each, 2 drachms; extract of leptandra, resin of cimicifuga, each, 1 drachm. Mix thoroughly together, form a pill mass, and divide into 60 pills.

Action, Medical Uses, and Dosage.—These pills are useful in many *uterine affections*, acting as a uterine tonic and alterative. One pill may be given every 1, 2, or 4 hours, according to the urgency of the case (J. King).

PILULÆ LEPTANDRÆ COMPOSITÆ.—COMPOUND PILLS OF LEPTANDRA.

Preparation.—Take of extract of leptandra, 1 drachm; resin of podophyllum, ½ drachm; extract of rhubarb, a sufficient quantity. Mix together, and divide into 60 pills. Some prefer making these pills with extract of dandelion instead of rhubarb.

Action, Medical Uses, and Dosage.—This is a valuable cholagogue pill, very beneficial in *liver affections*, *obstinate constipation*, or wherever catharsis is required. It will likewise be found useful in *dysentery*. The dose is from 1 to 3 pills, once or twice a day. A very useful and effectual pill, that will not occasion gastro-intestinal irritation, may be made by thoroughly mixing together resin of podophyllum, 30 grains; extract of leptandra, 60 grains; extract of hyoscyamus, 45 grains; and dividing the mass into 60 pills. The *compound cathartic pill* of some of our practitioners is composed of resin of podophyllum, 15 grains; dry extract of leptandra, extract of hyoscyamus, each 1 drachm. Mix, and divide into 60 pills.

PILULÆ OLEORESINÆ EUPATORII COMPOSITÆ.—COMPOUND PILLS OF OLEORESIN OF QUEEN OF THE MEADOW.

Preparation.—Take of oleoresin of Eupatorium purpureum (eupurpurin), 40 grains; oleoresin of xanthoxylum, 20 grains; strychnine, 1 grain. Mix thoroughly together, and divide into 20 pills.

Action, Medical Uses, and Dosage.—This forms a stimulating diuretic, and will be found useful in *suppression of urine*, *torpor* or *paralysis of the kidneys or bladder*, *rheumatism*, *hepatic torpor*, *derangements of the digestive functions*, etc. The dose is 1 pill, to be repeated 3 or 4 times a day (J. King).

PILULÆ OPII (U. S. P.)—PILLS OF OPIUM.

Preparation.—"Powdered opium, six and one-half grammes (6.5 Gm.) [100 grs.]; soap, in fine powder, two grammes (2 Gm.) [31 grs.]; water, a sufficient quantity to make 100 pills. Beat the powders together with water, so as to form a mass, and divide it into 100 pills"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—(Same as *Opium*.) Old pills of opium are better than fresh pills or liquid preparations of the same when a local action and prolonged contact of the drug is desired in *painful gastric* and other *visceral disorders*. By their slow solution they are effectual in *gastric ulcers*, *gastralgia*, etc. Dose, 1 pill, which contains 1 grain of opium.

Related Pills.—Pilula Saponis Composita (*U. S. P.*, 1870). Opium, in fine powder, 60 grains; soap, in fine powder, ½ troy ounce. Beat together with water so as to form a pilular mass.

PILULÆ OPII ET PLUMBI (N. F.)—PILLS OF OPIUM AND LEAD.

Preparation.—"Powdered opium, six and one-half grammes (6.5 Gm.) [100 grs.]; lead acetate, six and one-half grammes (6.5 Gm.) [100 grs.]; to make 100 pills. Each pill contains 1 grain of opium and 1 grain of lead acetate" (see *Pilulæ*, N. F.). Adapted from *Nat. Form.*

Action, Medical Uses, and Dosage.—This agent is used chiefly by members of the old school as an astringent and anodyne in *bowel* and *bronchial disorders*. Dose, 3 to 5 grains.

PILULÆ PHOSPHORI (U. S. P.)—PILLS OF PHOSPHORUS.

Preparation.—Phosphorus, six centigrammes (0.06 Gm.) [1 gr.]; althæa, in No. 60 powder, six grammes (6 Gm.) [93 grs.]; acacia, in fine powder, six grammes (6 Gm.) [93 grs.]; chloroform, glycerin, water, balsam of tolu, ether, each, a sufficient quantity to make 100 pills. Dissolve the phosphorus in a test-tube in five cubic centimeters (5 Cc.) [81 ♏] of chloroform, with the aid of a very gentle heat, replacing from time to time any of the chloroform which may be lost by evaporation. Mix the althæa and acacia in a mortar, next add the solution of phosphorus, then immediately afterward a sufficient quantity (about four cubic centimeters [4 Cc., 65 ♏]) of a mixture of 2 volumes of glycerin and 1 volume of water, and quickly form a mass, to be divided into 100 pills. Dissolve ten grammes (10 Gm.) [154 grs.] of balsam of tolu in fifteen cubic centimeters (15 Cc.) [243 ♏] of ether, shake the pills with a sufficient quantity of this solution until they are uniformly coated, and put them on a plate to dry, occasionally rolling them about until the drying is completed. Keep the pills in a well-stoppered bottle.

The *U. S. P.* pill contains $\frac{1}{100}$ grain of phosphorus, that of the *British Pharmacopœia* (1898) $\frac{1}{50}$ grain of phosphorus, which is twice the strength of the phosphorus pill in *British Pharmacopœia*, 1885. It is necessary in handling phosphorus that its oxidation be prevented if possible, and this is accomplished by dissolving it in a closed tube in chloroform, the vapor of which prevents its oxidation. It may also be melted under water as is directed by the *British Pharmacopœia*, 1885. The present *British Pharmacopœia* employs a solution of phosphorus in carbon disulphide. Besides tolu balsam, rosin has been proposed as an excipient (A. W. Gerrard ; cacao butter (Walling) has also been successfully employed.

Action, Medical Uses, and Dosage.—Same as for *Phosphorus* (which see). Dose, 1 to 2 pills.

PILULÆ PHYTOLACCÆ COMPOSITÆ.—COMPOUND PILLS OF POKE.

Preparation.—Take of extract of poke, 2 drachms; alcoholic extract of stillingia, 1 drachm; extract of stramonium, 8 grains. Mix thoroughly together, form into a pill mass, and divide into 64 pills.

Action, Medical Uses, and Dosage.—These pills will be found of value in *osteocopus*, or *pains in the bones* of a mercurial or syphilitic character, and are also beneficial in *rheumatism*, *syphilis* and *scrofula*. The dose is one pill every 2, 3 or 4 hours, as the urgency of the case may require. The fluid extract of stillingia may be substituted for the alcoholic extract, and pulverized poke root added as an excipient (J. King).

PILULÆ PODOPHYLLI BELLADONNÆ ET CAPSICI (N. F.)

PILLS OF PODOPHYLLUM, BELLADONNA, AND CAPSICUM.

SYNONYM: *Squibb's podophyllum pills.*

Preparation.—"Resin of podophyllum (*U. S. P.*), one and six-tenths grammes (1.6 Gm.) [25 grs.]; alcoholic extract of belladonna leaves (*U. S. P.*), eight decigrammes (0.8 Gm.) [12.5 grs.]; capsicum, in moderately fine powder, three and two-tenths grammes (3.2 Gm.) [50 grs.]; sugar of milk, in fine powder, six and one-half grammes (6.5 Gm.) [100 grs.]; acacia, in fine powder, one and six-tenths grammes (1.6 Gm.) [25 grs.]; glycerin, syrup (*U. S. P.*), each, a sufficient quantity to make 100 pills. Each pill contains $\frac{1}{4}$ grain of resin of podophyllum, $\frac{1}{8}$ grain of extract of belladonna leaves, $\frac{1}{2}$ grain of capsicum, 1 grain of milk sugar, $\frac{1}{4}$ grain of acacia, glycerin, syrup, each, a sufficient quantity" (see *Pilulæ*, N. F.). Adapted from *Nat. Form.*

Action, Medical Uses, and Dosage.—Efficient laxative and cathartic. Dose, 1 to 2 pills.

PILULÆ POLYGONI COMPOSITÆ.—COMPOUND PILLS OF WATER-PEPPER.

Preparation.—Take of dried sulphate of iron, and resin of cimicifuga, each, 1 drachm; oleoresin of iris, 15 grains; extract of water-pepper, a sufficient quantity. Mix well together, and divide into 60 pills.

Action, Medical Uses, and Dosage. These pills are emmenagogue, and exert an especial influence on the female organs of generation. They have been used with advantage in *chlorosis*, *amenorrhœa*, *dysmenorrhœa*, *uterine leucorrhœa*, etc. The dose is 1 pill every 2 or 3 hours (J. King).

PILULÆ QUININÆ COMPOSITÆ.—COMPOUND PILLS OF QUININE.

Preparation.—Take of sulphate of quinine, extract of cornus, and tartaric acid, each, in powder, 1 drachm; alcoholic extract of black cohosh, a sufficient quantity. Mix together, and divide into 4-grain pills.

Action, Medical Uses, and Dosage.—These pills are tonic and antiperiodic, and may be employed in *intermittent and remittent fevers*, and in all diseases attended with symptoms of periodicity. The addition of the tartaric acid renders the quinine more readily soluble in the juices of the stomach. The dose is 1 pill every 1, 2, or 3 hours, according to the severity or urgency of the symptoms. A *compound quinine pill* is occasionally employed, which is composed as follows: Take of sulphate of quinine, hydrochlorate of berberine, each, 1 drachm; resin of podophyllum, 10 grains; extract of nux vomica, 8 grains. Mix, and divide into 60 pills (J. King).

PILULÆ QUININÆ SULPHATIS.—PILLS OF SULPHATE OF QUININE.

Preparation.—Take of sulphate of quinine, 1 drachm; aromatic sulphuric acid, 45 drops; drop the acid into the quinine on a tile or slab, and triturate with a spatula until it assumes a pilular consistence; then divide into 60 pills. The same can be effected much more readily by substituting a very small quantity of tartaric acid in solution for the aromatic sulphuric acid (J. King). This pill should be coated with either sugar or gelatin.

This method of forming quinine into a pill mass was made known by Mr. E. Parish. The ingredients, when mixed, form a fluid, which soon thickens into a paste, and finally becomes quite solid, and so adhesive as to be readily divided and rolled into pills; care must be taken not to allow the mass to become too dry and brittle before dividing it, as it is liable to do if allowed to remain too long. In this form, a portion of the neutral sulphate being converted into the soluble bisulphate, the preparation more nearly resembles the solutions in composition, and is believed to be more certain and rapid in its action. When it is desired to incorporate other substances in powder with the quinine thus prepared, as ferrocyanide of iron, etc., they should be added to the mass when it is just so soft that, upon their addition, it will immediately assume the proper consistence. It is not, however, advisable to employ this process when any considerable quantity of other ingredients are prescribed with the quinine, unless a little syrup or honey is also added to prevent the too rapid hardening and consequent crumbling of the mass.

Action, Medical Uses, and Dosage.—(For the uses of these pills, see *Quininæ Sulphas*.) Each pill contains 1 grain of sulphate of quinine, and 12 are equivalent to 1 ounce of good Peruvian bark. The above pill mass may be made into 2 or 5-grain pills if desired, which will not be found inconveniently large.

PILULÆ RESINÆ PODOPHYLLI COMPOSITÆ.—COMPOUND PILLS OF RESIN OF PODOPHYLLUM.

Preparation.—Take of resin of podophyllum, scammony, gamboge, each, in powder, 1 drachm; castile soap, ½ drachm. Triturate the powders thoroughly together for about half an hour, then add the soap. Mix, and beat the whole together until they are thoroughly incorporated. Divide the mass into 120 pills.

Action, Medical Uses, and Dosage.—This is a most valuable pill for all diseases where cathartics are required, and has cured many cases of *hepatic affections* by a continued use of them. The dose is 1 or 2 pills every night. They have no tendency toward producing constipation, but rather the reverse, and, after using them for several days in succession, they will generally be found so active that it will be necessary to omit them for a number of days before resuming their administration. They may be safely used in all ordinary cases where purgation is desired; they operate freely and thoroughly, and usually without causing nausea, griping, or debility.

In consequence of the difficulty with which pure scammony is obtained in this country, many practitioners substitute for it, in these pills, extract of apocynum, or extract of rhubarb, or oleoresin of iris, either of which will probably be found preferable to an impure or counterfeit scammony (J. King). A very useful pill for *saturnine constipation* is the following: Take of resin of podophyllum, 6 grains; extract of nux vomica, 7 grains; extract of belladonna, 4½ grains. Mix, and divide into 10 pills. Dose, 2 or 3 pills a day, accompanied with sulphurous baths (Van den Corput).

PILULÆ RHEI (U. S. P.)—PILLS OF RHUBARB.

Preparation.—"Rhubarb, in No. 60 powder, twenty grammes (20 Gm.) [309 grs.]; soap, in fine powder, six grammes (6 Gm.) [93 grs.]; water, a sufficient quantity to make 100 pills. Beat the powders together with water so as to form a mass, to be divided into 100 pills"—(*U. S. P.*). This pill contains 3 grains of rhubarb.

Action, Medical Uses, and Dosage.—Mildly laxative in 3-grain doses (1 pill). Of value in mild forms of *constipation* (see *Rheum*). Dose, 1 to 3 pills.

PILULÆ RHEI COMPOSITÆ (U. S. P.)—COMPOUND PILLS OF RHUBARB.

SYNONYM: *Compound rhubarb pills.*

Preparation.—"Rhubarb, in No. 60 powder, thirteen grammes (13 Gm.) [201 grs.]; purified aloes, in fine powder, ten grammes (10 Gm.) [154 grs.]; myrrh, in fine powder, six grammes (6 Gm.) [93 grs.]; oil of peppermint, one-half cubic centimeter (0.5 Cc.) [8 ♏]; water, a sufficient quantity to make 100 pills. Mix the oil of peppermint with the powders, then beat the mixture with water so as to form a mass, to be divided into 100 pills"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Tonic laxative (see *Myrrh*, *Aloes*, and *Rhubarb*). Useful in *chronic constipation* and *gastric* and *intestinal flatulence.* Dose, 1 to 4 pills.

PILULÆ SAPONIS COMPOSITÆ (ECLECTIC).—COMPOUND PILLS OF SOAP.

SYNONYM: *Diuretic pills.*

Preparation.—Take of oils of spearmint, juniper, and sassafras, each, 1 fluid drachm: castile soap, 1½ drachms. Beat the soap in an iron mortar, gradually adding the oils, and, when the ingredients are thoroughly incorporated, divide into 18 pills (Beach's *Amer. Prac.*). This is not the *Compound Pill of Soap* (*Pilula Saponis Composita*) of the *British Pharmacopœia* or the *U. S. P.*, 1870 (for which, see *Related Pills*, under *Pilulæ Opii*).

Action, Medical Uses, and Dosage.—These pills are stimulant and diuretic, and are very beneficial in *gravel* and *chronic urinary affections.* The dose is 3 pills, 3 times a day, or 1 pill every hour through the day. They were first recommended by the late Prof. T. V. Morrow, M. D.

PILULÆ SCAMMONII COMPOSITÆ.—COMPOUND SCAMMONY PILLS.

Preparation.—"Take of resin of scammony, 1 ounce; resin of jalap, 1 ounce; curd soap, in powder, 1 ounce; strong tincture of ginger, 1 fluid ounce; rectified spirit, 2 fluid ounces. Add the spirit and the tincture to the soap and resins, and dissolve with the aid of a little heat; then evaporate the spirit by the heat of a water-bath until the mass has acquired a suitable consistence for forming pills"—

(*Br. Pharm.*, 1885). The *British Pharmacopœia* (1898) replaces the rectified spirit with an equal quantity of tincture of ginger.

Action, Medical Uses, and Dosage.—(See *Scammonium.*) A drastic purgative. Dose, 5 to 15 grains.

PILULÆ TARAXACI COMPOSITÆ.—COMPOUND PILLS OF DANDELION.

Preparation.—Take of bloodroot, in powder, 1 drachm; resin of podophyllum, 10 grains; extract of dandelion, 1 drachm; oil of spearmint, 5 minims. Mix the powder with the extract, add the oil, beat up thoroughly together, and divide into 50 pills.

Action, Medical Uses, and Dosage.—Laxative, nauseant, and diuretic. They are of much efficacy in *jaundice*, *hepatic diseases*, and *affections of the kidneys*. The dose is 1 or 2 pills, 3 times a day, sufficient to produce a slight sensation of nausea. This pill is superior to the one made after the old formula (T. V. Morrow, M. D.).

PILULÆ VALERIANÆ COMPOSITÆ.—COMPOUND PILLS OF VALERIAN.

Preparation.—Take of the alcoholic extract of scullcap, and extract of chamomile, each, 2 drachms; extract of boneset, sulphate of quinine, of each, 1 drachm; capsicum, 20 grains; oil of valerian, ½ drachm, by weight. Mix the articles together, beat them until thoroughly incorporated, and divide into 90 pills.

Action, Medical Uses, and Dosage.—These pills are tonic and nervine, and may be used in all cases where such a combination of action is desired. The dose is 1 pill, every 2 or 3 hours.

PILULÆ VIBURNI COMPOSITÆ.—COMPOUND PILLS OF HIGH CRANBERRY.

Preparation.—Take of alcoholic extracts of high cranberry, blue cohosh, and unicorn root, each, ½ drachm; extract of partridge-berry, 1 drachm. Mix together, and divide into 40 pills.

Action, Medical Uses, and Dosage.—These pills are of superior efficacy in *uterine diseases*, as *amenorrhœa*, *dysmenorrhœa*, *leucorrhœa*, etc.; as a uterine tonic in *habitual miscarriages;* and may be given during *pregnancy* to relieve cramps and many other unpleasant sensations occurring at that period. The dose is 1 or 2 pills, 3 times a day (J. King.)

PIMENTA (U. S. P.)—PIMENTA.

"The nearly ripe fruit of *Pimenta officinalis*, Lindley"—(*U. S. P.*). (*Eugenia Pimenta*, De Candolle; *Myrtus Pimenta*, Linné; *Pimenta vulgaris*, Wight and Arnott.)

Nat. Ord.—Myrtaceæ.

COMMON NAMES: *Allspice, Pimenta, Pimento, Jamaica pepper.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 111.

Botanical Source.—This tree, the *Eugenia Pimenta* of De Candolle, is an evergreen, reaching to the height of 25 feet, or more. The trunk is erect, with many round branches toward the summit; twigs compressed, the younger and the pedicles downy. The leaves are opposite, entire, oblong or oval, with pellucid dots, and somewhat opaque and smooth. The flowers are small, in axillary and terminal, trichotomous panicles; some flowers are fourfid and subsessile in the forks of the panicle. Calyx-tube is nearly globose, the limb being divided down to the ovary into 4 roundish segments. Petals 4, greenish-white. Stamens numerous, distinct; ovary 2-celled. Berry globose, 1-seeded, black, the size of a pea. Embryo roundish, with the cotyledons consolidated (L.).

History.—The allspice, or pimento tree, is a native of South America and the West India Islands, especially Jamaica. The tree completes its growth in about seven years, though fruit may be had from it in its third year: it flourishes best in a limestone soil. The unripe berries are the official part, and are more generally known by the name of *Allspice*. Other names, as *Jamaica pepper*, *Bayberry*, etc., have been given to them. They are gathered just before maturity, thoroughly dried, and then packed for foreign markets. When these trees are in blossom they emit a most delicious fragrance. The pimento tree is not improved by cultivation. After the old groves, or *walks*, as they are called, are exhausted, a clearing is made in the forest near the old groves, and, through the agency of birds and the winds, seeds are scattered in this open area, and a new grove springs up. When the young trees are two or three years old the weaker ones are cut down. After thus thinning the grove, it requires no further attention. The fruit is gathered in July and August, the young fruit-laden tips of the branches being broken off (which benefits the trees) and thrown upon the ground, where they are stripped of the berries by women and children and placed in bags, carried to a sunny exposure and dried, either by solar or artificial heat, and again bagged for the market. The stems of young pimento trees at one time were exported from Jamaica to England and the United States, to be used for umbrella sticks. They came in bundles, containing from 500 to 800 sticks, each representing a young pimento tree (*Amer. Jour. Pharm.*, 1882, p. 11, from *Scient. Amer.*, 1881).

Description.—Pimento, or allspice, also known as *Piper Jamaicense*, and *Semen Amomi*, when dried, becomes brownish-black, round, wrinkled, and umbilicate at the apex. Its odor and taste combines that of cinnamon, nutmegs, and cloves; hence its name, *allspice*. Boiling water takes up the aroma, and alcohol all the active properties. The infusion is brown, and has an acid reaction on litmus paper. The *U. S. P.* describes pimenta as being "about 5 Mm. $\frac{1}{5}$ inch) in diameter, nearly globular, crowned with the short, 4-parted calyx or its remnants, and a short style; brownish or brownish-gray, granular and glandular, 2-celled; each cell containing 1 brown, plano-convex, roundish-reniform seed; odor and taste pungently aromatic, clove-like"—(*U. S. P.*).

Chemical Composition.—Two-thirds of the fruit consists of the shell, and one-third of the seeds. The berries contain a volatile oil (see *Oleum Pimentæ*), which may be obtained by distillation, a green, soft resin, of a burning aromatic taste, a concrete fatty substance, tannic acid, gum, sugar, malic and gallic acids, etc. (Bonastre). They also contain starch (Braconnot). Dragendorff (1871) found a minute portion of an alkaloid in the fruit. The latter, upon incineration, leaves 6 per cent of ash. W. W. Abell (*Amer. Jour. Pharm.*, 1886, p. 163) obtained from the leaves $\frac{1}{2}$ per cent of an essential oil bearing a close resemblance to oil of bay (*Myrcia acris*). The leaves also contain 0.4 per cent of tannin and 11.25 per cent of ash.

Action, Medical Uses, and Dosage.—Pimento is a hot, aromatic stimulant, and carminative, and may be used where such agents are indicated. It is seldom employed in medicine, but is used largely as a hot aromatic in cookery; and sometimes it is added to other medicines to render them more agreeable. A tincture has been advised as a local remedy in *chilblains*. Dose of the powder, from 10 to 30 grains; of the tincture, from 1 to 2 fluid drachms; of the oil, from 2 to 5 drops.

PIPER (U. S. P.)—PIPER.

"The unripe berries of *Piper nigrum*, Linné"—(*U. S. P.*).

Nat. Ord.—Piperaceæ.

Common Name: *Black pepper*.

Illustration: Bentley and Trimen, *Med. Plants*, 245.

Botanical Source.—Piper nigrum is a perennial vine with a trailing or climbing stem, round, smooth, shrubby, flexuose, dichotomously branched, jointed, swelling at the joints, and often throwing out radicles there which adhere to bodies like the roots of ivy, or become roots striking into the ground. The leaves are from 4 to 6 inches long, alternate, distichous, broad-ovate, acuminate, of a dark-green color, glossy above, paler beneath, 5 to 7 nerved, the nerves connected by lesser transverse ones or veins, and prominent beneath; the petioles are round, and from $\frac{1}{2}$ to 1 inch long. The flowers are whitish, small, not stalked, and borne in spikes opposite the leaves, chiefly near the upper ends of the branches, pedunculate, 3 to 6 inches long, slender, drooping, apparently some male, others female, while sometimes the flowers are furnished with both stamens and pistils. Stamens 3. The fruit ripens irregularly all the year round, is sessile, the size of a pea, at first green, then red, and afterward black, covered by pulp (*L.*).

History and Description.—Piper nigrum is a native of the East Indian continent, notably the Malabar coast, as well as of many islands in the Indian ocean, where it is extensively cultivated, as well as in the West Indies. Commercial grades are known as *Malabar*, *Singapore*, *Penang*, *Sumatra pepper*, etc. The berries are collected while red, before they have fully matured, and when dried, form the *black pepper* of commerce; when allowed to ripen, and then divested of their husks by being soaked in water, dried, rubbed and winnowed, they constitute *white pepper*, which is less pungent and aromatic than the black. Sumatra and Java furnish the principal portion of the black pepper met with in this country and Europe. The berries, which are about the size of a currant, are officially described as "globular, about 4 Mm. ($\frac{1}{6}$ inch) in diameter, reticulately wrinkled, brownish-black or grayish-black, internally lighter, hollow, with an undeveloped embryo; odor aromatic; taste pungently spicy"—(*U. S. P.*). Alcohol or ether extracts their virtues completely; water only partially.

Chemical Composition.—The sharp taste of pepper is due to the presence of about 6 to 8 per cent of the weak alkaloid *piperine* ($C_{17}H_{19}NO_3$) which in substance is almost tasteless, but develops its sharp taste when in solution. White pepper seems to contain even more piperine than black. Piperine, when boiled with alcoholic caustic potash, is decomposed into the potassium-salt of *piperic acid* ($C_{12}H_{10}O_4$), and into the powerfully basic *piperidine* ($C_5H_{11}N$) (see *Piperinum*). According to T. Weigle (*Chem. Zeitung*, 1893, p. 1365), the sharp taste of the fresh fruit is produced by the piperine being dissolved in the essential oil; old fruits taste less sharp owing to partial resinification of the essential oil and consequent partial crystallization of piperine. The odor of the fruit is due to the essential oil (*oil of pepper*) which is devoid of sharp taste. From 1 to 2.3 per cent may be obtained from the powdered fruit by distillation with water. It is colorless to yellowish green, slightly lævo-rotatory and has a specific gravity of 0.880 to 0.905 Its principal constituent is *lævo-phellandrene* (Schimmel & Co., 1890). The pepper fruit also contains cellulose, large quantities of starch (as much as 32 per cent), some coloring matter and a viscid, non-saponifiable, tasteless and almost odorless oil ($C_{10}H_{16}O_4$), probably formed from the essential oil by oxidation. It is soluble in alcohol of 90 per cent, in ether, and petroleum ether; piperine is hardly soluble in the latter solvent (Weigle). Pepper fruit dried at 100° C. (212° F.), leaves from 3.2 to 5.7 per cent of ash; its average is 4.5 per cent. Tannin is absent in the pepper fruit. Buchheim (1876) obtained from the pepper fruit, besides *piperine*, an amorphous alkaloid *chavicine* soluble in alcohol, ether and petroleum ether. Alcoholic caustic alkali decomposes it into the alkali salt of *chavicic acid*, and *piperidine* (compare *Piperinum*).

Adulterations and Tests.—Falsification of the whole pepper fruit is of rare occurrence. It may be found occasionally admixed with the fruit of cubebs, allspice, piper longum, etc. A globular iron ore (*bean-ore*) has been reported as an adulterant of whole pepper (*Chem. Zeitung*, 1889, p. 1030). Adulteration of powdered pepper may be recognized by the microscope and by chemical methods. The determination of ether extract, representing the piperine and resin, in conjunction with the determination of ash may be useful in deciding the purity of a given sample. Mr. J. E. S. Bell (*Amer. Jour. Pharm.*, 1888, p. 481) found sixteen out of twenty samples of pepper, mostly from American markets, to be pure. The ether extract in the four impure samples varied from 3.29 to 4.11 per cent, the ash from 7.25 to 8.59 per cent, while in pure pepper it varies from 3 to 5 per cent The highest yield of ether extract was 7.85 per cent. Genuine black pepper should yield 7.66 per cent piperine (Niederstadt). T. F. Hanausek (1884) mentions among adulterants of powdered pepper, crust of bread, flour, linseed cake, acorn meal, sawdust, powdered olive kernels; of late (1898), powdered exhausted coriander fruit, less frequently mineral matters, such as sand, gypsum, etc. Mr. F. A. Hennessy (*Amer. Jour. Pharm.*, 1890, p. 276) reports on the wholesale manufacture of "spice mixture" from a low grade of wheat flour. Also see an interesting article on "poivrette," an adulterant of powdered pepper made from olive kernels, in *Amer. Jour. Pharm.*, 1887, p. 146. (For a detailed consideration of the microscopical and chemical analysis of pepper, see J. König, *Die Menschl. Nahrungs- und Genussmittel*, 3d ed., 1893, p. 673; also see literature in Flückiger's *Pharmacognosie*, 3d ed., 1891, p. 914.)

Action, Medical Uses, and Dosage.—Pain and redness are the results of the local application of powdered pepper. Internally administered it excites in the mouth and fauces a burning sensation, warms the stomach and slightly quickens the circulation. Abdominal heat and burning, marked thirst, vomiting, fever, and sometimes convulsions follow an excessive dose. It may produce an urticaria, which, however, soon disappears. Large doses increase renal activity and irritate the urinary tract. Black pepper is a gastro-intestinal stimulant, and is much used as a condiment to improve the flavor of food, and to favor its digestion by stimulating the stomach. It has been advantageously used as a carminative to remove *flatulency*, and to correct the nauseating or griping quality of other drugs, and is sometimes added to quinine in cases where the stomach, from torpidity or other cause, is not acted upon by the quinine alone. It has been recommended as a remedy in *intermittents*, but very often fails, though it nearly always materially assists the action of quinine. As a gastric stimulant it is very valuable in *congestive chill*, *cholera morbus*, and associated with hydrastis, nux vomica, or other stomachic bitters is effectual in *atonic dyspepsia*. Combined with macrotys it has rendered good service in *atonic amenorrhœa* and *dysmenorrhœa*. The unbroken seeds of white pepper taken in teaspoonful doses 2 or 3 times a day, have been recommended to overcome the *obstinate constipation of dyspeptics;* they are, however, rarely used at present.

The dose of black pepper is from 1 to 15 grains. Prof. Scudder, with whom black pepper was a favorite drug, directs from 1 to 10 drops of the following tincture: Take finely ground black pepper, ℥viii; alcohol, 98 per cent, Oj. Pack the drug in a percolator, moisten with a portion of the alcohol, allow it to stand a day, and then pass through it the remaining portion of alcohol.

Specific Indications and Uses.—Gastric atony; congestive chills.

Related Peppers.—LONG PEPPER. This pepper is derived from two species of Piper, *Piper officinarum*, De Candolle (*Chavica officinarum*, Miquel), producing the Java long pepper, and *Piper longum*, Linné (*Chavica Roxburghii*, Miquel) producing the India long pepper. Both species grow in the islands of the Indian Ocean, the latter species also in the Philippine Islands, in southern India, Malabar, Bengal and Ceylon.

The *Java long pepper* grows in cylindrical aments consisting of a multitude of minute ovoid berries, each $\frac{1}{10}$ of an inch long, densely arranged in spiral form around a common axis, the whole spike being about $1\frac{1}{2}$ to 2 inches long and $\frac{1}{4}$ inch thick and of an ashen gray color. When washed they are reddish brown. The fruits are collected before maturity, dried in the sun, and have a mild aromatic odor but a pungent, aromatic taste.

India long pepper is of similar growth, but its spikes are shorter, only from 1 to $1\frac{1}{2}$ inch in length, and the fruits are less pungent. Its aromatic taste and odor are gradually developed upon drying. It is less esteemed than the Java variety. Long pepper contains piperine (Winkler, 1828; Flückiger, *Pharmacognosie*, 1891), and yields upon distillation with water, 1 per cent of a bland, thickish, yellow-green oil of specific gravity 0.861, and resembling ginger in odor. Long pepper is rarely used medicinally in the United States.

Piper Novæ-Hollandæ.—Australia. The berries of this pepper contain an essential oil reputed useful in *gonorrhœa* and related disorders.

PIPER METHYSTICUM.—KAVA-KAVA.

The root of *Piper methysticum*, Forster (*Macropiper methysticum*, Miquel).

Nat. Ord.—Piperaceæ.

COMMON NAMES: *Ava*, *Kava-kava*, *Intoxicating long pepper*, *Ava pepper shrub.*

Botanical Source and History.—This is a shrub about 6 feet high, somewhat resembling the bamboo in growth, a native of and common in cultivation in the South Sea Islands. It was discovered by James Cook, the celebrated explorer, in 1769, in the Tahiti Islands. The leaves (see illustration in *Pharm. Jour. Trans.*, 1876, p. 149) are alternate, cordate, with a wavy, entire margin, and an abrupt, acute point. The petiole is about an inch long, dilated at the base, and furnished with linear, erect stipules. The veins are prominent, about 12, diverging from the base of the leaf-blade. The flowers are small, apetalous, and arranged on slender spikes. Those bearing male flowers are axillary and solitary. The female spikes are numerous. This shrub is known in its native country under the names *Kava*, *Ava*, *Arwa*, *Ava-kava*, *Kava-kava*, etc., and is the "Intoxicating Long Pepper," from which a disgusting drink is prepared by the natives, and even by the whites, of these islands. This drink is invariably made by chewing the root of the plant to a pulp, covering this with water, macerating a short time, and then straining it through "fow," a fibrous material obtained from the bark of a certain native tree. The taste is said to resemble soap-suds and tannin. (For the methods of its preparation by the natives and its uses, see an interesting illustrated paper by Dr. R. H. True, in *Pharm. Review*, 1896, p. 28; also see T. R. N. Morson's abstract from Mariner's History of the Tonga Islands, in *Pharm. Jour. Trans.*, Vol. III, 1844, p. 474; and Dr. Seeman's Letters from the Fiji Islands, in the *Althenæum*, 1861.) The leaf is chewed with the betel-nut, and the dried root, under the name *pipula moola*, forms an article of commerce in India.

Description.—The root is the part recommended for use in medicine. Of the lot inspected by us, the main root seems to have grown horizontally beneath the surface of the ground, sending up stalks at intervals of from 2 to 4 inches. Each stalk is from ½ to 3 inches in diameter at the base, and is hollow. The cavity extends through the main root, thus giving to a longitudinal section of the root the appearance of several separate roots having grown together. Externally, the main root is brown, and covered with a thin bark. From the sides and lower part are secondary roots, about ½ to ¾ of an inch in diameter. These appear to be arranged about the bases of the stalks; in some cases they are quite long, and commence to send out rootlets at a distance of 6 inches from the main root. Internally, the large root is covered with a network of fibers beneath the bark. Coarse medullary rays compose the body. The root breaks with a fibrous fracture; it is frequently much worm-eaten internally, though, to an external examination, apparently sound. After chewing a little of it, a peculiar, acrid, benumbing sensation is imparted to the parts of the mouth with which the pulp comes in contact. This property is possessed in a much greater degree by the small rootlets.

Chemical Composition.—The chief constituent of kava-kava root, amounting to 49 per cent, is starch (Gobley, 1860). It also contains about 1 per cent of a neutral, tasteless, crystallizable principle called *kavahin* or *methysticin* (Morson, 1844; Cuzent, 1860). It is hardly soluble in cold water, easily soluble in alcohol and ether. C. Pomeranz (*Chem. Centralbl.*, 1890, p. 124) found *methysticin* ($C_{15}H_{14}O_5$) to be the methyl ester of *methysticic acid* ($C_{14}H_{12}O_5$) which stands in close relationship to *piperic acid* of Fittig and Mielck (see *Piperinum*). Dragendorff (*Heilpflanzen*, 1899) differentiates *methysticin* from *kavahin*, stating the latter to be *methylene protocatechuic aldehyde* (which is the chemical name for *heliotropin* or *piperonal*). An alkaloid, *kavaine*, was isolated in 1889 by Lavialle (*Amer. Jour. Pharm.*, 1889, p. 136). The active principle of kava-kava consists, however, in an acrid resin (2 per cent, Gobley, 1857) which was differentiated by Lewin (*Pharm. Centralhalle*, 1886, p. 72) into *alpha-resin*, which is a strong local anæsthetic, and the less active *beta-resin*.

Action, Medical Uses, and Dosage.—The root of Piper methysticum has a pleasant, somewhat lilac odor, and a slightly pungent, bitter and astringent taste, which augments the salivary discharge. It has marked general and local anæsthetic properties. It has been employed as a pleasant remedy in *bronchitis*, *rheumatism*, *gout*, *gonorrhœa*, and *gleet*, and has also been recommended as a powerful sudorific. It appears to exert its influence more especially upon diseased mucous membranes, and may be found useful in *chronic catarrhal affections* of various organs, and in *chronic inflammation of the neck of the bladder*. The action of the root varies, according to the amount taken; in small doses, it is tonic and stimulant; while in large doses it produces an intoxication, which, unlike that from alcohol, is of a reserved, drowsy character, and attended with confused dreams. The natives who use its infusion as an intoxicating beverage for a considerable length of time, are said to become affected with a dry, scaly, cracked, and ulcerated skin, and vision becomes more or less obscured. According to Kesteven, leprous ulcerations may be produced by its habitual use. M. Dupouy, who has given considerable attention to the therapeutical virtues of this drug, arrives at the following conclusions: Given in drink, kava is a sialagogue, but is not sudorific. In medicinal doses, it acts upon the stomach, similar to the bitter stimulants, increasing the appetite, without occasioning diarrhœa or constipation, and may prevent catarrhal affections of this portion of the digestive tube. It exerts a special stimulation upon the central nervous system, differing essentially from ethylic intoxication; and, as its taste is agreeable, one soon becomes a proselyte to it. It has a very powerful action upon aqueous diuresis, and may be classed among the most efficient diuretics. It does not occasion priapism, but, on the contrary, antagonizes it. It is endowed with remarkable and prompt blennostatic properties, augmenting the discharge previous to effecting its cure. It is of undoubted efficiency in *acute vaginitis* or *urethritis*, allaying the inflammation, causing the pain during micturition to disappear, when dysuria is present, and suppressing the mucopurulent catarrh from the vesico-urethral mucous membrane. It has, over other blennostatic agents, the marked advantages of being pleasant to take, of augmenting the appetite, of occasioning neither diarrhœa nor constipation, of alleviating or entirely subduing pain during urination, of completely changing the character of the discharge, and of effecting the cure in a very short time—10 or 12 days. He can not too highly recommend its employment, especially in the treatment of *gonorrhœa*. Ellingwood (*Mat. Med.*, 1898) declares it of great value in subacute and slow forms of gonorrhœa, and especially in *gleet*. It is a remedy for *nocturnal incontinence of urine* in the young and old, when due most largely to muscular weakness.

The anticatarrhal action is probably due to the resin present, and the diuretic effects to the neutral crystallizable principle, methysticin or kavain. There may likewise be present some other active principle, not yet detected, to account for certain other influences following its employment. Piper methysticum has been successfully employed in *atonic dyspepsia* and in *neuralgic* or *spasmodic dysmenorrhœa*. Prof. Webster (*Dynam. Therap.*) regards it as our most reliable remedy for *neuralgia*, particularly of the parts supplied by the fifth cranial nerve, as in *dental neuralgia* (when not due to exposure of the dental pulp), *neuralgic affections of the eyes*, *ears*, etc., and in *reflex neuralgias* in other parts of the body, as *gastric* and *intestinal neuralgia*, *abdominal neuroses*, from prostatic, urethral, or testicular disorders, and pectoral pain due reflexly to *nervous dyspepsia*. He also suggests its employment in *renal colic*. Piper methysticum has proved useful in *dropsy*, *intestinal catarrh*, and in *hemorrhoids*. Sixty or 70 grains of the scraped root, macerated for about 5 minutes in a quart of water, may be taken in the course of 24 hours, repeating this quantity daily, as long as required. The dose of the fluid extract of the root is from 15 to 90 minims, in a glass of water, repeating the dose every 3 or 4 hours; specific piper methysticum, 5 to 30 minims.

Specific Indications and Uses.—Neuralgia, particularly of the trifacial nerve; toothache; earache; ocular pain; reflex neuralgia; anorexia; dizziness and despondency; gonorrhœa; chronic catarrhal inflammations; vesical irritation; painful micturition; dysuria.

Related Species—*Piper Betle*, Linné. An indigenous East Indian creeper, the leaves of which, together with the areca nut (also called betel nut), and the addition of lime and sometimes catechu, constitute the celebrated masticatory of the Asiatics, the richer natives adding such aromatics as cloves, camphor, cardamoms, nutmegs, etc. Betel leaf, masticated, exerts a gently stimulant and exhilarant effect, and such is its power that, when deprived of it, its habitué experiences a sense of languor and fatigue. (See an interesting illustrated article, by Dr. Rodney H. True, on the subject of betel chewing, in *Pharm. Review*, 1896, pp. 130 and 177.) It has several medicinal applications among the natives, being especially used to harden the gums, preserve the teeth, and sweeten the breath. It is said to improve the voice, and is reputed aphrodisiac. (For Indian uses of the drug, see either Dymock's *Materia Medica of Western India*, or Dutt's *Hindu Materia Medica*.) Piper Betle leaves are about 5 inches long, broad-ovate, obliquely heart-shaped at base, acuminate, 5 to 7-nerved, and leathery. Their upper surface is glossy. They have an aromatic, bitter, burning taste. Betel leaves contain an essential oil, the composition of which differs according to the geographical source of the leaves. Eykman (1889) found the oil from Java leaves to contain a peculiar phenol which he called *chavicol* ($C_6H_4.C_3H_5.OH$, *para-allyl-phenol*). The characteristic constituent of all betel oils, however, is *betel phenol* (Bertram and Gildemeister, 1889), an isomer of *eugenol* (see *Oil of Cloves*). Siam betel oil also contains the sesquiterpene *cadinene* ($C_{15}H_{24}$). (For interesting details, see Gildemeister and Hoffmann, *Die Ætherischen Oele*, 1899, p. 426; also see Dymock, *Mat. Med. of Western India;* and article under *Areca*).

PIPERAZINUM.—PIPERAZINE.

FORMULA: $C_4H_{10}N_2$. MOLECULAR WEIGHT: 85.9.

SYNONYMS: *Piperazidine*, *Diethylene-diamine*, *Ethylene-imine*, *Dispermine*, *Hexahydro-pyrazine*.

Preparation.—This substance, once thought to be identical, chemically, with spermine, may be produced when ethylene bromide (or chloride) is acted upon by ammonia, and the product of the reaction subjected to fractional distillation. The fraction, distilling between 130° and 180° C. (266° to 356° F.), deposits, on cooling, crystals of piperazine (A. W. Hofmann). (For the process of W. Majert and A. Schmidt, see *Amer. Jour. Pharm.*, 1893, p. 188.)

Description.—Piperazine, a patented preparation of R. Schering, forms crystalline, colorless masses; when crystallized from water, it forms lustrous, glass-like, tabular crystals. Exposed to the atmosphere, it rapidly absorbs carbon dioxide, and is very deliquescent. It fuses between 104° to 107° C. (219.2° to 224.6° F.), although the true melting point seems to be 112° C. (233.6° F.). It boils at about 145° C. (293° F.). Alcohol does not dissolve it as readily as water, in which it is very soluble. Its aqueous solution has a distinctly alkaline reaction. Chemically, it stands in close relation to *piperidine* (see *Piperinum*), as the two formulæ here given will show: $CH_2:(CH_2.CH_2)_2:NH$ (piperidine); $NH:(CH_2.CH_2)_2:NH$ (piperazine). It forms a characteristic, insoluble, red double salt with bismuth iodide. It unites with uric acid to form a compound soluble in 50 parts of water, hence is thought to be more valuable than lithium carbonate, for the removal of uric acid in excess from the body, on account of its greater solvent action. Its hydrochlorate forms lustrous, silky needles, and is likewise very soluble in water.

Action, Medical Uses, and Dosage.—Marked physiological effects are not produced by ordinary doses of piperazine. This agent appears to be a solvent of great power for uric acid, and is, therefore, a remedy for the conditions hinging upon a *uric acid diathesis*. It also dissolves *phosphatic* and *oxalic concretions*. The cases for its exhibition are those in which there is a persistent oversecretion of uric acid and urates, with dry skin, sickening backache and general muscular aching, and scanty secretion of urine of high specific gravity and with brick-dust deposits. With such conditions, it relieves *acute rheumatism*, *rheumatic pericarditis*, *gout*, and *chronic rheumatic arthritis*. It has recently been found of much value in *acute* and *chronic gonorrhœa*, and in *purulent cystitis*, daily doses of 10 grains having been employed in carbonated water (Tison and Attaix, *Gaz. Méd. de Strasbourg*, 1896). For ordinary use, about 3 grains every 3 hours, or 5 grains 3 times a day, in water or carbonated water, will be the proper dosage (Ellingwood).

Related Preparations.—LYCETOL, *Dimethylpiperazine tartrate*. A permanent white powder, melting at 243° C. (469.4° F.), and obtained by expelling the water of crystallization (3 molecules) from the well-crystallizable salt; it is readily soluble in water, with a pleasant acidulous taste (For its preparation and properties in detail, see *Pharm. Centralhalle*, 1894, p. 180.) This remedy, in doses of 15 to 30 grains, well diluted, daily, is praised as a decided uric acid solvent, and of therapeutic value in the various phases of *gout*, *lithæmia*, *chronic rheumatism*, *renal calculus*, and *renal colic*.

UROTROPIN, *Hexamethylene tetramine* ($C_6H_{12}N_4$).—This agent is produced by the action of ammonia upon formaldehyde. It forms white crystals, readily soluble in water, but difficultly soluble in alcohol. The aqueous solution has a pleasant, sweetish taste, and the drug is excreted by the kidneys unchanged. This agent, in doses of 15 to 30 grains, is said to be a very positive remedy in *phosphaturia*, and *purulent cystitis* and *pyelitis*. Sixty grains, well diluted with water, may be given in a day.

PIPERINUM (U. S. P.)—PIPERIN.

FORMULA: $C_{17}H_{19}NO_3$. MOLECULAR WEIGHT: 284.38.

"A neutral principle obtained from pepper, and obtainable also from other plants of the natural order *Piperaceæ*"—*U. S. P.*).

Source, History, and Preparation.—Piperin, the active principle of pepper (see *Piper*), exists in the black, white and long pepper, and in the berries of *Cubeba Clusii*, Miquel. It was first obtained by Oersted, of Copenhagen, in 1819, who believed it to be an organic base. Pelletier (1821) proved, however, that it is a non-basic principle. It may be isolated by various methods. According to Cazeneuve and Caillol (*Jahresb. der Pharm.*, 1877, p. 68), powdered pepper is mixed with milk of lime, the mixture evaporated to dryness on the water-bath, and extracted with ether. This solvent upon evaporation leaves piperin in the form of impure crystals, which are purified best by crystallization from acetone (Flückiger, 1891). Sumatra pepper yielded Cazeneuve, on an average, 8.10 per cent; Singapore white pepper, 9.15 per cent of piperin. T. Stevenson (see *Amer. Jour. Pharm.*, 1885, p. 513) prepares an extract from 50 grammes of pepper with methyl alcohol, dissolves out the resinous portion by means of potassium carbonate; the residual piperin is washed with water and recrystallized from alcohol.

Description and Chemical Composition.—*Piperin* ($C_{17}H_{19}NO_3$) is described by the *U. S. P.* as forming "colorless or pale yellowish, shining, prismatic crystals, odorless, and almost tasteless when first put in the mouth, but on prolonged contact producing a sharp and biting sensation. Permanent in the air. Almost insoluble in water; soluble in 30 parts of alcohol at 15° C. (59° F.), and in 1 part of boiling alcohol; very soluble in hot acetic acid; only slightly soluble in ether. When heated to 130° C. (266° F.) piperin melts; upon ignition it emits alkaline vapors, and is consumed, leaving no residue. The alcoholic solution of piperin is neutral to litmus paper. Concentrated sulphuric acid dissolves piperin with a dark blood-red color, which disappears on dilution with water. When treated with nitric acid, piperin turns rapidly first orange and then red, and the acid acquires a yellow color, deepening to reddish as the crystals dissolve. On adding to this solution an excess of potassium hydrate T.S., the color is at first yellow, but upon boiling it becomes blood-red"—(*U. S. P.*). Piperin is also soluble in chloroform, benzol, carbon disulphide, but almost insoluble in petroleum ether. Piperin has only weak basic properties, being hardly soluble in dilute acids. With hydrochloric acid and platinic chloride, however, it forms a well crystallizable double salt. Piperin is not decomposable even by boiling solution of caustic potash (Gerhardt); but prolonged heating with alcoholic solution of caustic potash decomposes it into *piperidine* and the *potassium salt of piperic acid* (v. Babo and Keller), according to the following equation: $C_{17}H_{19}NO_3+KOH = C_{12}H_9O_4K+C_5H_{11}N$. *Piperin*, reversedly, was synthetized from these constituents by L. Rügheimer (1882). *Piperic acid* ($C_{12}H_{10}O_4$), being nearly insoluble in water, may be precipitated from the solution of its potassium salt by the addition of hydrochloric acid, and recrystallized from alcohol. The acid forms yellow crystals, melting at 150° C. (302° F.). According to Fittig and Mielck (1869), it has the formula: $CH_2{:}O_2{:}C_6H_3.CH{:}CH.CH{:}CH.COOH$. The potassium salt by oxidation yields *piperonal* (which see). *Piperidine* ($C_5H_{11}N$) is a volatile, strong base, which may be separated in the above reaction by distillation with steam and collecting the vapors in dilute acid. It has the odor of ammonia and pepper, and forms well crystallizable salts with acids. Ladenburg, in 1885, succeeded in obtaining piperidine by synthesis, proving it to be *hexa-hydro-pyridine* ($C_5H_5N.H_6$, or $CH_2{:}[CH_2.CH_2]_2{:}NH$).

Action, Medical Uses, and Dosage.—Formerly this agent was frequently substituted for or used in conjunction with the cinchona alkaloids in the treatment of *malarial fevers*. Piperin is now occasionally employed in *intermittent fever*, but will be found less efficient than the alcoholic extract of black pepper. Its use has also been advised in *colic*, *diarrhœa*, *cholera*, *scarlatina*, *chronic gonorrhœa*, and in solution as a wash for *tinea capitis*. Piperin should not be administered with astringents, as it is thereby rendered nearly inert. The dose is 1 to 8 grains, 3 or 4 times a day (see *Piper*).

Derivative of Piperin.—PIPERONAL, or HELIOTROPIN ($C_8H_6O_3$). This compound is an aldehyde, the methylene ether of protocatchuic aldehyde, and has the formula: $CH_2{:}O_2{:}C_6H_3.CHO$. Its corresponding acid ($CH_2{:}O_2{:}C_6H_3.COOH$) is called *piperonylic acid*. Piperonal is obtained by oxidizing the potassium salt of *piperic acid* (see *Piperinum*; also see *Piper Methysticum*) with potassium permanganate in neutral solution. It forms small, white crystals, soluble in alcohol and ether, but sparingly soluble in cold water (1 in about 600). It resembles coumarin and vanillin in odor, and is now manufactured for purposes of perfumery; but it has also been given medicinally in 10 to 15-grain doses, every 3 hours, as an antipyretic and an antiseptic.

PISCIDIA.—JAMAICA DOGWOOD.

The bark of the root of *Piscidia Erythrina*, Jacquin.

Nat. Ord.—Leguminosæ.

COMMON NAME: *Jamaica dogwood.*

ILLUSTRATION: Nuttall's *North American Sylva*, Plate 52.

Botanical Source and History.—This is a small tree, native of the West Indies, and known as Jamaica dogwood. It is rarely found in southern Florida. The

Fig. 200.

Piscidia Erythrina.

flowers are in lateral clusters, appearing in profusion before the leaves. They have a broad, bell-shaped, 5-toothed calyx, and a papilionaceous corolla, of a dirty white color tinged with purple. The leaves are unequally pinnate, with entire, oval, acute leaflets, resembling those of the coffee-nut tree. The fruit is a 4-winged legume. The bark of the tree is very astringent, and is said to have been used in tanning. It is much employed in its native country as a fish poison (whence the generic name of the tree). It seems to act upon the lower animals as a poisonous narcotic.

Description.—Piscidia bark comes in quilled pieces, or in curved or flat sections. The corky layer is of a vivid orange (occasionally whitish) color, and is rugose, or appears fissured. Upon removal of the cork a deep ashen-gray surface appears, somewhat tinted with a brownish or blackish shade, and is marked with sinuous, longitudinal striæ, as well as by small ridges transversely arranged. Internally, it is smooth (sometimes fibrous) and of a brownish hue. The interior of the bark is bluish-green or brown-green, probably due to chlorophyll. It breaks with a fibrous, tough fracture, giving a narcotic, opium-like odor, and its taste, though slight at first, soon becomes acrid and bitter.

Chemical Composition.—The bark exhibits crystals of apparently oxalate of calcium, which, however, are phosphate of calcium (Berberich, 1898). According to Edward Hart (*Amer. Jour. Pharm.*, 1883, p. 369), the active principle is a neutral body, *piscidin* ($C_{29}H_{24}O_8$), which is neither a glucosid nor an alkaloid. It is produced by mixing 1 pound of the fluid extract of piscidia with 30 grammes of slaked lime, digesting for ½ hour, filtering, adding water in small amounts until the liquid becomes turbid; upon standing for 2 or 3 days the crystalline principle falls out, contaminated with some resin. They are finally recrystallized by means of alcohol. The principle occurs in prismatic, nearly colorless crystals, readily soluble in chloroform, boiling alcohol, and benzol, sparingly in cold alcohol and ether, insoluble in water. The crystals are also dissolved by strong acids, and from this solution are precipitated, apparently unchanged, by the addition of water. Its melting point is 192° C. (377.6° F.). These results were fully confirmed more recently by H. Berberich (*Amer. Jour. Pharm.*, 1898, p. 424), who made a complete analysis of the bark. Beside the active principle, *piscidia* (*piscidin*), some resin, caoutchouc, wax and fat, starch (1.34 per cent), were present; tannin was not found.

Action, Medical Uses, and Dosage.—Jamaica dogwood possesses active properties, its chief uses being to control pain and to produce sleep. Dr. Isaac Ott (see *Pharmacology of Newer Materia Medica*, p. 597), who made extensive experiments with the drug, declares its physiological effects to be essentially as follows: It increases the salivary and cutaneous secretions; slows the pulse, increases the arterial tension, succeeded by a fall of tension due to a weakening of the heart; dilates the pupils, except when passing into a state of asphyxia, when contraction takes place; it does not affect the irritability of the motor nerve fibers, nor does it attack the peripheral sensory nerve endings; it reduces reflex action by stimulating Setschenow's centers, and induces a tetanoid condition by stimulation of the spinal marrow; finally, he pronounces it narcotic to frogs, rabbits, and men. Piscidia destroys life by causing heart failure or by arresting respiratory action. Unpleasant results have been occasioned by even small doses of piscidia; among these are nausea, vomiting, headache, etc. Convulsions were provoked in the case of a woman who had been given a ½-drachm dose for hemicrania. The drug is recommended to replace opium, chloral, and similar narcotics. Dr. Hamilton (Burnett's *Outlines*, p. 684) states that a tincture of the bark of this tree is, the same as the bark itself, astringent and irritating. He also observes that it is most powerfully and remarkably narcotic and diaphoretic, and that its local application is a specific in removing *toothache*. For the latter purpose it has also been applied locally and given internally at the same time, in *irritation of the dental pulp, inflammation of the peridental membrane, alveolar abscess*, as well as in other painful affections of the mouth. *Burns, scalds* and *hemorrhoids* have been relieved by it, while a solution of it has been recommended as an injection in *gonorrhœa* (Fearn). Internally administered, it relieves pain, overcomes spasm, allays nervous excitability, and induces sleep. It is a favorite remedy in prolonged *insomnia*, particularly in the aged, and in those of an excessively nervous temperament. It should at least be given the preference over opiates until its utility or non-utility is established. It has rendered good service in *neuralgia*—particularly *sciatica, abdominal neuralgia, renal neuralgia, migraine*, and *tic-douloureux*. It allays the pain of *cholera morbus*, and the *gastro-enteralgia* sometimes following *enteric fever*. It also relieves *painful spasms of the muscles* and *acute articular* and other forms of *rheumatism*. In the disorders of women it has rendered excellent service in alleviating neuralgic and other forms of *dysmenorrhœa* and in various *pelvic neuroses*. With viburnum, it has been administered to check *false labor-pains* and *threatened abortion*. *Hysterical convulsions, delirium tremens* and the *insomnia of insanity* have yielded to it. In the pain of *carcinoma* and that attending *fractures*, it has been preferred by some to opium and other anodynes. It relieves the spasmodic element of *pertussis* and *asthma*, and has been lauded for *reflex coughs* and the cough of *spasmodic* and *chronic bronchitis*, and *pulmonary consumption*. Foltz (Webster's *Dynam. Therap.*, p. 595) praises it in *neuralgia of the eyeball* (where opium was not tolerated) and in *supraorbital neuralgia*, the dose given being from 10 to 20 drops of the fluid extract every 2 or 3 hours. He speaks lightly of it for the relief of pain in *acute catarrh of the tympanum*. Others speak highly of it in *acute abscess of the external auditory canal* and in *iritis, panophthalmitis*, and other inflammatory and painful affections of the eye. The dose of the fluid extract ranges from 10 drops to 2 fluid drachms; of specific Jamaica dogwood, 10 to 60 drops.

Specific Indications and Uses.—Insomnia and nervous unrest; to allay spasm, control pain and allay nervous excitability: migraine; neuralgia.

PIX BURGUNDICA (U. S. P.)—BURGUNDY PITCH.

"The prepared, resinous exudation of *Abies excelsa*, Poiret"—(*U. S. P.*). (*Abies excelsa*, De Candolle; *Pinus excelsa*, Lamarck; *Picea excelsa*, Link; *Pinus Picea*, Du Roi; *Pinus Abies*, Linné.)

Nat. Ord.—Coniferæ.

Common Names: *Norway pine, Spruce fir, Norway spruce fir.*

Illustrations: Bentley and Trimen, *Med. Plants*, 261; Woodville, *Med. Bot.*, 208.

Botanical Source.—This tree inhabits northern Germany, the Alps, Russia, Norway, and other northern parts of Europe, as well as of Asia, and also grows now in this country. It is a large tree, often having a diameter exceeding 4 feet, and attaining an altitude of 140 feet. The leaves are somewhat tetragonal, short, scattered, mucronate, dark-green, and glossy above. The male catkins are solitary, growing out of the axils, and purplish; the scales staminiferous at the apex. The female catkins are simple, purple, growing from the summit; the ovaries 2; the cones cylindrical, pendent, with oval, imbricated, slightly indented scales. The *Polyporus officinalis*, or *Larch agaric*, is a fungus nourished on this tree.

Though only the *Abies excelsa*, Poiret, is given as the official source of this drug, it is also prepared from the concretions formed upon *Abies Picea* (*Pinus Picea*, Linné; *Pinus pectinata*, De Candolle) (see below). The term Burgundy pitch is a misnomer, since no such substance has ever been produced in Burgundy. In France, resin is produced from *Pinus maritima*, Poiret (*P. Pinaster*, Aiton and Lambert). The bulk of true Burgundy pitch comes from Finland, and smaller quantities at one time came from the Black Forest in Germany, and from Vienna (see D. Hanbury, *Amer. Jour. Pharm.*, 1867, p. 547). The resin from which Burgundy pitch is prepared, is collected by making longitudinal incisions into the bark of the trees. The exudate is called *Abietis resina*, *Thus*, or *Frankincense* (a term also applied to *Olibanum*), and forms concrete tears, consisting of resin and volatile oil similar to oil of turpentine. An exudate, formerly collected in Alsatia from the same tree, and known under the name of *Strassburg turpentine*, is now obtained on a small scale only (see *Terebinthina*). Burgundy pitch proper is prepared from the exudate by boiling it in water and straining it. In composition, it largely consists of *abietic acid*.

Description.—Burgundy pitch is officially described as being "hard, yet gradually taking the form of the vessel in which it is kept; brittle, with a shining, conchoidal fracture, opaque or translucent, reddish-brown or yellowish-brown, odor agreeably terebinthinate; taste aromatic, sweetish, not bitter. It is almost entirely soluble in glacial acetic acid, or in boiling alcohol, and partly soluble in cold alcohol"—(*U. S. P.*). Burgundy pitch softens by the warmth of the hand. Much of the article now found in commerce is a concoction. D. Hanbury (1867) believes it to be obtained by melting together common resin with palm oil or other fats, water being stirred in to produce an opaque appearance. The characteristic odor of true Burgundy pitch, and its nearly complete solubility in alcohol, and especially in glacial acetic acid, may aid in establishing some of its possible sophistications.

Action and Medical Uses.—Burgundy pitch is generally used externally for the purpose of producing a redness of the surface with a slight serous exhalation. Occasionally, it produces an eruption of pimples, sometimes minute blisters, and in some rare instances has been known to cause hardness, considerable suffering, and irritation, terminating in one or more ulcers. It has been principally employed as a counter-irritant in *chronic diseases*, especially of the lungs, stomach, intestines, etc., as well as in *local rheumatic affections*. It enters into the composition of several salves and plasters.

Related Species.—*Abies Picea* (*Pinus pectinata*, De Candolle; *Abies pectinata*, Lamarck; *Pinus Abies*, Du Roi; *Abies alba*, Miller; *Abies excelsa*, Link; *Pinus Picea*, Linné; *Pinus taxifolia* of *French Codex*), *European silver fir*, *Silver pine*. This tree grows in the mountains of Siberia, Germany, and Switzerland (L.). Branches horizontal; leaves copious, linear, either acute or emarginate, entire, spreading more or less perfectly in two rows, sometimes curved to one side; upper surface of a dark, shining, rather glaucous green; under glaucous white. Male flowers numerous, axillary, solitary, about as long as the leaves, yellow; their axis the length of the toothed involucre; anthers remarkable for their rounded, 2-lobed crest, crowned with a pair of divaricated horns. Female catkins lateral, erect, cylindrical, green; bracts, much narrower than the capillary scales, distinguished by a long, projecting, awl-shaped point, very conspicuous in the full-grown cones, which are also erect, 3 or 4 inches long, cylindrical, of a reddish-green, till they turn brown in drying (L.). According to Tingley, this species alone furnishes the true *Burgundy pitch*.

Retinol.—This product, obtained in 1838, as resin oil or resinol, from Burgundy pitch, by destructive distillation, is a yellowish, oleaginous fluid, boiling above 280° C. (536° F.). It is not soluble in water, but is itself a solvent for many substances, such as numerous alkaloids, phosphorus, phenol, iodol, cocaine, aristol, salol, etc. It is a non-irritating antiseptic, and in 8-grain doses, in capsule, it has been used in *gonorrhœa*. Besides being a vehicle for the application of the substances named above, it has been injected (5 to 10 per cent solution) in *cystitis*, and used locally in *vaginitis*.

PIX CANADENSIS.—CANADA PITCH.

The prepared juice or resinous exudation from *Abies canadensis*, Michaux (*Tsuga canadensis*, Carrière; *Pinus canadensis*, Linné; *Picea canadensis*, Link).

Nat. Ord.—Coniferæ.

Common Names: *Canada pitch*, *Hemlock pitch*, *Gum hemlock* (improperly).

Botanical Source and Preparation.—Canada pitch is obtained from the oleoresinous exudate of the hemlock spruce tree (see *Abies canadensis* for botanical source). It is sometimes improperly termed *gum hemlock*.

Mr. F. Stearns (1859) reports that the resin is collected by two methods—either by cutting a cup-like cavity in the tree, allowing the oleoresin to accumulate therein, from which it is then collected; the more common method of producing pitch, however, is that of removing the bark and wood around the pitch-laden knots and gnarled portions, putting the pieces together into boiling water, skimming the resinous product from the surface of the water, and purifying by melting and straining a second time.

Description and Chemical Composition.—Purified Canada pitch or gum hemlock, is at first whitish, but gradually becomes darker colored, changing to a yellow, brown, or blackish color. It is pulverable, almost insipid, of a faint characteristic odor, unlike that of turpentine, and has the specific gravity 1.033. A gentle heat renders it soft and tenacious, and, when elevated to nearly 93.3° C. (200° F.), liquefies it. It consists of resin, the composition of which has not been studied, with a small quantity of volatile oil. An essential oil is also obtained by distilling with water the branches and leaves of the tree, about 8 pounds of which yield an ounce of the oil. It is known as *oil of hemlock*, or *oil of spruce*. The oil, according to Bertram and Walbaum (1893), contains *lævo-pinene* and *lævo-bornyl-acetate*. This result was verified by C. G. Hunkel (*Pharm. Review*, 1896) on a genuine specimen of oil distilled by himself. About 51 per cent bornyl-acetate was present (also see *Abies canadensis*). The leaves and bark of the root and the trunk also contain notable amounts of tannin (see analyses and description of hemlock tannin by Prof. H. Trimble, in *Some North American Coniferæ*, 1897, pp. 111–118). An aqueous extract of the bark is used by tanners.

Action and Medical Uses.—Canada pitch is a mild stimulant, and, when in contact with the skin for a few hours, causes a slight degree of redness. It is frequently substituted for Burgundy pitch, as it possesses similar virtues. The tincture of hemlock pitch is diuretic and stimulant. It is not so eligible for plasters, however, on account of its softness.

PIX LIQUIDA (U. S. P.)—TAR.

"An empyreumatic oleoresin obtained by the destructive distillation of the wood of *Pinus palustris*, Miller, and of other species of *Pinus* (*Nat. Ord.—Coniferæ*)"—(*U. S. P.*).

SYNONYM: *Resina empyreumatica liquida*.

Source and Preparation.—The trees generally employed in producing tar are, besides the above-named *Pinus palustris*, Miller, the American species, *Pinus rigida*, Miller, *Pinus Tæda*, Linné; and also the European species, *Pinus sylvestris*, Linné; and *Larix sibirica*, Ledebour (see *Terebinthina*). Tar is made in several northern countries of Europe (*e. g.*, Stockholm tar), and in the United States, especially in North Carolina and Virginia, from the waste of pine or fir timber; it is usually prepared by making a conical cavity in the earth, communicating at the bottom with a reservoir. Logs or billets of wood are then placed, so as not only to fill the cavity, but to form a conical pile over it, which is covered with turf or earth, and kindled at the top. The admission of air is so regulated, that the wood burns from above downward, with a slow and smothered combustion. The wood itself is reduced to charcoal, and the smoke and vapors formed are obliged to descend into the excavation in the ground, where they are condensed, and pass along with the liquefied matters into the receivers. This mixture is termed tar, *Pix liquida*. By long boiling or distillation in retorts, tar is deprived of its volatile ingredients (*Oil of Tar;* see *Oleum Picis Liquidæ*), and converted into pitch, *Resina nigra*, or *Pix nigra*.

Description and Chemical Composition.—The *U. S. P.* describes tar as "thick, viscid, semifluid, blackish-brown, heavier than water, transparent in thin layers, becoming granular and opaque with age; odor empyreumatic, terebinthinate; taste sharp, empyreumatic. Tar is slightly soluble in water, soluble in alcohol, fixed or volatile oils, and solution of potassium or sodium hydrate.

Water agitated with tar acquires a pale yellowish-brown color and an acid reaction, yields with ferric chloride T.S. a transient green color, and is colored brownish-red by an equal volume of calcium hydrate T.S."—(*U. S. P.*). Upon prolonged standing, tar becomes granular from the deposition of pyrocatechin. Tar is a very complex substance and varies in composition according to the method of preparation and the kind of wood employed. The tar from leaf-trees, *e. g.*, the beech, is rich in phenols (see *Creosotum*) while pine-wood tar contains more resinous matters. Pine-wood tar also differs from beech-wood tar in being miscible with melted lard. Coal tar differs from wood tar principally in containing more basic substances, such as aniline and quinoline, while wood, upon dry distillation, yields more acid products, *e. g.*, pyroligneous acid. (For constituents of wood tar, see *Acetic Acid* and *Creosotum.*)

Action, Medical Uses, and Dosage.—Tar is stimulant, diuretic and diaphoretic. It has been advantageously used in *chronic coughs*, *chronic bronchial* and *laryngeal affections;* the inhalation of its vapor acts as a stimulant and irritant to the bronchial mucous membrane, promoting its secretion, but is seldom used. It is chiefly used externally as a local application to some cutaneous affections, as *porrigo*, *tinea capitis*, *lepra*, *psoriasis*, *prurigo*, *eczema*, and *herpes circinatus*. Excellent results sometimes follow its employment in *suppurating burns*, *excoriations*, *furuncles*, *cracked nipples*, and *piles*. Oakum, a dressing sometimes impregnated with tar forms a good antiseptic absorbent for pus-bathed surfaces, and also to *obstinate ulcers*. It is an excellent antipruritic and that is its specific use. A *tar-water* has been recommended in *cough* and *bronchial affections*, and to prevent the reproduction of *boils*. It is prepared as follows: To ½ gallon of boiling water, add 1 pint of tar and 1 pint of honey; stir the mixture, and when cold strain off the liquid. It is stimulant and diuretic, and may be taken 3 or 4 times a day, in doses of a wineglassful. It will also be found beneficial as a wash in some forms of cutaneous disease. B. J. Crew recommends the following: Rub 2 drachms of oil of tar with 40 grains of carbonate of magnesium, add a portion of 14 ounces of water, mix well; and then add the balance, filter, and add simple syrup, 2 ounces. The dose is a small wineglassful, 3 times a day (*Amer. Jour. Pharm.*, Vol. XXVII, p. 13). (See also *Aqua Picis.*) M. Adrian gives the following formula for a *glycerinated tar*, which has the consistence of an ointment, and the advantage of being soluble in water, and of not adhering to the skin: Take of tar, 15 parts; glycerin, 15 parts; water, 30 parts. Mix. The French employ emulsions, syrups, wine, and concentrated alkaline solutions of tar, which, however, have not been introduced into the medical practice of this country. Internally, the dose of tar is from 30 to 60 grains, 3 or 4 times a day, or even oftener, but it is commonly used in the form of tar-water, 1 pint of which may be taken in a day.

Specific Indications and Uses.—Locally to itching surfaces.

Related Product.—PIX NAVALIS, *Pix nigra*, *Resina nigra*, *Pix solida*, *Resina pini empyreumatica; Pitch*, or *Black pitch*. This substance is obtained by evaporating or distilling off the more volatile constituents of wood tar; in the second case, *oil of tar* (see *Oleum Picis Liquidæ*) distills over and pitch remains as residue. It is a black, firm substance, having a faint, tarry odor, a brilliant fracture, softening by the warmth of the hand, melting in boiling water. It is soluble in alcohol, and in alkaline solutions, and consists of empyreumatic resin and colophony (*rosin*).

Pix nigra has been used internally in *ichthyosis*, and certain *obstinate diseases of the skin;* its dose is from 10 to 60 grains, and may be made into pills with flour or other farinaceous substance. Pereira says it may be taken to a great extent, not only without injury, but with advantage to the general health. In *piles* it has been used with great advantage in the form of the following ointment: Take of pitch, wax, resin, each, 10 ounces; olive oil, 1 pint. Melt them together, and express through linen, and when nearly cool, stir in four ounces of Scotch snuff.

PLANTAGO.—PLANTAIN.

The root and tops of *Plantago major*, Linné.

Nat. Ord.—Plantaginaceæ.

COMMON NAMES: *Plantain*, *Rib grass*, *Ripple-grass*, *Ribwort*.

Botanical Source.—This is a perennial acaulescent plant with a round scape 1 to 3 feet in height, arising from a fibrous root. The leaves are ovate, smoothish, somewhat toothed, 5 to 7-nerved, each of which contains a strong fiber which may be pulled out, and abruptly narrowed into a long, channeled petiole. The flowers are white, very small, imbricated, numerous, and borne on a cylindrical spike 5 to 20 inches long. Small plants are frequently found with the spikes only ½ to 2 inches long, and the leaves and stalks proportionately small. The stamens and styles are long; the seeds numerous (G.—W.).

History and Chemical Composition.—Plantain is a well-known herb, growing in rich, moist places, in fields, by the roadsides, and in grass plats, and is common in Europe and America. It flowers from May to October. The root has a somewhat sweetish, salty taste; the leaves are bitterish and unsavory. The plant loses its medicinal activity by drying. All its preparations should be made from the freshly-gathered roots and tops. Water or alcohol extracts the virtues of the plant. The leaves contain chlorophyll, resin, wax, albumin, pectin, citric and oxalic acids (Th. Koller, *N. Jahrb. f. Pharm.*, 1868, p. 139). Upon incineration, they leave 12.8 per cent ash. Sugar is present, while alkaloids and glucosids are absent (D. Rosenbaum, *Amer. Jour. Pharm.*, 1886, p. 418). The root, according to Strawinsky (*ibid.*, 1898, p. 189), contains starch, wax, fatty matter, dextrose, saccharose, mucilage, traces of tannin, but no alkaloid or glucosid. The ash was 24.7 per cent, moisture 6.9 per cent.

Action, Medical Uses, and Dosage.—Plantain is alterative, diuretic, and antiseptic, once considered vulnerary. The tops and roots, in strong decoction, have been highly recommended in *syphilitic*, *mercurial*, and *scrofulous diseases*, in the dose of from 2 to 4 fluid ounces, 3 or 4 times a day. It is likewise reputed beneficial in *menorrhagia*, *leucorrhœa*, *hematuria*, *colic*, *cholera infantum*, *aphthæ*, *diarrhœa*, *dysentery*, *incipient phthisis*, *pulmonary hemorrhage*, *dysuria*, and *hemorrhoids*. The specific medicine may be employed in these disorders. The juice taken internally, in doses of 1 fluid ounce every hour, and also applied to the wound, is in high repute as an antidote to the *bites of venomous serpents*, *spiders*, and *insects*. It is a remedy for *toothache* from dental caries, the cavity being cleansed and specific plantago major applied on cotton to the sensitive pulp, renewing every half hour. Its internal use is said to control toothache through its effects upon the trifacial, *tic-douloureux* being benefited in the same manner. The same preparation, locally applied, often relieves *earache*. *Bedwetting* in children, due to relaxed vesical sphincter, with profuse colorless discharge of urine, is said to be relieved by plantago. Externally, the bruised leaves, or an ointment made with them, is useful in *wounds*, *ulcers*, *ophthalmia*, *eczema*, *erysipelas*, and some other cutaneous affections. The best forms of administration are the juice dissolved in diluted alcohol, and evaporated by gentle heat to the consistence of an extract; and specific plantago major, the dose of which is from 1 to 5 drops.

Specific Indications and Uses.—Locally, toothache and earache.

Related Species.—*Plantago lanceolata*, Linné; *Lance-leaved plantain*, has properties similar to common plantain. Its leaves contain much bitter matter. Locally applied, it has proved a hæmostatic for small *bleeding surfaces*.

Plantago cordata, Lamarck.—This is an indigenous perennial plant, known likewise as the *Heart-leaved plantain*. It is an acaulescent herb, with stout, naked scapes, 1 or 2 feet in height. Leaves radical, cordate-ovate, broad, smooth, somewhat toothed, thickish, about 6 inches long, 6 or 8-ribbed below, with a thick midrib, on long, stout petioles. Flowers small, whitish, somewhat imbricate, the lower one scattered, and on elongated spikes which are from 6 to 8 inches long; bracts ovate, obtuse. Calyx and corolla lobes very obtuse. Pyxis a third longer than the calyx, 2-celled, with 2 seeds in each cell (G.—W.). This plant grows in moist places, and along the banks of rivers, from New York and New Jersey to Tennessee, also from Ohio to Wisconsin, and flowers from April to August. The root is the part used, and it yields its properties to water. The root of Plantago cordata is astringent, anodyne, antispasmodic, and antiemetic. The decoction and extract have been successfully used in *Asiatic cholera*, checking the disease in a short time; they have likewise proved beneficial in *dysentery*. The plant is certainly deserving of more extended investigation, for it directly influences the nervous system, controlling irritation. A poultice of the roots is recommended as an application to old, indolent *ulcers*, *bruises*, *wounds*, etc. It allays inflammation and reduces swelling.

Plantago Psyllium, Linné; *Flea-wort*, *Flea-seed plant.*—South Europe and Barbary. The seeds of this species are flea-colored, boat shaped, and shining on the convex surface. They yield a mucilage, used in southern Europe as that of flaxseed, slippery elm, etc., is used in this country. The seeds, in tablespoonful doses, in a glass of water, before dinner, have been successfully employed to relieve *chronic constipation*. The *Plantago arenaria*, Waldstein and Kittaibel, and *Plantago Cynops*, Linné, also contain mucilage.

Plantago Ispaghula, Roxburgh (*Plantago decumbens*, Forskal), *Spogel* or *Ispaghul seed*.—This little plant is common throughout northwestern India, Arabia, and neighboring countries.

The seeds are the parts used. They are about ⅛ of an inch in length, and half as broad, concave on one side, convex upon the opposite, and according to the *Pharmacographia*, are so light as to require 100 to weigh a single grain. Spogel seed have long been employed in India, and, in 1868, were admitted to a position in the *Pharmacopœia* of that country. For an illustration of this plant, see *New Remedies*, 1878, p. 68.) Spogel seed are very mucilaginous, and form a thick jelly with water. They are employed, either in substance or in decoction, in India, for the treatment of *diarrhœa* and *dysentery*,. In chronic diarrhœa, they are often given whole, in doses of from 1 to 2 drachms, mixed with a little syrup, or powdered and mixed with sugar and water. When bruised and moistened with water, the seeds are often used by physicians, in India, as an emollient poultice.

Dr. O. S. Laws (*Calif. Med. Jour.*, 1899) calls attention to a plant of the Plantago family, growing in damp situations in southern California and Arizona, as a valuable local remedy for *nasal catarrh*. He applies equal parts of the tincture of the roots, water and glycerin, on cotton placed in the nasal fossæ. He calls it *Plantago aquatica;* it is probably *Alisma Plantago.*

PLASMÆ.—PLASMAS.

History.—In 1858, G. F. Schacht proposed *glycerin* as a substitute for oils and fats in ointments, the glycerin being heated with starch, and the compounds thus formed being termed "Plasmas." This term we propose to employ here for all solid or semisolid preparations for external use, excepting *glycerites*, in which glycerin forms an important basis. These preparations are more costly than the ordinary fatty ointments, but there are certain cases in which the latter irritate the parts to which they are applied, and, consequently, aggravate the disorders for which they are used, which is not the case with the plasmas, the glycerin being comparatively unirritating, not possessed of any rancidity, nor of any irritating fatty acids, etc. In addition to these advantages, it can be removed at any time without the use of soap and friction, and its application does not involve soiling and greasing the garments or bed-clothing (see *Glycerita*). The formula of Mr. Schacht is to take powdered starch, 70 grains; glycerin, 1 fluid ounce; mix the ingredients and heat to 115.5° C. (240° F.), constantly stirring. If a large quantity (6 or 8 pounds) is to be prepared, he advises that the starch be triturated with one-twelfth of the glycerin, placing the remainder on the fire, heating it to 126.6° C. (260° F.), and then stirring it thoroughly into the mixture previously made. By this means much time is saved, as well as labor, in stirring the mass. He states that the plasma does not mold by keeping.

Other formulæ besides that of Mr. Schacht's have, at various times, been offered to the profession, thus: Mr. H. Seymour has offered the following: (1) Take of Fuller's earth, ½ ounce; palm oil, 2 drachms. (2) Take of Fuller's earth, ½ ounce; oil of sweet almonds, 2 fluid drachms; water, 2 fluid drachms; glycerin, 1 fluid drachm. More recently, Mr. T. B. Groves has proposed a new basis for ointments, which he calls *Glycelæum*. It is made by triturating together almond meal (from oil-cake, or decorticated pressed sweet almonds), ½ ounce; glycerin, 1 ounce; olive oil, 3 ounces. Mix by trituration in a mortar. It forms a soft, semi-gelatinous paste, which, when mixed gradually with water or a watery fluid, readily forms an emulsion. As it remains unaffected by the ordinary temperatures of the body, its softness is not an objection to its use, which, in fact, is an advantage, as it leaves plenty of room for powdery admixtures of every kind (*Trans. Brit. Conf.*, 1867; *Chem. and Drug.*, Sept. 14).

PLASMA ACIDI CARBOLICI.—PLASMA OF CARBOLIC ACID.

Preparation.—Take of carbolic acid 6⅘ parts; glycerin, 27⅕ parts: prepared chalk, finely powdered, 94 parts. Mix together the carbolic acid and glycerin, and then add the chalk; mix thoroughly by kneading, and enclose in closely stopped jars (Thomas E. Jenkins, *Amer. Jour. Pharm.*, 1869, p. 292). This gives a preparation possessing the proper consistence, and preserving its properties unimpaired for a long time, when kept in closed jars. It is offered as a substitute for Dr. Lister's preparation made with putty, which dries very rapidly and become hard.

Action and Medical Uses.—This plasma is used as a surgical dressing to *wounds*, etc., effectually excluding the action of the air and other external agencies, and at the same time preventing any tendency to gangrene or putrefaction.

PLASMA CUPRI SULPHATIS.—PLASMA OF COPPER SULPHATE.

Preparation.—Take of finely powdered sulphate of copper, 20 grains; glycerin 1 fluid ounce; finely powdered starch, 70 grains. Dissolve the copper salt in the glycerin, then add the starch; heat the mixture to 115.5° C. (240° F.), constantly stirring, and continue the heat and stirring until the consistence of a soft ointment is acquired. Keep in closely stopped jars.

Action and Medical Uses.—This forms an excellent local application to *granulated lids*, and in other *ophthalmic affections;* also as a stimulant to *chancres*, *ulcers*, etc.

PLASMA PETROLEI.—PLASMA OF PETROLEUM.

Preparation.—Take of finely powdered starch, 70 grains; petroleum, 1 fluid drachm; glycerin, 1 fluid ounce. Triturate the starch and petroleum together until quite smooth, gradually add the glycerin, and heat to 115.5° C. (240° F.), constantly stirring (G. F. Schacht).

Action and Medical Uses.—This is very valuable as a local application in many *cutaneous diseases*, and in *hemorrhoids*.

PLASMA PICIS LIQUIDÆ.—PLASMA OF TAR.

Preparation.—Take of finely powdered starch, 2 drachms; glycerin, purified tar, each, 6 ounces. Add the glycerin, warm, to the starch, stir well together, heat to 115.5° C. (240° F.), gradually add the tar, and stir constantly until thoroughly incorporated (Brady).

Action and Medical Uses.—This will be found useful as a local application to *wounds*, *ulcers*, and in several forms of *cutaneous diseases*.

PLASMA POTASSII IODIDI.—PLASMA OF POTASSIUM IODIDE.

Preparation.—Take of finely powdered starch, 140 grains; glycerin, 2 fluid ounces; iodide of potassium, 2 drachms. Dissolve the iodide of potassium in the glycerin, then add the starch gradually with trituration, and heat to 115.5° C. (240° F.), constantly stirring until it is of the proper consistence.

Action and Medical Uses.—A local application to *scrofulous* and *other tumors*, several forms of *cutaneous diseases*, and wherever the external use of iodide of potassium is indicated.

PLASMA ZINCI OXIDI.—PLASMA OF ZINC OXIDE.

Preparation.—Take of finely powdered starch, 140 grains; glycerin, 2 fluid ounces; oxide of zinc, 1 drachm. Triturate the starch and oxide of zinc together, gradually add the glycerin, then heat to 115.5° C. (240° F.), constantly stirring until thoroughly incorporated.

Action and Medical Uses.—A local application for severe *burns*, and in *cutaneous diseases*, as, *herpes*, *eczema*, *pemphigus*, *chafes*, *chaps*, etc.

PLATINUM.—PLATINUM.

SYMBOL: Pt. ATOMIC WEIGHT: 194.3.

Source and History.—Platinum occurs in nature only in its elemental form, but is almost invariably contaminated with other metals, *e. g.*, iridium, osmium, rhodium, iron, copper, etc. It has probably been known for centuries in Mexico and other Central American countries. The Spanish gave it the name, "Platina del Pinto," from its silver-like appearance, and its occurrence in the gold-bearing sand of the River Pinto, in Brazil. In 1819 platinum was discovered in the Ural mountains, its present chief source. Platinum, in addition to the countries named, also occurs in Borneo, Australia, in Canada and in some parts of the United States, *e. g.*, North Carolina, California, and Oregon. Occasionally, though rarely, it is found in the form of cubical or octahedral crystals. Platinum is obtained pure from its ore in the same manner as spongy platinum (see below) is prepared. The metal obtained is melted down by means of the oxyhydrogen blow-pipe flame.

Description.—Platinum is a tin-white metal, somewhat darker than silver, ductile, malleable, unalterable in air or water, and has a specific gravity of 21.5 (Deville and Debray). It is only fusible by the highest heat that can be artificially produced. It may be drawn into wires of extreme thinness. Platinum utensils (crucibles, dishes, retorts) have become indispensable to analytical and technical chemists. Pure platinum is indifferent toward boiling sulphuric, hydrochloric or nitric acids. The presence of impurities, *e. g.*, nitrous acid in sulphuric acid or a concentration of the latter acid greater than 94 per cent are liable, in large operations, to cause notable quantities of platinum to be dissolved. The presence of iridium, though it renders the platinum brittle, causes it somewhat to resist the corrosive action of the acid (see in this connection an interesting paper by M. Scheurer-Kestner in *Pharm. Jour. Trans.*, Vol. VI., 1875–76, p. 505). Platinum is readily dissolved by a mixture of hydrochloric and nitric acids (*nitro-muriatic acid, aqua regia*), and is also attacked by free chlorine, bromine, and iodine. Platinum forms fusible alloys with lead, tin, etc.; hence, if platinum crucibles be heated with lead, etc., they become readily perforated.

H. Hager (*Handbuch der Pharm. Praxis*, 1886, p. 716) enumerates the following operations which should not be carried out in platinum vessels: (1) The fusion of alkali sulphides, or the reduction of sulphates with charcoal; (2) contact with liquids containing chlorine, bromine, iodine, aqua regia; (3) heating platinum to redness on a sand-bath, *i. e.*, in contact with silicic acid, which would cause the platinum to become brittle; (4) fusion of lithium salts and of alkali nitrates; (5) fusion of caustic alkalies or alkaline earths, oxides of calcium, barium, strontium, magnesium; (6) fusion of such metals as bismuth, lead, tin, cadmium, or the heating of reducing mixtures which, upon fusion, yield these metals; (7) exposure of the metal to a white heat in contact with metallic oxides giving off oxygen under this condition, *e. g.*, oxides of lead, bismuth, nickel, copper, etc.; (8) heating phosphoric acid and acid phosphates when mixed with carbon, owing to the liberation of phosphorus, which would form platinum phosphide; (9) boiling down such decomposable liquids as ferric chloride; (10) fusion of iodides and bromides; (11) the heating of all minerals, etc., yielding a volatile film (*Beschlag*), upon charcoal when heated by means of the blow-pipe. Nor should platinum utensils be heated in a sooty flame, owing to the possible formation of platinum carbide, which blisters the metal. Arsenic and melting potassium cyanide are likewise harmful.

Platinum in the form of wire, especially when warmed to about 50° C. (122° F.), has the property of condensing oxygen gas on its surface; this property is possessed to an even more remarkable degree by the two forms of platinum known as *spongy platinum* and *platinum black*. *Spongy platinum* is a soft, gray, porous mass of platinum, obtained by igniting ammonium platinic chloride ($PtCl_6[NH_4]_2$). It rapidly condenses oxygen on its surface. By directing a current of hydrogen upon spongy platinum, the oxygen contained in it causes the hydrogen to ignite. On this principle Doebereiner's lamp is based. Mixtures of oxygen with the vapors of alcohol or ether, or other inflammable vapors, may likewise be ignited by means of spongy platinum; or slow oxidation may be induced. *Platinum black* is an even more finely divided form of platinum, and may be obtained in various ways, *e. g.*, by reducing platinic chloride solution ($PtCl_6H_2$) with glycerin and caustic potash; or by treating an alloy of platinum and zinc or copper with nitric acid, whereby platinum remains undissolved in the form of platinum black. This substance, when washed out and thoroughly dried, absorbs 800 times its volume of oxygen, thereby becoming red-hot. In the form of platinum-asbestos (finely divided platinum deposited upon asbestos fibre), platinum black is being used with success in organic analysis in the place of oxide of copper; likewise in the manufacture of sulphuric acid by a new process, which consists in conducting an absolutely dust-free mixture of sulphur dioxide and oxygen over platinum asbestos at a *low* temperature (see Von Wartha, *Chem. Zeitung*, 1899, p. 977). Platinum black also has the property of oxidizing alcohol, forming acetic acid, a reaction that might be carried out on a larger scale.

Two oxides of platinum are known—the *monoxide* (PtO), forming with acids the brownish-green *platinous* salts, and the *dioxide* (PtO_2), which forms the yellow or brown *platinic* salts. Platinum dissolved in nitro-hydrochloric acid forms *platinic chloride*, supposed to be $PtCl_4$, but in reality a double compound ($PtCl_6H_2+6H_2O$). Platinic chloride causes insoluble crystalline precipitates in solutions of potassium, rubidium, cæsium or ammonium salts (*e. g.*, $PtCl_6K_2$, or $PtCl_6[NH_4]_2$), but not in sodium or lithium salts, which form water-soluble crystals (*e. g.*, $PtCl_6Na_2+6H_2O$). Precipitates are also produced with solutions of many alkaloids; in orde to test for these, the absence of potassium and ammonium salts must be pr viously established.

Salts of Platinum.—PLATINI CHLORIDUM, *Platinic chloride*, *Platinum tetrachloride*, *Platini bichloridum* ($PtCl_4$), *Nitromuriate of platinum*. The term *bichloridum* has reference to the old nomenclature of the salt and must not be confused with platinum bichloride ($PtCl_2$) as accepted to-day. The tetrachloride is prepared by dissolving platinum in nitro-hydrochloric acid, and cautiously evaporating the solution on the sand bath to drive off all excess of acid and the water of crystallization. The heat must not exceed 120° C. (248° F.). A dark, reddish-brown, deliquescent, saline mass is obtained, which is soluble in water, alcohol or ether. It is a powerful caustic poison. It was formerly often recommended, in doses of from ⅛ to ¼ of a grain, 3 or 4 times a day, in *secondary syphilis*. It may be administered in aqueous solution, or in pill form. An ointment, composed of 5 grains of the bichloride, 10 grains of extract of belladonna, and 160 grains of lard, has been applied to *indolent* and *syphilitic ulcers* (Hæfer).

By evaporation of the platinic chloride solution on the water-bath, brown-red deliquescent crystals of the composition ($PtCl_6H_2+6H_2O$) are obtained. By precipitating from this compound the excess of HCl by means of silver nitrate, and evaporating the supernatant liquid, non-deliquescent crystals of the composition ($PtCl_4+5H_2O$) result. The compound $PtCl_6H_2+6H_2O$ has action and uses similar to the bichloride, being employed in doses about one-half the size of those of the latter.

PLATINI ET SODII CHLORIDUM, *Sodii platino-bichloridum*, *Platino-bichloride of sodium*, *chloroplatinate of sodium*.—This salt may be procured by dissolving 170 parts of pure bichloride of platinum (platinum tetra-chloride, see above), and 58.5 of pure chloride of sodium, in separate portions of distilled water. Mix the solutions, and cautiously evaporate to crystallization. The crystals are red, soluble in water or alcohol, and have the formula, $PtCl_4.2NaCl+6H_2O$. When heated they lose their water of crystallization, and become anhydrous, forming a yellow powder. This is recommended in *syphilitic* and *scrofulous diseases*, in doses of ⅛ grain to ½ grain, 3 times a day, in powder with starch, pill, or a mucilaginous solution. It is milder in its action than the bichloride of platinum. Half a drachm of the sodium salt of platinum dissolved in ½ pint of decoction of poppies, has been used as an injection in *gonorrhœa*; or, 2 grains to 1 ounce of oil or fat has also been used.

PLATINI IODIDUM, *Platinic iodide* (PtI_4).—A blackish or brown-black non-crystalline tasteless powder, not soluble in water, but dissolving with a light-red color, in either potassium iodide, or carbonate.

PLATINI ET POTASSII CYANIDUM, *Potassium platino-cyanide* ($2KCN.Pt[CN]_2.3H_2O$).—In long acicular or prismatic crystals, yellow, with a handsome blue surface reflection. Exposed to air they become rose-colored and opaque. Hot water freely dissolves it. In solution it precipitates ferrous salts blue-white, cupric salts, green-blue, and mercurous nitrate, blue. Its barium compound ($BaPt[CN]_4+4H_2O$) is sensitive to the Roentgen rays, and is used in the preparation of the fluoroscope by means of which the effects of the rays are rendered visible.

None of the platinum compounds, which are said to resemble therapeutically the salts of gold, are employed in Eclectic practice. Platinum forms an excellent material for laboratory utensils.

PLUMBI ACETAS (U. S. P.)—LEAD ACETATE.

FORMULA: $Pb(C_2H_3O_2)_2+3H_2O$. MOLECULAR WEIGHT: 378.0.

SYNONYM: *Sugar of lead*, *Acetas plumbicus*, *Cerussa acetata*, *Saccharum saturni*.

"Lead acetate should be kept in well-stoppered bottles" (*U. S. P.*).

Preparation.—Acetate of lead is prepared in considerable quantities in this country, England, Holland and France, and may be obtained by several methods; either carbonate of lead (see *Plumbi Carbonas*) or litharge (*Plumbi Oxidum*) is dissolved in acetic acid, or the hot vapors of acetic acid are made to act upon lead oxide; the product is dissolved in water, and the solution obtained is evaporated to crystallization. In the latter operation a slight excess of acetic acid is always necessary (see directions in *Br. Pharm.*, 1885). As prepared for use in the arts, wood-vinegar and litharge being employed, the salt is impure and generally ranges in color from white to reddish or brown. Lead acetate is largely used in calico printing and dyeing as a mordant.

Description.—Lead acetate, as required by the *U. S. P.*, should form "colorless, shining, transparent, monoclinic prisms or plates, or heavy, white, crystalline masses, or granular crystals, having a faintly acetous odor, and a sweetish, astringent, afterward metallic taste. Efflorescent, and absorbing carbon dioxide, on exposure to the air. Soluble, at 15° C. (59° F.), in 2.3 parts of water, and in 21 parts of alcohol; in 0.5 part of boiling water, and in 1 part of boiling alcohol. When heated to 40° C. (104° F.), the salt loses its water of crystallization (14.25 per cent). It fuses at 200° C. (392° F.) with the loss of acetic acid, and when strongly heated it is completely decomposed, with the evolution of carbon dioxide and acetone, leaving a residue of finely divided metallic lead mixed with oxide and carbonate. On heating the salt with sulphuric acid, vapors of acetic acid are evolved. The aqueous solution of the salt has a slightly acid reaction, and yields a black precipitate with hydrogen sulphide T.S., a yellow one with potassium iodide T.S., and a white one with diluted sulphuric acid"—(*U. S. P.*). When lead acetate is dissolved in water, a small quantity of a white precipitate is usually formed, consisting of carbonate of lead, due to the carbonic acid, which is usually present in water, or to the action of the carbon dioxide contained in the air, if the salt has not been kept in well-stoppered vessels; a small quantity of acetic acid will redissolve this deposit, and render the solution clear. When exposed to a vacuum kept dry by sulphuric acid or quicklime, the acetate of lead falls into a white powder, which is completely anhydrous. Acetate of lead is incompatible with alkalies and alkaline earths, and especially with those acids or their soluble salts which form a precipitate with soluble lead salts, as sulphuric, phosphoric, hydrochloric, hydriodic, oxalic, malic acids, etc., and partially even by water containing carbonic acid.

Tests.—Acetate of lead dissolved in distilled water is precipitated as white carbonate of lead when treated with sodium carbonate. The above precipitate of lead sulphate, produced by the addition of sulphuric acid is quite characteristic for lead salts; it is soluble in basic ammonium tartrate (difference from barium sulphate). Lead sulphate also differs from barium sulphate by turning black in contact with ammonium sulphide. Complete solubility of lead acetate in distilled water acidulated with acetic acid, shows the absence of sulphates, and, to some extent, of chlorides. "A 10 per cent solution of the salt, prepared with water which has recently been boiled, should be clear, or only slightly opalescent (limit of carbonate), and should yield, with potassium ferrocyanide T.S., a pure white precipitate (absence of iron or copper). If to the aqueous solution hydrochloric acid be added until no further precipitate is produced, and the remainder of the lead removed from the filtrate by hydrogen sulphide, a portion of the new filtrate should not be affected by the addition of a slight excess of ammonia water (absence of zinc or iron). If another portion of the last filtrate be evaporated to dryness, it should leave no residue (absence of salts of the alkalies or of zinc)"—(*U. S. P.*). (For *Plumbi Subacetas*, see *Liquor Plumbi Subacetatis*.)

Action, Medical Uses, and Dosage.—I. LEAD. (For description, etc., see under *Plumbi Oxidum.*) Lead is a poison, though not specially active, and when taken internally it is absorbed, and may be detected in the fluids and solids. In acute lead poisoning there is a burning, prickling sensation in the fauces, thirst, dryness of tissues, gastric uneasiness and vomiting and severe intermittent colic relieved by pressure. Obstinate constipation is the rule. The abdomen is tense with the skin retracted and cold. The stools are dark, due to the formation of lead sulphide. If protracted, the nervous system is involved, giddiness, torpor, and coma sometimes being present, while numbness, cramps of calves of the leg and inner side of thighs, and paralysis may take place. A blue line may sometimes be observed upon the gums. For acute poisoning the soluble sulphates mentioned below, under *Lead Acetate*, are the proper antidotes. When the system is impregnated with lead (chronic lead poisoning) it is said to produce a leaden discoloration of the gums, teeth, and mucous membrane of the mouth, a peculiar lead taste and odor, jaundice, emaciation, and a feeble, irregular, state of the circulation, the pulse being often reduced to 40 or 45 beats per minute. In large doses, or when continued for some time in small doses, lead gives rise to certain abdominal pains, termed *lead colic;* sharp pains in the limbs, unaccompanied by either redness or swelling, and which are increased by motion, and diminished by pressure, and are frequently accompanied by hardness, and cramps in the affected parts, and which condition is termed *lead arthralgia; lead paralysis*, which attacks the extremities, more commonly the superior, and which appears to affect the extensor muscles principally, the hands being bent or dropped *wrist-drop*) and the arms dangling by the side. There may also be a paralysis of sensation. The brain may also become affected with what is termed *lead encephalopathy*, manifested by furious or tranquil delirium, more or less profound coma, or convulsions. *Painters' colic* (*colica pictonum*) is a peculiar affection attacking painters and other workers in lead. Its most characteristic symptoms are severe colic with a sense of sinking about the region of the navel, and a peculiar form of paralysis allowing the hands to drop (*wrist-drop*). General paralysis may occur, the skin becomes yellow, and on the abdomen retracted, constipation is obstinate, emaciation marked, the blue line is pronounced, and if severe enough epileptoid convulsions ending in death, may ensue. When convulsions occur death is very apt to follow. Painters and workers in lead are more commonly poisoned, but occasionally families are poisoned by drinking water from new lead pipes (allowing solutions of sulphuric acid or soluble sulphates to stand in the pipes will prevent this); typesetters are prone to lead-poisoning, and flour has been known to contain enough lead (from repairing holes in the mill stones with lead) to act as a poison. Lead chromate used to color pastry has produced serious results. In cases of chronic poisoning by lead, the antidotal treatment is, to place the patient in a bath made by dissolving sulphide of potassium, 4 ounces in 30 gallons of warm water, which converts the lead on the surface to a black sulphide, which must be removed by means of soap and water, and a good stiff brush, and which should be repeated every few days until the skin no longer becomes discolored by the sulphuretted bath. Internally, water acidulated with sulphuric acid should be drank; or solutions of the sulphates of sodium, magnesium, or alum. A decoction of ground ivy (*Nepeta Glechoma*) may be drank freely; or, water acidulated with the juice of preserved barberries. Iodide of potassium has been recommended, and is said to render the lead with which it comes in contact more soluble, so that it can be more readily passed from the system. The latter salt is by far the most common antidote now employed for *chronic* lead poisoning. The bowels must be kept regular by castor oil, to which croton oil may be added if necessary; opiates may be given to relieve pains and cramps; tonics to improve the strength when there is much debility; and nux vomica or strychnine, with electro-magnetism and frictions or shampooing, to overcome the paralysis. (For a record of wholesale poisoning through flour containing metallic lead, see *American Journal of Pharmacy*, 1888, p. 148.

II. Lead Acetate.—Acetate of lead, in doses of from 1 to 4 grains, every 1, 2, or 4 hours, is an efficient astringent and sedative. It is usually given in pill form. In large doses, it is an irritant; and in long-continued, small doses, it may induce the peculiar constitutional action of the preparations of lead. Its best antidote is sulphate of sodium, sulphate of magnesium, or phosphate of sodium, which should be followed by emetics, if necessary, and then by alternate purgatives and opium. Generally, an excess is followed by vomiting, which prevents any serious injury, and, as long as the bowels are kept regular, its effects upon the constitution are seldom experienced. Large doses have, at times, been taken, even to several drachms, without occasioning more than severe sickness, some pain in the stomach, vomiting, etc. Few fatal cases have been recorded. Some practitioners make extensive use of it in *active* or *passive hemorrhages from the lungs, bowels, womb*, etc., in which it is employed with the view of diminishing the caliber of the bleeding vessels, thereby checking the flow. It is generally given in connection with opium. It has also been exhibited in *colliquative diarrhœa*, *chronic dysentery*, to check excessive secretion in *bronchitis*, to remove obstinate *mercurial ptyalism*, and in *gastric irritability* attending certain forms of *fever*. In *passive hemorrhages*, the following has been found efficient: Take of acetate of lead, 2 grains; opium, ½ to 1 grain; capsicum, 2 grains; form into a pill with conserve of roses, and give 1 every hour or two, in urgent cases every 10 minutes. While administering this agent, the gums should be frequently examined, and as soon as a blue line is observed along their edge, indicative of its constitutional influence, its use should be stopped. Many practitioners, however, denounce its internal administration, and employ it occasionally, in solution, as an external application, in cases of *superficial inflammations*, as in *erythema*, *erysipelas*, spreading inflammation of the subcutaneous cellular tissue, and in many *cutaneous diseases*. The solution may be made by dissolving 1 drachm of the salt in 5 or 8 fluid ounces of distilled water, to which 1 fluid drachm of distilled vinegar may be added to prevent the oxide from being thrown down; 1 or 2 grains dissolved in 1 fluid ounce of pure water forms a common collyrium, but should not be used when the cornea is ulcerated, lest a deposit of lead leave an opacity after the parts are healed. In inflammations, opium is often conjoined with it, 4 grains of each being added to every fluid ounce of water. So much improvement has been recently made in American practice, that we believe even the external use of this agent can be, in a great measure, dispensed with. It forms a favorite injection among the laity for the cure of *gonorrhœa*, and is undoubtedly the most universally successful application, when used in alcoholic solution, for the relief of *poisoning by Rhus Toxicodendron*.

PLUMBI CARBONAS (U. S. P.)—LEAD CARBONATE.

FORMULA: $(PbCO_3)_2Pb(OH)_2$. MOLECULAR WEIGHT: 772.82.

SYNONYMS: *White lead*, *Cerussa*, *Flake white*, *Magistery of lead*, *Plumbum carbonicum*, *Carbonas plumbicus*, *Plumbum hydrico-carbonicum*.

Lead carbonate should be kept in well-closed vessels.

Preparation.—Lead carbonate is found in nature in the form of certain rare minerals, and may be prepared artificially by causing a current of carbonic acid gas to pass through a certain quantity of solution of subacetate of lead, prepared by boiling solution of acetate of lead with litharge. This is *Thénard's process*, of which *Benson's process* is a modification. Washed litharge, with a little acetate of lead, is made into a thin paste with water, and, with continual stirring, a current of carbon dioxide is conducted into the mixture until absorption ceases. The best mode of preparation, even at this day, and yielding a product of great "covering power" for the purposes of painting, is the old-time *Dutch process*. This consists in placing rows of earthenware pots under sheds, pouring into each pot a little acetic acid, placing above this, inside of each pot, a roll of sheet lead, and covering the entire arrangement with tan-bark. The heat of the decomposing bark causes evaporation of the vinegar, this unites with the lead to form basic acetate of lead, and the carbon dioxide supplied from the decomposing organic matter of the bark converts this into *white lead*.

Description and Tests.—Carbonate of lead is described by the *U. S. P.* as "a heavy, white, opaque powder, or a pulverulent mass, without odor or taste. Permanent in the air. Insoluble in water or alcohol, but soluble in acetic or diluted nitric acid, with effervescence. When strongly heated, the salt turns yellow without charring, and, if heated in contact with charcoal, it is reduced to metallic lead"—(*U. S. P.*). In the latter case, the metallic globule is surrounded by a volatile zone (*Beschlag*) of the yellow oxide. The salt parts with its combined water at 155° C. (311° F.), but does not lose weight at 100° C. (212° F.). The salt is somewhat soluble in water containing carbonic acid. It is blackened by sulphide of hydrogen, and by ammonium sulphide. The composition of white lead is variable, but should correspond to an oxycarbonate of lead $(PbCO_3)_2Pb(OH)_2$. This formula allows for a loss in weight of about 14 per cent upon igniting the salt, while the official requirements (see below) fixes the limit at 15 per cent. Barytes (barium sulphate) is a common adulterant of the white lead employed in the arts. A mixture of barytes (1 part) and white lead (1 part) is known as *Venetian white;* barytes (2 parts) and white lead (1 part), as *Hamburg white;* and barytes (3 parts) and white lead (1 part), as *Dutch white*. Barytes is easily detected by its insolubility in nitric acid. "If 2 Gm. of the salt be dissolved in a mixture of 2 Cc. of nitric acid and 10 Cc. of water, it should not leave more than 0.02 Gm. of residue (limit of insoluble foreign salts). This solution yields a black precipitate with hydrogen sulphide T.S., a yellow one with potassium iodide T.S., and a white one with diluted sulphuric acid. On completely precipitating the solution with hydrogen sulphide, the filtrate should not leave more than a trifling residue on evaporation (limit of salts of the alkalies, alkaline earths, or of zinc). If 1 Gm.

of the salt be strongly ignited, in a porcelain crucible, it should leave a residue of lead oxide weighing not less than 0.85 Gm."—(*U. S. P.*).

Action and Medical Uses.—Carbonate of lead is never used internally. It has been applied externally as an astringent and desiccative to *irritated surfaces*, *burns*, *scalds*, etc. It may be dusted over the parts. Applied in the form of ointment, 1 part to 8 of simple cerate; or, as a lotion, 1 part to 3 parts or more of linseed oil. Being a very poisonous compound, it should not, as it occasionally is, be applied to excoriated surfaces. It may be used on *local congestion of the skin*. Its absorption is said to be attended with considerable danger.

PLUMBI IODIDUM (U. S. P.)—LEAD IODIDE.

FORMULA: PbI_2. MOLECULAR WEIGHT: 459.46.

SYNONYMS: *Plumbum iodatum*, *Ioduretum plumbicum*.

"Lead iodide should be kept in well-stoppered bottles, protected from light"—(*U. S. P.*).

Preparation.—Iodide of lead is prepared by dissolving 4 ounces (av.) of nitrate of lead in 1½ pints of hot, distilled water, and then mixing with it a solution of 4 ounces (av.) of iodide of potassium in ½ pint of water; allow the precipitate to subside, throwing it on a filter, washing it well with cold water, and drying on bibulous paper, by exposure to the atmosphere. The reaction is as follows: $Pb(NO_3)_2 + 2KI \quad 2KNO_3 + PbI_2$. This equation represents equal parts, by weight, of the two salts employed. An excess of potassium iodide would hold some lead iodide in solution. The yield is about 133 parts of lead iodide from each 100 parts of nitrate employed. Acetate of lead should not be substituted for the nitrate, as the resulting acetate of potassium is a solvent of iodide of lead. Lead iodide may also be obtained by the action of hydriodic acid upon lead, which dissolves quite readily in this fluid.

Description.—Iodide of lead is officially described as "a heavy, bright-yellow powder, without odor or taste. Permanent in the air. Soluble in about 2000 parts of water at 15° C. (59° F.), and in about 200 parts of boiling water, separating from the latter solution in brilliant, golden-yellow spangles or crystalline laminæ. Very slightly soluble in alcohol, but soluble, without color, in solutions of the fixed alkalies, in concentrated solutions of the acetates of the alkalies, of potassium iodide, and of sodium hyposulphite, and in a hot solution of ammonium chloride. When moderately heated, the salt fuses to a thick, reddish-brown liquid, which congeals, on cooling, to a yellow, crystalline mass. At a higher temperature it is decomposed, with the evolution of violet vapors of iodine, leaving a lemon-yellow residue of lead oxyiodide"—(*U. S. P.*). Boiling ether decomposes lead iodide, the iodine dissolving in it, while pale-yellow lead oxyiodide is left behind (Vogel). Exposure to moisture and light tends to the decomposition of salt with liberation of iodine.

Tests.—"If 1 Gm. of the salt be triturated with 2 Gm. of ammonium chloride and 2 Cc. of water, a nearly white mixture will result. If this be transferred to a test-tube, and heated in a water-bath for a few minutes, a clear and almost colorless solution should be formed (absence of chromate and of other insoluble foreign salts). On cooling this solution, a solid mass of nearly colorless, fine, silky crystals will be produced, and, on adding water or diluted sulphuric acid to this mass, yellow lead iodide will be separated. If 1 Gm. of the salt be boiled for a few minutes with 20 Cc. of water, the mixture then cooled and filtered, the lead removed from the filtrate by hydrogen sulphide, and the new filtrate somewhat concentrated by evaporation, a portion of this liquid when mixed with a little sulphuric acid, and tinted with a drop of indigo T.S., should not become decolorized on heating (absence of nitrate). If another portion of the liquid be carefully neutralized with ammonia water, it should not become colored red by a drop of ferric chloride T.S. (absence of acetate). If the remainder of the filtrate be evaporated to dryness, it should leave no residue (absence of soluble foreign salts)"—(*U. S. P.*). As to the chemistry of the reaction between lead iodide and ammonium chloride, see H. C. C. Maisch, *Amer. Jour. Pharm.*, 1884, p. 91.

Action, Medical Uses, and Dosage.—Lead iodide has been used both internally and externally in the treatment of *scrofulous* and *syphilitic tumors*, *indolent* *ulcers*, *periostitis*, etc. It is now seldom used internally, except by a few, who believe it efficient in reducing *splenic hypertrophy of malarial origin*. The dose internally is from $\frac{1}{5}$ to $\frac{1}{2}$ grain, cautiously increased to 3 or 4 grains, in pill form, with confection of roses. Externally, an ointment may be used, composed of 1 part of iodide of lead and 8 parts of lard; to be applied to the *tumors* by friction. The application of the ointment is reported to have cured a *dermoid cyst of the orbit* (Foltz, in Webster's *Dynam. Therap.*). It is liable to produce the ordinary effects of the lead preparations, in consequence of which, as an external application, iodide of cadmium has been preferred.

PLUMBI NITRAS (U. S. P.)—LEAD NITRATE.

FORMULA: $Pb(NO_3)_2$. MOLECULAR WEIGHT: 330.18.

SYNONYMS: *Normal lead nitrate*, *Plumbum nitricum*, *Nitras plumbicus*, *Azotas plumbicus*, *Lead saltpetre*.

Preparation.—This salt may be obtained by dissolving litharge (PbO), in fine powder, 4½ ounces, in diluted nitric acid, 1 pint, by the aid of a sand-bath heat. Filter, and set the liquor aside to crystallize, concentrate the residual liquid to obtain more crystals. Dry the crystals, on bibulous paper, in a warm atmosphere, and preserve in a well-closed bottle.

Description and Tests.—"Colorless, transparent, octahedral crystals, when obtained by the spontaneous evaporation of cold solutions, or white, nearly opaque crystals, when formed by the cooling of hot solutions; without odor, and having a sweetish, astringent, afterward metallic taste. Permanent in the air. Soluble in 2 parts of water at 15° C. (59° F.), and in 0.75 part of boiling water; almost insoluble in alcohol. When strongly heated, the salt decrepitates, emits nitrous vapors, and finally leaves a residue of lead oxide. The aqueous solution has an acid reaction, and yields a black precipitate with hydrogen sulphide T.S., a yellow one with potassium iodide T.S., and a white one with diluted sulphuric acid"—(*U. S. P.*). Lead nitrate is almost insoluble in strong nitric acid. Diluted alcoholic liquids dissolve it. Triturated with sulphur in a hot mortar, a feeble detonation is produced, and the lead is reduced to the metallic state. Trituration of this salt with oxidizable substances should, therefore, be avoided. Iron occasions no precipitate when kept in solution of nitrate of lead. It forms a precipitate with fibrin and albumen, also with sulphates, chlorides, and sulphides.

This compound is largely employed in the arts, in making *chrome yellow* and *chrome red* (neutral and basic lead chromate), in preparing mordants for dyeing purposes, and in the preparation of iodide of lead for medicinal use. "A 10 per cent aqueous solution of the salt should give, with potassium ferrocyanide T.S., a pure white precipitate (absence of iron or copper). If hydrochloric acid be added to the aqueous solution until no further precipitate is produced, and the remainder of the lead be removed from the filtrate by hydrogen sulphide, a portion of the new filtrate should not be affected by the addition of a slight excess of ammonia water (absence of zinc or iron). If another portion be evaporated to dryness, it should leave no residue (absence of the salts of the alkalies, or of zinc)"—(*U. S. P.*). The presence of copper would also be indicated by the blue solution produced by the addition of excess of aqua ammoniæ to the aqueous solution of the salt, after the white precipitate of lead hydroxide ($Pb[OH]_2$) has subsided.

Action, Medical Uses, and Dosage.—Lead nitrate produces the general effects of the soluble salts of lead. It is rarely used internally, though recommended, in doses of $\frac{1}{4}$ to 1 grain, in pill or solution, many years since, in *asthma*, *epilepsy*, and to check *hemorrhages*. Externally, a solution has been employed as a topical application to *wounds*, *ulcers*, *sore nipples*, *cancerous tumors*, *chapped hands*, *cutaneous affections*, and *phagedenic ulcers;* also as an injection in *offensive discharges from the vagina*, *urethra*, etc. It destroys the odor of *gangrenous affections*. The powder is a good application to destroy the *fungoid ulcerations*, with saneous discharges, arising from *onychia*, and is accredited with the cure of *epithelioma*. When applied to *sore nipples*, these should always be washed with warm water each time before the child is put to the breast. From 10 grains to 1 drachm of the nitrate, dissolved in 1 fluid ounce of distilled water, according to the strength desired, has been used. Nitrate of lead is likewise used as a disinfectant. It completely destroys the unpleasant odor of animal and vegetable substances which are evolving sulphide of hydrogen, or sulphide of ammonium. *Ledoyen's disinfecting fluid* is a solution of 8 drachms of nitrate of lead in ½ pint of distilled water.

PLUMBI OXIDUM (U. S. P.)—LEAD OXIDE.

FORMULA: PbO. MOLECULAR WEIGHT: 222.36.

SYNONYMS: *Litharge, Semivitrified oxide of lead.*

"Lead oxide should be kept in well-closed vessels"—(*U. S. P.*).

Preparation.—When lead is heated in the air so as to be converted into vapor, it burns with a white light and forms oxide of lead, which, when thus obtained, is termed *flowers of lead*. If melted lead be exposed to a current of air, it is rapidly oxidized on its surface; if the latter be renewed by continual stirring, the whole mass becomes converted into gray *lead ash*, this being a mixture of an amorphous yellow oxide (PbO), termed *massicot*, and gray particles of unoxidized metallic lead. Upon further oxidation, the latter also becomes converted into the oxide. If oxidation of the lead is carried out at a temperature above the melting point of the resultant oxide, the latter, upon cooling, solidifies in the form of a brick-red mass, called *litharge*, consisting of crystalline scales. It is largely obtained in the process of cupellation, *i. e.*, the obtaining of silver from argentiferous galena. Pure lead oxide may be obtained by igniting pure lead carbonate or oxalate to constant weight in a porcelain crucible.

Description.—The official requirements for lead oxide are: "A heavy, yellowish or reddish-yellow powder, or minute scales, without odor or taste. On exposure to the air it slowly absorbs moisture and carbon dioxide. Almost insoluble in water, to which it, however, imparts a faintly alkaline reaction; insoluble in alcohol; but soluble in acetic or diluted nitric acid, and in warm solutions of the fixed alkalies. When heated, the oxide assumes a brownish-red color, becoming yellow again on cooling. It fuses at a red heat. When heated in contact with charcoal, it is reduced to metallic lead"—(*U. S. P.*). It is likewise reduced to metallic lead at a dull-red heat by hydrogen and by carbon monoxide gas. Litharge is commercially distinguished by its color, as *yellow* or *silver litharge*, and *red* or *gold litharge*. Oxide of lead is soluble in water to the extent of only 1 in about 7000 parts (A. M. Comey, *Dict. Inorg. Solubilities*, 1892). Glycerin and sugar solutions also slightly dissolve it, and acquire the odor of caramel and a brownish color upon being digested with it. Lead oxide is also soluble in warm solution of lead acetate, basic lead acetate being formed (see *Liquor Plumbi Subacetatis*). Lead oxide dissolves in caustic alkali with formation of a *plumbite*, *e.g.*, PbO_2K_2. The specific gravity of oxide of lead is about 9.5.

Tests.—Litharge is liable to contain, among other impurities, the following: Metallic lead, minium (red lead), iron, copper, oxide of antimony, silicic and carbonic acids, etc. Brick dust and yellow ochre (an earthy iron silicate) have been used as adulterants. A pure article conforms to the following pharmacopœial requirements: "Lead oxide should be soluble in diluted nitric acid with but little effervescence (limit of carbonate), and without the development of the odor of nitrous acid, leaving not more than a trifling residue (absence of silicate, barium sulphate, etc.). The solution, which should be colorless, yields with hydrogen sulphide T.S. a black precipitate, with potassium iodide T.S. a yellow one, and with diluted sulphuric acid a white precipitate, the latter being soluble in a strong solution of sodium hydrate. If from the solution in diluted nitric acid the lead be precipitated by sulphuric acid, the filtrate, after the addition of an excess of ammonia water, should not assume more than a slight bluish tint (limit of copper), nor yield more than traces of a reddish-yellow precipitate (limit of iron). If 5 Gm. of the oxide contained in a small flask be shaken with 5 Cc. of water, then 20 Cc. of acetic acid added, and the mixture boiled for a few minutes and filtered, the insoluble residue, when well washed and dried, should not weigh more than 0.075 Gm. (absence of more than 1.5 per cent of insoluble impurities). When strongly heated, in a porcelain crucible, the oxide should not lose more than 2 per cent of its weight (limit of carbonate and of moisture)"—(*U. S. P.*). Mr. F. W. Haussmann (*Amer. Jour. Pharm.*, 1897, p. 572) found nearly all of 25 commercial specimens examined tolerably pure.

Action and Medical Uses.—Oxide of lead is used in the preparation of lead plaster and other compounds of lead. It is sometimes employed, sprinkled on *ulcers*, etc., as an astringent and desiccative, though, as a rule, care should be taken not to use it where the skin is broken. It enters into the composition of several plasters and ointments. A mixture of sweet oil and litharge may be applied to *burns*, provided the skin is intact, and a superficial caustic, prepared of litharge and caustic potash, is sometimes employed to destroy *genital warts*. When boiled with cream of lime, it forms a plumbite of calcium, which has been employed as a hair-dye.

Lead and Its Compounds.—Plumbum, *Lead*. Symbol: Pb. Atomic Weight: 206.4. This metal has been known from earliest antiqnity, and is frequently mentioned in the Bible. It exists in nature occasionally as an oxide; and in the form of normal lead carbonate (*white lead ore*) it constitutes the mineral *cerussite*. Its most common ore is, however, sulphide of lead, termed *galena* (*galenite*, PbS), from which it is extracted by roasting the sulphide in a reverberatory furnace, which drives off the greater part of the sulphur in the form of sulphurous acid (sulphur dioxide gas); it is then smelted with coal and lime, the lead collected and cast into large ingots, called "*pigs.*" By another method, galena is roasted so as to convert part of it into lead oxide (PbO), another into lead sulphate ($PbSO_4$). By now elevating the heat the remaining lead sulphide acts on these oxygenated ores, whereby sulphurous acid escapes and metallic lead melts out. The reaction is as follows: $2Pb+PbSO=Pb_3+SO_2$, and $PbSO_4+PbS=Pb_2+2SO_2$. When silver is present in galena it is separated by cupellation (see *Argentum*). Lead is of a bluish-white color, and when newly scraped is very bright, but soon tarnishes (oxidizes) when exposed to the air. It is almost tasteless, and emits a peculiar odor on friction. It is one of the softest of the metals, is malleable, but not very ductile, and has the specific gravity 11.35. It enters into alloys with other metals. It fuses at 334° C. (633.2° F.) and at a very strong heat boils and evaporates. The vapors ignite when in contact with air, lead oxide being formed. The fused metal crystallizes upon slowly cooling. The beautiful phenomenon known as the "lead tree" is produced by the action of zinc upon a solution of acetate of lead (for directions see, *e. g.*, Merck's *Report*, 1898, p. 17). Lead drawn across paper produces a gray streak, thus, by prior use, leading up to the term "lead pencil," although this is now made from graphite (see *Carbon*), not from lead. This metal forms several oxides: (1) Lead suboxide (Pb_2O); (2) lead oxide (PbO) (see *Plumbi Oxidum*); (3) lead sesquioxide (Ph_2O_3); (4) red lead or minium (Pb_3O_4); (5) lead dioxide or peroxide (PbO_2) (see *below*). Dilute acids and concentrated nitric acid scarcely affect lead; it is dissolved, however, by diluted nitric acid with evolution of nitrous vapors. It is also, though slowly, dissolved by strong sulphuric, hydrochloric and hydriodic acids when warm. Organic acids, *e. g.*, acetic, tartaric and citric acids, in a strength of about 6 per cent, at temperatures between 25° and 35° C. (77° and 95° F.), will dissolve lead sufficiently to make the use of lead utensils for cooking purposes dangerous to health (see experiments by F. P. Hall, *Amer. Jour. Pharm.*, 1884, p. 115). The corrosive action of water on lead pipes seems to depend on the simultaneous presence of oxygen and carbon dioxide. Small quantities of chlorides, nitrates, ammonia and organic matter in water free from these gases do not attack lead. A trace of sodium, or calcium bicarbonate added to distilled water, completely prevents the solution of lead, a protecting crust being formed on the metal. Likewise, a hard white crust (basic lead sulphate) is formed in solution of calcium sulphate, if free from an excess of carbon dioxide. No lead is then dissolved (see M. Müller, *Amer. Jour. Pharm.*, 1888, p. 250). The presence of ammonium nitrate especially induces corrosion of lead (see M. M. P. Muir, in Roscoe and Schorlemmer's *Chemistry*, p. 296). These and other experiments tend to show that for hard water, not liable to contain much free carbonic acid gas, lead pipes are a safe hydrant material for potable waters. Lead in solution may be detected by the black precipitate of lead sulphide, yielded in acid or neutral solution, by hydrogen sulphide gas; by the white, insoluble precipitate of lead sulphate produced when diluted sulphuric acid or a soluble sulphate is added; the precipitate is somewhat soluble in hydrochloric or nitric acids, and readily soluble in ammonium tartrate or acetate; from this solution yellow potassium chromate precipitates lead chromate ($PbCrO_4$). Lead sulphate is colored black by ammonium sulphide or hydrogen sulphide, which is not the case with barium sulphate. Iodide of potassium, with soluble lead salts, produces a yellow precipitate (see *Plumbi Iodidum*). Also, see methods for the detection of lead in potable water in *Jahresb. der Pharm.*, 1896, pp. 801–803). Medicinally, the preparations of lead are rarely used internally, except as sedatives and astringents in *hemorrhages* and *dysenteries*. The acetate is more generally employed. Their internal use is very apt to produce constipation, loss of appetite, indigestion, griping pains, etc. They are more commonly used as topical applications in *superficial inflammations*, *contusions*, *fractures*, *excoriations* (rarely), etc., and some forms of *cutaneous disease*. (For action of lead and lead poisoning see, *Plumbi Acetas*.)

Plumbi Oxidum Rubrum (Pb_2O_4), *Red oxide of lead.*—Red oxide of lead, also known by names of *Red lead*, *Minium*, etc., is prepared on a large scale from the oxide of lead (*yellow massicot*), by absorption of oxygen, *i. e.*, by exposing it, with the access of air, to a temperature just short of what is required to cause fusion, stirring it occasionally, for a day and a half or upward, and allowing the product to cool slowly. A fine grade of red lead is procured by calcining the oxide of lead obtained from the carbonate, and is known as *Paris red*. It is not so dense as the common red lead, and has a vivid, orange-red color. It is also known as *Sandix* and *Orange-red*.

Red lead is a tasteless powder, of an intense scarlet-red color, often inclining to orange, and very heavy, its specific gravity being 9.096. It does not sensibly lose weight at 400° F., but when heated to redness, it gives out oxygen gas, and gradually runs into a dark-brown glass of considerable hardness. Red lead is used in the manufacture of flint glass, which is a *silicate of lead*, and which is an exceedingly brilliant and fusible glass. Red lead is insoluble in water. Nitrous acid dissolves it entirely, forming nitrite of lead. Diluted acetic acid, or nitric acid, also a solution of lead acetate, instantly render it dark-brown, resolving it into two oxides, one of them, the lead oxide (PbO), which is dissolved, and the other, the peroxide or dioxide (PbO_2), which remains. Addition of oxalic acid or sugar will effect complete solution by these acids or lead acetate. Any insoluble foreign matter that may be present—*e.g.*, brick dust, oxide of iron, etc.—is thus left as residue. Diluted sulphuric acid does not affect minium. The only pharmaceutical purposes for which this article is used, is in plasters, as, for instance, the *Black plaster* or *Black salve*, a useful and efficient agent in *cuts, wounds, ulcers*, some *cutaneous affections*, etc. It is used in the arts for fine painting, for coating metals, cementing joints in metals, and, as stated above, in preparing flint glass.

Plumbi Dioxidum (PbO_2), *Lead dioxide, Lead peroxide, Puce oxide of lead.*—This is a dark or flea-brown, insoluble powder. When red lead is treated with diluted nitric acid, lead peroxide is left undissolved. It is also obtained by adding to solution of a lead salt solution of chlorinated soda or chlorinated lime. When a lead salt is acted upon by the electric current, lead dioxide, or rather its hydrate, *plumbic acid* (PbO_3H_2), is deposited at the positive pole. Lead dioxide is slowly decomposed in diffused light; oxygen is evolved, and red lead remains. If the dioxide is heated, litharge and oxygen are produced. Lead dioxide, warmed with hydrochloric acid, produces chlorine, and is converted into plumbic chloride ($PbCl_2$). The dioxide is insoluble in nitric acid, but becomes soluble in this acid upon addition of oxalic acid or sugar and warming. Lead dioxide is soluble in alkalies, forming therewith crystallizable *plumbates, e.g., potassium plumbate* ($PbO_3K_2+2H_2O$). Lead dioxide is employed in analytical chemistry as an oxidizing agent, also in the manufacture of matches.

Plumbi Chloridum ($PbCl_2$), *Chloride of lead, Horn lead.*—Lead chloride may be formed when lead is dissolved in concentrated, boiling hydrochloric acid, and the solution diluted with water. It is readily obtained by dissolving 4 parts of acetate of lead in 12 parts of distilled water, and then adding pure hydrochloric acid, as long as a precipitate is formed (about 3 parts). Throw the precipitate on a filter, wash it a few times with distilled water, and dry it with a gentle heat; the yield will be about 2⅔ parts. It is a white powder, consisting of fine needles, odorless, of a sweetish, astringent taste, and permanent in the air. Heated, it fuses, forming, when cold, a horny, semi-transparent mass (*plumbum corneum*); at a higher temperature, it is completely volatile without decomposition. The salt requires about 140 parts of cold, and not quite 30 parts of boiling water for solution. The solution has an acid reaction. It is completely soluble in strong hydrochloric acid, from which solution it is precipitated by the addition of water. Alcohol does not dissolve the salt. If it contains copper, it acquires a greenish tint on becoming moist in the air; and aqua ammoniæ causes a deep-blue solution. There are several oxychlorides (basic chlorides) of lead, the minerals *matlockite* (Pb_2OCl_2) and *mendipite* ($Pb_3O_2Cl_2$). Commercial preparations are known as *Turner's yellow, Paris, Verona*, or *Cassel yellow* ($PbCl_2.7PbO$). They are obtained by heating together lead oxide, or carbonate, or red lead, with chloride of lead in varying proportions, or ammonium chloride, or even sodium chloride may replace lead chloride. *Pattinson's white lead* (1849) is also an oxychloride of lead ($Pb[OH].Cl$) obtained by precipitating solution of chloride of lead with lime-water in definite proportions (Roscoe and Schorlemmer's *Chemistry*, Vol. II, Part I, p. 287).

Chloride of lead is employed externally, as an astringent and caustic application. It combines with fibrin and albumen forming insoluble compounds, and, when absorbed into the system, it produces the usual effects of the compounds of lead. When applied to *cancerous ulcerations*, and in *painful neuralgic affections*, it is said to allay pain and restrain morbid action, and also to allay inflammation. It may be used in the form of lotion, 1 drachm of the chloride dissolved in a pint of water; or, as an ointment, 1 part of the chloride to 8 parts of lard. It is also a disinfectant.

Plumbi Tannas, *Tannate of lead.*—This salt may be obtained by adding a solution of tannic acid, drop by drop, to a solution of acetate of lead, until a precipitate is no longer formed. Collect the precipitate on a filter, wash and dry it. The salt thus formed is a bitannate of lead, an almost white powder, which subsequently changes to a brown color. It has been recommended as an application in *excoriations, sloughing bed sores, chronic ulcers of the feet, sore nipples*, etc. It may be dusted on the parts, applied in the form of liniment, composed of 3 ounces of the salt moistened with 2 fluid drachms of alcohol, and applied while moist; or used in ointment, 2 parts of the tannate to 5 parts of lard.

The *German Pharmacopœia* directs the extemporaneous preparation of Unguentum Plumbi Tannici (*Cataplasma ad Decubitum*, or *Plumbum Tannicum Pultiforme*): Tannin (1 part), lead subacetate solution (2 parts), lard (17 parts).

Lead Chromate ($PbCrO_4$), *Chrome yellow, Lemon yellow, Paris yellow, Leipsic yellow, Chromate of lead, Lemon chrome.*—A neutral lead compound formed when a solution of lead salt, usually the nitrate, is precipitated with potassium chromate or bichromate. It is a beautiful canary or lemon-yellow powder. If digested with a weak potash solution, or with solution of potassium chromate, about half its chromic acid is taken up and a basic lead chromate (PbO,

$PbCrO_4$) results. This is a bright-red compound, which is used alone or mixed with varying quantities of neutral lead chromate (chrome yellow), producing the pigment known as *Chrome red*, *Chrome orange*, and *American vermilion*. *Chrome green* is a mixture of Prussian blue and chrome yellow. Chrome yellow must not be used for coloring food materials, because of its poisonous nature. Fatalities have resulted from its use by bakers to give color to cakes and pastries (see *Amer. Jour. Pharm.*, 1888, p. 151).

Naples Yellow.—A yellow pigment consisting of *lead stibiate*. It may be obtained by fusing a mixture of tartar emetic (1 part), nitrate of lead (2 parts), and sodium chloride (4 parts), or by roasting a mixture of litharge and antimony trioxide.

Mineral Yellow, *Patent yellow*.—A pigment containing principally lead oxychloride (see *Plumbi Chloridum*).

PODOPHYLLUM (U. S. P.)—PODOPHYLLUM.

"The rhizome and rootlets of *Podophyllum peltatum*, Linné"—(*U. S. P.*).

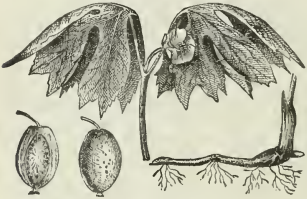
Nat. Ord.—Berberideæ.

Common Names: *May apple*, *Mandrake*, *Wild lemon*, *Raccoon-berry*. *Wild mandrake*, etc.

Illustrations: Bentley and Trimen. *Med. Plants*, 17; Johnson, *Med. Bot. of N. A.*, Plate I.

Botanical Source.—May apple is an indigenous, perennial herb, with a long, jointed, dark-brown rhizome or root, about half the size of the finger, spreading extensively in rich grounds in which it is introduced, and giving off fibers at the joints; internally, it is yellowish. The stem is simple, round, smooth, erect, dividing at top into 2 round petioles, from 3 to 6 inches long, each petiole supporting a leaf; is about a foot high, and invested at its base by the sheaths which covered it when in bud. The leaves are large, peltate-palmate, oftener cordate, in from 5 to 9 wedge-shaped lobes, each lobe 6 inches long from the insertion of the petiole, 2-lobed and dentate at the apex; smooth, yellowish-green on the upper surface, paler and slightly pubescent beneath. In barren stems which support but one leaf, the peltate character is the most perfect. The flower is solitary in the fork of the stem, on a round, nodding peduncle, 1 to 2 inches long, white, large, about 2 inches in diameter, and somewhat fragrant. The calyx consists of 3 oval, obtuse, concave, caducous sepals, which cohere in the bud by their scarious margins. The corolla is composed of from 6 to 9 white, obovate, obtuse, smooth, concave petals, curiously netted with slight, transparent veins. Stamens from 9 to 20, shorter than the petals, curving upward, with yellow, oblong anthers twice as long as the filaments, not opening by perfect uplifted valves. Ovary oval, compressed, and obscurely angular. Stigma subsessile, convex, its surface rendered irregular by numerous folds and convolutions. The fruit is fleshy, ovoid-oblong, 1-celled, 1 or 2 inches in length, of a lemon color, with brownish spots when ripe, and crowned with the large, persistent stigma; the flavor of the mucilaginous pulp is somewhat similar to that of a strawberry, and incloses 12 seeds in pulpy arils (L.—W.—G.). (For paper on microscopical structure of the rhizome of podophyllum, by Prof. E. S. Bastin, see *Amer. Jour. Pharm.*, 1894, p. 417.)

Fig. 201.



Podophyllum peltatum; with rhizome and fruit.

History.—Intimately associated with the progress of Eclecticism is the drug, *podophyllum* and its resin, *podophyllin*. The introduction of the latter to the medical profession by Prof. John King, who first prepared it and indicated its therapy at a time when improved and reliable pharmaceuticals were most urgently demanded, and when the introduction of indigenous remedies that could be administered in small doses, freed from extraneous and inert materials, with certain and definite results, was a necessity, marks an epoch in the history of Eclectic medicine. Podophyllum was one of the earliest favorites of our school of practice, and before the introduction of *podophyllin*, was much more extensively employed than at present. By many, in the treatment of certain disorders, its use is still preferred to that of its resin.

This plant, which grows abundantly from Canada to Florida, and throughout the middle and western states, is one of the most attractive of our medicinal plants. It is said to be scarce in the New England states. In the middle states, it is familarly known as Mandrake, and farther west as the May apple. It has also borne the names of Wild mandrake and Mayflower, and, on account of its fruit, Raccoon-berry, Indian apple, and Wild lemon. The name *podophyllum* is derived from two Greek terms—*poys*, foot; *phyllon*, leaf—either on account of its resemblance to the webbed foot of some aquatic bird, or in allusion to its long, firm stalk, which bears the leaves. Making their appearance in the early spring, the conical shoots may be seen piercing the ground in large patches, and, in a short time, expanding into wide-spread, umbrella-like leaves, which almost completely hide the ground beneath them. The plant is found growing in rich, moist soil, along the border of woodlands and on the banks of streams, as well as in low meadows and marshy situations. The rhizomes occur in great abundance, from 1 to 2 inches underneath the surface of the soil. May apple is hardy and will thrive in fence corners of cultivated fields, often resisting the advance of agricultural improvements, when other common fence-weeds have been exterminated. It is not, as is the case with many other valuable medicinal plants, likely to be very soon eradicated.

The creeping rhizome, which often attains a length of 1 to 6 feet, and is about one-fifth of an inch in thickness, sends up a stem to the height of about 1 foot. This stem then forks at the top and each petiole so created bears a single peltate leaf of palmate variety, having 6 or 7 lobes. Flowerless plants have only 1 leaf, generally centrally peltate, with from 7 to 9 lobes. In the fork of the stem the flower appears—a single, fragrant, beautiful, waxy-white blossom, about 2 inches wide. The flowers are eagerly sought for by the children of cities, and on account of their beauty and delightful fragrance, find ready purchasers among the lovers of "wild beauties." The bloom, which appears in May, hence the names May flower and May apple, is followed in August and September by a small, yellowish-green, lemon-like, succulent berry, about the size of a plum. Its flavor is agreeable to many persons, and its taste is sub-acid and sweetish. It may be eaten with impunity, though all other parts of the plant produce pronounced physiological effects. It is, however, slightly laxative, and possesses diuretic properties. The young shoots, it is said, were used by the aborigines for suicidal purposes. Like most drugs of the order Berberideæ, podophyllum has a bitter, acrid taste. Its therapeutic activity is due to a resinous principle of a compound nature, known as *podophyllin* (see *Resina Podophylli*). The root was well known to the Indians as an active cathartic; the proper time for collecting it is in the latter part of October, or early part of November, soon after the ripening of the fruit. The medicinal properties of the leaves are not satisfactorily determined, though by some deemed poisonous (see *Chemical Composition*).

Podophyllum has been extensively used in domestic practice, oftentimes to the detriment of the patient. The Cherokee Indians, according to Rafinesque, employed the "fresh juice of the root for deafness, putting a few drops of the juice in the ear." Settlers learned from the Wyandottes, that roasting the root deprived it somewhat of its drastic qualities. The famous "Indian Doctor" Hough recommended the "powdered root as an escharotic to cleanse foul and ill-conditioned ulcers, and to dispose them to heal and to promote the exfoliation or removal of carious or rotten bones." The powder was sprinkled on the parts once, and again, if necessary, in from 2 to 5 days. In domestic veterinary (?) practice, which often amounts to barbarity, the drug was employed to cure poll-evil in horses, the root being plunged into the sore and allowed to remain several days. Both Bigelow and Eberle praised the purgative qualities of this drug.

Description.—The *U. S. P.* thus describes the root: "Of horizontal growth, consisting of joints about 5 Cm. (2 inches) long, flattish, cylindrical, about 5 Mm. (¼ inch) thick, but somewhat enlarged at the end, which has a circular scar on the upper side, a tuft of about ten, nearly simple, fragile roots, on the lower side, and is sometimes branched latterly; smooth or somewhat wrinkled, orange-brown, internally white and mealy, with a circle of small wood-bundles; pith large; nearly inodorous; taste sweetish, somewhat bitter and acrid"—(*U. S. P.*). It is readily reduced to a grayish powder, having somewhat the odor of ipecacuanha, and breaks with a short fracture. Its active principles are readily taken up by alcohol, or ether; water takes up only a portion of its activity.

Chemical Composition.—The active principle of the root is a resinous body, soluble in alcohol and practically insoluble in cold water. It was discovered by Dr. John King, in 1844 (see historical notes, by J. U. Lloyd, *Amer. Jour. Pharm.*, 1890, p. 242), and named by him "*Resin of Podophyllum.*" It was afterward known as *podophyllin* (also see *Resina Podophylli*). Mr. John R. Lewis (*ibid.*, 1847, p. 165) found, in addition, gum, starch, albumen, gallic acid, fixed oil, etc. Prof. F. B. Power (*Proc. Amer. Pharm. Assoc.*, 1877, p. 420) disproved the statement of Prof. F. F. Mayer (1863) that berberine and saponine occur in the root. The resin of podophyllum was thoroughly investigated by Podwissotzky (see Prof. F. B. Power's abstract in *Amer. Jour. Pharm.*, 1882, pp. 102–115). According to this authority, the resin may be differentiated by ether into the insoluble, inert brown resin *podophyllic acid*, which is also insoluble in petroleum ether and water, soluble in alcohol and chloroform; and the soluble active principle, *podophyllotoxin*. This substance is a white, resinous, amorphous powder, very bitter, of slightly acid reaction, soluble in diluted alcohol and hot water, completely soluble in chloroform, also soluble in ether when free from the aforenamed podophyllic acid. It is insoluble in petroleum ether; hence pure podophyllotoxin may be obtained by treating a chloroformic extract of the rhizome with ether, and precipitating the ethereal solution with petroleum benzin, which keeps fatty matters dissolved. Both chloroform and ether must be alcohol-free, as far as possible, otherwise the podophyllotoxin will be contaminated with the yellow crystallizable coloring matter, *podophyllo-quercetin*, which is soluble in alcohol, ether and alkaline solutions, sparingly soluble in chloroform, insoluble in water. It produces a dark, greenish-brown coloration, with ferric chloride. R. Kürsten (*Archiv der Pharm.*, 1891, p. 220) obtained 0.2 per cent of *podophyllotoxin* in well-defined crystals melting at 93° to 95° C. (199.4° to 203° F.) and having the composition, $C_{23}H_{24}O_9+2H_2O$. *Podophyllotoxin*, according to Podwissotzky, is not a uniform body, but is a mixture of inert, resinous *picropodophyllic acid* and the cathartic, crystallizable, bitter principle *picropodophyllin*, the latter being held in solution by the former and falling out when the solvent is neutralized by an alkali. From the filtrate the acid is precipitated upon the addition of mineral acid. *Picropodophyllin*, the active principle, crystallizes in silky needles, and is a neutral body. It shares in general the solubilities of podophyllotoxin except that it is insoluble in water. For this reason Podwissotzky prefers the more soluble *podophyllotoxin* as a therapeutic agent. *Picropodophyllin* is soluble in 90 to 95 per cent alcohol, but hardly soluble in alcohol of 50 to 80 per cent. It also dissolves readily in glacial acetic acid. By warming its alcoholic solution or evaporating this solution with excess of ammonia, it is converted into an inert, amorphous, acid substance.

Podophyllotoxin was found by Dunstan and Henry (see *Amer. Jour. Pharm.*, 1898, p. 246) to be the active principle of both the Indian and American podophyllum, but these authors consider it to be a well-defined body of the composition $C_{15}H_{14}O_6$, which differs from the formula arrived at by Kürsten (1891). It is strongly lævo-rotatory, and acts as a powerful purgative and intestinal irritant. When heated with alkalies it takes water and is converted into the salt of an unstable gelatinous acid (*podophyllic acid*, $C_{15}H_{26}O_7$). This readily loses water again, being converted into the crystalline *picropodophyllin* of Podwissotzky, which, as Kürsten (*loc. cit.*) has ascertained, is an isomer of podophyllotoxin. Warming with aqueous alkalies again converts it into podophyllic acid. Picropodophyllin is claimed by Dunstan and Henry to be therapeutically inert. An uncrystallizable resin, *podophylloresin* was also isolated and found to be purgative.

The *leaves* of Podophyllum peltatum were analyzed by T. J. Husband (*Amer. Jour. Pharm.*, 1860, p. 200), who states that they are devoid of cathartic properties, and, when dried, are probably non-poisonous. B. F. Carter (*ibid.*, 1886, p. 449) collected leaves soon after flowering and found them to contain 6 per cent of a greenish-black bitter resin, all of which was soluble in alkali and alcohol, 90 per cent being soluble in ether, a hard resin remaining; 86 per cent in chloroform, 40 per cent in petroleum benzin, etc., and a considerable quantity being soluble in boiling water. This resin seems to exert a milder action than that from the rhizome.

Action, Medical Uses, and Dosage.—Physiologically, podophyllum acts as a certain, but slow cathartic. Small and repeated doses short of catharsis may induce ptyalism; on this account both podophyllum and podophyllin have been called "vegetable mercury" and "vegetable calomel." Under the influence of a cathartic dose, the intestinal and hepatic secretions are augmented and after a considerable time copious alvine evacuations result. Considerable pain and griping may attend its action, which, however, may be modified by such agents as leptandra, hyoscyamus and belladonna. Common salt increases its purgative power. Unlike other cathartics, its effects are permanent and leave the bowels in an improved condition. If the dose be too large, violent emeto-catharsis may result. Although the cholagogue value of this drug was asserted by our practitioners for years, it took extensive physiological investigations, conducted by Rutherford and Vignal, to convince our regular friends that it really possessed such a property. The green root internally administered, acts as an irritant poison, causing hypercatharsis, hyperemesis, gripings, and other unpleasant symptoms; even the recently dried root, in doses of from 30 to 60 grains, is a drastic cathartic and emetic; but the violence of its action is materially modified by age, or roasting. Either the green or the dried root continuously applied to the cutaneous structure, occasions irritation, followed by suppuration. Irritation of the mucous membrane is the result of contact with the powder, and workers in this drug and its resin are liable to conjunctival inflammation. Overdoses of podophyllum have produced death, and the drug, when contraindicated, may give rise to prolonged gastro-intestinal irritation and even inflammation. As a cathartic, very little tormina is produced by it when compared with the completeness of its purgative action. It acts somewhat like jalap, though more slowly. To render its hydragogue, it should be administered with potassium bitartrate on which account it has been found serviceable in *dropsical affections*.

Podophyllum may be used in nearly all cases in which podophyllin is useful, though there are some conditions where the former gives better results than the latter. These conditions we will briefly notice. It is conceded that as an alterative it is infinitely more decided in its action than the resin. It exerts a powerful influence upon the whole glandular system. Associated with proper hygienic measures and the indicated tonics and other alterative drugs, it will give good results in *constitutional syphilis*, *rheumatism* and *scrofula*. The dose should be small, not sufficient to produce any marked intestinal activity. In stomach troubles, podophyllum is superior to podophyllin. It acts as a gentle stimulant tonic, improves the appetite, and is particularly valuable in *atonic dyspepsia*, *gastric* and *intestinal catarrh*, and all *atonic forms of indigestion*, when the patient complains of dizziness, loss of appetite and heavy headache. There is indisposition to exertion, the movements being heavy and sluggish, the tongue is dirty and flabby, and the superficial veins, abdomen, and tissues in general, are characterized by *fullness*. Its action on the hepatic viscus renders it particularly serviceable where gastric disturbances are due to hepatic torpor. In stomach troubles, hydrastis, iris, lobelia, agrimonia and ipecac may also be indicated and associated with this drug. Podophyllum, iris, chionanthus and chelidonium are excellent agents for *chronic hepatitis*. By its slow and thorough action, yet permanent in its effects in restoring and maintaining the normal hepatic and intestinal secretions, podophyllum is one of the very best agents to overcome *habitual constipation*, and more especially if it be due to portal engorgement. The small dose should be given and continued until the evacuations become regular and normal. Formerly this drug was much employed in *bilious*, *remittent* and *intermittent fevers*. Cathartic and sometimes emeto-cathartic doses were employed with the result of producing so profound an impression on the hepatic function and on the portal circle and general glandular system that, it is asserted, the disease was often aborted, or at least rendered milder and of short duration. It is never so employed at the present day. As an emeto-cathartic it should be given in warm ginger tea. When a cathartic is needed, which, however, is not often, the specific podophyllum may be combined with compound syrup of rhubarb and potassa (neutralizing cordial), or to render it milder, lobelia, ipecac, leptandra, hyoscyamus or belladonna may be administered with it. As a cathartic in *dropsy* it has done good service, and should, in this disease, be given with cream of tartar. It has likewise been found very beneficial in *dysmenorrhœa*, *amenorrhœa*, *incontinence of urine*, *worms*, and some *affections of the bladder*. Further uses of this drug will be given when considering podophyllin. The usual medicinal dose of specific podophyllum ranges from 1 to 10 drops. Dose of the powdered root, as a cathartic, from 10 to 30 grains; of the tincture, from 10 to 60 drops; as a sialagogue and alterative, from 1 to 5 grains of the powder, or from 1 to 10 drops of the tincture.

Specific Indications and Uses.—Podophyllum is specifically indicated by *fullness* of tissues, and particularly by fullness of superficial veins; oppressed full pulse; dirty yellowish coating of tongue and dizziness. It is contraindicated by pinched features and tissues, contracted skin and tongue.

Related Species.—*Podophyllum Emodi*, Wallich. Dymock and Hooper report (*Pharm. Jour. Trans.*, 1889, Vol. XIX, p. 585) that this plant of the Kashmere valleys and other Himalayan points contains in its rhizome 12 per cent of a cathartic resin. It is altogether probable that the constituents of the latter are identical with those of our podophyllin. One-half grain of it purges. It was thought that the Indian drug might supplant *P. peltatum*, owing to its supposed superiority in active principle. John C. Umney, however, points out *Amer. Jour. Pharm.*, 1893, p. 24) that while *P. Emodi* yields 11.4 per cent and *P. peltatum* only 5.9 per cent of resin, the latter contains nearly twice as much of the active *podophyllotoxin* as the resin obtained from the Indian drug. The inferior medicinal action of the latter agrees with this result.

Podophyllum montanum of Rafinesque, having a slender, deeply furrowed stem; the leaves with sharp, bifid segments, palmate, not peltate, with narrow sinuses, and many unequal teeth; the petals 6 to 7, oblong, obtuse; stamens 7 to 9, and berry yellowish, oblong, is possessed of similar medicinal properties.

POLEMONIUM.—AMERICAN GREEK VALERIAN.

The root of *Polemonium reptans*, Linné.

Nat. Ord.—Polemoniaceæ.

COMMON NAMES: *American Greek valerian*, and sometimes called *Blue bells* and *Jacob's ladder*.

Botanical Source.—This indigenous perennial plant has a creeping root and a smooth, erect, weak, fleshy, diffusely-branched stem from 12 to 20 inches high. The leaves are alternate and pinnately divided; leaflets 7 to 11, ovate-lanceolate, acute, subopposite, smooth, entire, sessile, an inch long and half as wide; upper leaflets sometimes confluent. The flowers are numerous, terminal, rather large, nodding, on short petioles, blue, and nearly bractless. Calyx campanulate, 5-cleft; segments lanceolate-acute, persistent, much shorter than the tube of the corolla. Corolla rotate-campanulate, limb 5-lobed, erect, tube short, closed at the base by 5 staminiferous valves. The stamens are 5, equally inserted at the summit of the corolla tube; the filaments slender, declined, and hairy-appendaged at the base; the anthers introrse. The capsules are 3-celled and 3-valved; the cells from 2 to 3-seeded (W.—G.).

History.—This is a handsome plant, growing in woods, damp grounds, and along shady river banks, from New York to Wisconsin, bearing blue flowers in May. The root is the part used, and yields its virtues to water; it has not been analyzed.

Action, Medical Uses, and Dosage.—Alterative, diaphoretic, and astringent. A warm infusion of the root will, it is said, produce copious perspiration, and has been found serviceable in *pleurisy*, *febrile* and *inflammatory diseases*. The tincture, made of whiskey, in doses of from 1 to 2 fluid ounces, 2 or 3 times a day, has been found valuable in *scrofulous diseases*, and other chronic diseases where an alterative is indicated. The infusion is recommended in the *bites of venomous snakes and insects*, and in *bowel complaints* requiring the use of astringents. Reported to have cured *consumption*, but these cases were probably of severe *bronchorrhœa*. Useful in *bronchial and laryngeal affections*. The plant deserves investigation.

Related Species.—*Polemonium cœruleum*, or *Greek valerian*, is a native of England. It has been found in swamps in New York, Vermont, and New Jersey. It is larger and more numerously-flowered than the above, and is often found cultivated in gardens. Stems about 2 feet high, stout, hollow, several from the same root, each dividing at top into a corymbose panicle. Leaves mostly radical, on long, grooved petioles, pinnately 11 to 17 foliate; segments sessile, ovate-lanceolate, subopposite, acuminate, oblique, odd one lanceolate. Flowers blue, terminal, suberect. This plant, probably, possesses medicinal virtues similar to the one above (W.)

POLYGONUM.—WATER PEPPER.

The fresh herb of *Polygonum Hydropiper*, Linné.

Nat. Ord.—Polygonaceæ.

COMMON NAMES: *Smart weed, Water pepper.*

ILLUSTRATION: Britton and Brown, *Illustrated Flora of Northern United States, Canada, and the British Possessions*, Fig. 1333.

Botanical Source.—This is an annual, glabrous plant, with a simple or branched, erect stem, of a red, reddish, or sometimes greenish color, from 8 inches to 2 feet high. The lanceolate, or oblong-lanceolate, leaves are from 1 to 4 inches long, acute or acuminate at apex, ciliate, undulate, or slightly crisped, punctate, and very acrid. The ocreæ are cylindric, fringed with short bristles, or occasionally slightly pubescent, generally swollen at the base on account of the development of flowers within. The flowers are borne in a panicled raceme, which is narrow, drooping, interrupted, and from 1 to 3 inches long. The green calyx is usually 4-parted (3 to 5), and conspicuously punctate; stamens 4, occasionally 6; style 2 or 3-parted, short; fruit a lenticular achene, triangled, broad-oblong or ovoid, slightly gibbous, dull and granular (Britton and Brown).

History.—Polygonum Hydropiper is a well-known, intensely acrid plant, found growing in nearly all parts of the United States, in ditches, low grounds, among rubbish, and about brooks and water-courses, flowering in July, August, and September. That growing in our section of the country being naturalized from Europe; Britton and Brown state that it is perhaps indigenous in the far northwest. There are many species of Polygonum (at least 38), some of which, although possessing similar virtues, differ materially in medical potency. The whole plant (*P. Hydropiper*) is medicinal, and has a biting, pungent, acrid taste. and imparts its virtues to alcohol or water. Age renders it inert, and heat impairs its medicinal qualities. It should be collected and made into a tincture while fresh.

Chemical Composition.—According to analysis by H. Trimble and H. J. Schuchard (*Amer. Jour. Pharm.*, 1885, p. 21), the tops and leaves contain 3.46 per cent of tannin, 7.4 per cent of ash, and resin, wax, gum, sugar, etc. The active (pungent) principle was found to disappear upon heating; it was contained in the alcoholic extract of the drug, after successive treatment with petroleum spirit and ether. Dr. C. J. Rademaker, however, asserted (*ibid.*, 1871, p. 490; and 1886, pp. 279 and 373) that the active principle consists of crystallizable *polygonic acid*, which, when pure, differs in its reactions from those for tannic or gallic acids. It is soluble in water, less soluble in ether, and insoluble in petroleum spirit. The heat of the water-bath does not destroy any of its properties.

Action, Medical Uses, and Dosage.—Water pepper is stimulant, diuretic, emmenagogue, antiseptic, diaphoretic, and vesicant. Dr. Eberle found it very efficient in the dose of a teaspoonful of the saturated tincture, repeated 4 or 5 times a day, or from 2 to 5 grains of the aqueous extract, in *amenorrhœa;* probably, an alcoholic extract would be found more active. He states that the use of it caused an increase of the heat of the body with a kind of formication, with bearing down and sense of fullness in the pelvic region. The infusion, in cold water, has been found serviceable in *gravel*, *colds*, and *coughs*, and in *milk-sickness*, and, mixed with wheat-bran, in *bowel complaints*. In *Asiatic cholera*, the patients, wrapped in a sheet moistened with a hot decoction, are said to have been much benefited, and to have recovered. In combination with sulphate of iron and gum myrrh, it is said to have cured *epilepsy*—probably dependent on some uterine derangement. Externally used as fomentation (simmered in water and vinegar) in *gangrene*. The infusion, or a fomentation of the leaves, has been beneficially applied in *chronic ulcers* and *hemorrhoidal tumors*, also as a wash in *chronic erysipelas* and *inflammations*, and as a fomentation in *tympanites* and *flatulent colic*. The fresh leaves, bruised with the leaves of May-weed, and moistened with the oil of turpentine, and applied to the skin, will speedily vesicate. The ashes of the plant combined with the ashes of the garden thyme (*Thymus vulgaris*) are, it is said, used by many empiries, injected, in solution, into the bladder as a solvent for *gravel* and *stone;* hazardous and doubtful treatment. The infusion, in cold water, forms an excellent local application in the *sore mouth of nursing women*, and in *mercurial ptyalism*. The decoction or infusion, in hot water, is not so active as when prepared in cold or warm water. Dose, of the infusion, from 2 to 4 fluid ounces; of the saturated tincture, from 1 to 4 fluid drachms, 3 or 4 times a day: specific polygonum, 1 to 60 drops.

Related Species.—*Polygonum Persicaria*, Linné, called *Smart weed*, *Lady's thumb*, or *Spotted knotwood*, possesses similar but inferior medicinal properties, and may be distinguished from the above by the deeper-green or purplish color of the whole plant, a brownish, heart-shaped spot near the center of the leaf, and its rose-colored flowers, in short, dense, terminal spikes. It has a feebly astringent, saline taste, and, at one time, was considered antiseptic.

Polygonum arifolium, Linné, *Sickle grass*, *Halbert-leaved tear-thumb*, or *Hastate knot grass*.—This plant grows in low and wet grounds throughout the United States, flowering from June to September. An infusion, in cold water, is a powerful diuretic, useful in *uric acid* and *phosphatic gravel*, *strangury*, *gonorrhœa*, and all *urinary affections*; it must be drank freely. Also of service in *catarrh of the bladder*, and in muscular debility of this organ.

Fagopyrum esculentum, Mœnch (*Polygonum Fagopyrum*, Linné; *Fagopyrum Fagopyrum* [L.], Karsten), or *Common buckwheat*, may be used as follows, to recall the flow of milk in the breasts of nurses, where it has disappeared for several days. Stir into any amount of buckwheat flour, a sufficient quantity of buttermilk to form a poultice; warm it, but be careful not to boil or make it hot. Apply it thus warm, over the whole breast, and renew it every 4 or 6 hours. Sometimes it requires to be thus used for 3 or 4 days before its effect will be produced; usually, however, 24 hours will be sufficient. The seeds, deprived of their husks, contain about 70 per cent of starch and 13 per cent of gluten (Zenneck).

Polygonum erectum, *Erect knot grass*, *Bird knot grass*, *Goose grass*, *Bird weed*.—This is a perennial herb, common to the western and middle states and British America. It is found in abundance about country dooryards, roadsides, waste places, damp soils, etc., blossoming from June to October. This plant, in infusion, has been found highly efficient in the treatment of *diarrhœa*, and especially in *summer complaint of children*.

Polygonum amphibium, Linné, *Water persicaria*.—A variable plant growing in wet situations. It may be readily cultivated, and has been recommended for tanning purposes, as the dried stems yield over 17 and the root above 21 per cent of tannin.

Polygonum punctatum, Elliott (*Polygonum acre*, H. B. K., not of Lamarck , *Dotted* or *Water smart weed*.—A smooth annual or perennial, acrid species, found in swamps and other wet places throughout the most of North America. Has been used for similar purposes as smart weed.

Polygonum hydropiperoides, Michaux (*Polygonum mite*, Persoon), is *Mild water pepper*, found in wet soil and swamps throughout the United States, and flowering from June to September. It has decided stimulating properties. Eberle pronounces it a most active and certain emmenagogue (see *Amer. Jour. Pharm.*, 1883, p. 195).

Bistorta, *Bistort*.—The rhizome of *Polygonum Bistorta*, Linné, or *Snakeweed*. This plant is found in swampy places throughout the northern countries of the globe, being present in the United States northward from Colorado. The rhizome, which is recognized in some European pharmacopœias, is blackish-brown, peculiarly distorted, S-shaped, sub-annulate, reddish internally, and breaks with an almost smooth fracture. When broken it exhibits a large pithy center, surrounded by a single circle of many small, woody bundles, enveloped by a thicker bark. It is odorless, but powerfully astringent in taste, as it contains tannin to the extent of 21 per cent (Bowman, 1869). P. Krebs found tannin (15 per cent), resin (0.30 per cent), wax and fat, starch, dextrin, dextrose, mucilage, gallic acid, etc. (*Amer. Jour. Pharm.*, 1891. p. 476). It is employed where a vegetable astringent such as geranium, is indicated.

POLYMNIA.—UVEDALIA.

The root of *Polymnia Uvedalia*, Linné.

Nat. Ord.—Compositæ.

Common Names: *Bearsfoot*, *Leaf-cup*.

Botanical Source.—This is a large, perennial plant, from 3 to 6 feet in height, and found in ravines, on the edges of woods, etc., in the central states, from Illinois to Florida. The stems are erect, stout, branched, and covered with a rough, hoary pubescence. The leaves are large, thin, opposite, deltoid in outline, and abruptly contracted at the base to short dilated leaf-stalks. They are 3-lobed, with acute, sinuate-angled lobes, bright green on both surfaces, and studded below with numerous rough points. The flower heads appear late in summer, and are disposed in loose, corymbose clusters. The involucre is double; the outer consisting of about 5 ovate, obtuse, leaf-like scales, which are ciliate on the margin; and the inner, of the smaller thin bracts of the pistillate flowers. The flower heads are radiate, and the receptacle chaffy. The ray flowers are about 10, in a single row, each being nearly 1 inch in length; they are oblong, of a bright-yellow color, and equally 3-toothed at the apex. The ray flowers are pistillate, and alone fertile, as the disk-florets, although perfect, do not produce fruit. The fruit is an obovoid, black achenium, slightly flattened, and ribbed lengthwise.

History, Description, and Chemical Composition. Polymnia Uvedalia was introduced as a medicine, about 1870, by Dr. J. W. Pruitt, the root being the part employed. This, when dry, is from 6 to 12 inches in length, and from ¼ inch to ½ inch in diameter at the base of the plant. It extends downward into the ground, and running parallel with it several small roots springing from the base of the plant are often observed. The shape is somewhat like that of dandelion, but longer, not so tapering, and more flattened from the effect of drying. Toward he lower end it often divides into several fleshy rootlets, and secondary roots frequently spring from the main root. The outer surface is of a leather-color, and very much wrinkled longitudinally. Internally, it is white, or of a greenish cast, and soft, with the exception of a few woody fibers near the bark. It contains a large amount of resin, and exhales an unpleasant, animal-like odor when broken. Alcohol extracts from the root all its medicinal principles, the extractive matter mainly consisting of glucose in considerable proportion; a form of tannin which precipitates ferrous sulphate, black; an odorous principle, soluble in water and alcohol; and a mixture of two resins, which is present in greater amount than any other of its characteristic constituents; this resinous compound is heavier than water, of a brownish-yellow color, soft and sticky at ordinary temperatures, and possesses the odor of the root. It dissolves completely in chloroform, ether, and alcohol, imperfectly in benzin, which separates it into: (1) A dark-brown, hard resin, of an acrid taste, which remains undissolved; this is insoluble in carbon disulphide, but freely dissolves in chloroform, ether, and alcohol. (2) A light straw-colored, balsam-like, resinous body, heavier than water, rather thicker than Canada balsam, which it otherwise very nearly resembles; it readily dissolves in ether, alcohol, benzin, chloroform, and carbon disulphide, has the odor of polymnia root, and likewise an acrid taste. Undoubtedly, polymnia depends upon these resinous bodies for its medicinal virtues. The aqueous solution of the evaporated tincture yields a precipitate with phospho-molybdate of ammonium, but not with other alkaloidal reagents, and after precipitation of the tannin with either ferrous sulphate or gelatin, the filtrates give negative results with the phospho-molybdate of ammonium. Polymnia Uvedalia is used in medicine in form of tincture and ointment.

OINTMENT OF POLYMNIA.—Take of fresh polymnia root 8 troy ounces; lard or mutton suet 16 troy ounces; cut the root into small pieces, and, having added the lard, heat the mixture until water ceases to evaporate, and then strain while hot. The ointment is of a light-greenish color, and possesses the disagreeable odor of the root.

Action, Medical Uses, and Dosage.—Polymnia was introduced to the medical profession, in 1870, by Dr. J. W. Pruitt, although it had several years previously been highly lauded, under the name of *Bear's foot*, as a remedy in *rheumatism*. Dr. Pruitt recommended it in the form of ointment, as a local application in *mammary* and other *glandular tumors* or *abscesses*, in *splenic enlargement*, and, indeed, in all *painful swellings* and *local inflammations*. Subsequently, he employed a tincture of it internally, in connection with its external use, and found its efficacy to be thereby augmented. The tincture alone, was likewise found efficient in the treatment of *chronic intermittent fever*, *ozœna*, *scrofulous ophthalmia*, and similar affections. According to Dr. Pruitt, it may be considered a specific in *splenic enlargement* from malarial influence. Prof. J. M. Scudder, M. D., has used it with good effect in *chronic gastritis*, *chronic hepatic enlargement*, *hypertrophy of the cervix uteri*, *chronic metritis with hypertrophy*, *uterine subinvolution*, and *engorgement of the lower lobes of the lungs;* according to him the indications for its use are full, flabby, sallow tissues, impaired circulation, atonic impairment of function, and glandular enlargement. The efficacy of this drug in the effections named has been corroborated by many other practitioners who have tested it. It stands to-day at the head of spleen remedies, influencing not only the splenic circulation and reducing hypertrophies of that organ, but has more or less control over the other distributive branches of the cœliac axis. It is a remedy for *congestive* or *engorged states of the spleen* and other *ductless glands*. When *dyspepsia* depends upon a sluggish circulation in the gastric and hepatic arteries, and is attended with full, heavy, and burning sensations in the parts supplied by those branches, we have in uvedalia an efficient remedy. It even exerts a beneficial action in some cases of that intractable malady, *leucocythemia*, though it more often fails. The remedy to be of benefit in all glandular difficulties should be used for several weeks. For its influence in *splenic engorgement* (*ague cake*) the ointment should be applied warm over the spleen, while specific polymnia uvedalia should be given in from 5 to 10-drop doses every 3 or 4 hours. It is a remedy for imperfect blood-elaboration, with tumid, sodden abdomen, and for the removal of low inflammatory deposits. With Prof. Scudder the following was a favorite hair tonic: ℞ Specific uvedalia, ℥ii; bay rum, ℥vi. Mix. Rub thoroughly into the scalp once or twice a day. *White swelling* is stated to have been cured by the use of polymnia, both internally and as a local application, but we know of no authentic cases. The ointment appears to be a stimulating discutient. The dose of the tincture is from 10 to 60 minims, 2 or 3 times a day; of specific polymnia uvedalia from 2 to 20 drops.

Specific Indications and Uses.—Full, sodden, inelastic, flabby tissues; splenic and hepatic enlargements, fullness, weight and burning in the region of liver, stomach and spleen; congestive states and impaired functions of the parts supplied by the cœliac axis; impaired blood-making with tumid abdomen; low inflammatory deposits.

Related Species.—*Polymnia canadensis*, Linné, is a smaller plant than the preceding, and is found in similar localities. The stems are clammy, pubescent, and have long internodes. The lower leaves are pinnately-parted, the upper ovate, five-lobed, abrupt at the base, sub-regularly sinuate-toothed, and on slender, horizontal leaf-stalks. The flower-heads are smaller than those of the *P. Uvedalia*, and have acute involucral scales. The rays are of a pale, sulphur-yellow color, and are not longer than the involucre; they are three-toothed at the apex, the middle tooth being longer than the others. The two plants we have just described, are the only other indigenous species of Polymnia, and, together with a few South American species, constitute the genus.

POLYPODIUM.—COMMON POLYPODY.

The rhizome and tops of *Polypodium vulgare*, Linné.

Nat. Ord.—Filices.

Common Names: *Common polypody*, *Rock polypod*, *Fern-root*, *Rock-brake*, *Brake-root*, *Female fern*, etc.

Botanical Source.—Polypodium has a perennial, creeping, irregular, brown rhizome, with membranous scales extending to the caudex or base of the stipe. The fronds are 6 to 12 inches high, distiched, green, smooth, deeply pinnatifid, being divided into alternate segments, nearly to the mid-vein, which are linear-oblong, obtuse, crenulate, the upper ones gradually smaller, parallel, a little curved, about a quarter of an inch wide. The stipe is naked and smooth. The fruit is borne on the lower surface of the frond, in large, distinct, golden dots, sori, or capsules, without any indusium, round, in a double row, and becoming finally brownish (W.—Eaton).

History and Description.—Polypody is common on shady rocks, in woods, and mountains throughout the United States. The root and tops are used in medicine. The root is of some length, 2 to 4 lines in diameter, frequently crooked, with chaffy scales, which are readily removed, and having many delicate, knobby rootlets. It has a peculiar, rather unpleasant odor, and a saccharo-mucilaginous, somewhat sickening taste. Water extracts its properties. Its constituents, according to Hager (*Handbuch der Pharm. Praxis*), are fatty oil (about 8 per cent), resin, some tannin, mannit, dextrose, dextrin, starch, malic acid, and a sweet substance resembling glycyrrhizin.

Action, Medical Uses, and Dosage.—This plant is pectoral, demulcent, purgative, and anthelmintic. A decoction or syrup has been found very valuable in *pulmonary* and *hepatic diseases*, and a strong decoction is recommended as a purgative, and for the expulsion of *tænia* and other *worms*. Dose of the powdered plant, from 1 to 4 drachms; of the decoction or syrup, from 1 to 4 fluid ounces, 3 or 4 times a day.

Related Species.—*Polypodium adiantiforme*, a West Indian plant, is regarded by the natives as a pronounced antisyphilitic, and medical testimony seems to confirm its reputation in that direction. The Central American fern, *Polypodium friderichsthalianum*, is said to possess like virtues, and to be a remedy against the bite of the Mexican insect, *toboba* (*New Idea*, 1885; from Dragendorff's *Heilpflanzen*).

POLYTRICHUM.—HAIR-CAP MOSS.

The whole plant of *Polytrichum juniperum*.

Nat. Ord.—*Polytrichiaceæ*.

COMMON NAMES AND SYNONYMS: *Hair-cap moss*, *Bear's bed*, *Ground moss*, *Robin's rye*, *Herba adianthi aurei*.

Botanical Source.—This plant is indigenous and perennial, with a simple or divided stem, more generally simple, slender, of a reddish color, from 4 to 7 inches in height. The leaves are linear-lanceolate, awn-pointed, entire, flattish, appressed, somewhat spreading, with the margins inflexed. The capsule is oblong, 4-sided, and the angles acute; the calyptra densely hairy and white; the lid or operculum short-beaked from a convex base; and the apophysis depressed and discoidal. The peristome is single, of 64 teeth, adherent by their summits to the membranous-dilated apex of the columella. Inflorescence diœcious; sterile flowers terminal and cup-shaped (W.—G.).

History.—This is an evergreen plant, found on high, dry places, along the margins of dry woods, and exposed places, mostly on poor, sandy soil, and is of a darker-green color than the mosses in general. The leaves are closely set on the stem about one-half its length, above which the stem is naked, terminating in a capsule, covered with a white, hairy hood or calyptre. The whole plant is medicinal. It yields its properties to boiling water by infusion. It has not been analyzed, but is deserving of chemical investigation. The similar species, *P. formosum*, according to Reinsch, contains fatty oil, a crystalline substance, resins, a trace of tannin, etc. (Wittstein, *Handwörterbuch d. Pharmakogn. d. Pflanzenreichs*, Breslau, 1882).

Action, Medical Uses, and Dosage.—This is a very valuable and important, but somewhat neglected, remedial agent. It is a powerful diuretic in strong infusion. In doses of 2 fluid ounces of the infusion, every ½ hour, it has been known to remove from a dropsical patient from 20 to 40 pounds of water in the space of 24 hours. It possesses but very little smell or taste, and never produces any nausea or disagreeable sensation in the stomach. It may be used in connection with hydragogue cathartics, or even alone, in *dropsies*, with the most decided advantage; and is a very useful article in *uric acid* and *phosphatic gravel*, and other *urinary obstructions*, and especially *urinal suppression from cold*. Prof. Jones considered it worthy to be ranked among the first, if not at the head, of the class of diuretics. Notwithstanding the reputation of this plant, as a diuretic, I have known it frequently to fail in producing the slightest increase of the urinary discharge (J. King). A strong infusion of the fresh plant should be used when possible to obtain it; give specific polytrichum, 5 to 60 drops, every 1 to 3 hours.

POPULUS.—AMERICAN POPLAR.

The bark of the *Populus tremuloides*, Michaux.

Nat. Ord.—Salicaceæ.

COMMON NAMES: *American poplar*, *American aspen*, *Quaking aspen*, *White poplar*.

Botanical Source and History.—This tree attains the height of 20 to 50 feet, with a diameter of 8 to 12 inches. It is covered with a smooth, greenish-white bark, except on the trunks of very old trees. The leaves are orbicular-cordate, abruptly acuminate, dentate-serrate, smooth on both sides, pubescent at the margins, dark-green, 3-nerved, 2 to 2½ inches long, and 1½ as wide, on long, slender, and laterally compressed petioles, which accounts for the continual agitation of the leaves by the slightest breeze. The aments are plumed with silken hairs, and are about 2 inches long and pendulous, appearing in April, long before the leaves. The scales are cut into 3 or 4 deep, linear divisions, and fringed with long hairs (W.—G.). This tree is common in lower Canada and in the northern and middle states. The bark is the medicinal part, and should be collected in the spring, just as the sap begins to rise. Its virtues are imparted to alcohol, water, or acetic acid. There are several varieties of this tree, all of which possess similar properties, as the *Populus grandidentata*, Michaux; *P. candicans*, Aiton, etc.

Chemical Composition.—The glucosids, *populin* and *salicin*, are constituents common to the barks of nearly all species of Populus, as *P. tremuloides*, *P. tremula*, *P. alba* (for the latter, see analysis by M. F. Schaak, *Amer. Jour. Pharm.*, 1892, p. 226). The leaf-buds of *P. nigra*, *P. dilatata* (*P. pyramidalis*), and *P. balsamifera*, were found by Piccard (*Jahresb. der Pharm.*, 1865, p. 24; and 1873, p. 39) to contain a yellow coloring matter, *chrysin* (*acetyl-benzoyl-phloroglucin* [$C_{15}H_{20}O_8$]), *tectochrysin* ($C_{16}H_{12}O_4$), *salicin* and *populin*, resin and essential oil, which he believes (*ibid.*, 1875. p. 70) to contain *dipentene* ($C_{10}H_{16}$). The buds of the American aspen (*Populus tremuloides*), according to R. Glenk (*Amer. Jour. Pharm.*, 1889, p. 240), contain an acid resin of a hop-like odor, soluble in alcohol, caustic potash, glacial acetic acid, acetic ether, and amyl alcohol; slightly soluble in chloroform, ether, carbon disulphide, oil of turpentine, and benzol; insoluble in water. For description of the bitter glucosid, *salicin* ($C_{13}H_{18}O_7$, or $C_6H_4O.[C_6H_{11}O_5].CH_2OH$), see *Salicinum*.

Populin (*benzoyl-salicin*, $C_{20}H_{22}O_8.2H_2O$, or $C_{13}H_{17}.[C_7H_5O]O_7.2H_2O$) was discovered, in 1831, by Braconnot, and occurs, together with salicin, in the bark and the leaves of several species of Populus, The leaves of *P. tremula* contain more populin than the bark, and may be employed to advantage in its isolation. To prepare both, an aqueous decoction of the bark is precipitated by subacetate of lead, the filtrate freed from lead by carefully adding sulphuric acid, filtered again, treated with charcoal, and evaporated to a smaller bulk. The salicin, upon cooling, crystallizes out; the filtrate, upon the addition of potassium carbonate, yields a precipitate of populin, which is obtained pure by recrystallization from water. Populin is a very light substance, snow-white, with a sweetish taste not unlike that of liquorice. It requires about 2000 times its weight of cold and about 70 times its weight of boiling water to dissolve it. Alcohol, when boiling, dissolves it, depositing the populin on cooling in the form of a crystalline magma. It is soluble in acetic, nitric and phosphoric acids, from which solutions it is precipitated by alkalies. It is hardly soluble in ether. Boiling with diluted mineral acids decomposes it into dextrose, benzoic acid and *saligenin* ($C_6H_4OH.CH_2OH$), which is further converted into resinous *saliretin*. Concentrated sulphuric acid gives with populin a purple-red solution. When heated on platinum foil it burns with a strong flame, emitting an aromatic odor. By oxidation with a mixture of sulphuric acid and potassium bichromate, the odor of salicylic aldehyde ($C_6H_4.OH.CHO$), the principal constituent of the oil of *Spiræa Ulmaria*, is evolved.

Action, Medical Uses, and Dosage.—Poplar bark is tonic and febrifuge, and has been used in *intermittent fever* with advantage. An infusion of it is reputed a valuable remedy in *emaciation* and *debility*, after protracted fevers and reproductive disorders of the nervous and hysterical, *lumbricoid worms*, *impaired digestion*, *chronic diarrhœa*, *intermittent fevers*, etc. As a diuretic, it has been beneficially used in *urinary affections*, *gonorrhœa*, *gleet*, etc. Both populus and populin have a decided affinity for the genito-urinal tract. It is thought to aid the recuperative powers of the kidney when undergoing granular degeneration. In tenesmic vesical irritation and in tenesmus after urination it is decidedly effective. Minute doses—fraction of a drop—are most beneficial here. It is suggested by Prof. Webster for trial in stubborn *uterine congestion* and *prostatic hypertrophies*. The Large aspen, *P. grandidentata*, is said to be the most active and bitter. Dose of the powdered bark, 1 drachm, 2 or 3 times a day; of a saturated tincture of the fresh bark, from a fraction of a drop to 30 drops; of populin, 1 x trituration, 1 grain every 2 or 4 hours.

Specific Indications and Uses.—Marked debility with impairment of digestion; tenesmic vesical irritation; tenesmus *after* micturition.

Related Species.—Several species of Populus besides American poplar have been employed more or less in medicine, and probably most of them depend upon both salicin and populin for their virtues. Among those employed are *Populus nigra*, or *European black poplar*; *Populus tremula*, *European aspen*; *Populus alba*, *silver-leaf poplar*, etc. See the above-named species for chemical composition.)

Populus balsamifera, Linné, *Balsam poplar*.—This tree, also called *Tacamahac*, or *Tacamahac poplar*, attains the height of 50 to 70 feet, with a trunk about 18 inches in diameter. Branches smooth, round, deep-brown; buds acuminate, smooth, covered in the spring with an abundance of fragrant, viscid, balsamic juice. Leaves ovate, gradually tapering and pointed, smooth on both sides, with fine glandular serratures, deep-green above, whitish and reticulate-veined beneath, on long petioles; sometimes 2 glands at the apex of the petiole. Scales dilated, slightly hairy (L.—W.). This tree is found in Canada, the northern parts of the United States, and in Siberia. In this country it is in blossom in April. The leaf-buds are the medicinal parts, and should be collected in the spring; they are covered with a fragrant resinous matter, which may be separated in boiling water, and upon which their virtues depend. They have an agreeable, incense-like odor, and an unpleasant, bitterish taste. The balsamic juice is collected in Canada in shells, and sent to Europe, under the name of *tacamahaca*. Alcohol or spirits is the proper solvent. (For chemical composition, see Piccard, *loc cit.*.)

Populus candicans, Aiton.—The buds of the *Populus candicans*, Aiton, or *Balm of Gilead*, possess virtues similar to the above. The tree is of less stature than the *P. balsamifera*, the leaves are broader, and heart-shaped, with a distinct sinus at the base; the petioles are hairy and the branches terete (G.) Poplar buds are reputed stimulant, tonic, diuretic, and antiscorbutic. A tincture has been beneficially employed in *affections of the chest*, *stomach*, and *kidneys*, and in *rheumatism* and *scurvy*. With lard or oil they form a useful external application in *bruises*, *swellings*, *wounds*, some *cutaneous diseases*, *rheumatic pains*, etc. Added to ointments they prevent, in a great measure, their liability to become rancid, but in this respect are not equal to paraffin, which will wholly prevent rancidity in cerates and ointments prepared with it, as discovered by Prof. E. S. Wayne. The bark is said to be tonic and cathartic, and to have proved of service in *gout* and *rheumatism*. Dose of a tincture of the buds, from 1 to 4 fluid drachms; this is excellent for *colds* and *pain in the chest*. An extract of the bark made with diluted acid, in the dose of from 5 to 15 grains, 3 times a day, is a useful tonic in *debility*, *intermittent fever*, *rheumatism*, etc.

POTASSA (U. S. P.)—POTASSA.

FORMULA: KOH. MOLECULAR WEIGHT: 55.99.

SYNONYMS: *Caustic potash*, *Potassium hydrate*, *Potassium hydroxide*, *Potassa caustica*, *Potassii hydras*, *Potassæ hydras*, *Oxydum potassicum*, *Kali hydricum fusum*, *Lapis causticus chirurgorum*, *Caustic potassa*, *Kali purum*, *Vegetable alkali*, *Fixed alkali*.

"Potassa should be kept in well-stoppered bottles made of hard glass"—(*U. S. P.*).

Preparation.—Caustic potash is prepared by the interaction of potassium carbonate or bicarbonate and calcium hydroxide, the solution of caustic potash thus obtained (see *Liquor Potassæ*) being rapidly evaporated in a clean silver vessel until there remains a clear fluid of oily consistence, a drop of which, when removed on a warm glass rod, solidifies on cooling. The liquid is then poured into molds of proper shape and allowed to cool, care being taken to exclude the carbon dioxide of the air as much as possible. Evaporation should not be conducted in an iron vessel, because the concentrated liquid dissolves notable quantities of iron. This product is now hardly ever prepared by the pharmacist.

Description.—The officially recognized caustic potash is described as occurring in "dry, white, translucent pencils, or fused masses, hard and brittle, showing a crystalline fracture; odorless, or having a faint odor of lye, and a very acrid and caustic taste. Great caution is necessary in tasting and handling it, as it rapidly destroys organic tissues. Exposed to the air, it rapidly absorbs carbon dioxide and moisture, and deliquesces. Soluble, at 15° C. (59° F), in about 0.5 part of water, and in 2 parts of alcohol; very soluble in boiling water, and in boiling alcohol; slightly soluble in ether. When heated to about 530° C. (986° F.), potassa melts to a clear, oily liquid, and at a bright red heat it is volatilized unchanged. When introduced into a non-luminous flame, it imparts to it a violet color. A solution of potassa, even when greatly diluted, gives an intensely alkaline reaction with litmus paper"—(*U. S. P.*). It dissolves in water and combines with acids with evolution of much heat, and forms a number of crystallizable salts.

Impurities and Tests.—Commercial caustic potash is liable to contain as impurities: potassium chloride, potassium carbonate, alumina, lime, iron, sulphates, admixed common salt, etc. Prof. W. Dunstan (*Amer. Jour. Pharm.*, 1886, p. 173) found five specimens of commercial caustic potash in sticks to contain from 0.34 to 1 per cent of potassium nitrite, on account of which it liberated iodine from acidulated potassium iodide solution. The specimens contained from 78 to 79 per cent of total alkali. All the impurities mentioned are insoluble in alcohol, hence purified caustic potash ("potash by alcohol") may be obtained by dissolving the alkali in alcohol, decanting, evaporating the clear fluid to dryness and melting the dried mass. Mr. Carl E. Smith (*Amer. Jour. Pharm.*, 1898, p. 392) calls attention to a probably fraudulent substitution of commercial caustic potash by caustic soda. Both the present *U. S. P.* and that of 1880 demand caustic potash to contain 90 per cent of potassium hydroxide, the remainder to consist of carbonate, water and other impurities, the quantities of which are limited by the pharmacopœial tests subjoined. This standard, however, has never been attained on a manufacturing scale. E. Goebel (*Proc. Amer. Pharm. Assoc.*, 1885, p. 472) reports eight specimens of potassa in sticks to contain 75.5 to 79.5 per cent total and 63.3 to 72.3 caustic alkali. Prof. E. L. Patch (*ibid.*, p. 474) found in seven specimens from 57 to 86 per cent total and from 52 to 81 per cent caustic alkali One specimen of German origin, "purified by alcohol," gave 70 per cent of total alkali and 8.57 per cent of carbonate, with traces of sulphates, chlorides, silica and iron. As recently as 1892 Prof. J. U. Lloyd found the total alkali (calculated as hydroxide) in 30 casks of crude commercial American potash to vary from 16 to 84 per cent. By insisting in his purchases on a minimum amount of 70 per cent total alkali, Prof. Lloyd secured a marked improvement of the quality (see *Proc. Amer. Pharm. Assoc.*, 1892, p. 192). Mr. Carl E. Smith reports (*loc. cit.*) on a sample of the best crude potassa in sticks of the New York market, finding it to be not much below the pharmacopœial standard. It contained 86.4 per cent of potassium hydroxide (KOH), 4.85 per cent of potassium carbonate (K_2CO_3), 1.8 per cent of sodium hydroxide (NaOH), 1.4 per cent of potassium chloride (KCl), 0.1 per cent of potassium silicate ($K_2Si_4O_9$), and 5.55 per cent of water. The *U. S. P.* directs for caustic potash the following tests: "The aqueous solution (1 in 20) should be perfectly clear and colorless (absence of organic matter). After acidulation with hydrochloric acid it yields bright yellow precipitates with platinic chloride T.S., and with sodium cobaltic nitrite T.S."—(*U. S. P.*). The precipitate with platinic chloride ($PtCl_4$) consists of octahedra having the composition $PtCl_6K_2$; they are insoluble in alcohol and nearly insoluble in water. The corresponding sodium compound is soluble in water and alcohol. The precipitate with sodium cobaltic nitrate has the composition $Co_2(NO_2)_{12}K_6$, combined with varying quantities of water. According to Mr. Carl E. Smith (*loc. cit.*), a dilution of 0.3 to 0.2 per cent of potassium hydroxide (KOH) is the approximate limit of the sensitiveness of this test. "A concentrated aqueous solution (1 in 10), when dropped into tartaric acid T.S., produces a white, crystalline precipitate, which redissolves when the potassa is added in excess"—(*U. S. P.*). This precipitate ($C_4H_4O_6KH$) is the well-known *cream of tartar* or acid potassium tartrate (see *Potassii Bitartras*). The added excess of potassa produces the soluble neutral tartrate ($C_4H_4O_6K_2$). "If 1 Gm. of potassa be dissolved in 10 Cc. of water, and slightly supersaturated with acetic acid, 10 Cc. of the solution should not be colored or rendered turbid by the addition of an equal volume of hydrogen sulphide T.S. (absence of arsenic, lead, etc.), nor by the subsequent addition of ammonia water in slight excess (absence of iron, aluminum, etc.). The remainder of the acidulated solution should not be rendered turbid by ammonium oxalate T.S. (absence of calcium). If a solution of 1.5 Gm. of potassa in 10 Cc. of water be slightly supersaturated with nitric acid, then 0.5 Cc. of decinormal silver nitrate V.S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the addition of more silver nitrate V.S. (limit of chloride). If to a solution of 3.5 Gm. of potassa in 10 Cc. of water, strongly supersaturated with hydrochloric acid, 0.1 Cc. of barium chloride T.S. be added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of barium chloride T.S. (limit of sulphate). If 1 Gm. of potassa be dissolved in 2 Cc. of water, and added to 10 Cc. of alcohol, not more than a slight, colorless precipitate should occur within 10 minutes (limit of silicate). After boiling this alcoholic solution with 5 Cc. of calcium hydrate T.S. and filtering, not the slightest effervescence should take place on adding the filtrate to an excess of diluted hydrochloric acid (limit of carbonate)"—(*U. S. P.*). Mr. Carl E. Smith (*loc. cit.*) justly points out that this test for silicate and carbonate is insufficient, because the precipitate produced by alcohol may largely consist of carbonate which may thus be mistaken for silicate and besides impair the test for carbonate. The author suggests that silica be tested for separately, by repeatedly evaporating on the water-bath an aqueous solution of the sample with excess of hydrochloric acid to perfect dryness, whereby silicic acid becomes insoluble and may be filtered, washed out, dried and weighed. The carbonate and total alkali may be determined in one operation by titrating a dilute solution of the sample (1 Gm. in 250 Cc. of water) with normal sulphuric or hydrochloric acids, employing phenolphtalein as indicator, adding the acid until the purple color disappears, then adding methyl orange and titrating until the color changes to red. The acid consumed with methyl orange as indicator is equivalent to half the quantity of carbonate present, while the quantity of acid consumed with phenolphtalein as indicator, minus that consumed with methyl orange, is equivalent to the caustic alkali present. This procedure is based on the fact that potassium carbonate (K_2CO_3) becomes neutral toward phenolphtalein at the point where it is converted into bicarbonate ($KHCO_3$), *i. e.*, when half of its potassium is converted into neutral sulphate or chloride. The bicarbonate, however, is still alkaline toward methyl orange; if this be added to the colorless liquid, the change to red takes place at the point where the remaining half, *i. e.*, all of the bicarbonate, is converted into the neutral salt. "If 0.2 Gm. of potassa be dissolved in 2 Cc. of water, and carefully mixed with 4 Cc. of pure sulphuric acid and 2 drops of indigo T.S., the blue color should not be discharged (limit of nitrate). To test for *soda*, dissolve 0.56 Gm. of potassa in 5 Cc. of water, add a few drops of phenolphtalein T.S., and then, from a burette, enough tartaric acid T.S. (3 Gm. in 20 Cc.) to accurately neutralize the solution. Next add another volume of the tartaric acid T.S., equal to that first used, and then enough absolute alcohol to completely precipitate the potassium bitartrate formed. Separate the precipitate by filtration and wash it with a little alcohol. The filtrate should not require more than 0.2 Cc. of normal potassium hydrate V.S. to restore the red color (absence of more than 1.5 per cent of soda). To neutralize 0.56 Gm. of potassa should require not less than 9 Cc. of normal sulphuric acid (each cubic centimeter corresponding to 10 per cent of pure potassium hydrate), phenolphtalein being used as indicator"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Caustic potash is powerfully corrosive; when applied to soft animal textures, it first attracts their water, and then rapidly disorganizes them, producing with the fatty constituents, a soapy solution, after which extensive inflammation ensues around the part, previous to the separation of a deep slough. It has no action as a poison, except what depends directly on the local injury occasioned; no direct influence being exerted through the medium of absorption. The symptoms of poisoning from its ingestion are: Intense burning pain from mouth to stomach and bowels; acrid, caustic taste; vomiting of alkaline and bloody material, diarrhœa, delirium, convulsions, and cold, clammy surface. If the dose is large and not vomited, death quickly takes place; if death is not immediate, it may result later from laryngeal and gastro-intestinal inflammation and ulceration, or, after many months, death may be due to starvation, due to stricture of the œsophagus, produced by the healing of the lesions caused by the poison in passing through that tube. Acids, as vinegar, lemon-juice, etc., and the fixed oils, are antidotes to its injurious action, producing with it harmless salts of potassium or soapy solutions. The long-continued use of liquor potassæ may occasion a cachexia closely resembling scurvy.

It is administered internally only when in solution, as an antacid, antilithic, and diuretic (see *Liquor Potassæ*). Externally, it is used in its solid state for making caustic issues, opening *abscesses*, and destroying *tumors*, and is applied for the cure of *ingrown nails*, *paronychia*, *sinuses*, *callous ulcerations*, and to destroy *unhealthy granulations*, but from its extreme deliquescence, it is very apt to spread and act on parts not desired. To obviate this, the integuments around the parts to be acted on should be protected by 2 or 3 layers of cloth, spread with adhesive plaster, and perforated with a hole in the center, of the necessary size. Then a rod of potassa, slightly moistened at the end, is to be gently rubbed over that portion of the skin embraced in the perforation of the plaster. It must be rubbed until the skin becomes discolored, when an elm or bread-and-milk poultice must be applied. In a few days the eschar will be detached. After the slough separates, the retraction of the surrounding skin always makes the surface of the issue much larger than the circle originally cauterized, the extent of which must be regulated accordingly (C.). In applying the caustic, wrap it with paper. Occasionally this caustic is employed in the destruction of *tumors*, *cancers*, etc., and on the surface of unhealthy or malignant *ulcers*. A very unscientific application of a solution of this caustic, applied to the spine, has been recommended in the treatment of *tetanus*.

Potassium and Its Compounds.—Kalium, or Potassium. Symbol: K. Atomic Weight: 39.03. Metallic potassium was discovered, in 1807, by Sir Humphrey Davy, who obtained it by passing a powerful galvanic current through a small piece of caustic potash, the metal being liberated at the negative pole in the form of quicksilver-like globules. Subsequently, Gay-Lussac and Thénard obtained it by passing melted potassium hydroxide over iron-turnings, heated to whiteness in an iron tube. Potassium is now usually prepared by reduction of potassium carbonate with carbon at a white heat, according to the equation: $K_2CO_3+C_2=K_2+3CO$. An intimate mixture of both substances is first obtained by igniting cream of tartar in a covered crucible, which leaves a mixture, well known as *black flux*. This, while still warm, is mixed with a considerable proportion of charcoal, in coarse powder and small fragments recently ignited, and allowed to cool in a covered crucible. The whole is then introduced into an iron retort, which is then subjected to a white heat. The potassium distilling over is conducted into pure naphtha cooled by ice. In recent years, potassium is also obtained by the electrolytic decomposition of potassium salts, *e. g.*, the chloride.

Potassium is a solid, soft, bluish-white metal, of bright metallic luster when freshly cut, but becoming instantly tarnished and oxidized when exposed to the air, from which it absorbs oxygen. It should, therefore, be kept in purified naphtha or petroleum benzin, liquids which contain no oxygen. At the temperature of 10° C. (50° F.), it is soft and malleable like wax; at 58° C. (136.4° F.), it becomes perfectly fluid; and at 0° C. (32° F.), it is hard and brittle, exhibiting a crystalline structure. It is lighter than water, its specific gravity being 0.865, and is an excellent conductor of heat and electricity. Thrown upon the surface of water, it decomposes that liquid with rapidity, with evolution of an intense heat, the following reaction taking place: $K_2+H_2O=K_2O+H_2$; $K_2O+H_2O=2KOH$. The hydrogen gas evolved, carrying with it small particles of the metal, takes fire, and communicating the combustion to the potassium, the whole burns with a kind of explosion, emitting a purplish, violet, or rose-tinted light. Heated in oxygen gas it burns with a brilliant white light. Metals and metalloids, whose attraction for oxygen are too strong to be overcome by the usual means, are isolated by potassium. Thus, it decomposes the oxides or chlorides of aluminum, glucinum, yttrium, thorium, and zirconium, and the boracic and silicic oxides, in each case the element resulting. Potassium is found chiefly in the ashes of land plants, as oxide of potassium united to carbonic acid, and is also contained as chloride in the ashes of sea plants. Many rocks, minerals, and soils contain it; indeed, it is necessary to the growth of plants. It occurs as silicate in granite, feldspar (*orthoklase*), mica (*muscovite*), as chloride, near Stassfurt, Germany, in *sylvine* (KCl), *carnallite* ($MgCl_2+KCl+6H_2O$), and in the waters of the sea. In the form of nitrate it constitutes *saltpeter*. Potassium forms chiefly two compounds with oxygen—a dry, grayish-white *monoxide* (K_2O), and an orange-yellow *tetroxide* (K_2O_4), which is formed, *e. g.*, by combustion of metallic potassium in absolutely dry oxygen. Its monoxide unites with acids, forming salts of potassium, some of which are used in medicine. Potassium also combines with hydrogen, sulphur, and mercury, forming an amalgam with the latter. Potassium salts are generally colorless, unless the characteristic acid has a peculiar color. Nearly all potassium salts are readily soluble in water; the sulphate is less soluble; very little soluble are the bitartrate, the platinic hydrochloride (see *Potassa*), the silicofluoride ($SiFl_6K_2$, the picrate ($C_6H_2[NO_2]_3OK$), and the perchlorate ($KClO_4$). Among the compounds of potassium not mentioned in our main articles are the following:

Potassium Silicate ($K_2Si_4O_9$), or "*Soluble glass*," is prepared after the method of making the corresponding sodium salt, by fusing together potassium carbonate (10 parts , fine sand (15 parts), and charcoal (1 part). *Gout* and *rheumatism* have been treated with it, but without results to commend it. Its local surgical uses are those of sodium silicate which see .

Potassium Cobaltic Nitrite ($CO_2[NO_2]_{12}K_6+2H_2O$).—Upon adding to a solution of a cobaltous salt, previously acidulated with acetic acid, an excess of solution of potassium nitrate, nitrogen monoxide is liberated, and, after a time, a crystalline, yellow, double salt (cobaltic-potassium nitrite) is precipitated. The reaction takes place as follows: $Co_2Cl_4+4NO_2K+4NO_2H+6NO_2K=Co_2(NO_2)_6.6NO_2K+4ClK+2H_2O+2NO$. Solutions of acid hardly dissolve it. It has the therapeutic properties of the nitrites, and has been employed in *asthma*, *valvular heart diseases*, and in *renal disorders*, in which arterial tension is high, and dyspnœa marked (Roosevelt), being preferred to other nitrites on account of its limited solubility and more permanent character (Gibbs). Dose, ¼ to ½ grain every 2 hours.

Potassii Osmas ($K_2OsO_4.2H_2O$), *Potassium osmate.*—To a solution of osmium tetroxide in caustic potash add alcohol; the resulting red liquid, when concentrated, deposits potassium osmate as a crystalline powder. If slowly evaporated, dark-garnet crystals form. This salt is permanent in a dry, but deliquescent in a moist atmosphere, at the same time undergoing decomposition. Solutions in water are likewise unstable. It has an astringent and sweetish taste, and is used as a substitute for osmic acid. It is employed hypodermatically chiefly in the form of a 1 per cent solution, or it may be given by mouth in doses of $\frac{1}{35}$ to $\frac{1}{45}$ grain

Osmic Acid, or *Perosmic acid* ($OsO_4=254.14$) *Acidum osmicum*, or *perosmicum* , is the accepted name for *Osmium tetroxide*, from which potassium osmate may be prepared as stated above. Osmic acid proper (OsO_4H_2) is not known in the free state. The tetroxide is intensely poisonons. It is prepared by heating metallic and finely divided osmium to a temperature of near 400° C. (752° F.), in a current of air, or in the presence of oxygen. The metal then burns and the tetroxide, being vaporized, is collected in a cooled receiver. Thus sublimed, it forms exceedingly hygroscopic, yellow needles, which form neutral, colorless, acrid solutions with water. Osmium tetroxide boils at about the same temperature as water, and sublimes at somewhat above the ordinary temperature, giving off intensely poisonous vapors, which attack the lungs and the eyes most violently. Organic compounds are oxidized by it, and iodides are decomposed with liberation of iodine. Its solution in alcohol or ether deposits, upon standing for 1 day, all the osmium in the form of the tetrahydroxide (OsO_4H_4). Sulphurous acid produces with the aqueous solution a series of colors, changing from yellow to red, green, and blue. A freshly-made, 1 per cent solution is used hypodermatically (3 to 5 drops), or $\frac{1}{65}$ grain, internally, for the cure of *goitre, sarcoma, ancroid tumors, scrofulous ulcers, epilepsy*, and *lumbago*. It is a dangerous drug. It is used in microscopy for staining and hardening purposes.

Potassii Cantharidas ($C_{10}H_{12}K_2O_5.2H_2O$), *Potassium cantharidate.*—Cantharidin (1 part), potassium hydroxide (2 parts), water (100 parts). Heat together on a water-bath. By concentrating the clear solution, the salt may be obtained in the form of crystals. Twenty-five parts of cold water and 12 parts of boiling water dissolve the salt. Acid precipitates cantharidin from the solution (also compare *Cantharis*). This compound has, in recent years (1891), been proposed, by Liebreich, for some varieties of *tuberculosis*. It is injected hypodermatically in doses of a solution representing $\frac{1}{324}$ to $\frac{1}{216}$ grain of cantharidin.

Potassii Telluras ($K_2TeO_4+5H_2O$), *Potassium tellurate.* Neutralize a solution of pure crystallized telluric acid ($H_2TeO_4+2H_2O$) in water with potassium hydroxide. Evaporate to dryness, and wash with alcohol. It forms a crystalline, white powder, not soluble in alcohol, but freely so in water. This salt, in doses of from $\frac{1}{2}$ to $\frac{3}{4}$ grain, in pill or in alcoholic mint-julep, at bedtime, has been given in *pulmonary consumption* to control *colliquative sweating*. A similar sodium salt is prepared by substituting caustic soda for caustic potash. Both give to the breath a strong alliaceous odor.

POTASSA CUM CALCE (U. S. P.)—POTASSA WITH LIME.

Synonyms: *Vienna paste*, *Vienna caustic*, *Pulvis causticus Viennensis* (*or Londoninensis*), *Pulvis causticus cum calce*.

Preparation.—"Potassa, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]; lime, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]; to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Rub them together, in a warm iron mortar, so as to form a powder, and keep it in a well-stoppered bottle"—(*U. S. P.*).

Description.—"A grayish-white powder, deliquescent, having a strongly alkaline reaction, and responding to the tests for calcium and potassium. It should be soluble in diluted hydrochloric acid without leaving more than a small residue"—(*U. S. P.*).

Action and Medical Uses.—This agent is used like potassa as a caustic, though it is slower and milder in action, and more readily controlled than the former. It is best applied as a paste prepared with a little alcohol. *Filho's caustic* is an improvement, being in sticks, and is in good form to treat disorders of the *uterine cervix*.

Related Preparations.—Causticum Commune Mitis, *Common milder caustic.* This is an old preparation. It is made by dissolving caustic potash in 3 parts (by weight) of water, and bringing it to the consistence of a paste by adding sufficient lime. Another method is that of mixing burned lime (powdered) with an equal part (by weight) of soft soap.

Soda cum Calce (N. F.), *Soda with lime, London paste.*—Soda, lime, each, equal parts. Reduce them to powder in a clean iron mortar, previously warmed, and mix them intimately. Keep the powder in small, well-stoppered vials.

Causticum cum Potassa et Calce, *Filho's caustic* (*Caustique de Filhos*).—This preparation is made by adding to fused caustic potash (100 parts) burned lime, in powder (10 parts), and molding in sticks by pouring the fused mass into leaden tubes. It is official in the *French Codex*.

POTASSA SULPHURATA (U. S. P.)—SULPHURATED POTASSA.

A mixture of essentially potassium trisulphide (K_2S_3) with potassium hyposulphite and some potassium sulphate.

Synonyms: *Liver of sulphur*, *Sulphuret of potassium*, *Hepar sulphuris*, *Potassii sulphuretum*, *Sulphide of potassium*.

History and Preparation.—This substance was known as early as the eighth century. The name "hepar sulphuris—liver of sulphur," was given it by the celebrated monk, Basil Valentine. To prepare it take of "sublimed sulphur, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; potassium carbonate, dried, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]. Mix the powdered and dried potassium carbonate thoroughly with the sublimed sulphur, and gradually heat the mixture, in a covered crucible, which should be only about half filled with it, until the mass ceases to foam and is in a state of perfect fusion. Then pour the fused mass on a cold marble slab, and, after it has cooled, break it into pieces, and keep it in a well-stoppered bottle"—(*U. S. P.*). The reaction is usually stated to take place according to the following equation: $3K_2CO_3$(414 parts)$+8S$ (256 parts)$=K_2S_2O_3+K_2S_3+3CO_2$. The pharmacopœial proportion of 2 parts of carbonate to 1 part of sulphur does not conform to this equation, unless, as was formerly the case, the carbonate is of 80 per cent or less. In the present *U. S. P.*, which demands a strength of 95 per cent, the quantity of sulphur directed is insufficient, and should be raised from 100 to at least 124 parts of sulphur. By the present formula, the pharmacopœial product necessarily contains a notable quantity of unacted-upon potassium carbonate (see B. Hirsch, *Pharm. Rundschau*, 1893, p. 281). The formation of sulphate takes place by oxidation of the hyposulphite when the crucible is opened too often for the purpose of watching the progress of the reaction. The latter may be judged by dissolving a sample of the mass in water; it should entirely dissolve (absence of free sulphur).

Description and Tests.—"When freshly prepared, sulphurated potassa forms irregular pieces of a liver-brown color, which, by exposure to the air, gradually absorb moisture, oxygen, and carbon dioxide, and change to a greenish-yellow and finally to a gray mass containing potassium carbonate, hyposulphite, and sulphate. The compound has a faint odor of hydrogen sulphide, and a bitter, alkaline taste. Soluble in 2 parts of water at 15° C. (59° F.), with the exception of a small residue. Alcohol dissolves only the potassium sulphide, leaving the other constituents (hyposulphite and sulphate) undissolved. The aqueous solution (1 in 10) is of an orange-yellow color, is strongly alkaline to litmus paper, and gives off the odor of hydrogen sulphide. On adding to it acetic acid in slight excess, an abundance of hydrogen sulphide is evolved, while sulphur is precipitated. In this liquid, after filtration, sodium bitartrate T.S. produces an abundant, white, crystalline precipitate. On triturating 1 Gm. of sulphurated potassa with 1 Gm. of crystallized copper sulphate and 10 Cc. of water, and filtering, the filtrate should remain unaffected by hydrogen sulphide T.S., corresponding to at least 12.85 per cent of sulphur combined with potassium to form sulphide"—(*U. S. P.*) A white deposit in the aqueous solution, unaltered by a large quantity of water, denotes the presence of silica or alumina; a black or gray one is probably iron; a yellow one free sulphur. Carbonate of potassium is detected by the addition of lime-water, which renders the solution turbid. If the liver of sulphur, when treated with diluted sulphuric acid, effervesces without evolving any hydrogen sulphide, it has become useless. A characteristic test for sulphides of alkalies and alkaline earths consists in the formation of a beautiful deep-violet coloration with solution of sodium nitroprusside ($Na_4Fe_2[CN]_{10}[NO]_2+4H_2O$).

Action, Medical Uses, and Dosage.—This is true "*hepar sulphur*" (*sulphuris*), and should not be confounded with the preparation (calcium sulphide) used by homœopaths under the same name. In large doses it is an energetic, narcotico-acrid poison, causing acrid taste, vomiting, mortal faintness, and convulsions, with an emission of the odor of sulphuretted hydrogen. In small doses, from 2 to 10 grains in solution, or in pill with soap or liquorice, and repeated 3 or 4 times a day, it acts as a general stimulant, increasing the frequency of the pulse as well as the heat of the body, and promoting the different secretions, especially those of the mucous membranes. It is likewise antacid, alterative, and antispasmodic, and has been used in *whooping-cough*, *chronic rheumatism*, *asthma*, *obstinate diseases of the skin*, *painters' colic*, *gout*, etc. (P.) Externally it has been very efficient in *chronic diseases of the skin*, as *eczema*, *scabies*, *lepra*, *pityriasis*, etc., in which it is used in the form of ointment, wash, or bath. Half a drachm of the sulphide to 1 ounce of lard forms an ointment; the same quantity to 1 fluid ounce of water, forms a wash or lotion. One part of the sulphide to 1000 parts of water, forms a bath. This bath is employed in *lead palsy*. It should not be used when there is fever or hemorrhages. By prolonged use vesicular or papular skin eruptions are apt to occur. Dose, 1 to 10 grains.

Related Compounds.—Potassii Sulphidum (K_2S), *Potassium monosulphide*, is formed by passing into a solution of caustic potash a stream of sulphuretted hydrogen, until it is saturated, and lastly adding to the product a like quantity of solution of potassa. The following reaction takes place: $KOH + H_2S = KSH + H_2O$; $KSH + KOH = K_2S + H_2O$. This alkaline, bitter solution, yields, by concentration *in vacuo*, prismatic crystals, colorless and deliquescent, and containing 5 molecules of water of crystallization. Alcohol partially dissolves it.

Potassii Sulphocarbonas (K_2CS_3), *Potassium sulphocarbonate (thiocarbonate)*, is produced by agitating potassium monosulphide in aqueous solution with carbon disulphide. The yellowish or red-brown fluid, carefully concentrated at 30° C. (86° F.) gives deliquescent, yellow, hydrated crystals, or if the red-brown fluid be treated with alcohol, a crystalline deposit. Soluble in alcohol, and of a sharp, cooling, sulphur-like taste. When carbon disulphide is shaken together with an alcoholic solution of caustic potash, a compound ($CS.OC_2H_5.SK$) is formed, called *potassium xanthogenate*. The crude compound was recommended by Dumas as a means to destroy the phylloxera on grapevines. In moist condition, it slowly evolves carbon disulphide. The above compound (K_2CS_3) is also a constituent of its solution.

POTASSII ACETAS (U. S. P.)—POTASSIUM ACETATE.

Formula: $KC_2H_3O_2$. Molecular Weight: 97.89.

Synonyms: *Acetas potassicus, Acetas kalicus, Acetate of potash, Acetate of potassium, Acetate of potassa, Terra foliata tartari, Sal diureticum, Diuretic salt.*

History and Preparation.—This salt in solution was known to Pliny, and was first obtained by Raymond Lully. Its properties were described in 1610 by Philip Müller, of Freiberg. The salt is prepared simply by dissolving carbonate or bicarbonate of potassium in solution of acetic acid, keeping the latter in slight excess, and evaporating the solution to dryness by carefully heating it on a sand-bath.

Description.—As met with in commerce, the salt often has a foliaceous appearance, not unlike spermaceti, which gave rise to its former name, *foliated earth of tartar*, acetic and tartaric acids having been at one time believed to be identical. The salt is officially described as "a white powder, or crystalline masses of a satiny lustre, odorless, and having a warming, saline taste. Very deliquescent on exposure to the air. Soluble at 15° C. (59° F.), in 0.36 part of water, and in 1.9 parts of alcohol; with increasing temperature it becomes much more soluble in both liquids. When heated to 292° C. (557.6° F.), the salt fuses. At a higher temperature it decomposes, blackens, and evolves vapors having an empyreumatic odor (an alliaceous odor would indicate the presence of arsenic), and finally leaves a white residue of potassium carbonate, which should be completely soluble in water"—(*U. S. P.*). Acetone is among the products of volatilization. Owing to its ready deliquescence, the salt should be kept in well-stoppered bottles. The aqueous solution of the salt soon becomes moldy, and the acetate is converted into carbonate. "The aqueous solution (1 in 20) colors litmus paper blue, but does not redden phenolphtalein T.S. Upon the addition of sodium cobaltic nitrite T.S., a copious yellow precipitate is formed. The addition of sodium bitartrate T.S. to the aqueous solution causes a white, crystalline precipitate. When the salt is heated with a small amount of sulphuric acid, vapors of acetic acid are evolved. The addition of a little ferric chloride T.S. to a solution of the salt produces a deep red color, and, upon the application of heat, a pale brown, flocculent precipitate of basic ferric acetate separates"—(*U. S. P.*). Potassium acetate is contained in many vegetable juices, and upon incineration is found in their ashes in the form of potassium carbonate. Potassium acetate is incompatible with the sulphates of sodium and magnesium, tartaric acid, the stronger acids, earths and their salts, bichloride of mercury, and some other metallic salts.

Impurities and Tests.—Impurities are rarely present; the most probable are carbonate of potassium, if this is left in excess during the preparation of the salt; sulphate of potassium, chloride of potassium, alumina, lime, magnesia, iron, lead, copper, tin, etc., which may respectively be detected by the pharmacopœial tests as given below. If lime is present, ammonium oxalate will produce, in the aqueous solution of the salt, a white precipitate, insoluble in diluted acetic acid. Magnesium is recognized by adding to the aqueous solution of the salt, ammonium chloride, aqua ammoniæ, and ammonium carbonate, filtering, and adding to the filtrate ammonium phosphate. A crystalline precipitate denotes the presence of magnesium. "Having prepared a solution of 2.5 Gm. of the salt in 50 Cc.

of water, use 10 Cc. of it for each of the following tests: After a portion has been acidulated with a few drops of hydrochloric acid, the addition of an equal volume of hydrogen sulphide T.S. should produce no precipitate (absence of arsenic, lead, etc.). In another portion, acidulated with hydrochloric acid, 1 Cc. of barium chloride T.S. should produce no visible change (absence of sulphate). If to a portion of the solution, acidulated with nitric acid, 0.1 Cc. of decinormal silver nitrate V.S. be added, the liquid should, after filtration, show no further change on the addition of more silver nitrate V.S. (limit of chloride). The addition of 0.3 Cc. of potassium ferrocyanide T.S. should effect no change in the solution within 15 minutes (limit of iron). No coloration or precipitate should be produced by adding 1 Cc. of ammonium sulphide T.S. (absence of iron, aluminum, etc.). Fragments of the salt sprinkled upon sulphuric acid, should produce no effervescence (absence of carbonate), nor impart any color (absence of readily carbonizable, organic impurities). If 1 Gm. of potassium acetate be, by thorough ignition, converted into carbonate, the residue should require, for complete neutralization, not less than 10 Cc. of normal sulphuric acid (corresponding to at least 98 per cent of pure potassium acetate), methyl orange being used as indicator"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Acetate of potassium is one of the most important of the salts employed in Eclectic medicine. In the dose of 2 or 3 drachms, it causes mild purging, which is occasionally attended with griping; and, in *dropsy*, it will often cause copious watery discharges by stool and urine. In doses of from 10 to 40 grains, it causes diuresis, to which effect is due its former name of *Sal Diureticum*. It is the ideal renal depurant, for it not only increases the watery constituents of the urine, but, by inducing retrograde metamorphosis, it augments the solid constituents as well. It acts not only upon the renal organs, but upon the remote parts of the body, serving to eliminate from the system much of the broken-down elements upon which diseased conditions depend. From the fact that it is decomposed before leaving the body, with the formation of potassium carbonate, it has been used in *dropsy*, to render the urine alkaline in *uric-acid diathesis*, and in other cases where diuresis is indicated. It is a remedy for *lithemia*. By its depurant action, it has cured *intermittent* and *remittent fevers*, when the usual treatment has failed. Not only does it remove the morbid products of fevers, but it also acts as a refrigerant. It should be well diluted, lest it irritate the gastric membranes. It should be remembered that all of the potassium salts act best when largely diluted, and the acetate is often given best in water to which a little vinegar has been added.

In *scrofulous conditions*, when old and broken-down tissues stand in the way of recovery, this salt acts as a true alterative in ridding the system of these obstructions, and the same is true in all inflammations marked by deposits of cacoplastic material. In *chronic diseases of the spleen* and *liver*, especially *hepatic congestion*, with limited secretion of bile, it is often the best remedy. In *chronic jaundice*, 30 or 40 grains of the salt should be given every 4 hours. It is a remedy for dropsies when the liver is inactive, or after scarlatina, but generally not otherwise, and, to increase its diuretic power, it may be given with parsley, spearmint, or queen of the meadow.

It has likewise been found beneficial in *acute* and *chronic rheumatism*, *acute vaginitis*, *gonorrhœa*, and in several obstinate cutaneous affections, when given in doses to increase the urinary discharge. It may be given with confidence in the early stages of *ovaritis*, *mastitis*, or *orchitis*. Prof. Locke recommends the following for *acute rheumatism*, with increase of temperature, swelling of the joints, and dirty tongue: ℞ Potassium acetate, ʒvj; salicylic acid, ʒii; aqua, fl℥iv. Mix. Sig. Dose, a teaspoonful in a wineglassful of water, every 3 or 4 hours. It should not be given when the tongue is pointed and red. With the special sedatives, it is often useful in *pneumonia*, and, given early, it may influence *phthisis* by preventing the deposition of tubercular matter. In *syphilis*, it may be administered awhile in alternation with the iodide of potassium. In *chronic ague*, it may be given to assist the antiperiodic. In *skin affections*, where the urinary secretion is imperfect, it aids other remedies, and is of itself often sufficient in *pimples*, *furunculous eruptions*, *scaly tetter*, and *psoriasis*. It should be borne in mind that to act properly the kidneys should be in good condition, otherwise too much should not be expected of the drug. It aids in curing *carbuncle*. Locally, it has been used to cure *acne*, the pimples being first emptied of their contents, and the parts touched with the deliquesced salt. The usual dose of potassium acetate ranges from 5 to 40 grains, well diluted; as a laxative, 4 drachms, though it is seldom used for this purpose. From 30 grains to 3 drachms may be taken in a day.

Specific Indications and Uses.—Retention of worn-out material in the body; imperfect renal excretions of the broken-down solids; deposits of cacoplastic material, giving rise to inflammations and fevers, especially malarial fever; tongue pallid, with light, pasty fur; scanty urine, with dull headache; sluggish lymphatic action; rheumatism, with swollen joints, dirty tongue, and fever; hepatic torpor and infarction.

POTASSII BICARBONAS (U. S. P.)—POTASSIUM BICARBONATE.

FORMULA: $KHCO_3$. MOLECULAR WEIGHT: 99.88.

SYNONYM: *Kali carbonicum acidulum, Acid potassium carbonate, Hydrogen potassium carbonate, Bicarbonas potassicus, Bicarbonas kalicus.*

"Potassium bicarbonate should be kept in well-stoppered bottles"—(*U. S. P.*).

Preparation and History.—As originally prepared by Cartheuser, in 1757, this salt was produced by the interaction between caustic potash and ammonium carbonate. It is now frequently prepared by a method introduced by Cavendish, that is, by passing a current of carbon dioxide into a solution of potassium carbonate until saturated, then filtering from precipitated impurities (silicic acid), and evaporating to crystallization at a heat not to exceed 70° C. (158° F.). The reaction which takes place is as follows: $K_2CO_3+H_2O+CO_2=2KHCO_3$.

Another method of obtaining potassium bicarbonate consists in exposing a moistened magma of potassium carbonate, in shallow dishes, to the prolonged action of carbonic acid gas until a sample, diluted with water, produces a white precipitate with solution of corrosive sublimate, consisting of mercuric bicarbonate; a yellow precipitate would indicate unaltered carbonate. (For details regarding this method, as well as another, whereby solution of potassium carbonate is warmed with solution of ammonium carbonate to a temperature not exceeding 75° C. [167° F.], see Hager, *Handbuch der Pharm. Praxis*, Vol. II, 1886, p. 250.)

Description.—The *U. S. P.* describes the salt as in "colorless, transparent, monoclinic prisms, odorless, and having a saline and slightly alkaline taste. Permanent in the air. Soluble in 3.2 parts of water at 15° C. (59° F.), and in 1.9 parts at 50° C. (122° F.). At a higher temperature, the solution rapidly loses carbon dioxide, and, after being boiled, contains only potassium carbonate. Almost insoluble in alcohol. The dry salt begins to lose carbon dioxide at 100° C. (212° F), and this loss increases at a higher temperature, until, at a red heat, the salt has lost 30.97 per cent of its original weight, leaving a residue of carbonate"—(*U.S.P.*). The salt does not dissolve or disorganize animal textures. In contact with acids, it briskly effervesces. An impure bicarbonate of potassium, in powder form, known as *Sal æratus*, was once used extensively in baking.

Impurities and Tests.—Bicarbonate of potassium is liable to contain as impurities the sulphate or chloride of potassium, arising from an impure carbonate employed in its preparation. The sulphate and chloride may be detected by the use of chloride of barium or nitrate of silver, these causing a white precipitate in its solution acidulated with nitric acid. Carbonate of potassium may be known by adding a solution of corrosive sublimate, which will cause a brownish-red precipitate, if as little as 1 per cent of the carbonate be present (see *Preparation* above).

The *U. S. P.* gives the following identity-reactions and tests for purity: "The pure salt, when dissolved in water, is at first neutral to litmus paper and to phenolphtalein T.S., but the solution soon becomes feebly alkaline by partial conversion of the salt into carbonate. Sodium cobaltic nitrite T.S. produces in the aqueous solution a copious yellow precipitate. Tartaric acid T.S., added to the aqueous solution in excess, causes a white, crystalline precipitate. A solution of 0.5 Gm. of potassium bicarbonate in 10 Cc. of water, should not at once be colored red by 1 drop of phenolphtalein T.S. (limit of carbonate). Dissolve 2.5 Gm. of the salt in 30 Cc. of diluted acetic acid, and, having made up the volume to 50 Cc. with water, use 10 Cc. for each of the following tests: No visible change should occur in a portion of this solution upon the addition of an equal volume of hydrogen sulphide T.S. (absence of metallic impurities). The addition of 0.3 Cc. of potassium ferrocyanide T.S. to another portion should not produce a blue color within 15 minutes (limit of iron). After adding a few drops of nitric acid and 0.1 Cc. of decinormal silver nitrate V.S. to another portion, and filtering, the further addition of silver nitrate V.S. should not affect the filtrate (limit of chloride). To neutralize 1 Gm. of potassium bicarbonate should require 10 Cc. of normal sulphuric acid (corresponding to 100 per cent of pure salt), methyl orange being used as indicator"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Bicarbonate of potassium is antacid, antilithic, and diuretic, is less irritating and unpleasant than the carbonate and liquor potassæ, and may be used in larger doses. It is preferred, as a general rule, to the carbonate, for which it may, in nearly all cases, be used as a substitute. The indications for this salt are those for potash—"a leaden pallor of the tongue, and tremulous muscles." Following this indication, it is a good drug in *gout*, *fevers*, *syphilis*, *scrofula*, and *rheumatism*, with deposits of lithic acid in the urine. It may be given with mint water and syrup of stillingia. In *gonorrhœa*, it relieves the irritation produced by acid urine and other discharges. In combination with gentian, rhubarb, and mint water, it is a good remedy in *atonic dyspepsia*, with indications for an alkali, and in the form of neutralizing cordial with rhubarb and peppermint herb (Locke's formula), it is an excellent antacid in *infantile diarrhœa* with green, offensive discharges. It is of value in *cutaneous disorders*, depending upon a malarial cachexia and errors in diet. Dose, 10 to 30 grains, well diluted, as an antacid and antilithic; 1 to 2 drachms, as a diuretic. Potassium bicarbonate, in well-diluted solution, forms an excellent agent for softening and removing the scales formed upon the palpebral margins in *ciliary blepharitis*.

Specific Indications and Uses.—Leaden pallor of tongue and mucous membranes, and tremulous action of the voluntary muscles; fullness of muscles; debility out of proportion to diseased conditions.

Related Products.—POTASSII SESQUICARBONAS, *Sesquicarbonate of potassium*, *Mild vegetable caustic*. When a solution of potassium bicarbonate ($KHCO_3$) in water is evaporated by boiling, half of its carbonic acid is gradually given off and the normal carbonate (K_2CO_3) results. If evaporation is carried to the point where only one-fourth of its carbonic acid is given off, the solution contains potassium sesquicarbonate, which crystallizes out upon standing. It is claimed by some to be a crystallizable, deliquescent substance of definite composition, while others claim that the product is a mixture of mono- and bicarbonate of potassium. As prepared by the process mentioned, this mild caustic is sold in the form of a white powder, having an alkaline odor, a sharp, strongly alkaline taste, is permanent in dry air, very soluble in water, but insoluble in alcohol. Owing to the fact that carbonate of potassium is deliquescent, and that this preparation contains that salt, the bottle containing this salt must be well closed.

The above preparation differs materially from the original *Vegetable caustic*, which was prepared by making a strong lye of hickory or oak-wood ashes, and evaporating it in an iron kettle to dryness. This formed an impure caustic potash, of a dingy-gray or greenish color very caustic, but less so than the hydroxide of potassium, very deliquescent, and soluble in water. It is more severe in its action than the mild caustic, and has to be employed occasionally in cases where the latter exerts but little or no beneficial influence. As it rapidly extracts moisture from the atmosphere, it must, as soon as prepared, be placed in glass bottles with good corks or stoppers. Each of these preparations is escharotic, but they do not, like the hydroxide of potassium, destroy or decompose the healthy tissues; their action appears to be altogether exerted upon abnormal growths and conditions of parts. They are employed as local applications to *fistulas*, *cancers*, *fungous growths*, *indolent ulcers*, *unhealthy conditions of mucous tissues*, as in *ophthalmic affections*, *diseases of the Schneiderian membrane*, of the *mouth and throat*, *urethra*, *vaginal walls*, and *cervix uteri*. Prof. Scudder, who was very partial to this preparation, says (*Spec. Med.*): "In *chronic disease of bone*, and in *caries*, it exerts a most kindly influence upon the diseased tissues, promoting the removal of the dead bone, and at the same time stimulating the living. In *disease of the soft tissues* going on to suppuration, the same may be said, the local application promoting the removal of dying tissue in suppuration, yet strengthening the tissues adjoining. This may be noticed especially in the treatment of [illegible], as the thorough injection with a saturated solution of sesquicarbonate of potash arrests the progress of the disease, and establishes healthy suppuration." In solution, it has been injected into the uterus in *dysmenorrhœa*, *uterine leucorrhœa*, etc., without any unpleasant symptoms arising. In these latter cases the milder caustic should be used, commencing with a weak solution, and gradually increasing in strength until the maximum degree that can be used is obtained. Upon healthy tissues these agents exert but very feeble action; and in unhealthy conditions they bring about a normal action without exciting undue degree of inflammation. They are agents of great value.

POTASSII BICHROMAS (U. S. P.)—POTASSIUM BICHROMATE.

FORMULA: $K_2Cr_2O_7$. MOLECULAR WEIGHT: 293.78

SYNOYMS: *Potassium dichromate, Bichromas kalicus, Bichromate of potash, Red chromate of potash,* or *potassa, Kali chromicum rubrum, Kali bichromicum.*

Source and Preparation.—The chief source of all chromium compounds is the mineral *chrome iron ore* which is essentially *ferrous chromite, i.e.,* a compound of ferrous oxide and chromic oxide ($FeO.Cr_2O_3$). It occurs in Russia, Sweden, and many parts of the United States. Bichromate of potassium is made on the large scale by the decomposition and oxidation of chromic iron ore. The latter is mixed with lime, and roasted with free access of air in a reverberatory furnace until decomposition of the ore has taken place. Formerly nitrate of potassium was employed to oxidize the ore. The mass is then lixiviated with water, and the resultant solution of chromate of calcium (CrO_4Ca) decomposed by the addition of carbonate of potassium, and filtered from the calcium carbonate; the yellow, neutral chromate solution is then acidulated with sulphuric acid, and the bichromate solution evaporated to crystallization. Thus it is seen that the bichromate may be obtained from the neutral yellow chromate by acidulating the solution of the latter with sufficient sulphuric or acetic acids to convert half of the potassium of the neutral chromate into sulphate or acetate, as follows: $2K_2CrO_4+H_2SO_4=K_2SO_4+H_2O+K_2Cr_2O_7$. The solution upon sufficient evaporation yields large crystals of bichromate (see also *Related Compounds*).

Description and Tests.—"Large, orange-red, transparent, triclinic prisms, or 4 sided tables, odorless, and having a bitter, metallic taste. Permanent in the air. Soluble in 10 parts of water at 15° C. (59° F.), and in 1.5 parts of boiling water; insoluble in alcohol. The salt fuses below a red heat, without loss of weight, forming a dark brown liquid. At a white heat it evolves oxygen and leaves a residue of neutral potassium chromate and green chromic oxide. The aqueous solution (1 in 20) has an acid reaction upon litmus paper. On mixing 4 Cc. of the aqueous solution with 0.5 Cc. of alcohol, and then with 1 Cc. of sulphuric acid, the liquid will assume a green color and emit the odor of aldehyde. Sodium cobaltic nitrite T.S. produces in the aqueous solution a copious yellow precipitate"—(*U. S. P.*). Solutions of potassium bichromate form colored precipitates with salts of the various heavy metals, *e. g.*, salts of lead (*chrome yellow*), mercury, silver, barium, etc. These precipitates are soluble in diluted nitric acid; but silver chloride and barium sulphate are insoluble, hence the presence of chlorides or sulphates as impurities may be easily recognized by this test. The orange-red solution of potassium bichromate, especially when acidulated, is reduced to green by organic substances, *e. g.*, alcohol (see above), hydrogen sulphide, sulphurous acid, ferrous sulphate, etc. When heated with hydrochloric acid, chlorine is evolved. The chromate in these processes is reduced to salts of the chromic oxide (Cr_2O_3). The *British Pharmacopœia* (1898) directs the following quantitative test for the purity of potassium bichromate: "5.66 grammes of ferrous sulphate, dissolved in a little water and acidulated with sulphuric acid, should not cease to yield a blue color with solution of potassium ferricyanide until such a quantity of solution as contains 1 gramme of the potassium bichromate has been added"—(*Br. Pharm.*, 1898). This reaction takes place according to the equation $6(FeSO_4+7H_2O)+7H_2SO_4+K_2Cr_2O_7=3Fe_2(SO_4)_3+K_2SO_4+Cr_2(SO_4)_3+49H_2O$. The proportions directed by the *British Pharmacopœia* correspond to 99.7 per cent of the pure salt.

Potassium bichromate is extensively employed in the arts, being used in dyeing operations and tanning industries, as well as for other minor purposes.

Action, Medical Uses, and Dosage.—Internally, this salt is a poison, though it has been used as an alterative in *venereal* and *scrofulous affections*, in doses of $\frac{1}{12}$ to $\frac{1}{5}$ or $\frac{1}{6}$ of a grain, 3 or 4 times a day. In excessive doses this salt is a violent irritant and corrosive poison, and may quickly produce death. An ounce is said to have occasioned death in about half an hour, insensibility having occurred 5 minutes after its ingestion. The symptoms are vomiting, dark hemorrhagic mucus, purging, violent pain in the abdomen, excessive thirst, cold surface, cold breath, feebleness of speech, with quick, feeble pulse, hurried respiration, coma, cardiac failure, collapse, and death. If death does not occur, urinal suppression may last for many days. As small a dose as 2 drachms has produced death. Calico printers suffer from ulcers on the hands and the destruction of the nasal membranes and septum from inhalation of its dust. When this salt is applied in solution to the skin, habitually, it first produces an eruption of papulæ, which become pustular, and, provided the exposure be continued, forms deep sloughs under the pustules, of a peculiarly penetrating character. Externally it is a caustic, and one of its chief therapeutical uses is as an external application; it may be used in aqueous solution, from 30 to 60 grains to the ounce of fluid, or in the state of powder. Its solution possesses very powerful antiseptic properties, and will be found advantageous in cases of *gangrene, dry mortification*, etc. It is milder than chromic acid, and may be used for many of the purposes for which the acid is employed (see *Chromic Acid).* Bichromate of potassium in saturated solution has been recommended as a local application to *warts, excrescences*, and *tubercular elevations;* it causes but little pain, and often removes these growths by absorption without any slough; or if a slough has formed, it serves to expedite the cure, and it is not followed by deep, unmanageable ulcers. Internally, it is emetic and irritant in doses of $\frac{3}{4}$ of a grain. In doses of $\frac{1}{16}$ of a grain, repeated 3 times daily, it acts as an alterative, and occasionally as a sialagogue, and has been advantageously used in *syphilis;* gradually increasing the dose to $\frac{1}{3}$ of a grain. It should be used in pill form in combination with some tonic or alterative vegetable extract. It is much used in calico printing, and in preparing artificial valerianic acid from fusel oil. Paper impregnated with solution of it, and dried, forms excellent tinder. The alkaline carbonates, magnesia, soap, etc., are its antidotes. Of recent years potassium bichromate has been used for its specific action upon the throat and alimentary canal. Upon the former its specific effects are exerted upon the mucous membrane of the fauces, larynx, and trachea, seemingly not extending to the smaller bronchioles. *Hoarseness* and exudation, with *cough*, are the special guides to its selection. With these conditions, it may be used to relieve the hoarseness following *acute affections of the larynx* from cold, singing or speaking. In *diphtheria* and *pseudo-membranous croup* it may be added to the remedies employed, while in the latter stillingia liniment is to be externally applied. It acts also upon the bronchi and larger bronchioles, controlling irritation, and relieving hard, rasping cough of the subacute, bronchial type. It should be thought of in any inflammation with a tendency to low grades of deposit, and in *laryngeal irritation*, with hoarseness and dryness of the laryngeal tissues. It is a remedy for *croupous conjunctivitis* and *indolent corneal ulcers* with stringy secretions, and in granulated lids with tenacious discharges. Locally, a strong solution may be applied in *acute trachoma* with large granulations. Potassium bichromate is a remedy for muscular pain. In *non-inflammatory chronic rheumatism*, with deficient force to the circulation, this agent sometimes does good service, and is particularly valued by some practitioners in *syphilitic rheumatism.* It relieves the cramping, rheumatoid pains of *muco-enteritis* and *acute diarrhœa* occurring in cold weather (Webster). The recuperative power of the drug is shown in *chronic diarrhœa* and in *chronic dysentery*, with ulceration of the colon. *Chronic pharyngeal ulcers, syphilitic* or otherwise, *chronic gastritis*, and *round gastric ulcer*, are reputed cured by it. A yellow-coated tongue and *catarrh of the stomach* are the indications for it in dyspeptic troubles. The dose for specific purposes should be about 2 or 3 grains of the 3 x trituration, every 2 to 4 hours.

Specific Indications and Uses.—Respiratory irritation, with hoarseness, harsh or croupal cough, scanty expectoration, or thick, tenacious sputa, difficult respiration, and subacute inflammation; inflammations with low grade of deposits; muco-enteritis and irritative diarrhœa, with tenesmic rheumatoid pain; dyspepsia with gastric catarrh and yellow-coated tongue; corneal ulcers with stringy discharges; croupous conjunctivitis; trachoma with tenacious discharges; non-inflammatory, rheumatic or muscular pain; pseudo-membranous croup; laryngeal irritation and hoarseness from singing or speaking.

Related Compound.—*Potassium chromate* (K_2CrO_4). Molecular Weight: 193.9. To a hot solution of potassium dichromate add potassium carbonate until effervescence ceases. The solution becomes yellow, and, upon evaporation, yields canary-yellow, 6-sided crystals, which melt without decomposition. Two parts, or less, of water effect their solution. The salt in solution turns red litmus paper blue. It is employed as a laboratory reagent.

POTASSII BITARTRAS (U. S. P.)—POTASSIUM BITARTRATE.

FORMULA: $KHC_4H_4O_6$. MOLECULAR WEIGHT: 187.67.

SYNONYMS: *Cream of tartar*, *Crystals of tartar*, *Tartarus depuratus*, *Potassii tartras acida* (*Br.*), *Acid potassium tartrate*, *Supertartrate of potassa*, *Cremor tartari*, *Bitartras kalicus*, *Bitartras potassicus*, *Kali bitartaricum*.

Source, History, and Preparation.—This salt, commonly called *Cream of tartar*, was known to the ancient Greeks and Romans as a deposit from fermenting grape juice. Its chemical nature was cleared up by Scheele in 1769. It is obtained from the *crude tartar*, *argol*, or *winestone* of commerce, a constituent of many vegetable juices, especially of grape juice. When the sugar contained in the latter is converted into alcohol, in which the tartar is insoluble, it becomes deposited upon the sides of the fermenting casks in the form of a grayish or brownish, indistinctly crystalline substance. The tart wines deposit it in the largest quantity; it is composed of bitartrate of potassium (good commercial grades contain 80 to 85 per cent), tartrate of calcium (about 5 to 10 per cent), coloring matter, alumina, and other accidental impurities. The red wines give a *red tartar* (*Red argol*), and the white wines a *white tartar* (*White argol*), the first being brown-red in color, the second more gray. From the crude argol, purified cream of tartar (*tartarus depuratus*) is obtained by recrystallization from boiling water. In order to remove the coloring matter, a hot aqueous solution is agitated with charcoal, or aluminum hydroxide, or the white of egg, etc. If a hot, saturated solution of tartar be cooled, the surface of the liquid becomes coated by a layer of very fine crystals of bitartrate; hence this crust was called *cream of tartar*. An easy mode of purifying cream of tartar is to convert it into Rochelle salt by dissolving it in solution of sodium carbonate, the solution is then purified by animal charcoal, and the cream of tartar precipitated by means of hydrochloric acid.

Description.—As officially described potassium bitartrate forms "colorless or slightly opaque, rhombic crystals, or a white, somewhat gritty powder, odorless, and having a pleasant, acidulous taste. Permanent in the air. Soluble in about 201 parts of water at 15° C. (59° F.), and in about 16.7 parts of boiling water; very sparingly soluble in alcohol. When a small portion of the salt is heated on platinum foil, it chars and emits inflammable vapors having the odor of burning sugar. At a higher temperature, with free access of air, the carbon of the black residue is oxidized, and a white, fused mass of potassium carbonate remains, which has an alkaline reaction, and effervesces strongly with acids. The aqueous solution of the salt has an acid reaction upon litmus paper. With sodium cobaltic nitrite T.S. it yields a copious yellow precipitate. In the aqueous solution of the salt, rendered neutral by potassium or sodium hydrate T.S., silver nitrate T.S. produces a white precipitate which, on boiling, becomes black by the separation of metallic silver. If, before applying heat, enough ammonia water be added to dissolve the white precipitate, upon boiling the solution a mirror will be deposited on the sides of the test tube"—(*U. S. P.*). Cream of tartar is readily soluble in water to which borax or boracic acid has been added, forming a solution termed *soluble cream of tartar*, or *borotartrate of potassium*. It is incompatible with all alkaline substances, *e. g.*, ammonia water, carbonates of sodium or potassium, magnesium oxide, with all of which it forms soluble compounds; salts of heavy metals, *e. g.*, lead acetate, likewise decompose it, insoluble tartrates being formed.

Adulterations and Tests.—As found in commerce, bitartrate of potassium is always contaminated with from 3 to 10, or even 14 per cent of tartrate of calcium; also frequently with copper, which gives it a green tint. These impurities may be removed, without any great loss of material, by finely powdering the cream of tartar, and digesting it at a gentle heat, with very dilute hydrochloric acid. To detect the tartrate of calcium agitate the cream of tartar with a solution of aqua ammoniæ, then filter and add oxalate of ammonium, which causes a white precipitate if a calcium salt be present. If a large amount of tartrate of calcium be present, the ammonia will not dissolve all of the powder. If copper be present, ferrocyanide of potassium added to an aqueous solution will give a chocolate or reddish-brown precipitate. The latter is bluish-green when iron is present. Intentional adulterations of cream of tartar usually consist of starch, chalk, clay, or alum. Some samples have been found to consist for the greater part. or almost entirely, of calcium sulphate or phosphate. The presence of carbonate of calcium will cause an effervescence with weak acids; starch may be known by the blue color caused upon the addition of iodine; mineral substances, by their insolubility in boiling water; alum, by the white precipitate caused upon the addition of chloride of barium, and which is insoluble in nitric acid. The tests of the *U. S. P.*, in addition to the characteristics given under *Description*, are as follows: "If 1.5 Gm. of the salt be shaken with 30 Cc. of water and the mixture filtered, 10 Cc. of the filtrate, after being acidulated with nitric acid, should not be rendered turbid by 0.5 Cc. of silver nitrate T.S. (absence of chloride), nor by 0.5 Cc. of barium chloride T.S. (absence of sulphate). A solution of 0.5 Gm. of the salt in 3 Cc. of ammonia water should leave no insoluble residue (absence of insoluble matter), nor be affected by ammonium sulphide T.S. (absence of copper, lead, iron, etc.). If 1.2 Gm. of potassium bitartrate be repeatedly agitated, during half an hour, with a mixture of 5 Cc. of acetic acid and 1 Cc. of water, and the mixture be then diluted with 30 Cc. of water, and filtered, the clear filtrate should not be rendered turbid, within one minute, by the addition of 0.5 Cc. of ammonium oxalate T.S. (limit of calcium salt). The odor of ammonia should not be evolved on heating the salt with a slight excess of potassium or sodium hydrate T.S. If 1.88 Gm. of potassium bitartrate be thoroughly ignited at a red heat, it should require for complete neutralization not less than 9.9 Cc. of normal sulphuric acid (each Cc. corresponding to 10 per cent of the pure salt), phenolphtalein being used as indicator"—(*U. S. P.*). With regard to the last-mentioned test. Mr. Carl E. Smith (*Digest of Criticisms*, *U. S. P.*, Part II, 1898) points out that direct titration of the salt with caustic alkali is preferable to titration with acid after ignition, because in the latter case the presence of calcium tartrate affects the accuracy of the result, and because of the greater convenienc of the former method.

Action, Medical Uses, and Dosage.—Bitartrate of potassium is diuretic and laxative. Doses of about 20 grains generally act as a diuretic. In large doses it occasions severe and long-continued purging of watery discharges, seldom, however, griping, or producing subsequent debility; on this account, it forms an invaluable agent in *dropsy*. Excessive doses cause gripings and flatulence, with symptoms of gastro-enteritis. Its continued use deranges the digestive functions, and produces emaciation. A combination of sulphur, bitartrate of potassium, and confection of senna, is frequently used with advantage as a laxative in *piles*, *prolapsus ani*, etc., and in some diseases of the skin. Equal parts of sulphur and cream of tartar in teaspoonful doses are often employed for *piles with constipation*. It is frequently combined with jalap, the compound powder of jalap, resin of podophyllum, sulphur, etc. In solution, sweetened with sugar, or in lemonade, it forms an agreeable, cooling drink, very useful in many *fevers*. As a hydragogue in *post-scarlatinal dropsy*, Prof. Locke (*Syllab. of Mat. Med.*) recommends: ℞ Cream of tartar, ℥ss; juniper berries, ℥ss; boiling water, Oj. Mix. Filter after standing a couple of hours and give in wineglassful doses, 3 or 4 times a day. Equal parts of bitartrate of potassium, powdered rhatany root, and myrrh, form a good dentifrice. Two drachms of cream of tartar added to 1 pint of milk, form a *cream of tartar whey*, which, when diluted with water, is sometimes given in *dropsical* and *febrile complaints*. Dose, as a cathartic, from 4 to 6 drachms; as an aperient, 1 or 2 drachms; and in dropsy, it may be given in doses of from 1 to 3 drachms, in water, 4 or 5 times a day.

POTASSII BROMIDUM (U. S. P.)—POTASSIUM BROMIDE.

FORMULA: KBr. MOLECULAR WEIGHT: 118.79.

SYNONYMS: *Bromide of potash*, *Bromide of potassium*, *Bromuretum potassicum*, *Bromuretum kalicum*.

Preparation.—Bromide of potassium may be prepared by several methods. The *U. S. P.*, 1870, obtained it by double decomposition of pure potassium carbonate with solution of ferrous bromide previously prepared by the action of bromine upon iron filings in the presence of water. The reaction takes place with precipitation of insoluble ferrous carbonate as follows: $FeBr_2+K_2CO_3$ $FeCO_3+2KBr$. The resulting solution of potassium bromide is then evaporated to crystallization. The process of the *British Pharmacopœia* (1885) consists in the action of bromine upon caustic potash, whereby potassium bromide and bromate are formed, according to the equation: $6Br+6KOH = 5BrK+BrO_3K+3H_2O$. The solution is evaporated to dryness, the salts mixed with charcoal and exposed to a red heat; the bromate is thus reduced to bromide, carbonic oxide being evolved. The fused mass, when cold, is dissolved in water, filtered and evaporated to crystallization. Potassium bromide may also be prepared by neutralizing hydrobromic acid with caustic potash.

Description.—Bromide of potassium is officially described as occurring in "colorless or white, cubical crystals, or granules, odorless, and having a pungent saline taste. Permanent in the air. Soluble, at 15° C. (59° F.), in about 1.6 parts of water, and in 200 parts of alcohol; in less than 1 part of boiling water, and in 16 parts of boiling alcohol; also soluble in 4 parts of glycerin. On heating the salt upon platinum foil, it decrepitates; near 700° C. (1290° F.) it fuses without decomposing, and at a bright red heat it volatilizes, communicating a violet color to the flame. The aqueous solution (1 in 20) is neutral, or has, at most, only a scarcely perceptible alkaline reaction upon litmus paper. The addition of tartaric acid T.S., or sodium bitartrate T.S., produces in it, after some time, a white crystalline precipitate. Sodium cobaltic nitrite T.S. produces in it at once a copious yellow precipitate. If to 10 Cc. of the aqueous solution of the salt a few drops of chloroform be added, then 1 Cc. of chlorine water, and the mixture be agitated, the liberated bromine will dissolve in the chloroform, imparting to it a yellow or brownish-yellow color without a violet tint"—(*U. S. P.*). A violet tint would denote the presence of iodine. Potassium bromide is precipitated also by acetate of lead and by mercurous and mercuric salts.

Impurities and Tests.—The commercial article frequently contains iodide of potassium, and the chloride is a regular constituent for which the *U. S. P.*, by the test given below, fixes an upper limit of 3 per cent. Commercial samples have been found to contain as much as 7 or 8 per cent of chloride. The alkaline reaction of bromide of potassium is due to adhering carbonate of potassium; if it is present in an appreciable quantity the salt becomes moist in the air, and effervesces with acid. If bromate of potassium is present, the addition of hydrochloric acid will liberate both bromic and hydrobromic acids, which at once act upon each other with liberation of bromine; hence a brown color is developed upon the addition of the acid. The reaction takes place as follows: $5BrH+BrO_3H = Br_6+3H_2O$. Of eight samples of commercial potassium bromide analyzed by Mr. G. H. Charles Klie (*Amer. Jour. Pharm.*, 1894, p. 382) none contained bromate, but five failed in the test for chlorides, as given below, and one contained appreciable quantities of sulphate. The *U. S. P.* directs the following tests for impurities: "If 1 Gm. of the salt be dissolved in 10 Cc. of a mixture of 100 Cc. of water and 0.2 Cc. of normal sulphuric acid, no red tint should be imparted to the solution by the addition of a few drops of phenolphtalein T.S. (limit of potassium carbonate)"—(*U. S. P.*). These proportions correspond to about 0.138 per cent of carbonate. Prof. V. Coblentz (*Amer. Jour. Pharm.*, 1884, p. 543) found the carbonate to vary from 0.01 to 3.10 per cent. "If a little of the salt be held in a non-luminous flame on a perfectly clean platinum wire, the flame should be colored violet at once, without any appearance of yellow (absence of sodium). If diluted sulphuric acid be dropped upon crushed crystals of the salt, they should not at once assume a yellow color (absence of bromate). If 10 Cc. of the aqueous solution (1 in 20) of the salt be mixed with a little starch T.S., the addition of a few drops of chlorine water should not produce a blue color (absence of iodine). Ten Cc. of the aqueous solution (1 in 12) should not be rendered turbid by the addition of 0.5 Cc. of ammonia water and of 0.5 Cc. of ammonium sulphide T.S. (absence of iron, aluminum, etc.); nor should 10 Cc., after being slightly acidulated with acetic acid, be rendered turbid by an equal volume of hydrogen sulphide T.S. (absence of arsenic, lead, copper, etc.); nor by 0.5 Cc. of ammonium oxalate T.S. (calcium); nor by 0.5 Cc. of potassium sulphate T.S. (barium); nor by 0.5 Cc. of barium chloride T.S. (sulphate); nor be colored blue by 0.5 Cc. of potassium ferrocyanide T.S. (iron). If 0.5 Gm. of the well-dried salt be dissolved in 10 Cc. of water, and 2 drops of potassium chromate T.S. be added, it should not require more than 42.85 Cc. of decinormal silver nitrate V.S. to produce a permanent red color of silver chromate (absence of more than 3 per cent of chloride)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This salt, whose therapeutic properties were discovered by accident while the drug was being tried as a substitute for the iodide, is the most important and most powerful of the bromides. The bromides as a rule have a bitterish and sharply saline taste, and when ingested are rapidly diffused throughout the system, and are eliminated by the kidneys, skin, salivary and intestinal glands and bronchial membranes. When the kidneys are inactive the effects of the bromides are much more pronounced. The effects of bromide of potassium on the system appear to be slightly similar to those of iodide of potassium, with the addition of a sedative influence upon irritable or excited conditions of the nervous system. When given in small doses and continued daily for several months it does not exert any injurious effect, and may be detected in the urine by the application of starch, and a few drops of chlorine, which impart a yellow color. If the alimentary canal is in an irritable condition its use is apt to produce diarrhœa. The same effect is produced by concentrated doses, and gastric catarrh is one of the untoward results of the long-continued administration of large doses of the bromides. It generally produces diuresis. The bromides derive their therapeutical efficiency from several effects, the chief of which probably is their sedative influence upon the sympathetic system of nerves. They are known to slow the action of the heart, and in the case of the potassium salt the base undoubtedly adds to the heart-depression; they diminish the supply of blood to the tissues, and reduce temperature. Two drachms of the potassium salt have reduced the temperature a half degree in a healthy adult; the tension of the arterioles is diminished and breathing is depressed by the bromides. The long-continued use of the bromides induces a diminished sensibility of the fauces, which is also produced by a solution locally applied, and a disturbed action of the muscles of deglutition. This action, as well as the impaired tactile sensation of all parts of the mucous tissues, the skin, and the palmar and plantar surfaces is thought to be due to the local action of the salt in being eliminated by these parts. Sexual desire and the power of erection are diminished by the bromides in large doses, the potassium salt being the most active in this respect. The protracted use of the salt in doses of from ½ to 2 drachms a day intensify the hypnotic effects which are produced by a few doses and a continual drowsiness is experienced. The breath becomes bromous and fetid, the fauces red and swollen and a condition known as *bromism* becomes established. This condition differs from the effects stated only in intensity, and among the chief symptoms are the following: Fetid breath, acneiform and other cutaneous eruptions, including boils, pustules and ulcers, diminished sensibility of the fauces, base of tongue, epiglottis and skin; slow, feeble heart-action, marked pallidity, anemia, cold extremities, general sense of coolness, breathlessness and quickened heart-action on the slightest exertion, tremulous and uncertain locomotion, suppression or repression of sexual desire; complete genital relaxation, disordered menstruation and a general inertia and heaviness of movement; drowsiness, generally with natural sleep, sometimes, however, lethargic; weakness of intellect, enfeebled memory, silly or meaningless laughter, headaches, mental confusion, and occasionally insanity, are among its effects. Pulmonary and gastric catarrh, with diarrhœa, or sometimes constipation, are common. Finally death, preceded by fever and coma, relieves the wreck of humanity of all his sufferings.

Of the bromides, the sodium salt is least, and the potassium compound the most toxic; lithium bromide is most active as a hypnotic, sodium bromide next, and potassium bromide least in hypnotic power (Bartholow). Ammonium bromide is the quickest to produce its effects.

Bromide of potassium is a very valuable therapeutical agent, but, in many respects, it has been greatly overrated. It is a very powerful nervo-sanguine sedative (Locke). As an alterative, for which it was first used, it is very inferior to the iodide. For this purpose, it has been successfully used in *enlarged spleen* and *liver*, *swelling of the lymphatic glands*, *scrofula*, *ovarian enlargements*, *goitre*, *catarrhal affections*, and *hypertrophy of the cardiac ventricles*. Potassium bromide is not a remedy in anemia and debility, but is efficient and applicable only in plethoric and sthenic conditions. Owing to its decided control over the genital organs, it is one of the best of remedies for *nocturnal emissions*, when the patient is full-blooded or plethoric, and there is excitation of the nervous system and the circulation. It does not benefit, and may even harm the pale, bloodless individual. The remedy acts best when the person is in fairly good health, but who, from lascivious dreams, and vascular excitement, and nervous irritability of the ejaculatory ducts, is an easy victim to *spermatorrhœa*. Often the venereal excitation is so pronounced as to more nearly resemble *satyriasis*. It is, therefore, a remedy for *sexual hyperæthesia*, with determination of blood to the genitalia.

If administered in proper cases, in *gonorrhœa*, it will prevent *chordee*, and may be given when that condition has already supervened. *Priapism*, due to various causes, in infants and young men, is relieved by this drug. *Hysteria*, bordering upon *nymphomania*, or when associated with sexual irritation, regular twitchings of the facial muscles, and abdominal or uterine throbbing, is signally relieved by this drug. It is equally efficient in many of the *nervous disorders of the menopause*, when plethora is prominent. In actual *nymphomania*, it is one of our best agents. For genital troubles, large doses are required—20 to 40 or 60 grains in plenty of water, 3 or 4 times a day; in nervous disturbances of females, 10 to 20 grains, 3 or 4 times a day. Bromide of potassium is not employed as an antipyretic by members of our school. It is, however, valued by some in *urethral fever*, caused by the introduction of instruments into the urethra, and by operations upon that canal. It may be used in the *delirium of fevers*, and in *cerebral*, *spinal*, or *cerebro-spinal inflammations*, when these conditions are sthenic. A very important property of the drug is its control over certain *spasmodic affections*. Thus it is frequently of value in *puerperal* and *infantile convulsions*, from teething or nervous irritation. After infantile convulsions have been controlled by chloroform, their return may be prevented by grain doses for each year of the child's age, every 1 or 2 hours. It has proved successful in *pertussis;* and also in *spasmodic asthma*, in doses of 20 or 30 grains, repeated 2 or 3 times a day.

It is useful in *nervous palpitation of the heart*, especially when there is cerebral fullness. It controls the *vomiting of pregnancy*, when not due to gastric wrongs; also acting well in *sea-sickness* and the *vomiting of congestion of the brain*. Furious *puerperal mania*, the *night terrors* of children, with *somnambulism*, reflex irritations in infantile complaints, and *headache*, from congestion, are conditions in which it has rendered very effectual service. The headache relieved by it, is associated with a flushed face, throbbing and fullness of the cerebral vessels, and great mental agitation. *Sthenic insomnia*, with the same symptoms without the headache, is promptly overcome by the drug. It is often combined with chloral and the other bromides in such disorders, and it may be used where opium would do harm. As a rule, cold applications to the head assist its action in headache. The dose should be about 25 grains to start with, followed every ½ hour by 10-grain doses. In *acute mania*, with violent manifestations, from 20 to 40 grains may be given every hour with excellent calmative effect, and in *delirium tremens*, with great excitation of the nervous and vascular systems, from 10 to 20 grains, each, of bromide of potassium and chloral hydrate, form an excellent treatment. It has cured in *tetanus* and *tetanus neonatorum*, and is antagonistic to strychnine. The *amblyopia* of the intemperate, and the *tinnitus* from the effects of quinine, are often relieved by it. Elixir of bromide of potassium is a favorite agent in some quarters to quickly overcome the effects of *drunkenness*. *Enteralgia* of children, with intense colicky pain and contraction or knotting of the intestines, purely nervous in character, and *spasmodic œsophageal stricture*, are relieved by this salt. Headache, due to *eye-strain*, is relieved by 10 to 15-grain doses of this drug, every 3 hours, but its protracted use is charged with causing recurrent corneal ulcers (Foltz).

Bromide of potassium is generally conceded to be the best-known remedy for *epilepsy*. It appears to protract the frequency, and render lighter attacks of epilepsy from any cause, but a cure can not be expected when the malady depends upon organic lesions or tumors, or upon sexual disorders, remediable only by operative procedures, as phimosis, or when congenital. It does, however, act better than any other agent when the trouble depends upon genital irritation, or irritation of the cerebellum, or fright. In the cases to which it is especially applicable, there is extreme susceptibility to external impressions and plethora. It must be given in from 15 to 40-grain doses, well diluted, 4 times a day, and continued until a complete saturation of the system is acquired, as evidenced by the acneiform eruptions. These cutaneous blemishes are said to be diminished or prevented by administering Fowler's solution with the salt. In cases of epilepsy, apparently cured, the drug should be continued for some time afterward.

Owing to its power of blunting the sensibility of the mucous tissues, it has been used to prepare the way for the passage of urethral bougies, and the use of the laryngoscope. Twenty to forty grains of the salt, mixed with an ounce of lard, forms an ointment useful in *bronchocele*, *enlarged spleen*, and *scrofulous tumors*; and this should be conjoined with the internal use of iodine, or the bromide. Solutions, ointments, or suppositories containing this salt, and introduced into the rectum, relieve *cystic irritability*, and are said to reduce *prostatic hypertrophy*. The dose of bromide of potassium ranges from 1 to 60 grains, 3 or 4 times a day.

Specific Indications and Uses.—Plethoric conditions, with vascular and nervous excitation; headache or insomnia, with throbbing pain and fullness in the cerebral vessels, and great mental excitation; spasmodic muscular contractions; restlessness and nervousness from sthenic conditions; violent mania; spermatorrhœa in the plethoric; nymphomania; satyriasis; epilepsy from sexual irritation or irritation of the cerebellum; strong sexual excitement; disorders associated with a vigorous circulation, without fever; extreme susceptibility to external impressions.

Related Compound.—BROMIDIA. A specialty of Battle & Co., of St. Louis, Mo. containing chloral hydrate, potassium bromide, and extracts of cannabis indica and hyoscyamus. The conditions in which it is used are *insomnia*, *nervousness*, *headache*, *neuralgia*, *nervous irritability*, *colic*, *mania*, *convulsions*, and *epilepsy*. As a sleep producer, the dose is from ½ to 1 fluid drachm, in water or syrup, every hour until sleep is induced.

Cæsium and Rubidium Salts.—These salts closely resemble the salts of potassium. Some of them are occasionally employed in medicine.

CÆSIUM AND AMMONIUM BROMIDE ($CsBr.3NH_4Br$).—Crystalline, white powder. Dissolves in water.

CÆSIUM HYDROXIDE ($CsOH$).—A somewhat deliquescent, grayish-white mass. With water, or alcohol, its behavior is similar to that of caustic potash.

CÆSIUM CARBONATE (Cs_2CO_3).—Very hygroscopic, white, sand-like compound, soluble in alcohol, and easily so in water.

CÆSIUM SULPHATE (Cs_2SO_4).—Colorless, permanent, anhydrous prisms, insoluble in alcohol, but very soluble in water.

CÆSIUM CHLORIDE ($CsCl$).—According to Botkin, this salt retards cardiac movements and increases the arterial pressure.

CÆSIUM BROMIDE ($CsBr$).—Prof. Laufenauer claims for this compound better results in *epilepsy* than from the other bromides.

RUBIDIUM AND AMMONIUM BROMIDE ($RbBr.3NH_4Br$).—A crystalline powder, white or yellowish-white, having a cooling, sharply saline taste, and easily dissolving in water. Rubidium has been found to exert medicinal actions similar to cæsium, and Laufenauer has used the above salt in doses of 1 to 2 drachms.

POTASSII CARBONAS (U. S. P.)—POTASSIUM CARBONATE.

FORMULA: K_2CO_3. MOLECULAR WEIGHT: 137.91.

SYNONYMS: *Salt of tartar*, *Carbonate of potassium*, *Carbonate of potash*, *Carbonate of potassa*, *Sal tartari*, *Potassii carbonas purus*, *Carbonas potassicus*, *Carbonas kalicus*, *Kali carbonicum*.

Source, History, and Preparation.—Potassium carbonate is a natural constituent of the waters of certain mineral springs. It is also one of the chief inorganic constituents of *ashes*, from inland plants, while plants growing near the sea yield more sodium carbonate. Other constituents of ashes are sodium, potassium, magnesium, and calcium, in the form of chlorides, sulphates, silicates, and phosphates. Ferric oxide, alumina, manganese, etc., are often present.

In former years, much potash was produced in the United States and Canada, but owing to the destruction of the woods, the manufacture has gradually declined; thus, the Canadian exports, in 1850, were more than twenty times those of the present day. (In this connection, see an interesting article on Canadian potash, by Dr. T. D. Reed, in *Proc. Amer. Pharm. Assoc.*, 1893, p. 126.) Russia and other countries around the Baltic Sea and of Europe furnish much of the present supply. Large quantities of potassium carbonate are now obtained as a by-product in the manufacture of sugar from sugar beets, these being rich in various potassium salts, which are accumulated in the uncrystallizable molasses. Another source of potassium carbonate is *suint*, the dried sweat of sheep contained in their wool. By evaporating the washings of the wool to dryness, and distilling the residue in iron retorts, an illuminating gas is obtained, and the charred residue in the retort yields to water carbonate of potassium (Clarke). The Stassfurt salt deposits are an indirect source of potassium carbonate. The chloride and sulphate of potassium there obtained are converted into carbonate by a process analogous to that of LeBlanc, for the manufacture of sodium carbonate (which see).

POTASH, or POTASHES or *Crude Potash*, is the brown mass obtained by lixiviating wood-ashes and evaporating to dryness, or to crystallization, in iron pots. The product is often melted in reverberatory furnaces in order to burn out carbonaceous matter. The resultant mass is yellow, brown, or greenish; the latter color is due to the presence of manganate. The American potash is often made by the use of lime, hence contains large quantities of caustic potash (see article on *Potassa*, for Prof. Lloyd's report on American potash).

PEARL ASH is purified crude potash, and is obtained by lixiviating the mass, allowing impurities (potassium sulphate) to crystallize out, boiling down to crystallization, freeing the crystals from adhering mother liquor (containing chlorides and silicates) by washing with a small amount of cold water, and finally heating the salt to redness. Pearl ash is the POTASSII CARBONAS IMPURA of the *U. S. P.*, 1870. According to its directions, it contained about 75 per cent of anhydrous potassium carbonate.

POTASSII CARBONAS (*U. S. P.*, 1890).—The potassium carbonate of the *U. S. P.*, 1880, was directed to be the compound $(K_2CO_3)_2.3H_2O$, which contains 83.7 per cent of the anhydrous salt; a minimum amount of 81 per cent was permitted, corresponding to a purity of 96.7 per cent. The present *U. S. P.* demands the salt K_2CO_3, and allows for an impurity of 5 per cent (see *Tests* below). The purest potassium carbonate may be obtained in several ways—by heating crystallized bicarbonate of potassium to redness, or by heating recrystallized potassium bitartrate to redness, until fumes are no longer disengaged, dissolving the carbonate in water, filtering from the charcoal formed, and evaporating the filtrate to crystallization. From this mode of preparation, potassium carbonate has received the name *salt of tartar*.

Description and Tests.—Carbonate of potassium, when exposed to the air, attracts moisture, speedily deliquesces, and forms an oleaginous fluid, termed by the earlier chemists *oleum tartari per deliquium*. Owing to its deliquescence, the *U. S. P.* directs that potassium carbonate should be kept in well-stoppered bottles. The official salt is "a white, granular powder, odorless, and having a strongly alkaline taste; very deliquescent. Soluble in 1.1 parts of water at 15° C. (59° F.), and in about 0.65 part of boiling water; insoluble in alcohol. When heated to 130° C. (266° F.), the salt loses all the water which it may have retained or absorbed; at a bright-red heat it melts, and at a white heat it volatilizes, communicating to the flame a pure violet color. Its aqueous solution (1 in 20) has a strongly alkaline reaction upon litmus paper, and effervesces with acids"—(*U. S. P.*). The effervescing gas is characterized as carbonic acid by the turbidity it will cause in a drop of lime-water held into it at the end of a glass rod. The potassium in the above solution may be recognized by the precipitate yielded with solution of platinic chloride, as well as by the following *U. S. P.* tests: "With excess of tartaric acid T. S. it slowly yields a white, crystalline precipitate; with sodium cobaltic nitrite T.S., a copious yellow precipitate is formed at once"—(*U. S. P.*).

Impurities in potassium carbonate are recognized by the following *U. S. P.* tests: "When a small portion of the salt, treated with a drop of hydrochloric acid, is introduced into a non-luminous flame on a perfectly clean platinum wire, the flame should be colored violet at once, without any appearance of yellow (absence of sodium). No residue should be left on dissolving 1 Gm. of the salt in 20 Cc. of water (absence of earthy impurities). No precipitate or coloration should be produced in the aqueous solution (1 in 20) by an equal volume of hydrogen sulphide T.S. (absence of metallic impurities). On neutralizing the solution with hydrochloric acid, no odor of burning sulphur, nor any white precipitate, should appear (absence of hyposulphite). If 2 Cc. of the aqueous solution (1 in 20) be carefully mixed with an equal volume of concentrated sulphuric acid, and, after cooling, 1 Cc. of ferrous sulphate T.S. be poured upon it so as to form a separate layer, no brown color should appear at the line of contact (absence of nitrate). If 0.5 Gm. of potassium carbonate be dissolved in 5 Cc. of diluted hydrochloric acid and 5 Cc. of water, the addition of 1 Cc. of barium chloride T.S. should not produce any turbidity (absence of sulphate). A solution of 0.5 Gm. of the salt in 5 Cc. of diluted hydrochloric acid mixed with 5 Cc. of water, should not be colored blue within 15 minutes by 0.3 Cc. of potassium ferrocyanide T.S. (limit of iron). If 0.5 Gm. of the salt be dissolved in 6 Cc. of diluted nitric acid and 4 Cc. of water, then 0.1 Cc. of decinormal silver nitrate V.S. be added, and the mixture filtered, no change should be produced in the filtrate by the further addition of silver nitrate V.S. (limit of chloride). If 10 Cc. of the aqueous solution (1 in 20) be mixed with 2 drops, each, of ferrous sulphate T.S. and ferric chloride T.S., and the mixture heated, and slightly supersaturated with hydrochloric acid, no blue color should appear (absence of cyanide)"—(*U. S. P.*). This important test is based on the conversion of potassium cyanide into potassium ferrocyanide when in contact with ferrous sulphate, as follows: $2FeSO_4+12CNK=Fe_2(CN)_{12}K_8+2H_2SO_4$. The potassium ferrocyanide then reacts in acid solution with ferric chloride, forming Prussian blue (see *Ferri Ferrocyanidum*). "The addition of a few drops of lead acetate T.S. to the aqueous solution should produce a pure white precipitate (absence of sulphide). To neutralize 0.69 Gm. of potassium carbonate should require not less than 9.5 Cc. of normal sulphuric acid (each cubic centimeter corresponding to 10 per cent of the pure salt), methyl orange being used as indicator"—(*U. S. P.*). (For a convenient method of determining potassium carbonate and potassium hydroxide in one operation, see *Potassa*.)

Action, Medical Uses, and Dosage.—All the carbonates of potassium are sufficiently corrosive to be energetic poisons. They occasion destruction of the mucous membranes of the fauces, œsophagus, stomach, and sometimes of the intestines—indicated at first by violent burning pain, prostration and vomiting, which is sometimes bloody, and if death does not ensue in consequence, in a few days, excessive emaciation follows, and constant irritation of the stomach and bowels. The proper antidotes to them are vinegar, lemon juice, or fixed oil.

Medicinally, carbonate of potassium is antacid, antilithic, and diuretic. Useful in *urinary affections*, where the morbid secretion consists of lithic acid, and the lithates, for which about 35 grains, in divided doses, should be given in the course of a day. Some prefer the potassium carbonates to the corresponding sodium salts, for antilithic purposes, on the supposition that they are the more energetic solvents. It is sometimes used in solution as an injection into the bladder for *calculus*. It has also been employed to remove *acidity of stomach*, and to increase the urinary discharge in *dropsical affections*. It has also been found occasionally available in *jaundice*. Mascagni has used it in *pneumonia* and other *inflammatory diseases*, with benefit, especially in those forms where there is a tendency to the deposition of false membranes. Combined with cochineal, it has considerable reputation in the treatment of *pertussis*. The *Cochineal mixture* is made as follows: Dissolve carbonate of potassium, 20 grains, in a gill of water, and add to it 10 grains of powdered cochineal, sweeten with loaf sugar, and give to an infant a teaspoonful 4 times a day; to a child 2 or 3 years old, 2 teaspoonfuls; 4 years and upwards, a tablespoonful or more. To this preparation 5 to 15 drops of tincture of belladonna is sometimes added. Externally, it has been used in the form of a solution to *wounds*, as a collyrium in some *affections of the cornea*, as an injection in *gonorrhœa*, and as an application to some *obstinate cutaneous eruptions*. Dose, of the powder, in solution, from 5 to 30 grains. For external use, ½ to 1 pound is usually employed for a bath; from 6 to 12 grains to the fluid ounce of water, for a lotion; and from 10 to 60 grains to an ounce of lard, for an ointment.

Carbonate of potassium, free from impurities, is used in making the common effervescent draught, or citrate of potassium. *Liquor Potassæ Carbonatis* (*Solution of carbonate of potassium*) is made by dissolving 20 ounces of carbonate of potassium in distilled water, 1 pint (Imp. meas.), and then filtering the solution. The dose is from 10 to 60 drops, in a sufficient quantity of water or mucilaginous fluid.

Specific Indications and Uses.—Leaden pallor of the tongue and mucous surfaces; muscular tremors; debility, all out of proportion to the diseased condition; articular pains.

POTASSII CHLORAS (U. S. P.)—POTASSIUM CHLORATE.

FORMULA: $KClO_3$. MOLECULAR WEIGHT: 122.28.

SYNONYMS: *Chlorate of potash, Chloras potassicus, Chloras kalicus, Kali muriaticum oxygenatum, Kali oxymuriaticum, Hyperoxymuriate of potassa.*

History and Preparation.—This salt was prepared as early as 1786 by Higgins, but its chemical character was distinctly pointed out in the same year by Berthollet. This author prepared it by the action of chlorine gas upon caustic potash, the following reaction taking place: $6KOH+6Cl=5KCl+KClO_3+3H_2O$. The present methods are modifications of this process, intended to improve the yield, because, as the formula shows, only one-sixth of the potassium is converted into chlorate. According to Liebig's proposition, an aqueous solution of chlorinated lime is evaporated to dryness. The calcium hypochlorite which it contains is thereby converted into calcium chlorate as follows: $3Ca(OCl)_2=Ca(ClO_3)_2+2CaCl_2$. The calcium chlorate is then dissolved in water and treated with potassium chloride; by double decomposition, potassium chlorate results, according to the equation $Ca(ClO_3)_2+2KCl=CaCl_2+2KClO_3$. The present methods of making potassium chlorate, on a large scale, are based on these reactions. Chlorine gas is conducted into milk of lime to saturation, the solution is evaporated to a certain bulk, treated with potassium chloride, and allowed to crystallize.

Description and Tests.—As officially described, potassium chlorate forms "colorless, lustrous, monoclinic prisms or plates, or a white powder, odorless, and having a cooling, saline taste. Permanent in the air. Soluble in 16.7 parts of water at 15° C. (59° F.), and in 1.7 parts of boiling water; insoluble in absolute alcohol, and but slightly soluble in mixtures of alcohol and water. At 234° C. (453.2° F.), the salt fuses, and above 352° C. (665.6° F.), it is decomposed into oxygen and potassium perchlorate; above 400° C. (752° F.), all its oxygen is liberated, and a white residue of potassium chloride remains, amounting to 60.8 per cent of the chlorate employed. The residue is readily soluble in water, and the solution yields a white, curdy precipitate with silver nitrate T.S. The aqueous solution (1 in 20) of the salt is neutral to litmus paper. With excess of tartaric acid T.S., the solution slowly yields a scant, white, crystalline precipitate; with sodium cobaltic nitrite T.S., or with platinic chloride T.S., a copious yellow precipitate is produced at once. When introduced into a non-luminous flame on a clean platinum wire, potassium chlorate communicates to the flame a pure violet color without admixture of yellow (absence of sodium). When heated with hydrochloric acid, the aqueous solution assumes a greenish-yellow color, and evolves chlorine"—(*U. S. P.*). Triturated with combustible substances, chlorate of potassium is highly dangerous, even in small quantities, hence the pharmacopœial caution: "Potassium chlorate should be kept in glass-stoppered bottles, and *great caution should be observed* in handling the salt, as dangerous explosions are liable to occur, when it is mixed with organic matters (cork, tannic acid, sugar, etc.), or with sulphur, antimony sulphide, phosphorus, or other easily oxidizable substances, and either heated directly, or subjected to trituration or concussion"—(*U. S. P.*). Mr. Charles Bullock reports (*Amer. Jour. Pharm.*, 1890, p. 385) that a mixture of chlorate of potassium and chloride of ammonium gradually undergoes decomposition with evolution of chlorine compounds. In one instance, some tablets, composed of the two salts mentioned, and more than one year old, underwent a sudden explosion, probably due to the formation of the highly explosive chloride of nitrogen. Concentrated sulphuric acid, when acting upon potassium chlorate, evolves free chloric acid, which at once yields the highly explosive *chlorine dioxide* (ClO_2). At a comparatively low temperature it decomposes, with explosion, into chlorine and oxygen. The chlorine evolved when potassium chlorate is mixed with hydrochloric acid, contains some chlorine dioxide, and was believed by Sir Humphrey Davy to be a new oxide of chlorine, which he named *euchlorine*. In reducing chlorate of potassium to powder by trituration, a little water should be added, enough to cover the salt, in order to prevent an explosion. Strain, and dry the powder. In order to test potassium chlorate for impurities, the *U. S. P.* directs as follows: "Separate portions, each of 5 Cc., of the aqueous solution (1 in 20) should not be rendered turbid by 0.5 Cc. of barium chloride T.S. (absence of sulphate); nor by 0.5 Cc. of ammonium oxalate T.S. (calcium); nor by 0.5 Cc. of silver nitrate T.S. (chloride); nor should an equal volume of hydrogen sulphide T.S., produce either a precipitate or a coloration (absence of metals). If a mixture of 1 Gm. of the salt with 0.5 Gm., each of iron and of zinc, in coarse powder or filings, be heated with 5 Cc. of potassium hydrate T.S., no evolution of ammonia should be perceptible either by moistened red litmus paper or by odor (absence of nitrate or nitrite)"—(*U. S. P.*). (For Jorisen's test for nitrate, see *Amer. Jour. Pharm.*, 1888, p. 489.)

Action, Medical Uses, and Dosage.—The theory, formerly entertained, that chlorate of potassium acted by giving to the blood oxygen, and thereby imparting to it a florid color, has been disproved, as it is now known that the salt is eliminated unchanged from the system, and that largely by the salivary glands. In very large doses, it is extremely poisonous, producing, besides the effects of potash, violent local inflammation. Gastro-intestinal inflammation, with violent pain and vomiting, and finally ending in death, was produced by 300 grains of the salt. Death, when caused by it, is believed to be due to the disorganization of the corpuscles, rendering them incapable of carrying oxygen, and from the obstruction of the renal emunctories with these broken-down discs, and the presence of crystals of the salt. The blood, though remaining fluid, is changed to a chocolate color, due to the transformation of oxyhæmoglobin into methæmoglobin. The organs containing blood also show this discoloration. Splenic and hepatic enlargements may ensue. Autopsies have revealed the following results of poisoning with this salt: The changes, besides the hypertrophies referred to above, were found chiefly in the gastro-intestinal tube and the kidneys. In the former were hyperemic, or inflamed, or eroded tracts, and, in the latter, the organs were found greatly enlarged, with adherent capsule and œdematous infiltration, overdistension of the renal vessels, and brownish plugs with adherent epithelial detachments in the uriniferous tubules. A physician, who took an ounce, died after 7 days of suffering from gastro-enteritis. At first diuresis was free, but finally suppressed. Daily doses of 160 grains have produced hot skin, headache, quick hard, and full pulse, white tongue, and increase of urine.

A typical case of poisoning by the drug may present the following symptoms: Faintness, great thirst, vomiting, hypochondrial and renal pain, headache, constipation or diarrhœa, chills, lowering of temperature, anemic skin, slight jaundice, and cyanosis. The urine is almost or quite suppressed, and, when voided at all, is very albuminous, and deposits tube-casts and a sediment of brown, altered blood discs. These, filtered out, leave the urine cherry-red in color. The chief lesions then are gastro-intestinal inflammation and acute nephritis, death being chiefly due to the blood destruction, producing profound anemia, and the plugging of the renal tubules, causing nephritis. The treatment of chlorate of potassium poisoning recommended, consists in the use of hot baths, saline cathartics and diuretics, and the transfusion of blood.

Chlorate of potassium is a very important remedy, particularly where there is a tendency to septicæmia. Besides its marked antiputrefactive properties, it seems to hold a position between chloride of ammonium and nitrate of potassium, and has been used in *malignant febrile diseases*, and in *cholera*. It is diuretic, and is recognized in the urine of those to whom it has been administered. The keynote to its selection is a cadaverous fetor of the secretions and breath. Under such circumstances, it is very useful in the affections named herein. It has been efficiently employed in *scorbutus*, *hepatic affections*, in *aphthous ulcerations of the mouth*, *cancrum oris*, *mercurial salivation*, *abscesses*, *boils*, *eruptions*, *ulcers*, *purpura hemorrhagica*, etc. In *ulcerative stomatitis*, where the ulcers spread to the tongue, gums, and lips, smell badly, and the gums are spongy and bleed easily, it is especially applicable. In these cases, there are pseudo-membranous deposits, and the lesions show very little disposition to recovery. Here a wash of the chlorate, with the drug taken internally, will promptly effect a cure. Associated with stillingia, it is a good agent in *syphilis* and *syphilitic ulcerations* of the mouth with cadaveric fetor. It is a useful agent in *diphtheria*, with the special indication referred to, but the kidneys should be carefully watched, and, if affected, the drug should be withdrawn. Chlorate of potassium is a much abused, but excellent agent. It has long been in domestic repute as a remedy for *ordinary sore throat*, and its indiscriminate and misapplied use has often failed in curing the trouble, but has, at times, led to serious renal disturbances. When indicated by the cadaverous odor of the breath, and bluish, pallid membranes, or ulcerated, foul discharging mucous surfaces, it is an excellent therapeutic agent in respiratory lesions. Under these conditions, it may be used locally in *influenza*, *ozæna*, and in the various forms of *pharyngitis*. Applied early, it often aborts *tonsillitis*. In *pneumonia*, with hot, pungent skin, putrid odor of breath, and increased secretion, it may be given in 5 or 10-grain doses, every 3 hours. It is also useful in *fetid purulent bronchitis*. As a remedy for *cough*, it is serviceable if the indications are followed, but should not be used when the mucous surfaces are dry, or when the urinary secretion is scanty. In *membranous croup*, it tends to prevent the formation of the membrane, and to favor its detachment when formed. For the *aphthous condition of the mouth*, with extensive tissue destruction, in *phthisis*, and where the patient can not take food, Prof. Locke recommends (Locke's *Syllabus*) the following: ℞ Saturated solution of potassium chlorate, ℥iv; colorless hydrastis, glycerin, syrup of morphine and simple syrup, aa, ℥i. Mix. Sig. Dose, 1 teaspoonful every 3 hours. In *scrofula*, it may be given with chloride of iron and syrup; in *chronic cystitis*, with putrid urine, it may be given in infusion of buchu. Use the drug in *erysipelas*, threatening *gangrene*. When large doses are administered, they should be given at meal-time, and in a large quantity of broth or other fluid. M. Isambert considers it a sedative to the nervous system, and to the circulation; a stimulant to the digestive organs and kidneys; and a stimulant and alterative to mucous tissues. It certainly proves very useful in *leucorrhœa*, *excoriations of the os uteri*, *chronic dysentery*, *nursing sore mouth*, some forms of *chronic ophthalmia*, and *gleet*. Its solution, used in injection, has effected cures of *leucorrhœa*, *erosion of the os uteri*, and *gonorrhœa*. It controls salivation. Perhaps its most important use is in obstetric practice, to correct the tendency to *septic conditions*, where there is *offensive lochia* and fetid discharges from retained clots and fragments of placenta. The better practice is to remove these disturbers by curetting and douching, but when this has not been done, the chlorate serves the purposes of controlling the tendency to putrescency. The offensive odor, reminding one of the dissecting room, here plainly points to the use of it, as in other conditions. It may be used both locally and internally, well diluted. As a rule, its use should be avoided in scarlatina, lest a nephritic complication should occur, and it is contraindicated when the mucous tissues are dry and secretion scanty. Applied in the form of powder with starch, or oxide of bismuth, it causes but little pain. In *gangrene* and *ulceration of the mouth*, it removes the offensive odor, lessens the discharge of saliva, and favors granulation. Daily applied, the powder has cured small *epithelial growths of the eyelids* (Foltz). Externally, it may be applied in solution as a wash or injection; from 6 to 15 grains being dissolved in a fluid ounce of water. It answers thus, in affections of the mouth, aided by its internal administration. The dose ranges from 1 to 30 grains, well diluted with water.

Specific Indications and Uses.—The puerperal antiseptic; troubles arising from decomposition of fragments of placenta, blood-clots, and absorption of lochia; fetid lochia; fetid breath; the fetor, as of decaying animal tissues; pallid tongue, pale or bluish membranes; ulcerated, foul-discharging mucous surfaces; tender mouth and gums, with fetid salivation; tongue coated, dirty, and thick; cough, with purulent expectoration; hot, pungent skin; cadaverous odor of discharges.

Related Salts.—POTASSII PERCHLORAS ($KClO_4$=138.24), *Potassium perchlorate*, *Hyperchlorate of potassium*. Melt potassium chlorate, and continue heating until the evolution of oxygen nearly ceases, and the mass becomes solid. The following reaction takes place: $2KClO_3 = KClO_4 + KCl + O_2$. Decomposition of the chlorate is nearly complete when a sample, treated with strong hydrochloric acid, produces only a light-yellow color. Remove the chloride formed by washing with cold water, the perchlorate being not easily soluble. The last traces of chlorate are removed by warming with hydrochloric acid. When crystallized, potassium perchlorate forms colorless, rhombic crystals, feebly saline to the taste, insoluble in alcohol, freely soluble in hot water, but not easily soluble in cold water. At a high heat (400° C. [752° F.]) it splits into potassium chloride and oxygen. It is employed in the preparation of perchloric acid, and as a medicine. According to Rabuteau (*Bull. de Thérap.*, 1869), it is useful as a diuretic and sedative in cases where quinine and potassium nitrate are applicable. It has been given in *pernicious fevers*, and in *intermittents*.

POTASSII CHLORIDUM (KCl = 74.40), *Potassium chloride*, *Sal digestivum sylvii*, *Kalium chloridum* or *chloratum*, *Chloruretum potassicum*.—This salt is used to a considerable extent in the preparation of potassium compounds. It occurs native abundantly as *sylvine* (KCl) and *carnallite* (KCl–$MgCl_2+6H_2O$), in the Stassfurt deposits, in the form of colorless or white cubes, without odor, but resembling sodium chloride in taste. It is but little soluble in alcohol, and freely so in 2 parts of hot and 3 parts of cold water. Care should be taken, on account of its obsolete name, *Kalium chloratum*, not to confuse this salt with *Potassium chlorate*. It is said to be a nervous and arterial sedative, and, in large doses, is poisonous. Such doses produce a jaundiced or a slate-hued skin, suppress the urine, which is dark in color and sometimes contains albumen, and also diarrhœa and vomiting. One hundred and fifty grains, in divided doses, killed a strong individual. It is employed as a medicine much as common salt is. It is inoperate in *epilepsy*, for which it has been tried. Potassium chloride is one of the Schuessler tissue salts, and is valued by Schuessler's followers to prevent the deposition of plastic exudates in acute disorders, as *pneumonia*, and in *chronic hepatic affections*, where fibrous changes are anticipated. It is claimed that it reduces *congestion of the liver*, and, if given early, will prevent suppuration in *acute hepatitis*. It has been overestimated as a remedy to prevent *diphtheritic deposits*. It is also given in *boils, pimples, carbuncles*, etc. Five grains of the 3x trituration are added to 4 fluid ounces of water, and the solution administered in teaspoonful doses, every 2 to 4 hours.

POTASSII CITRAS (U. S. P.)—POTASSIUM CITRATE.

FORMULA: $K_3C_6H_5O_7+H_2O$. MOLECULAR WEIGHT: 323.59.

SYNONYMS: *Citrate of potassium, Citrate of potash, Potassæ citras, Kali citricum, Citras kalicus, Citras potassicus, Kalium citricum.*

Preparation.—"Take of carbonate of potassium, 8 ounces (av.), or a sufficiency; citric acid, in crystals, 6 ounces, or a sufficiency; distilled water, 2 pints (Imp.). Dissolve the citric acid in the water, add the carbonate of potassium gradually, and, if the solution be not neutral, make it so by the cautious addition of the acid or the carbonate of potassium. Then filter, and evaporate to dryness, stirring constantly after a pellicle has begun to form, till the salt granulates. Triturate in a dry mortar, and preserve the powder in stoppered bottles"—(*Br. Pharm.*, 1885). The process is one of simple neutralization, as follows: $3K_2CO_3+2H_3C_6H_5O_7=2K_3C_6H_5O_7+3H_2O+3CO_2$. If evaporation is conducted on a sand-bath, care should be taken not to burn the salt.

Description and Tests.—"Transparent, prismatic crystals, or a white, granular powder, odorless, and having a cooling, saline taste. Deliquescent on exposure to air. Soluble in 0.6 part of water at 15° C. (59° F.), and very soluble in boiling water; sparingly soluble in alcohol. When heated above 100° C. (212° F.), the salt begins to lose water; at 200° C. (392° F.), the water of crystallization (5.55 per cent) is completely lost. At 230° C. (446° F.), the salt begins to decompose, turns brown, and, at a higher temperature, carbonizes and emits inflammable gases, which have a very pungent, acid odor. At a red heat, a blackened mass of potassium carbonate and carbon is left, which has an alkaline reaction, and strongly effervesces with acids. The aqueous solution of the salt is neutral to litmus paper. The salt yields a white, crystalline precipitate with sodium bitartrate T.S. With sodium cobaltic nitrite T.S., a yellow precipitate is formed. On mixing 10 Cc. of the aqueous solution (1 in 20) with 2.5 Cc. of calcium chloride T.S., the liquid remains clear until it is boiled, when a white, granular precipitate is produced"—(*U. S. P.*). This precipitate consists of neutral calcium citrate ($[C_6H_5O_7]_2Ca_3+4H_2O$), and is distinguished from the corresponding tartrate by being insoluble in excess of caustic potash. It is soluble in acetic acid (difference from calcium oxalate and racemate) (see *Tartaric Acid*).

The *U. S. P.* directs the following tests: "The aqueous solution (1 in 20) should not be colored red by a drop of phenolphtalein T.S., nor effervesce on the addition of an acid (absence of carbonate). Separate portions of this solution acidulated with nitric acid should not be affected by barium chloride T.S. (absence of sulphate), nor by silver nitrate T.S. (absence of chloride). A solution of 1 Gm. of potassium citrate in 1 Cc. of water should not deposit any precipitate on the addition of 1 Cc. of acetic acid (absence of tartrate)"—(*U. S. P.*). This test is based on the formation of cream of tartar (potassium bitartrate) upon the addition of acetic acid. "If 1.08 (1.079) Gm. of potassium citrate be thoroughly ignited at a red heat, it should require for complete neutralization not less than 10 Cc. of normal sulphuric acid (corresponding to 100 per cent of the pure salt), methyl orange being used as indicator"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—(See *Liquor Potassii Citratis.*) Dose, 20 to 40 grains, well diluted with water.

POTASSII CITRAS EFFERVESCENS (U. S. P.)—EFFERVESCENT POTASSIUM CITRATE.

Preparation.—"Citric acid, sixty-three grammes (63 Gm.) [2 ozs. av., 97 grs.]; potassium bicarbonate, ninety grammes (90 Gm.) [3 ozs. av., 76 grs.]; sugar, forty-seven grammes (47 Gm.) [1 oz. av., 288 grs.]. Powder the ingredients separately, and mix them thoroughly in a warm mortar. Dry the resulting, uniform paste rapidly at a temperature not exceeding 120° C. (248° F.), and, when it is perfectly dry, reduce it to a powder of the desired degree of fineness. Keep the product in well-stoppered bottles"—(*U. S. P.*).

This effervescing salt, when made into solution, is pleasantly acidulous. Lest decomposition take place, the temperature above directed should not be exceeded, for, under such circumstances, fusion and discoloration of the salt takes place, and an unpleasant, bitter taste develops.

Action, Medical Uses, and Dosage.—A pleasant form of administering potassium citrate. As a laxative, 100 grains may be dissolved in a glass of water.

POTASSII CYANIDUM (U. S. P.)—POTASSIUM CYANIDE.

FORMULA: KCN. MOLECULAR WEIGHT: 65.01.

SYNONYMS: *Cyanide of potash, Potassii cyanuretum, Cyanuret of potassium, Potassii cyanidum, Kalium cyanatum, Cyanuretum kalicum, Cyanuretum potassicum.*

Preparation.—Chemically pure potassium cyanide may be prepared by conducting the vapors of hydrocyanic acid into an alcoholic solution of potassium hydroxide. The cyanide, being nearly insoluble in alcohol, is precipitated in the form of a crystalline powder. The hydrocyanic acid is obtained by the action of diluted sulphuric acid upon potassium ferrocyanide (yellow prussiate of potash) (see *U. S. P.* process under *Acidum Hydrocyanicum Dilutum*). Usually potassium cyanide is prepared by Liebig's method, which consists in melting together previously dried potassium ferrocyanide (yellow prussiate of potash) 8 parts, with pure potassium carbonate (dried), 3 parts. The *U. S. P.* (1870) directs as follows: "Mix the salts intimately, and throw the mixture into a deep, iron crucible, previously heated to redness. Maintain the temperature until effervescence ceases, and a portion of the fused mass, of a pure white color, concretes upon a warm glass rod dipped into it. Then pour the liquid carefully into a shallow dish to solidify, ceasing to pour before the salt becomes contaminated with the precipitated iron. Break up the mass while yet warm, and keep the pieces in a well-stoppered bottle"—(*U. S. P.*, 1870).

The reaction takes place with formation of potassium cyanate (KOCN) and liberation of carbonic acid gas and iron, as follows: $Fe_2(CN)_{12}K_8+2K_2CO_3=10KCN+2KOCN+CO_2+Fe_2$. The formation of the cyanate may be prevented by adding charcoal, or the potassium cyanate may be dissolved out by means of alcohol. The *French Codex* prepares a purer potassium cyanide by strongly heating potassium ferrocyanide alone, whereby nitrogen is evolved and iron carbide formed, as follows: $Fe_2(CN)_{12}K_8=8KCN+2FeC_2+N_4$. The *U. S. P.* demands an article of 90 per cent strength.

Description and Tests.—As officially demanded, it forms "white, opaque, amorphous pieces, or a white, granular powder, odorless when perfectly dry, but, in moist air, exhaling the odor of hydrocyanic acid. The taste is sharp, and somewhat alkaline, but should be ascertained with great care, as the salt is very poisonous. In moist air the salt deliquesces. Soluble in about 2 parts of water at 15° C. (59° F.). Boiling water dissolves its own weight of the salt, but rapidly decomposes it. In alcohol it is but sparingly soluble. At a low red heat the salt fuses. Its aqueous solution (1 in 20) has a strongly alkaline reaction, and emits the odor of hydrocyanic acid. With an equal volume of sodium bitartrate T.S., it yields a white, crystalline precipitate. With sodium cobaltic nitrite T.S., a copious yellow precipitate is produced"—(*U. S. P.*). With soluble salts of heavy metals, potassium cyanide forms precipitates of metallic cyanides, soluble, as a rule, in excess of potassium cyanide, with the formation of double salts (see *Potassium Ferrocyanide*). The salt, when fused with access of air, attracts oxygen, and forms potassium cyanate. The salt is decomposed by the weakest acids, even carbonic acid, hence its odor of hydrocyanic acid. "Potassium cyanide should be kept in well-stoppered bottles"—(*U. S. P.*). Possible impurities in potassium cyanide consist in unchanged carbonate, ferrocyanide, potassium cyanate, etc., which are detected by the following official tests: A few drops of an aqueous solution (1 in 20) "give with silver nitrate T.S., a white precipitate, which is soluble in an excess of the solution of potassium cyanide, also in ammonia water, and in concentrated nitric acid (distinction from silver chloride). If 5 Cc. of the solution be shaken with a few drops of ferrous sulphate T.S., and a slight excess of hydrochloric acid then added, a blue precipitate (Prussian blue) will be produced. The aqueous solution (1 in 20) should not produce more than a slight effervescence on the addition of diluted hydrochloric acid (limit of carbonate). After the acid has been added in slight excess, a drop of ferric chloride T.S. should produce neither a blue (absence of ferrocyanide) nor a red color (sulphocyanate). A solution of 0.65 Gm. of potassium cyanide in 12 Cc. of water should require the addition of at least 45 Cc. of decinormal silver nitrate V.S. before the precipitate, which at first redissolves on agitation, becomes permanent (each cubic centimeter of the volumetric solution indicating 2 per cent of the pure salt)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This salt ranks in activity as a poison next to hydrocyanic acid (see *Acidum Hydrocyanicum* for action). Medicinally, it has been preferred to hydrocyanic acid, on account of its not so readily becoming decomposed, and being more constant in its strength. It is used in all instances where hydrocyanic acid is indicated, in the dose of about ⅛ of a grain, or less, and should be given in a tablespoonful of pure water, or diluted aromatic syrup. Great care must be employed in using it, if, indeed, it should be used at all. It adds to the efficiency of some *cough remedies*. Externally, it has been efficiently used in *sick headache*, *neuralgia*, *sciatica*, *rheumatism*, etc., being applied to the part on lint or linen, in the proportion of 8 grains of the cyanide to 2 fluid ounces of distilled water, keeping the part constantly moistened with it. This solution is one of the promptest agents for the removal of silver nitrate stains. The dark spots produced by nitrate of silver on the conjunctiva, are obliterated by dropping the solution of the cyanide into the eye on each alternate day (Guthrie). As this salt is extensively used in photography, silver plating, etc., numberless cases of poisoning have occurred from its use. Three grains internally have produced death. The treatment is the same as for hydrocyanic acid (which see). Atropine may be employed to antagonize its effects.

Specific Indications and Uses.—Same as for *Hydrocyanic Acid* (which see).

POTASSII ET SODII TARTRAS (U. S. P.)—POTASSIUM AND SODIUM TARTRATE.

FORMULA: $KNaC_4H_4O_6+4H_2O$. MOLECULAR WEIGHT: 281.51.

SYNONYMS: *Rochelle salt, Tartarated soda, Soda tartarata, Natrokali tartaricum, Tartras potassico-sodicus, Sal polychrestum Seignetti, Seignette's salt, Sodæ et potassæ tartras.*

History and Preparation.—This salt was introduced as a secret medicine, in 1672, by Seignette, an apothecary of Rochelle, France. Its composition and preparation was made known, in 1731, by Boulduc and Geoffroy. It is a double salt, tartrate of potassium and sodium ($C_4H_4O_6KNa+4H_2O$), and is prepared by neutralizing acid potassium tartrate (see *Potassii Bitartras*) with sodium carbonate. The following process agrees with that of the formula of the *British Pharmacopœia* (1898): Take of bitartrate of potassium, in powder, 16 ounces; carbonate of sodium, 12 ounces; boiling water, 4 pints (Imp. meas.). Dissolve the carbonate in the water, add the bitartrate to neutralization; boil and filter. Concentrate the liquor till a pellicle forms on its surface, and then set it aside to cool and crystallize. The residual liquor will yield more crystals by further concentration and cooling (*Ed.*). The *U. S. P.* (1870) employed the same weights (troy) and 5 pints of water; in other respects the process is the same.

Description and Tests.—Tartrate of potassium and sodium often forms crystals of a considerable size. The *U. S. P.* describes the salt as in "colorless, transparent, rhombic prisms, or a white powder, odorless, and having a cooling, saline taste. The crystals slightly effloresce in dry air. Soluble in 1.4 parts of water at 15° C. (59° F.), and in less than 1 part of boiling water; almost insoluble in alcohol. When heated to 74° C. (165.2° F.), the salt fuses to a colorless liquid, which, at a higher temperature, froths, becomes brown, and gradually carbonizes, while inflammable vapors are emitted, having the odor of burning sugar. Finally, a black residue is left, consisting of alkaline carbonate mixed with carbon. The aqueous solution of the salt is neutral to litmus paper. A 10 per cent aqueous solution yields, with an equal volume of acetic acid, a white, crystalline precipitate. With sodium cobaltic nitrite T.S., the solution yields a copious yellow precipitate. With silver nitrate T.S., it produces a white precipitate, which becomes black on boiling. To a non-luminous flame it communicates a yellow color (sodium), which, when viewed through a blue glass, appears violet-red (potassium)"—(*U. S. P.*). Sulphuric acid, added to the aqueous solution, combines with the sodium, and replacing it by hydrogen, causes a precipitate of small crystals of bitartrate of potassium; perchloric acid precipitates perchlorate of potassium; platinum tetrachloride gives a yellow precipitate. The solution of the salt is incompatible with acetate of lead, soluble barium and calcium salts, many acids, and salts containing excess of acid.

To test for impurities, the *U. S. P.* directs: "The aqueous solution (1 in 20) should not be rendered turbid by the addition of a small amount of ammonium oxalate T.S. (absence of calcium), nor by an equal volume of hydrogen sulphide T.S., either before or after acidulation with diluted hydrochloric acid (absence of arsenic, lead, copper, etc.). When heated with potassium hydrate T.S., the solution should not give off the odor of ammonia. If 10 Cc. of the solution (1 in 20) be mixed with 1 Cc. of hydrochloric acid, the addition of 1 Cc. of barium chloride T.S. should produce no turbidity (absence of sulphate). If 0.36 Gm. of the salt be dissolved in 9 Cc. of water, and then 1 Cc. of nitric acid and 0.2 Cc. of decinormal silver nitrate V.S. be added, and the mixture filtered, the filtrate should remain clear upon the further addition of silver nitrate V.S. (limit of chloride). If 1.41 Gm. of potassium and sodium tartrate be completely decomposed by ignition, the alkaline residue should require for complete neutralization not less than 10 Cc. of normal sulphuric acid (corresponding to 100 per cent of the pure salt), methyl orange being used as indicator"—(*U. S. P.*). Mr. F. W. Haussmann (*Amer. Jour. Pharm.*, 1894, p. 296), reporting on about 10 samples of commercial Rochelle salt, both in crystals and powder form, found them to be of a high degree of purity, especially free from lead.

Action, Medical Uses, and Dosage.—Tartrate of potassium and sodium is a mild, laxative, cooling salt, rather more agreeable than most neutral salts, and adapted for irritable or fastidious stomachs. Its dose is from 2 drachms to an ounce, dissolved in 8 to 10 parts of water. When given in the form of dilute solution, and so as not to excite purging, it becomes absorbed, and produces alkalinity of the urine; consequently, its use should be avoided in phosphatic urine, but is of advantage in *excessive acidity of the urine*, and has been employed with success in *acute rheumatism*, with acidity of the urine. Two drachms of tartrate of potassium and sodium added to 40 grains of bicarbonate of sodium, and put up in one (blue) paper, and 35 grains of tartaric acid, placed in the other (white) paper, form the gentle laxative known as *Seidlitz powder*. Dissolve the contents of each paper, separately, in half a tumbler of water, mix the two solutions, and drink immediately, while it is effervescing. The necessity for using two papers may be obviated, and a very satisfactory preparation obtained, by mixing 2 parts of bitartrate of sodium with 1 part of bicarbonate of sodium. The mixture keeps well even in paper, and effervesces briskly when mixed with water.

Related Salts. SODII CITRAS, *Sodium citrate* ($2C_6H_5Na_3O_7.11H_2O$). Saturate a solution of citric acid with sodium bicarbonate, evaporate, and set aside for crystallization. Forms white, rhombic pyramids of a non-bitter, saline taste. A pleasant cathartic in doses of from 1 to 1½ ounces.

SODII TARTRAS, *Sodium tartrate* ($Na_2C_4H_4O_6.2H_2O$). A white, crystalline salt, nearly tasteless, and acting as a pleasant purgative. Dose, 8 to 10 drachms.

POTASSII FERROCYANIDUM (U. S. P.)—POTASSIUM FERROCYANIDE.

FORMULA: $K_4Fe(CN)_6+3H_2O$. MOLECULAR WEIGHT: 421.76.

SYNONYMS: *Yellow prussiate of potash, Kalium ferrocyanatum, Cyanuretum ferroso-potassicum, Potassæ prussias flava, Kalium borussicum, Prussiate of potassa, Prussiate of potash, Ferrocyanuret of potassium, Ferroprussiate of potassa.*

History and Preparation.—Macquer, in 1752, by boiling Prussian blue with caustic potash, was the first to obtain this salt, and Berthollet, in 1787, qualitatively established its composition, stating it to contain iron, alkali, and prussic acid. Potassium ferrocyanide may be obtained by several methods. Ferrous salts, treated with excess of potassium cyanide, first yield a light-brown precipitate ($Fe_2[CN]_5K$), formerly thought to be ferrous cyanide ($Fe_2[CN]_4$). The precipitate is soluble in excess of potassium cyanide, with yellow color, potassium ferrocyanide resulting as follows: $Fe_2(CN)_5K+7CNK=Fe_2(CN)_{12}K_8$ (compare tests under *Potassii Carbonas*). Until within recent years, the following old method has been exclusively employed on a large scale. It consisted in exposing a mixture of pearl ash (impure potassium carbonate) and organic matter, such as hoofs, horns, and other nitrogenous animal matters to a cherry-red heat, in an iron crucible, and constantly stirring the mass. The calcined product is then cooled, lixiviated with water, and concentrated by evaporation; upon standing, crystallization takes place. The crystals are purified by repeated crystallization. This method, within recent years, is being largely supplanted by the manufacture of yellow prussiate of potash from waste products in the purification of illuminating gas. This salt was formerly very popular as a medicine.

Description and Tests.—Potassium ferrocyanide, as officially described, occurs in "large, soft, transparent, yellow, 4-sided, monoclinic tables, odorless, and having a mild, saline taste. Slightly efflorescent on exposure to dry air. Soluble in 4 parts of water at 15° C. (59° F.), and in 2 parts of boiling water; insoluble in alcohol. When heated to 60° C. (140° F.), the salt begins to turn white from loss of water, and when heated to 100° C. (212° F.), it is rendered anhydrous. The aqueous solution is neutral to litmus paper"—(*U. S. P.*). A low, red heat decomposes the salt, converting it into cyanide of potassium, carbide of iron, and other compounds, while distillation with diluted sulphuric acid yields vapors of hydrocyanic acid (see *Potassii Cyanidum*). "With sodium bitartrate T.S., the aqueous solution yields a white, crystalline precipitate. Sodium cobaltic nitrite T.S. produces a copious yellow precipitate. The color of the precipitate produced by ferric chloride T.S. is dark blue; that produced by copper sulphate T.S. is reddish-brown; while lead acetate T.S. or silver nitrate T.S. throws down a pure white precipitate"—(*U. S. P.*). These precipitates are salts of the crystallizable water- and alcohol-soluble *ferrocyanic acid* ($Fe_2[CN]_{12}H_8$), which may be obtained in the form of a precipitate by adding solution of hydrochloric acid to a concentrated solution of potassium ferrocyanide. The iron salt is the well-known Prussian blue (see *Ferri Ferrocyanidum*). The copper precipitate is characteristic for this metal. The aforenamed ferrocyanides of heavy metals are insoluble in diluted mineral acids, but decomposable by caustic alkalies. The precipitate formed in silver nitrate solution with potassium *ferricyanide* is orange-red.

The *U. S. P.* directs the following tests for impurities: "No effervescence should be caused by the addition of diluted sulphuric acid to a concentrated solution of the salt (absence of carbonate). The aqueous solution (1 in 20), acidulated with hydrochloric acid, should, upon the addition of barium chloride T.S., remain clear, or at most show but a trifling turbidity (limit of sulphate). If a mixture of 0.5 Gm. of the salt with 1.5 Gm. of pure potassium nitrate and 0.5 Gm. of pure, anhydrous sodium carbonate be heated to redness in a porcelain crucible, the residue dissolved in water, the filtered solution supersaturated with nitric acid, mixed with 0.1 Cc. of decinormal silver nitrate V.S., and again filtered, no turbidity should be produced in the filtrate by the further addition of silver nitrate V.S. (limit of chloride). The precipitate produced in the aqueous solution, acidulated with nitric acid, by silver nitrate T.S. should be of a pure white color, without a tinge of red (absence of ferricyanide)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Ferrocyanide of potassium is not poisonous, being absorbed and carried off quickly with the urine. Large doses are said to cause giddiness, debility, occasional non-fetid salivation, and ulceration of the mouth. From 5 to 12 grains, dissolved in water, and repeated 2 or 3 times a day, have been found efficient as a sedative and calmative in *febrile diseases*, *pertussis*, *tic-douloureux*, etc. It has also proved advantageous in *chronic bronchitis* and *night-sweats*. Its special place in therapeutics is to act as a sedative to the circulation, and to lessen nervous irritation, and it is indicated in chronic diseases with excitation, frequent pulse, marked nervous irritability, with impairment of the nerve centers. This agent is reputed useful in *genital hyperæsthesia* at the menopause, and in *ovarian irritation*. It relieves the manifestations of *hypochondria* of the male, and *hysteria* in chronic female disorders. Another indication for its use is a pale, lax condition of the mucous tissue, with over-secretion of mucus, as of *chronic vaginitis*, *intestinal catarrh*, and *catarrhal affections of the nose, throat*, and *bronchiæ*. Dose, 5 to 15 grains, every 3 hours. It is much used in the preparation of hydrocyanic acid, and as a reagent for detecting iron in solution. A mere trace of iron in solution occasions a blue precipitate with it.

Specific Indications and Uses.—Nervous irritability, with excited circulation; impairment of nerve centers; hysteria or hypochondriasis, with slow, imperfect waste and nutrition; ovarian irritation; genital hyperæsthesia; lax, pale mucous tissues, with mucorrhœa.

Related Compounds.—Potassii Ferricyanidum ($K_6Fe_2[CN]_{12}$), *Potassium ferricyanide, Potassium ferridcyanide, Red potassium prussiate, Red prussiate of potash*. This salt is obtained from the foregoing salt by oxidation. Into a cold solution of ferrocyanide of potassium, pass a current of chlorine gas until the liquid ceases to form a blue precipitate or a blue color with ferric chloride. Evaporate and allow to crystallize. The reaction is as follows: $Fe_2(CN)_{12}K_8 + Cl_2 = Fe_2(CN)_{12}K_6 + 2KCl$. It forms large, dark-red, or hyacinth-red prisms, transparent, anhydrous, saline and feebly astringent to the taste. Four parts of water effect its solution. Exposure to light causes it to be reduced again to potassium ferrocyanide, at the same time a blue precipitate being formed. Lead and mercuric salts produce no precipitates with it. It is the prominent test for *ferrous* salts, with which it strikes a deep-blue color, forming ferrous ferricyanide or *Turnbull's blue*, while *ferric* salts produce only a brown coloration. Silver salts form with it an orange, cupric salts a greenish-yellow, and mercurous compounds, a red-brown precipitate. This salt was first obtained by Gmelin.

Sodium Nitro-prusside ($Na_4Fe_2[CN]_{10}[NO]_2.4H_2O$).—The salts of *hydrogen-nitro-prusside*, or *nitro-prussic acid* ($H_4Fe_2[CN]_{10}[NO]_2$), are characterized by the beautiful violet coloration they yield when in contact with solutions of alkali sulphides. The sodium salt is obtained by dissolving powdered potassium ferrocyanide in diluted nitric acid, and warming on the water-bath. The reaction is accompanied by evolution of much gas, consisting especially of carbon dioxide and hydrocyanic acid. When the reaction is completed, nitrate of potassium falls out upon cooling. The mother liquor is then neutralized with sodium carbonate, and after filtration and further crystallization of nitrate, the salt is allowed to crystallize. *Sodium nitro-prusside* forms permanent, ruby-red prisms, soluble in 2½ parts of water. Exposure to light decomposes the solution, Prussian blue being precipitated, and nitric oxide evolved. The violet-blue color produced with soluble sulphides, as mentioned above, is a delicate test for the latter.

Potassium Sulphocyanate (or *Sulphocyanide*, as it was formerly called), *Potassium thiocyanate, Potassium rhodanate* ($KSCN=96.99$).—Melt together, at a low red heat, anhydrous potassium ferrocyanide (46 parts), sulphur (32 parts), and potassium carbonate (17 parts). Cool and treat the mass with boiling alcohol, in which the salt dissolves, crystallizing out upon cooling; it forms colorless prisms of a biting, saline, cooling taste. The salt deliquesces on exposure, and is easily dissolved by water or alcohol. This substance is a test for ferric salts, with which it produces a blood-red color, soluble in ether. The color is not readily affected by hydrochloric acid, but is dissipated by mercuric chloride (compare ferric chloride tests for *Meconic Acid*, under *Opium*). This reaction also serves as a test for cyanides. By melting potassium cyanide with sulphur, combination takes place with formation of potassium thiocyanate, which may be recognized by the above test. Likewise, sulphur may be tested for by this reaction. Potassium sulphocyanate has been suggested (Sommering) as a substitute for cyanide of potassium and prussic acid in therapy, on the ground that it is fully as effective without the inconveniences attending those drugs.

POTASSII HYPOPHOSPHIS (U. S. P.)—POTASSIUM HYPOPHOSPHITE.

Formula: KPH_2O_2. Molecular Weight: 103.91.

Synonyms: *Potassæ hypophosphis, Hypophosphite of potassium, Hypophosphite of potash, Hypophosphis kalicus, Hypophosphis potassicus, Kalium hypophosphorosum.*

Preparation.—This salt may be produced by neutralizing hypophosphorous acid (which see) with potassium carbonate, and carefully evaporating the solution to dryness, or it may be prepared by double decomposition of solutions of potassium carbonate and calcium hypophosphite, whereby potassium hypophosphite goes into solution, while calcium carbonate precipitates as follows: $K_2CO_3+Ca(PO_2H_2)_2=2KPO_2H_2+CaCO_3$. The salt may also be obtained by the action of phosphorus upon a warm, concentrated solution of caustic potash, the following reaction taking place with evolution of inflammable hydrogen phosphide gas: $P_8+6KOH+6H_2O=2PH_3+6PO_2H_2K$. When evaporating a solution of this salt, the temperature should be far below boiling, lest an explosion occur.

Description and Tests.—Potassium hypophosphite forms "white, opaque, hexagonal plates, or crystalline masses, or a granular powder, odorless, and having a pungent, saline taste; very deliquescent. Soluble at 15° C. (59° F.), in 0.6 part of water, and in 7.3 parts of alcohol; in 0.3 part of boiling water, and in 3.6 parts of boiling alcohol; insoluble in ether. When heated in a dry test-tube, the salt at first loses moisture, and then evolves spontaneously inflammable hydrogen phosphide gas, which burns with a bright-yellow flame. On triturating or heating the salt with nitrates, chlorates, or other oxidizing agents, it detonates violently. The aqueous solution (1 in 20) is neutral to litmus paper, and yields, with sodium bitartrate T.S., a white, crystalline precipitate. With silver nitrate T.S. a white precipitate is formed, which rapidly turns brown and black, owing to the separation of metallic silver. If a small quantity of an aqueous solution of the salt be acidulated with hydrochloric acid, and mercuric chloride T.S. added, so that the latter remain in excess, a white precipitate of mercurous chloride will at first be produced, which, upon further addition of the acidulated solution, is reduced to metallic mercury"—(*U. S. P.*). The latter two reactions are in consequence of the reducing qualities of potassium hypophosphite. The second reaction takes place, with the formation of phosphoric acid, as follows: $4HgCl_2+HPO_2H_2+2H_2O=4HgCl+4HCl+H_3PO_4$ and $4HgCl+HPO_2H_2+2H_2O=2Hg_2+4HCl+H_3PO_4$. The salt should be kept in close-stoppered bottles, and, owing to the danger involved in mixing it with oxidizers, should not be used in combination with the latter class of bodies.

The *U. S. P.* directs the following tests for this salt: "The aqueous solution of the salt (1 in 20) should not effervesce on the addition of an acid (absence of carbonate), nor should it be rendered turbid by ammonium oxalate T.S. (absence of calcium). Separate portions of 5 Cc. of the aqueous solution (1 in 20), heated with 1 Cc. of nitric acid, should remain clear upon the addition of silver nitrate T.S. (absence of chloride), or of barium chloride T.S. (absence of sulphate). Not more than a slight cloudiness should be produced in the aqueous solution of the salt by the addition of magnesia mixture (limit of phosphate). If 0.1 Gm. of dry potassium hypophosphite be dissolved in 10 Cc. of water, then mixed with 7.5 Cc. of sulphuric acid and 40 Cc. of decinormal potassium permanganate V.S., and the mixture be boiled for 15 minutes, it should not require more than 2 Cc. of decinormal oxalic acid V.S. to discharge the red color (corresponding to at least 98.7 per cent of the pure salt)"—(*U. S. P.*). Mr. Frank X. Moerk found one of two samples of potassium hypophosphite to contain over 13 per cent of potassium phosphite (PO_3HK_2) (*Amer. Jour. Pharm.*, 1889, p. 391).

Action, Medical Uses, and Dosage.—This salt is usually prescribed in the combination known as the compound syrup of the hypophosphites. The hypophosphites are particularly useful in allaying *pulmonary irritation* in atonic subjects, and in controlling *cough* and giving increased freedom of respiration. At the same time, the digestion, blood-making, and the nutrition of the body are improved by it. They are useful in *phthisis*, *bronchitis*, convalescence from debilitating diseases, the disorders produced by *mental strains*, *sexual excesses*, etc. The salt under consideration is especially useful in *chronic cough*, with thoracic pain, and in the *neuralgia* following *pleurodynia*, *rheumatism*, *muscular cramps*, etc. The indications are soreness or lameness, with pain and tenderness in the muscles. Dose, 1 to 25 grains.

Specific Indications and Uses.—Atony, with pallid tongue and membranes; muscular soreness, tenderness, pain, or lameness; chronic cough, with irritation and pain in the chest, pulse weak and rapid; emaciation.

Related Salt.—POTASSII PHOSPHAS (K_2HPO_4), *Potassium phosphate, Dipotassic orthophosphate*. This salt may be prepared by saturating solution of orthophosphoric acid with potassium carbonate until effervescence ceases, filtering, and allowing to crystallize. It forms a white, deliquescent powder, which crystallizes with difficulty. Potassium phosphate, from 10 to 30 grains, in water, 3 times a day, is employed in *phthisical* and *scrofulous diseases* as an alterative. According to the Schuessler treatment, it is a remedy for *mental depression, nerve exhaustion*, and in *brain* and *cord lesions*. Excessive prostration, morbid fear, and rapid blood-decay, are guides to its selection. The usual method of prescribing it is to add 5 grains of the 3 x trituration to 4 ounces of water, the dose of which is a teaspoonful every 2 hours in acute troubles, and every 4 hours in chronic affections.

POTASSII IODIDUM (U. S. P.)—POTASSIUM IODIDE.

FORMULA: KI. MOLECULAR WEIGHT: 165.56.

SYNONYMS: *Iodide of potassium, Iodide of potash, Kalium iodatum, Kali hydriodicum, Ioduretum kalicum, Ioduretum potassicum.*

Preparation.—Potassium iodide is obtained either by neutralization of hydriodic acid with caustic potash, or potassium carbonate, or by the action of potassium carbonate upon ferrous iodide, previously prepared by the action of iron filings upon iodine in the presence of water; or iodine is allowed to act upon caustic potash, whereby potassium iodide and iodate are formed, according to the equation: $3I_2+6KOH=5IK+IO_3K+3H_2O$. The iodate is then reduced to iodide by mixing the salts with charcoal and exposing to a dull-red heat (compare *Potassii Bromidum*).

Description.—"Colorless, transparent, or translucent, cubical crystals (the white, opaque, commercial variety being crystallized from an alkaline solution, and less pure), or a white, granular powder, having a peculiar, faint, iodine-like odor, and a pungent, saline, afterward bitter taste. Permanent in dry air, and but slightly deliquescent in moist air"—(*U. S. P.*). If it contain a small portion of carbonate of potassium or sodium iodide, it gradually attracts moisture from the air, becoming entirely liquid and yellowish from the liberation of iodine. "Soluble, at 15° C. (59° F.), in 0.75 part of water, and in 18 parts of alcohol; in 0.5 part of boiling water, and in 6 parts of boiling alcohol; also soluble in 2.5 parts of glycerin. When heated, the salt decrepitates. At a low, red heat it fuses, and at a bright-red heat it is volatilized without decomposition. Its aqueous solution is neutral, or has, at most, a scarcely perceptible alkaline reaction upon litmus paper. The salt yields a white, crystalline precipitate with sodium bitartrate T.S. If to 5 Cc. of the aqueous solution (1 in 20) of the salt, 1 Cc. of chlorine water be added, iodine will be liberated, and impart to the solution a yellow color. On agitating the mixture with a few drops of chloroform, this will acquire a violet color"—(*U. S. P.*). Other substances liberating iodine from potassium iodide are concentrated sulphuric acid, nitrous acid, ferric chloride, etc. The aqueous solution of potassium iodide readily dissolves iodine, forming a dark, reddish-brown fluid (see *Decinormal Iodine Volumetric Solution*). Potassium iodide forms characteristic compounds with the salts of heavy metals. With mercuric chloride, a vermilion-red precipitate of mercuric iodide is formed, soluble in excess of potassium iodide. The solution, containing the double salt, mercuric potassium iodide ($HgI_2.2IK$), is known as *Mayer's solution*, the well-known test-reagent for alkaloids. *Nessler's solution*, the delicate test-reagent for ammonia, is the same fluid rendered alkaline by the addition of caustic potash (see *Aqua Ammoniæ* and *U. S. P. Test Solutions*). Soluble mercurous salts produce with small amounts of potassium iodide a green precipitate of mercurous iodide (Hg_2I_2), soluble in excess of potassium iodide as mercuric potassium iodide, with precipitation of mercury, as follows: $Hg_2I_2+2IK=Hg+HgI_2.2IK$. From cupric salts, potassium iodide precipitates white, cuprous iodide, with liberation of iodine, as follows: $2CuSO_4+4KI=Cu_2I_2+I_2+2K_2SO_4$. Acetate of lead produces, with potassium iodide, a yellow precipitate of iodide of lead (which see). Nitrate of silver precipitates pale-yellow iodide of silver, which is almost insoluble in aqua ammoniæ (difference from silver chloride); insoluble in diluted nitric acid.

Tests.—Iodide of potassium is often rendered impure by the presence of foreign substances. Carbonate of potassium may be detected by lime-water, which would render the solution milky, or by alcohol, which does not dissolve the carbonate, but dissolves the pure iodide. Other impurities liable to be present are sulphate of potassium, iodate of potassium, chlorides of potassium or sodium, nitrates, metallic impurities, etc. The crystallized salt is naturally purer than the granulated (see analyses by G. H. Charles Klie, *Amer. Jour. Pharm.*, 1894, p. 380). The *U. S. P.* directs the following tests for potassium iodide: "No residue should be left when 1 Gm. of the salt is dissolved in 2 Cc. of diluted alcohol of specific gravity 0.928 (absence of less soluble salts)"—(*U. S. P.*). The strength of this alcohol is about 52.5 per cent by volume. "If 1 Gm. of the salt be dissolved in water and 0.05 Cc. (1 drop) of decinormal oxalic acid V.S. be added, no color should be produced by the subsequent addition of a drop of phenolphtalein T.S., even after heating (limit of alkali). When a fragment of the salt is brought into a non-luminous flame on a clean platinum wire, a violet color should appear at once (absence of sodium). If to a solution of the salt (1 in 20) in distilled water, from which all gases have been expelled by boiling, a little starch T.S. be added, and then a few drops of pure diluted sulphuric acid T.S., no blue color should appear at once (absence of iodate)"—(*U. S. P.*). This test is based upon the action of hydriodic acid upon iodic acid, which takes place according to the equation: $5IH + IO_3H = 3I_2 + 3H_2O$. "The aqueous solution (1 in 20) should not be colored or precipitated by the addition of an equal volume of hydrogen sulphide T.S., either before or after acidulation with hydrochloric acid (absence of arsenic, lead, copper, etc.). The aqueous solution should remain clear after the addition of barium chloride T.S. (absence of sulphate)"—(*U. S. P.*). Mr. L. F. Kebler points out that in the latter test the addition of hydrochloric acid should be directed, because the *U. S. P.* allows a trace of carbonate to be present, which causes turbidity with barium chloride (*Amer. Jour. Pharm.*, 1896, p. 197). "If 1 Gm. of the salt be mixed with 0.5 Gm., each, of iron and of zinc, in coarse powder or filings, and heated in a test-tube with 5 Cc. of sodium hydrate T.S., no ammoniacal vapors should be evolved (absence of nitrate or nitrite). No blue color should be communicated to 5 Cc. of the aqueous solution (1 in 20) by 0.1 Cc. (2 drops) of potassium ferrocyanide T.S. (absence of iron). If 5 Cc. of the aqueous solution be gently heated with 1 drop of ferrous sulphate T.S. and 0.5 Cc. of potassium hydrate T.S., no blue color should appear after acidulating the mixture with hydrochloric acid (absence of cyanide). If 0.5 Gm. of the well-dried salt be dissolved in 10 Cc. of water, and 2 drops of potassium chromate T.S. be added, it should require not more than 30.25 Cc. nor less than 30 Cc. of decinormal silver nitrate V.S. to produce a permanent red color of silver chromate (corresponding to at least 90.5 per cent of the pure salt)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—In very large doses, iodide of potassium is an irritant, though Dr. Elliotson states that 6 drachms may be given daily and continued for many weeks without inconvenience. In small doses, it is diuretic and alterative. Iodine has been detected in the urine a few minutes after the exhibition of the iodide. (Iodide of potassium, or iodine, may be detected in urine, by first adding starch to the suspected urine, then a few drops of nitric acid, or solution of chlorine; the blue iodide of starch will be precipitated.) A drachm of the iodide, taken in divided doses, has caused vomiting, colicky pains, slight diarrhœa, frequency of pulse, and slight exhaustion, and Dr. Laurie has known small doses to produce serious and even fatal results in certain constitutions. Mercurial salivation is frequently occasioned by the administration of this salt to persons who had been subject to mercurial treatment at some prior time. In some constitutions iodide of potassium produces certain symptoms termed *iodism*, as "violent vomiting and purging, with fever; great thirst; palpitation; rapid and extreme emaciation; cramps, and small, frequent pulse, occasionally with a dry cough, and terminating in death" (P.) (see also *Iodine*). Usually, the unpleasant symptoms occasioned by the use of iodide of potassium gradually pass away upon ceasing its use. A common result from the administration of this salt, is the condition produced simulating "summer catarrh." Being excreted partially by the air passages, it sets up a severe coryza, with bronchorrhœa, and swelling, congestion or even inflammation of the pharyngeal, laryngeal, and conjunctival membranes. The skin and kidneys are also more or less irritated. The action may be so severe as to inflame the antrum of Highmore and the frontal sinus, to cause hoarseness, dyspnœa, œdema of the larynx, impairment of sight and speech, and a paresis of the organs of speech. Even very small doses, in susceptible individuals, have produced symptoms of iodism. It is not uncommon for the iodide to produce an indurated form of acne, and, less commonly, urticaria, watery or bloody blisters, and iodic purpura. The latter consists of purple spots, chiefly upon the legs, which disappear after a short time. Rarely, large blebs form, which are extremely painful to the touch, and are filled with watery or bloody serum. These are termed *hydroa*, and have produced death. The iodides pass with exceeding rapidity into the blood, and are eliminated by the faucial, salivary, and broncho-pulmonary glands, but chiefly by the renal organs, the urine having been known to contain at least 90 per cent of the amount ingested. That it contaminates the milk of nursing mothers, is proven by its emaciating effects upon suckling infants. Iodide of potassium is more likely to do mischief when the kidneys are inactive; it should be very cautiously used, if at all, when the kidneys are diseased. As small a dose as 5 grains have produced decided iodic symptoms, while, as above stated, very large doses have been taken without apparent harm. It should always be given largely diluted with water, and the initial doses of the salt should always be small lest laryngeal œdema should result.

As a therapeutical agent, iodide of potassium has been widely and variously used. Properly employed, it is an agent capable of great good, but if improperly administered, may do irreparable harm. It increases retrograde metamorphosis, and the detritus is eliminated with the salt. If given beyond this action, it attacks the healthy tissues. Prof. Scudder has laid down the indication for its selection as "a broad, pallid, leaden-colored tongue, rather full. With this indication, it is a very certain antisyphilitic, whilst, with a red and contracted tongue, it is pretty sure to do the patient injury" (*Spec. Med.*, 159).

Iodide of potassium is usually given in all cases where iodine is indicated, being less irritating in its action. It appears to be more especially useful in *goitre*, *strumous enlargement of the glands*, *strumous sores* and *eruptions*, *strumous ophthalmia*, *syphilitic affections*, *mammary tumors*, *enlargement of the liver*, *amenorrhœa*, *leucorrhœa*, *mercurio-syphilitic sore throat*, *mercurial cachexia*, and *tubercular affections of serous tissues.* It is extensively employed in the above forms of disease, alone, or in combination with the compound syrup of stillingia, in the proportion of 4 drachms of the salt to a pint of the syrup.

Owing to its chemical action, it is the remedy relied upon in *chronic lead*, *mercurial*, and *arsenical poisoning.* It must, however, be very cautiously used, lest in its union with these minerals it aggravates so as to renew the poisonous effects of the original poisons. Not more than 20 grains should be given during the day. It is regarded as a singular fact that some cases of *mercurial sore-mouth* are relieved by it, while others are not; but, in the light of specific indications, this is not at all surprising. As an agent for *syphilis*, it is one of the most important remedies for the tertiary stage. It does harm, and is never indicated in the primary stage. Good hygienic and dietetic care are required in the first stage; small doses of the iodide in syrup of stillingia, as mentioned above, may be given in the second stage; but in the third stage, when the ulcerative processes, and the periosteal and bone complications ensue, the drug may be given in heavy doses with the greatest of benefit. Its efficiency in *ulcerative syphilitic destruction*, *caries*, *periostitis*, *nocturnal bone-pains*, *nocturnal tri-facial neuralgia*, all due to the syphilitic infection, is promptly and thoroughly declared. While large doses may here be exhibited, care should be taken not to produce iodism, lest a worse than the syphilitic condition be provoked. The vegetable alteratives, as phytolacca, berberis aquifolium, etc., are sometimes given with it. Potassium iodide has a marked action in reducing enlargements, and especially when due to *hyperemia* of the part. *Bronchocele* has been cured by it. A *syphilitic* or *scrofulous cachexia* is usually behind these troubles when so relieved, for it does not affect solid growths unaccompanied with a cachectic state. The many nervous disorders experienced by those affected by syphilis at the time or some remote period, are benefited by the iodide. Thus *epilepsy*, *severe neuralgia*, *headache*, *arthritic pains*, *chronic rheumatism*, and *gout* are relieved by it. *Lumbago*, *paraplegia*, and *sciatica* have been cured by it, when due to syphilis or chronic mineral poisoning. In *scrofulous conditions*, give it with cod-liver oil. The *eye disorders of syphilis*, *rheumatism*, and *scrofula*, such as *scrofulous* *corneal ulceration* and *opacity*, *scrofulous conjunctivitis*, and *rheumatic* or *syphilitic iritis*, are well treated with 5-grain doses after each meal. The lacteal secretions are dried by this salt, and though in health not a pronounced diuretic, and ordinarily harmful, where the kidneys are diseased it appears to relieve the *dropsy of Bright's disease* by acting efficiently as a diuretic, washing away the morbid products, though it does not cure or lessen the amount of albumen excreted. Owing to its action upon the mucous tissues in increasing secretion, it is of value in *dry asthma*, *dry cough*, and *chronic bronchitis* of a congestive or purulent type. As soon as its effect of increasing secretion is observed, it should be lessened in dose or withdrawn, so that it will not prove too debilitating. It has been thought of value to prevent the formation of the *diphtheritic membrane*, where there is marked dryness of the membranes. It has been used successfully in curing *aneurism*, by inducing thrombosis in the aneurismal sac. As a remedy for *skin diseases*, it is useful, when dependent upon a scrofulous or syphilitic taint. Upon a like cachexia probably depend those fibrous thickenings and deposits, inflammatory in character, which take place about joints, upon nerve-trunks and tendons, and the periosteal membranes, which are also relieved by the drug. *Syphilitic gummata* of the brain and elsewhere are often promptly dissipated by its use. It should be remembered that, when taken for a length of time, and especially if used in rather large doses, it will excite ptyalism, and frequently an affection of the mucous membranes of the air passages, very much resembling a cold in the head. The dose of it is from 2 to 30 grains, 3 times a day; the larger doses being employed in ulcerative syphilitic disorders. It should always be given in solution (water or milk) and well diluted, and should also be prescribed in the simplest possible form, on account of its numerous chemical relations with other bodies, many of which decompose it, and form insoluble iodides.

Specific Indications and Uses.—Pale, leaden-colored, rather full tongue; dryness of mucous membranes; nocturnal pains; scrofulous and syphilitic (tertiary) manifestations, with the above-mentioned tongue; blue line on the gums (chronic lead poisoning).

Related Compounds.—POTASSII IODAS (KIO_3=213.44), *Potassium iodate*. There are several methods of preparing this salt. Iodine is allowed to react with caustic potash, and the resulting mixture of iodide and iodate is treated with alcohol, which leaves potassium iodate undissolved; or it may be prepared by the action of iodine (in the form of its chlorine compound, ICl) upon potassium chlorate, as follows: $ICl+KClO_3=Cl_2+KIO_3$. The salt forms translucent or porcelain-like, cubical crystals, soluble in cold (13 parts) and boiling (3.1 parts water. Alcohol does not dissolve it, but it is freely soluble in solution of potassium iodide: This solution, acidulated, sets iodine free (see *Potassii Iodidum*). The salt is fusible, and when strongly heated, gives off oxygen, while potassium iodide remains. This agent has been substituted for potassium chlorate in *ulcerated conditions of the mouth and fauces*. *Gangrenous stomatitis*, *salivation*, and *diphtheria* have been treated with it, the usual dose being 4 to 8 grains. It appears to restrain the secretions of the mucous surfaces.

IODIA.—A combination of the active constituents of the green roots of stillingia, helonias, saxifraga, and menispermum; iodide of potassium, phosphate of iron, and aromatics. Employed in *uterine debility* and *menstrual derangements*, and in *syphilitic*, *cutaneous*, and *scrofulous diseases*. Dose, 1 to 2 fluid drachms, 3 times a day, before meals. Iodia is a specialty of Battle & Co., of St. Louis, Mo.

ELIXIR SALICYLIC COMPOUND.—A specialty of Wm. R. Warner & Co. (Philadelphia and New York), containing salicylic acid, gelsemium, sodium bicarbonate, and potassium iodide. It is designed for use in *rheumatism*, *lumbago*, *gout*, and like diseases. Dose, 1 to 2 teaspoonfuls.

POTASSII NITRAS (U. S. P.)—POTASSIUM NITRATE.

FORMULA: KNO_3. MOLECULAR WEIGHT: 100.92.

SYNONYMS: *Saltpetre*, *Saltpeter*, *Niter*, *Nitre*, *Nitrate of potash*, *Nitras kalicus*, *Nitras potassicus*, *Nitrum depuratum*, *Sal petræ*, *Sal nitri*, and *Sal prunelle* (when fused).

Source, History, and Preparation. Nitrate of potassium is a salt which was known to the ancients, though probably not sharply distinguished from other salts formed on the surface of soils by efflorescence. It is found in various parts of the globe, as in Europe, Egypt, South America, India, and in several parts of the United States. The greater part of the commercial article was at one time obtained from India, but is now largely supplanted by the artificial product Potassium nitrate is also found in several plants, as tobacco, crawley root, sunflower, nettle, etc. The process of obtaining it from the soil, or from heaps of earth containing decaying animal matter, consists in lixiviating the soil in an apparatus containing wood ashes. The resulting solution of nitrate of calcium is made to pass through the wood ashes, and reacts on the carbonate of potassium, producing nitrate of potassium and carbonate of calcium. The fluid thus obtained is evaporated and crystallized, and the crystals purified by recrystallization. The nitrification of soils is now known to be due to the presence of ferments and bacteria, which convert ammonium salts into nitrites and nitrates in the presence of sufficient alkali and the oxygen of the air.

Large amounts of nitrate of potassium are now produced by treating the chloride of potassium obtained from the mines at Stassfurt, Germany, with Chili saltpetre (sodium nitrate). By double decomposition, sodium chloride (common salt) and potassium nitrate (saltpetre) are formed as follows: $KCl + NaNO_3 = KNO_3 + NaCl$. Saltpetre from this source is called *conversion saltpetre*. It is an almost absolutely pure potassium nitrate. During the American war with England (1812), large quantities of saltpetre were prepared from the deposits in the Mammoth Cave of Kentucky. The wooden vats employed are still to be seen in that cavern. The salt erroneously termed *South American saltpetre*, is a nitrate of sodium (*Chili saltpetre*) (see *Sodii Nitras*).

Description.—Potassium nitrate occurs in the form of "colorless, transparent, 6-sided, rhombic prisms, or a crystalline powder, odorless, and having a cooling, saline, and pungent taste. Permanent in the air. Soluble in 3.8 parts of water at 15° C. (59° F.), and in 0.4 part of boiling water; very sparingly soluble in alcohol. When heated to 353° C. 667.4° F.), the salt melts. At a higher temperature it is decomposed, giving off oxygen at first, and then some of its nitrogen, leaving a residue of potassium nitrate, nitrite, and oxide. Thrown upon red-hot coals, the salt deflagrates. The aqueous solution is neutral to litmus paper"—(*U. S. P.*).

Cold is generated during solution of the salt in temperate or cold water. Alcohol, of specific gravity 0.878, dissolves about 1 per cent of this salt; it is not soluble in pure alcohol. When held in the non-luminous Bunsen flame, on a platinum wire, it imparts to it a violet color. When allowed to cool from a state of fusion, it concretes into a hard, fibrous, opaque, white mass, known in commerce by the name of *Sal prunelle* or *Crystal mineral*. Saltpetre, obtained by agitating the solution from which it crystallizes, occurs in the form of fine crystals, and is called *saltpetre flour*. Saltpetre, being a powerful oxidizer, should not be triturated together with easily combustible substances. Its most important use is in the manufacture of gunpowder, and of nitric acid.

Tests.—The presence of chloride of sodium or common salt renders nitre unfit as a constituent of gunpowder, owing to its tendency to absorb moisture from the air. When nitre is fused and allowed to cool, it assumes a radiated texture; the broader these radii, the purer the salt. If mixed with $\frac{1}{30}$ part of common salt, the radiated appearance is completely destroyed. Commercial samples of saltpetre have been found to contain, occasionally, as much as 75 per cent of sodium chloride (see *Amer. Jour. Pharm.*, 1886, p. 288).

The *U. S. P.* gives the following tests for potassium nitrate: "With sodium bitartrate T.S., the aqueous solution (1 in 20) yields a white, crystalline precipitate; with sodium cobaltic nitrite T.S., a yellow precipitate. If a small crystal of ferrous sulphate be dissolved in the aqueous solution (1 in 20), and then concentrated sulphuric acid be poured in, so as to form a separate layer, a dark-brown color will appear at the line of contact"—(*U. S. P.*). This is a general test for nitric acid and its salts, and is based upon the reduction of nitric acid by ferrous sulphate with evolution of nitric oxide, which dissolves in unattacked ferrous sulphate solution with brown color. The reaction takes place as follows: $6FeSO_4 + 3H_2SO_4 + 2HNO_3 \quad 3Fe_2(SO_4)_3 + H_2O + 2NO$. "If a drop of diphenylamine T.S. be mixed with the aqueous solution, and concentrated sulphuric acid be poured in, as in the preceding test, a deep-blue color will appear at the line of contact"—(*U. S. P.*). This test is based upon the formation of *diphenylamine blue*. "The aqueous solution (1 in 20) should remain unaffected by the addition of a few drops of potassium ferrocyanide T.S. (absence of iron); or of barium chloride T.S. (sulphate), or of silver nitrate T.S. (chloride); or of ammonium carbonate T.S., ammonium oxalate T.S., or ammonium sulphide T.S. (absence of calcium, zinc, etc.); or by the addition of an equal volume of hydrogen sulphide T.S., either before or after acidulation with hydrochloric acid (absence of arsenic, lead, copper, etc.). If to 5 Cc. of the aqueous solution of the salt, 1 Cc. of chlorine water and a few drops of starch T.S. be added, no blue color should appear (absence of iodine). No yellow color should appear when 1 Cc. of pure, concentrated sulphuric acid is added to 0.1 Gm. of the dry salt (absence of chlorate)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Nitrate of potassium is irritant, cathartic, refrigerant, and diuretic. If the body be kept cool, it acts chiefly as a diuretic; if warm, as a diaphoretic. In doses of from ½ to 2 ounces, in solution, it occasions heat and pain in the stomach, vomiting, excessive nervous depression, and sinking of the pulse, and has proved fatal in a few hours; some of the effects being purging, bloody stools, cold extremities, and convulsions. On account of the uncertainty of its cathartic effects, it is seldom used for that purpose. Its most common actions are to increase the cutaneous and renal secretions; to diminish the temperature of the system, and the frequency of the pulse; to keep the bowels gently open, and, in consequence of these influences, to lessen febrile and inflammatory action.

In the *Amer. Jour. Med. Sci.*, Vol. XVIII, p. 204, an account is given of experiments by five students on their own persons while in health. The salt was taken in solution, with the addition of a little mucilage, in quantities increasing gradually from 1 to 5 drachms daily; the proportion for each day being divided into 5 doses. After from 8 to 12 days' use of it in this manner, it was found to produce general weakness, indisposition to mental or physical exertion, fatigue from the least exertion, low spirits, a bruised sensation of the muscles and joints, constant disposition to sleep, slow and weak pulse. The appetite continued good, and digestion was not disordered; occasionally pain in the bowels, with purging. Blood drawn from the veins at this time had the color and density of cherry-juice, the white blood-corpuscles were increased in number and size, the blood-globules were paler, and the blood coagulated very quickly. There was an increase of the water, and a decrease of the solids of the blood, with a dimunition of its fat and an increased proportion of ash in the serum. The pulse did not assume its natural strength and frequency for several days after the discontinuance of the medicine. Potassium nitrate is extensively employed as a diuretic, and especially in *dropsical affections*. It has also been found beneficial in *acute rheumatism* and in *active hemorrhages;* and in these cases it may be given to the amount of 1 or 2 ounces in the course of 24 hours, dissolved in 2 quarts of cold water, and flavored with lemon-peel, and which must be divided into several doses. In *acute inflammatory rheumatism*, with excessive tenderness, from 5 to 20 grains, well diluted, may be given 4 times a day. In some cases of *acute dysentery*, given in association with resin of podophyllum and leptandra, it will be found very valuable in facilitating the cure. From 3 to 5 grains of nitre, dissolved in a little water, and this dose repeated 3 times a day, I have found very efficient in removing the *aching pain in the testicles*, complained of by onanists and persons who commit excessive venery. I am not aware that this action is named in any other medical work (J. King). In *sore throat*, nitre mixed with white sugar, and gradually swallowed, has given great relief; it also forms a useful addition to gargles in *quinsy*, and, in 3-grain doses, well diluted, it sometimes aborts this trouble. A mixture of nitre and gum Arabic lessens the scalding of *gonorrhœa*. Urinal incontinence is relieved by nitre. The fumes produced by the deflagration of nitrate of potassium with paper, have been inhaled with benefit in *spasmodic asthma*. To obtain them, blotting paper must be moistened with a saturated solution of the salt, and then dried; by burning the paper or smoking it in a pipe, the fumes may be inhaled; relief usually follows in about 15 minutes. It is frequently substituted for the bitartrate of potassium in our powder of ipecacuanha and opium. Sal prunelle (fused nitrate of potassium) has been found useful as an application to *cracked lips*. The dose of nitre as a sedative refrigerant, is from 10 to 20 grains, well diluted; as a diuretic, from 20 to 60 grains. There is no certain antidote known to the more serious influences of nitre. The treatment generally pursued is to evacuate the stomach by free emesis, giving water freely, and to combat gastric irritation by external counter-irritants, mucilage and opiates internally, and stimulants to overcome any tendency to prostration. When used as a medicine, nitre should be largely diluted with water. Large doses, or a continued use of it for some time, will cause gastro-intestinal pain. A paste of the powder, prepared with a little water, is said to remove *freckles*, if applied to the face twice a day.

Specific Indications and Uses.—Renal atony; scanty urine, with difficult breathing; dysphagia, as if from paralysis of the throat muscles; acute inflammatory rheumatism, with excessive tenderness; spasmodic asthma (vapor); tonsillar hypertrophy; aching testicular pain.

Related Preparations.—GUNPOWDER (*Pulvis pyrius*, *Pulvis nitratis*). Gunpowder is prepared by combining together, 5 or 6 parts of nitre, with 1 part, each, of charcoal and sulphur. However, these proportions vary with the different manufacturers of the article, so that there is no regular or official method for its preparation. The uses of gunpowder, aside from medicine, are too well known to require description. Recommended as a detergent and alterative in *chlorosis* and *dyspepsia*, also as a corrective of morbid secretions of the gastro-mucous membrane, dependent on, or accompanied with *subacute inflammation*. Dose, 10 grains, 3 or 4 times a day, gradually increased, occasionally using a mild laxative. Externally, applied in powder or ointment to *indolent ulcers*, and several forms of *cutaneous diseases*. Gunpowder, dissolved in water, and the solution taken in teaspoonful doses, 3 or 4 times in 24 hours, and continued daily, has cured *gonorrhœa*. Dr. Bone and Dr. Henry, two celebrated botanic practitioners of the earlier part of this century, made considerable use of this article in the treatment of some forms of *cutaneous disease*, *indolent ulcers*, and even *cancers*. For the formula they employed, see previous editions of *American Dispensatory*.) The ointment applied twice a day, was reputed to destroy *cancer*.

POTASSII NITRIS (KNO_2=84.96), *Potassium nitrite*.—This salt is obtained by heating potassium nitrate, either alone, or with addition of lead, copper, or iron ($NO_3K = NO_4K + O$). When lead is used, the liberated oxygen oxidizes the metal, forming litharge. It is amorphous and fusible, and often is put on the market in the form of white sticks, resembling those of caustic potash; also in crystalline, granular form. Besides being exceedingly deliquescent, it also absorbs carbonic acid gas from the atmosphere. It is readily soluble in water, insoluble in alcohol. The salt is used in the testing for potassium or cobalt by the formation of potassium cobaltic nitrite (see *Potassa*), also in the preparation of *diazo compounds* (see *Anilinum*). Its physiological and therapeutical effects are those common to the nitrites, particularly those of amyl nitrite. The usual dose is 3 grains, doses of 10 grains having produced dangerous toxic symptoms.

POTASSII PERMANGANAS (U. S. P.)—POTASSIUM PERMANGANATE.

FORMULA: $KMnO_4$. MOLECULAR WEIGHT: 157.67.

SYNONYMS: *Permanganate of potash*, *Potassæ permanganas*, *Kali hypermanganicum crystallizatum*, *Hyperpermanganas kalicus*, *Hyperpermanganas potassicus*.

History and Preparation.—As early as 1659, this salt was produced by Glauber, while fusing together caustic potash and black oxide of manganese. The *British Pharmacopœia* (1898) gives it the formula $K_2Mn_2O_8$, and states that it may be obtained by the interaction of potassium chlorate, potassium hydroxide, and manganese dioxide. (For this process, full directions are given in the *Br. Pharm.*, 1885.) Accordingly, an evaporated mixture of 4 parts of black oxide of manganese, 3½ parts of potassium chlorate, and 5 parts of caustic potash, previously dissolved in 4 parts of water, is exposed to a dull-red heat in a covered crucible, the fused, dark-green mass, boiled out with water, and the solution, decanted from insoluble manganese dioxide, is saturated with carbonic acid gas, and evaporated to crystallization. Purify by recrystallization.

In this process, potassium manganate (K_2MnO_4) is first formed, according to the equation: $3MnO_2+6KOH+KClO_3+3K_2MnO_4+KCl+3H_2O$. This compound, upon boiling with water, is decomposed into potassium permanganate and hydrated manganese dioxide, as follows: $3K_2MnO_4+3H_2O \quad K_2MnO_8+MnO_3H_2+4KOH$. The free caustic potash formed is neutralized by carbonic acid gas.

Description and Tests.—The *U. S. P.* describes potassium permanganate as "slender, monoclinic prisms, of a dark-purple color, almost opaque by transmitted, and of a blue, metallic lustre by reflected light, odorless, and having a taste at first sweet, but afterward disagreeable and astringent. Permanent in the air. Soluble in 16 parts of water at 15° C. (59° F.), and in 3 parts of boiling water. In contact with alcohol, it is decomposed. When heated, the salt decrepitates, and at 240° C. (464° F.), it decomposes, yielding oxygen, potassium manganate, and manganese dioxide. The aqueous solution of the salt is of a deep, violet-red color when concentrated, and of a rose color when much diluted, and this color is discharged by hydrogen sulphide, ferrous sulphate, oxalic acid, alcohol, and many other readily oxidizable substances, especially if the solution be first rendered acid by sulphuric acid. The solution is neutral to litmus paper"—(*U. S. P.*).

Potassium permanganate is one of the most energetic oxidizing agents known. It is readily decomposed when in contact with organic and oxidizable inorganic bodies, especially the substances before mentioned. By oxidation in acid solution, 5 atoms of oxygen, from each 2 molecules of the salt, become available, according to the following equation: $Mn_2O_8K_2+3H_2SO_4+2MnSO_4+K_2SO_4+3H_2O+O_5$. The available oxygen oxidizes ferrous to ferric salts, oxalic acid to carbonic acid, hydrochloric acid to chlorine, etc. On account of the definiteness of these reactions, potassium permanganate finds a most important application in volumetric analysis (see *U. S. P. Volumetric Solutions*). When its solution is warmed with strong alkali it turns green, oxygen being evolved and potassium manganate formed as follows: $2MnO_4K+2KOH=2MnO_4K_2+H_2O+O$. Permanganate of potassium should be kept in well-closed bottles, and secure from impure air and light. Its solution, not being permanent, should be made as required and should not be allowed to come in contact with caoutchouc, upon which it acts, being at the same time decomposed by it. On account of its action on organic bodies, a writer in the *British Medical Journal* (1862) has recommended it as calculated in an eminent degree to meet every case of poisoning by organic poisons, as, by aconite, strychnine, veratrine, cyanide of potassium, etc. Recently, this view has been revived and put into practice, but probably without any satisfactory results. In this manner, it is reputed an antidote for morphine poisoning.

The *U. S. P.* directs the following tests for potassium permanganate: "If 0.5 Gm. of the salt be boiled with 10 Cc. of ammonia water and 10 Cc. of water (or with 20 Cc. of water and 4 Cc. of alcohol) until it is completely decomposed, and the liquid then filtered, the clear, colorless filtrate will serve for the following tests: If to 5 Cc. of the filtrate, acidulated with nitric acid, barium chloride T.S. be added, not more than very slight turbidity should be produced (limit of sulphate). In another portion of 5 Cc., acidulated with nitric acid, silver nitrate T.S. should produce no precipitate or cloudiness (absence of chloride). If to another portion of 5 Cc. of the filtrate 1 drop of diphenylamine T.S. be added, and then 1 Cc. of pure, concentrated sulphuric acid be poured in, so as to form a layer beneath, no blue color should appear at the line of contact (absence of nitrate or chlorate). If 0.1 Gm. of the salt be dissolved in 10 Cc. of boiling distilled water, and 1 Cc. of sulphuric acid be cautiously added, the solution should require for complete decoloration not less than 31.3 Cc. of decinormal oxalic acid V.S. (corresponding to at least 98.7 per cent of the pure salt)"—(*U. S. P.*). A delicate test for manganous salts (except when chlorides are present) is based on the formation of a purple-colored solution of permanganic acid (MnO_4H), when warming a small quantity of the manganous salt with lead dioxide and nitric acid. The following reaction takes place: $2MnSO_4+5PbO_2+6HNO_3=2PbSO_4+3Pb(NO_3)_2+2H_2O+2MnO_4H$.

Action, Medical Uses, and Dosage.—Locally, permanganate of potassium imparts a brown stain. Unbroken mucous surfaces are unaffected by its application, but a hot, smarting pain is felt when the surface is denuded. Internally, it produces a disagreeable form of heartburn and gastric uneasiness, and a sense of pressure beneath the sternum. Irritant poisoning has resulted from as small a dose as 2 grains when concentrated, while 4 or 5 times that quantity have been taken, well diluted, without apparent injury.

Permanganate of potassium, in powder or a concentrated solution, is a caustic, stimulant, and disinfectant. In weak solutions, it is a stimulant and disinfectant. It has proved very useful in the treatment of various offensive and infectious diseases, as in foul, indolent, and gangrenous *ulcers*, or *abscesses*, *leucorrhœa*, *otorrhœa*, *cancerous ulcers*, *nasal catarrh*, *ozœna*, etc., destroying the fetid odor in these cases, checking exuberant granulations when present, and inducing a healthy appearance of ulcerated surfaces. It has likewise been found a very efficient local application in *phlegmonous erysipelas*, *hospital gangrene*, and *carbuncle*. In these affections it may be applied locally, as a wash, by injection, or by means of spray, and of different strengths, varying from 10 grains to 2 drachms or more to a pint of water, according to circumstances. In *carbuncle* and *felon*, these must first be incised slightly, and then the solution be applied, having the strength of 1 part of the salt to 2 of water, or the fluid may be injected without incision. One part of the salt dissolved in 9 parts of distilled water, has been suggested as a standard solution; of this from ½ to 2 parts may be added to 16 parts of water, as required, though it is always better to commence with the weaker solution. The standard solution of full strength may be used in *indolent ulcers*, *gangrene*, *cancer*, and commencing *diphtheria*. As it becomes more or less decomposed by contact with organic bodies, the solution is best applied by means of a glass brush or syringe. In *stomatitis*, *diphtheritic affections*, *croup*, and other fetid or unhealthy conditions of the mouth, throat, and fauces, *diphtheroid* and *malignant sore throat*, *ulcerated fauces*, *catarrhal hypersecretion*, *pharyngitis*, *laryngitis*, *tonsillitis*, and *ulcerated catarrhal conditions of the broncho-pulmonary tracts*, it may be used in spray or as a gargle, 1 part of the standard solution to 16 parts of distilled water. No other water should be employed in forming its solutions, on account of the organic matters they contain. This fluid may also be used to correct the odor of decayed teeth, to free the hands from any bad smell contracted during post-mortem examinations, and to correct any bad odor from the feet or axillæ. From the fact that serpent poison is destroyed by this drug, it has been recommended as a local agent in *bites of serpents*. It must be in direct contact with the poison to be of any service. It has been proposed for dog-bites, to prevent *rabies*.

The indications for the local use of permanganate of potassium are clearly defined by Prof. Scudder (*Spec. Med.*, p. 209) as follows: "The indications for its use are where the tissues are swollen from infiltration into the connective tissue. In cases of *wounds*, we will notice that the edges are swollen, and the process of repair stops. The infiltration continuing, the pus becomes watery and ichorous, granulations pale and flabby; the parts separate, and finally slough. In inflammation we have very nearly the same indications for its use—the inflammation always being of a low grade, and showing infiltration of cellular tissue." Prof. Locke (*Mat. Med.*, p. 413) tersely puts the indications as "fetid surfaces with granulations half rotten and half alive." A drachm of the permanganate in half a fluid ounce of water, and placed in a saucer under a table, bed, or other convenient place, destroys all odor, and has this great advantage over other deodorants, that it has no odor of its own. Six grains of permanganate of potassium dissolved in a fluid ounce of water, and used as an injection 3 times a day, has proved very successful in the treatment of *gonorrhœa*, to destroy the infective material, after which a weak solution (2 grains to 1 ounce of water) should be employed until a cure is effected. The stains of potassium permanganate may be removed with diluted hydrochloric, sulphurous, or oxalic acids, or solution of ferrous sulphate.

Internally, it has been recommended in *diabetes*, in doses of about 3 grains, given in 3 or 4 tablespoonfuls of water, 3 times a day, a little before meals; but its results have not been very encouraging. Its internal use in *diphtheria*, *scarlatina*, and *zymotic diseases*, generally has been found serviceable, though but seldom employed at the present day. One part of the salt to 10 of water, has been extolled as a remedy against *cholera*. One or 2 parts to 500 of water has been termed *ozonized water*, the dose of which is a fluid drachm in 2 fluid ounces of water, to be repeated 4 or 5 times a day; as an oxidizing agent in the blood, transforming lactic acid into carbonic acid. Administered in ½-grain doses, permanganate of potassium, dissolved in water and raspberry syrup, and repeated 3 times a day, has cured *acute rheumatism*. Within a very few years, the agent, in doses of 1 to 2 grains, 4 times a day, near the menstrual period, has been lauded as an efficient emmenagogue in *atonic amenorrhœa* from cold and other causes. Some declare it useless. Certain it is, that very uncomfortable and even painful gastric symptoms often overbalance the good it may do in this direction. The dose of this salt is from 1 to 2 grains, in pill, every 4 or 6 hours. Solutions for topical use range in strength from 1 in 500 to 1 in 10 parts of water, accordingly, as a stimulant antiseptic or a caustic is required. This salt is claimed to be an antidote for *poisoning by morphine*.

Specific Indications and Uses.—Flabby, pale, unhealthy, half-rotten granulations; fetid surfaces; swollen, infiltrated tissues, with lack of reparative force; low inflammations, with infiltration of connective tissues; phlegmonous erysipelas; inflammations, with low vitality and inclined to slough; early in boils and felons (to abort); watery, ichorous pus; atonic amenorrhœa, from cold, mental strain, or following sea-sickness, with mental depression and pelvic weight and dragging (?).

POTASSII SULPHAS (U. S. P.)—POTASSIUM SULPHATE.

FORMULA: K_2SO_4. MOLECULAR WEIGHT: 173.88.

SYNONYMS: *Sulphate of potash*, *Sulfas potassicus*, *Sulfas kalicus*, *Tartarus vitriolatus*, *Arcanum duplicatum*, *Neutral sulphate of potassium.*

Source and Preparation.—Potassium sulphate occurs in volcanic lava, in sea-water, and the water of mineral springs, and in the ashes of plants. In combination with magnesium salts, it forms the mineral *kainite* in the Stassfurt salt deposits. The salt has, at different times, been known as *Vitriolated tartar*, *Sal polychrestum*, *Sal de duobus*, etc. The medicinal salt may be prepared in different ways, either by neutralizing diluted sulphuric acid with caustic potash or potassium carbonate, and evaporating to crystallization, or by exposing to a red heat potassium bisulphate ($KHSO_4$), obtained as a by-product in the manufacture of nitric acid (see *Acidum Nitricum*). Sulphuric acid is expelled, and neutral sulphate remains, as follows: $2KHSO_4 = K_2SO_4 + H_2SO_4$. Potassium sulphate may also be prepared on a large scale from *kainite* ($K_2SO_4.MgSO_4.MgCl_2 + 6H_2O$) by several methods, one of which consists in boiling a solution of this salt with a calculated quantity of potassium chloride, whereby potassium sulphate crystallizes upon cooling, and *carnallite* ($MgCl_2.KCl + 6H_2O$) remains in solution.

Description and Tests.—Potassium sulphate forms "hard, colorless, transparent, 6-sided, rhombic prisms, terminated by pyramids, or a white powder, odorless, and having a somewhat bitter, saline taste. Permanent in the air. Soluble in about 9.5 parts of water at 15° C. (59° F.), and in 4 parts of boiling water; insoluble in alcohol. When heated, the crystals decrepitate. At a bright-red heat they fuse, and at a white heat the salt suffers partial decomposition. The aqueous solution is neutral to litmus paper. The aqueous solution of the salt yields a copious yellow precipitate with sodium cobaltic nitrite T.S., and a white, crystalline precipitate with excess of tartaric acid T.S."—(*U. S. P.*). Heated with carbonaceous matter, the salt is deoxidized, and sulphide of potassium is formed. A solution of sulphate of potassium, slightly acidulated with nitric acid, yields a white precipitate with chloride of barium, consisting of barium sulphate, insoluble in water and acids. Potassium sulphate is seldom adulterated, though it may contain impurities from carelessness in preparation.

The *U. S. P.* directs the following tests: "When held in a non-luminous flame on a clean platinum wire, the salt should at once impart to the flame a violet color (absence of sodium). The aqueous solution (1 in 20) should remain unaffected by the addition of an equal volume of hydrogen sulphide T.S., either before or after acidulation with hydrochloric acid (absence of arsenic, lead, copper, etc.); or by the addition of a small amount of ammonium sulphide T.S. (absence of zinc, iron, aluminum, etc.). Other portions of the aqueous solution should not be rendered turbid by the addition of ammonium oxalate T.S. (absence of calcium); or of sodium phosphate T.S. and ammonia water (magnesium); or of silver nitrate T.S. (chloride). The addition of potassium ferrocyanide T.S. should produce neither a blue (absence of iron) nor a red color (copper)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Sulphate of potassium is a mild, unirritating cathartic, in doses of 15 to 30 grains, when sufficiently diluted with water. In 1 or 2-ounce doses, it acts as a powerful irritant, and has given rise to fatal accidents. It has been used as an aperient after delivery, in *puerperal fever*, to remove intestinal accumulations in children, in *dyspepsia*, and in *jaundice*. Combined with 5 or 10 grains of rhubarb, it is useful in *hepatic disorders* and *hemorrhoids*. Given according to the Schuessler plan, the **3 x** trituration is reputed a good application in fugitive shifting *pains in the muscles* and in *chronic muscular rheumatism*, with debility and muscular soreness. Five grains of the triturate are added to 4 fluid ounces of water, the dose of which is a teaspoonful every 2 or 3 hours.

Specific Indications and Uses.—Dr. Scudder recommended this salt in doses of 5 to 10 grains, 3 times a day in a glass of water when the skin is dirty, tissues full and sodden, and skin scaly; wounds heal slowly, inflame, and suppurate.

Related Salts.—POTASSII BISULPHAS, *Potassium bisulphate, Potassæ bisulphas, Bisulphate of potassa, Bisulphate of potassium, Acid potassium sulphate.* Formula: $KHSO_4$. Molecular Weight: 135.85. This salt may be prepared as follows: Take of sulphate of potassium, in powder, 3 ounces; pure sulphuric acid, 1 fluid ounce. Place the acid and the salt in a small porcelain capsule, and to this apply a heat capable of liquefying its contents; the heat should be continued until acid vapors cease to be given off. The bisulphate, which concretes as it cools, should be reduced to a fine powder, and preserved in a well-stoppered bottle. The salt may also be obtained by recrystallizing from water the residue of potassium bisulphate which remains in the preparation of nitric acid. Precaution must be taken, however, to acidulate the solution with sulphuric acid, because otherwise the neutral salt will crystallize, a corresponding quantity of sulphuric acid passing into solution. According to the quantity of free sulphuric acid present, the following series of crystallizable double salts may be obtained: K_2SO_4; $K_2SO_4+KHSO_4$; $KHSO_4$; $KHSO_4+H_2SO_4$.

Bisulphate of potassium, formerly called *Sal enixum*, forms a white, crystalline powder, or small, oblique, tabular, 4-sided prisms; or, when obtained by extreme concentration and cooling, it forms an apparently firm, fibrous mass. It is odorless, of a very acid taste, is permanent in the air (but the concreted, fibrous mass effloresces), and is soluble in 2 parts of cold and ½ part of boiling water. Alcohol decomposes it into the neutral salt, which is insoluble, and sulphuric acid, which is soluble in alcohol. Exposed to a moderate heat the salt fuses; at a red heat it loses half its acid, and neutral sulphate of potassium remains (which see). It is incompatible with caustic soda and ammonia, the carbonates of these bases, earths and earthy salts, and most metals and their oxides. Bisulphate of potassium is laxative and tonic, and is very useful to keep the bowels regular during recovery from acute attacks, as well as to improve the appetite. Conjoined with rhubarb, it covers the bitter taste of the latter without injuring its medicinal properties. Seventy-two grains, each, of the bisulphate of potassium and carbonate of sodium, separately dissolved in 2 fluid ounces of water, form, when combined, a cheap effervescing purgative. Bisulphate of potassium may be taken in doses of from 20 grains to 2 drachms, properly diluted.

POTASSII SULPHAS CUM SULPHURE, *Sulphate of potassium with sulphur.*—Take of nitrate of potassium, in powder, and of sublimed sulphur, equal weights. Mix them well together, and throw the mixture, by small portions at a time, into a red-hot crucible. When the deflagration is over, allow the salt to cool and place it in a glass vessel, well stopped (*Ed.*). In this process the sulphur burns with a blue flame, and becomes oxidized at the expense of the oxygen of the nitre (nitric acid); the resulting grayish-white compound consists principally of sulphate of potassium, mixed probably with some sulphite. It is claimed to be much more soluble than the sulphate of potassium, and it crystallizes from solution in rhombic prisms. Both the substance itself and its yellowish solution have a sulphurous odor, and an acid reaction. Hydrogen sulphide is not obtained on the addition of an acid to it, nor is sulphide of lead thrown down by the salts of that metal. Eight parts of cold water dissolve one of this compound. It was formerly called *Sal polychrestum Glaseri, Glaser's sal polychrest* (C. P.). This preparation is considered a mild cathartic, resembling very much in its action, that of the sulphate of potassium. It was formerly much in vogue as a purgative in *dyspepsia, chronic cutaneous eruptions*, etc. The dose is from ½ to 1 drachm, and generally given with some other gentle laxative, as bitartrate of potassium.

POTASSII SULPHIS, *Potassium sulphite.*—Formula: $K_2SO_3.2H_2O$. Molecular Weight: 193.84. This salt is prepared by allowing sulphur dioxide to pass into a solution of potassium carbonate until all the carbon dioxide is driven off; upon slowly evaporating, potassium sulphite crystallizes; or the acid salt ($KHSO_3$) is prepared by continuing the current of sulphur dioxide to saturation; an equal quantity of potassium carbonate is then added, which produces the neutral salt, the solution of which is then carefully evaporated. Sulphite of potassium was official in the *U. S. P.*, 1880, which describes it as forming "white, opaque, obliquely-rhombic, octahedral crystals, or a crystalline powder, somewhat deliquescent, odorless, having a bitter, saline, and sulphurous taste, and a neutral or feebly alkaline reaction. Soluble in 4 parts of water at 15° C. (59° F.), and in 5 parts of boiling water; only sparingly soluble in alcohol. When gently heated, the salt loses its water of crystallization (18.5 per cent); at a red heat it is decomposed, and leaves a residue of an alkaline reaction. The aqueous solution of the salt yields a white, crystalline precipitate on the addition of a saturated solution of bitartrate of sodium. Addition of diluted hydrochloric acid to the aqueous solution, gives rise to the odor of burning sulphur, and this solution does not become cloudy (difference from hyposulphite)" (*U. S. P.*, 1880). This salt should be kept in well-stoppered bottles, as it slowly absorbs oxygen, being converted into potassium sulphate. To establish the absence of the latter, or its presence in small amounts, the *U. S. P.*, 1880, directs that a few drops of barium chloride T.S. should cause no precipitate, or produce but a white turbidity in a 1 per cent solution of the salt made strongly acid with hydrochloric acid. The *U. S. P.*, 1880, demanded for this salt a minimum strength of 90 per cent of the pure salt ($K_2SO_3+2H_2O$), which was to be ascertained by the following test: "If 0.485 Gm. of the salt be dissolved in 25 Cc. of water, and a little gelatinized starch added, at least 45 Cc. of the volumetric solution of iodine should be required until a permanent blue tint appears after stirring (corresponding to at least 90 per cent of pure sulphite of potassium)"—(*U. S. P.*, 1880). This agent is reputed to possess the same antifermentative and antiputrefactive qualities as the corresponding salts of sodium and magnesium (which see). From ʒi to ℥ss may be given, well diluted, in 24 hours.

Potassium Bisulphite ($KHSO_3$=119.89).—Pass an excess of sulphurous acid gas into a strong solution of potassium carbonate, and add strong alcohol, which causes this salt to be precipitated. It forms white needles of neutral reaction, yet with a sulphurous taste. It slowly evolves sulphur dioxide when exposed to the air. Its properties and uses are similar to those of potassium sulphite.

Potassium Pyrosulphite ($K_2[SO_2]_2O$).—Forms smooth, hard, glossy plates, having a saline taste. When heated, both sulphur dioxide and sulphur are evolved, the residue being sulphate of potassium. It is produced by passing into a hot and saturated solution of salt of tartar a stream of sulphur dioxide. Its uses are similar to those of potassium sulphite.

POTASSII TARTRAS.—POTASSIUM TARTRATE.

Formula: $K_2C_4H_4O_6.H_2O$. Molecular Weight: 243.66.

Synonyms: *Tartarus solubilis*, *Tartrate of potash*, *Soluble tartar*, *Tartras kalicus*, *Tartras potassicus*, *Potassæ tartras*.

History and Preparation.—Tartrate of potassium, also known by the names of *Soluble tartar*, *Sal vegetabile*, and *Tartarized kali*, was known as early as the seventeenth century. Boerhaave, in 1742, called it *Tartarus tartarisatus*, obtaining it by the action of potassium carbonate (*salt of tartar*) upon potassium bitartrate (*cream of tartar*), which is the method now usually employed. The reaction takes place with formation of the readily soluble, neutral tartrate, as follows: $2KHC_4H_4O_6+K_2CO_3=CO_2+H_2O+2K_2C_4H_4O_6$. In order to obtain a purer product, the bicarbonate is often employed. (For detailed directions, see preceding edition of this *Dispensatory*.)

Description.—Neutral tartrate of potassium forms fine, white, or transparent crystals, consisting of 4 or 6-sided prisms, or a white powder, odorless, somewhat deliquescent, and of a saline, slightly bitter taste, and a neutral reaction to litmus. It is soluble in 0.7 part of water at 15° C. (59° F.), and in 0.5 part of boiling water; almost insoluble in cold alcohol. Its aqueous solution decomposes upon keeping. When heated, the salt melts, becomes black, and evolves inflammable vapors, having the odor of burnt sugar. On moderate ignition, it leaves a blackened residue of an alkaline reaction, strongly effervescing with acids, on account of the formation of carbonate. Diluted acids precipitate crystals of cream of tartar from solutions of the salt, as follows: $K_2C_4H_4O_6+HCl=KHC_4H_4O_6+KCl$. Hence, the neutral potassium tartrate is incompatible with acids, or acid fruit juices; also with the salts of barium, magnesium, calcium, etc., owing to the formation of insoluble tartrates of these elements. A concentrated solution yields with test solution of silver nitrate a white precipitate, which becomes black upon boiling.

Tests.—Potassium tartrate is probably very seldom adulterated, but may contain accidental impurities. Mr. Haussmann (*Amer. Jour. Pharm.*, 1894, p. 297) found several commercial specimens to contain appreciable quantities of lead. If the salt does not yield a perfectly clear solution with water, tartrate of calcium is to be suspected; the filtered liquid, which will still retain a portion of the calcium salt, gives in this case a precipitate with oxalate of ammonium; if, when filtered from this, a fresh precipitate is caused by phosphate of ammonium, magnesium salts are present. If the residue, after dissolving the salt in water, is not entirely soluble in hydrochloric acid, silica is probably present. The presence of heavy metals, such as lead and copper, may be detected by the brown or black coloration or precipitate produced with hydrogen sulphide T.S. in an aqueous solution of the salt. Copper gives a reddish-brown, iron a blue precipitate or color with ferrocyanide of potassium; alumina may be detected by carbonizing the salt, boiling the residue with excess of diluted sulphuric acid, filtering, and then supersaturing with ammonia, when a white, flocculent precipitate occurs, which, being washed, dried, and heated with solution of cobaltous nitrate, on charcoal, acquires a blue color (*Thénard's blue*). Sulphuric and hydrochloric acids are also liable to be present in the form of salts.

The *U. S. P.*, 1880, directed for this salt the following tests: "A 10 per cent aqueous solution should yield no precipitate with test solution of oxalate of ammonium (absence of calcium). On adding nitric acid to a 1 per cent solution of the salt, until the precipitate first formed is redissolved, the resulting solution should yield no precipitate with test solution of chloride of barium (sulphate), and, at most, only a cloudiness with test solution of nitrate of silver (limit of chloride). If 2.938 Gm. of tartrate of potassium are ignited, until gases cease to be evolved, the alkaline residue should require, for complete neutralization, not less than 25 Cc. of the volumetric solution of oxalic acid (corresponding to 100 per cent of pure tartrate of potassium)"—(*U. S. P.*, 1880).

Action, Medical Uses, and Dosage.—This salt is a gentle purgative and diuretic, communicating alkaline properties to the urine, owing to the fact that it is eliminated as a carbonate. It has been employed in *dyspepsia*, *diarrhœa*, *liver complaint*, in *uric acid deposits*, and sometimes as an adjunct to other more active purgatives, as infusion of senna. It may be given in doses varying from 1 or 2 drachms to ½ ounce, or even an ounce, in sufficient water.

PRIMULA.—PRIMROSE

Primula officinalis, Jacquin (*Primula veris*, Linné).

Nat. Ord.—Primulaceæ.

COMMON NAME: *Primrose*.

Botanical Source.—The primrose is a perennial, stemless plant, having a short, upright, scaly root-stalk, of a brownish color, and giving off numerous fleshy roots, which contain a yellow meditullium and are covered with a thick and mealy bark. The pendulous flowers (*flores primulæ*) are borne in umbels of 10 or 12 upon scapes, which are either short or long. The 5-angled calyx is pale-yellow, while the corolla is of a lemon-yellow hue, and is marked in the throat with 5 blotches of a saffron color. The fresh root is slightly sweet in odor, while the taste, at first sweetish, is afterward acrid and bitterish. The flowers, when fresh, have a sweetish taste, and an odor suggestive of honey. When dry they have a deep-greenish color. Primrose is well known as a garden plant, and is native to the grassy and wooded lands of Europe and north Asia.

Chemical Composition.—The root of *Primula veris*, according to Saladin (1830), contains an acrid, neutral principle, which he called *arthanitin*, and which he had previously discovered in the root of *Cyclamen europæum*, Linné. Buchner and Herberger (*Repert. f. d. Pharm.*, Vol. XXXVI, 1831, p. 36) named it *cyclamin* ($C_{20}H_{34}O_{10}$, Hilger and Mutschler). It is a white, crystallizable powder, soluble in alcohol, insoluble in ether, chloroform, and oils; soluble, with difficulty, in water. The aqueous solution foams upon shaking. Upon drying the root, cyclamin decomposes to some extent. De Luca and Hilger found this substance to be a glucosid. By boiling with diluted acids, it splits into sugar and *cyclamiretin* ($C_{15}H_{22}O_2$). Saladin also found the root to contain a semisolid, yellowish essential oil, having the odor of fennel. It deposits *primula camphor* ($C_{11}H_{12}O_5$, Hilger and Mutschler), melting at 49° C. (120.2° F.), soluble in alcohol, ether, benzol, soluble with difficulty in water, and producing a violet color with ferric chloride.

Action, Medical Uses, and Dosage.—This plant constituted an important remedy in the early days of medicine. Under the names *Radix paralyseos* and *Radix arthritica*, it was formerly in great repute in *paralysis* and *gout*, and the plant was valued as a remedy in *muscular rheumatism*, *neuralgic headache* (*hemicrania*), *dysmenorrhœa*, *toothache*, *gravel*, and *insomnia*. Primula possesses sternutatory, astringent, vermifuge, antispasmodic, and pain-relieving properties. It is now seldom employed in medicine. Prof. J. M. Scudder (*Spec. Med.*, p. 212) suggests a tincture of the fresh plant in bloom (℥viij to alcohol, 98 per cent, Oj), the dose of which should range from the fraction of a drop to 10 drops. He gives the following indications: "Extreme sensitiveness, pain from slight impressions, restlessness, and insomnia." Infusion may be made of 5 to 10 per cent strength, the dose being ½ fluid ounce; dose of the flowers, 5 to 15 grains.

Related Species.—*Primula auricula*, Linné. Europe, in the mountains and cultivated. Fragrant lemon-yellow flowers. The aqueous distillate of the root deposits fragrant *auricula camphor* (Hunefeld). This species has, for ages, been used in certain parts of Germany as a remedy for *phthisis pulmonalis*. Other plants related to primrose are:

Primula elatior, Jacquin.—Europe. Large odorless flowers.

Lysimachia quadrifolia, Linné, *Crosswort.*—North America. Flowers yellow.

Lysimachia nummularia, Linné, *Moneywort.*—Europe, and naturalized in North America. Flower large and bright-yellow.

Primula obconica, England, is said to produce an eruption similar to that produced by poison ivy (*Rhus Toxicodendron*). Dr. J. H. Neale (see *Amer. Homœopathist*, Dec., 1897, p. 429) reports an interesting severe case of poisoning by this plant. Lotions of glycerin and alcohol (containing tincture of belladonna) gave relief.

PRINOS.—BLACK ALDER.

The bark and berries of *Prinos verticillatus*, Linné (*Ilex verticillata*, Gray).

Nat. Ord.—Aquifoliaceæ.

Common Names: *Black alder, Winterberry, Feverbush.*

Botanical Source.—This is an indigenous shrub of irregular growth, sometimes known as winterberry, having a stem 6 or 8 feet in height, with a grayish bark, and alternate branches. The leaves are alternate or scattered, on short petioles, oval, acute at the base, pointed, sharply serrate, of an olive-green color, smooth above, and downy beneath, particularly on the veins. The flowers are small, white, diœcious, on very short peduncles; the fertile ones somewhat clustered or solitary; the sterile ones sub-umbellate, and sometimes the flowers are monœcious. Calyx small, 6-cleft, and persistent. Corolla monopetalous, spreading, without a tube, the border divided into 6 obtuse segments. Stamens equal in number to the segments of the corolla, erect, with oblong anthers; in the fertile flowers they are shorter than the corolla, in the sterile they are equal in length to it. The ovary is large, green, and roundish, with a short style and obtuse stigma. The fruit consists of bright-scarlet, globular berries, about the size of a pea, supported by the persistent calyx, and crowned with the stigma. They are 6-celled, containing 6 long seeds, which are convex outwardly, and sharp-edged within. The berries are in scattered groups on the stem, forming small, apparently verticillate bunches (L.—W.).

History, Description, and Chemical Composition.—Black alder is common throughout the United States, growing in moist woods, swamps, edges of streams, etc., flowering from May to July, and maturing its fruit in the latter part of autumn. The bark and berries are medicinal. The dried bark of commerce is in pieces, either flat or slightly quilled, thin, white, with a greenish tint within, brownish-gray externally, readily pulverizable, inodorous, but of a bitterish, subastringent taste. It yields its properties to water by infusion or decoction. The berries have a saccharine, bitterish taste, and yield their virtues to water or alcohol. They should not be substituted, in practice, for the bark. They have not been analyzed. The bark contains, according to L. C. Collier (*Amer. Jour. Pharm.*, 1880, p. 437), resin, wax, tannin, chlorophyll, starch, sugar, albumen, and a yellow, amorphous, bitter principle. (For a quantitative analysis of the bark of this shrub, by J. Stewart Smith, see *Amer. Jour. Pharm.*, 1890, p. 275.)

Action, Medical Uses, and Dosage.—Black alder is tonic, alterative, and astringent. It strengthens the circulation, improves nutrition, and aids in the removal of waste material, thus effectually aiding the vegetative processes. It has been used with good effect in *jaundice*, *diarrhœa*, *gangrene*, and all diseases attended with great weakness. It has also been of service in *dropsy*. Two drachms of the powdered bark and 1 drachm of golden-seal, infused in a pint of boiling water, and, when cold, taken in the course of a day, in doses of a wineglassful, and repeated daily, has proved very valuable in *dyspepsia*. Externally, the decoction forms an excellent local application to *gangrene*, to *indolent ulcers*, some *affections of the skin*, etc. The berries are cathartic and vermifuge, and form, with cedar-apples, a pleasant and effectual worm medicine for children (see *Juniperus Virginiana*). Dose, of the powdered bark, from ½ to 1 drachm; of the decoction, 4 fluid ounces, 3 or 4 times a day. A tincture of the recent bark (℥viii to alcohol, 76 per cent, Oj) may be given in doses of from 5 to 30 drops. Black alder bark is an ingredient of several alterative syrups.

Related Species.—*Prinos glaber*, Linné (*Ilex glabra*, Gray), *Inkberry*. This species grows along the Atlantic seaboard, from Massachusetts south, being most abundant in the southern states. Its berries are black.

Prinos lævigatus, Pursh (*Ilex lævigatus*, Gray).—In northern states, in marshes and southward, and in the Allegheny Mountains.

PRUNUM (U. S. P.)—PRUNE.

"The fruit of *Prunus domestica*, Linné"—(*U. S. P.*).

Nat. Ord.—Rosaceæ.

COMMON NAMES: *Prune tree, Plum tree.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 96.

Botanical Source, History, and Description.—This tree is about 20 feet in height, thornless, and has serrate, oval-elliptic leaves, and pedunculated, whitish flowers, appearing singly or paired. A great number of varieties have been produced so that the fruits differ in size, shape, and color. Its native country is western Asia, but it is now cultivated in most temperate countries.

The dried or prepared fruit is the only official part, and furnishes the *prunes* of commerce. The best prunes come from Bordeaux; an inferior grade is received from Germany. California prunes are of superior quality. Prunes are prepared in warm countries by placing them on hurdles and drying them by solar heat; in colder climates, artificial heat is employed. They have a faint, peculiar odor, and a sweetish, slightly acidulous, and viscid taste. The official prunes are "oblong or subglobular, about 3 Cm. (1¼ inches) long, shrivelled, blackish-blue, glaucous; the sarcocarp brownish-yellow, sweet, and acidulous; putamen hard, smooth, or irregularly ridged; the seeds almond-like in shape, but smaller, and of a bitter-almond taste"—(*U. S. P.*).

Chemical Composition.—The fresh fruits contain about 80 or 85 per cent of water. Dried prunes, analyzed by Bertram (*Jahresb. der Pharm.*, 1878, p. 184), had the following composition: Kernels, 13.7; pulp, 86.3 per cent. The latter contained water (30.03), albumen (1.31), crude fiber (1.34), ash (1.18), nitrogen-free extractive matter (52.44); the latter consisting of grape sugar (42.28), cane sugar (0.22), starch (0.22), free acid (1.74), pectin matter (4.22), undetermined substance (3.76). The acid occurring in prunes, according to Scheele and later observers, is malic acid. The crushed seeds yield upon maceration and subsequent distillation with water, an essential oil containing hydrocyanic acid; this is due to the presence of *amygdalin* (about 1 per cent) and the ferment, *emulsin*, in the seeds (see *Amygdala*). They also contain a brown-yellow, non-drying, fixed oil. Gum sometimes exudes from the ripe fruits.

Action, Medical Uses, and Dosage.—In Germany, a sort of brandy is made from this fruit. Dried prunes are mildly laxative, and are frequently employed in decoction, or the fruit eaten stewed, in convalescence from acute diseases, forming a nourishing and agreeable diet. They are often added to cathartic decoctions, to improve the flavor, and promote the purgative effect. They enter into the composition of the confection of senna. In large quantities, and with some dyspeptics, they are apt to disorder the bowels. The following preparation has been administered with much success in *leucorrhœa*, *irregular menstruation*, and in *debility* from frequent *abortions*: Take of small raisins, or dried currants, 2 ounces, aniseseed, mace, and cinnamon, of each, ½ ounce; and 1 nutmeg, in powder. To these add 1 quart of prune brandy, and let them macerate for 2 weeks, frequently agitating. This is the formula as originally given. Of the clear tincture thus made, 1 fluid ounce may be given previous to a meal, and repeated 3 times daily.

PRUNUS VIRGINIANA (U. S. P.)—WILD CHERRY.

"The bark of *Prunus serotina*, Ehrhart," * * * "collected in autumn"—(*U. S. P.*). (*Cerasus serotina*, De Candolle; *Cerasus virginiana*, Michaux; *Prunus virginiana*, Miller.).

Nat. Ord.—Rosaceæ.

COMMON NAME: *Wild cherry.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 97.

Botanical Source.—The wild cherry is a large tree, generally from 50 to 80 feet high, from 2 to 4 feet in diameter, being of uniform size, and undivided to the height of 20 or 30 feet. The bark is black, rough, and separates naturally from the trunk in thick, slender laminæ. The wood is compact, fine-grained, receives a fine polish, and is extensively employed by cabinet manufacturers. The leaves are deciduous, oval-oblong, acuminate, finely and unequally serrate, with incurved, short, and callous teeth, thickish, smooth, no hairs on the under side, shining above, 3 to 5 inches long, half as wide, and borne on petioles which are furnished with 1 or 2 pairs of reddish glands. The flowers are white, in long, erect, terminal racemes, with a small, solitary flower now and then in the axil of the leaves next to the raceme. Bracts inconspicuous. Calyx with sharp, shallow segments. The fruit is a globular drupe, about as large as a pea, of a purplish black color, edible, but having a bitter taste (L.—W.—G.).

History and Description.—This tree is the *Cerasus serotina* of De Candolle, and the *Cerasus virginiana* of Michaux. It was long confused with and went by the name of *Prunus virginiana*, which properly belongs to the *Choke cherry*, as given by Linnæus (see *Related Species*).

The wild cherry tree is found in many parts of the United States, but is most abundant, and attains the greatest magnitude, in the southwestern states. Its flowers appear in May, and the fruit ripens in August and September. The official portion is the bark, and that of the root should be preferred to that of the trunk and branches. It should be renewed annually, as its properties are much impaired by age. As officially described, wild cherry bark is "in curved pieces or irregular fragments, 2 Mm. ($\frac{1}{12}$ inch) or more thick, outer surface greenish-brown, or yellowish-brown, smooth and somewhat glossy, marked with transverse scars; if the bark is collected from old wood, and deprived of the corky layer, the outer surface is nut-brown and uneven; inner surface somewhat striate or fissured. Upon maceration in water it develops a distinct bitter-almond odor. Its taste is astringent, aromatic, and bitter. The bark of the very large and of the very small branches is to be rejected"—(*U. S. P.*). Water and alcohol take up its virtues; boiling impairs its medicinal properties, by driving off the hydrocyanic acid. That gathered in the fall of the year is the best, inasmuch as it yields more hydrocyanic acid than that collected at any other season; the bark collected in the spring being the least desirable. In order to establish whether a given specimen of bark was collected in autumn, Grace E. Cooley (*Journal of Pharmacology*, 1897, p. 167) recommended to test it for starch and tannin. The starch contained in bark reaches a maximum in spring (April) and in autumn (October), and disappears almost entirely in summer and in winter. Tannin occurs in spring bark in a notably greater quantity than in bark collected in autumn. The distinction is recognizable by means of the ferric chloride test for tannin (for details, see the original paper). Hence, the bark collected in autumn is characterized chemically by containing much starch and little tannin, and yielding the largest amount of hydrocyanic acid.

Chemical Composition.—Dr. Stephen Procter (*Amer. Jour. Pharm.*, Vol. VI, 1834, p. 8), made the first detailed analysis of this bark, and found it to contain starch, resin, tannin, gallic acid, fatty matter, etc., and a straw-colored, volatile oil, analogous to that from bitter almonds, and, like the latter, containing prussic acid. Prof. W. Procter (*ibid.*, Vol. X, 1838, p. 197) showed that the volatile oil is the decomposition product of *amygdalin* (see *Amygdala*), which he isolated from the bark. A ferment, analogous to emulsin, is probably present. The yield in essential oil, according to Schimmel & Co. (*Report*, April, 1890), is 0.2 per cent. Prof. F. B. Power and Mr. Henry Weimar (*Pharm. Rundschau*, 1887, p. 203) state that wild cherry bark does not contain crystallizable amygdalin, but an analogous substance, obtainable only in an extract-like form, and probably more closely related to *laurocerasin* (see *Laurocerasi Folia*). According to the same authors, the fluorescent principle contained in the bark, is a crystallizable glucosid, which is probably also the cause of the peculiar bitterness of the bark (compare R. Rother, *Amer. Jour. Pharm.*, 1887, p. 286). The amount of hydrocyanic acid obtainable from the bark varies from 0.05 per cent, in April, to 0.14 per cent in October (J. S. Perot, *Amer. Jour. Pharm.*, 1852, p. 111). More recently, A. B. Stevens and J. N. Judy (*Proc. Amer. Pharm. Assoc.*, 1895, p. 226) found notably higher results—viz.: 0.32 to 0.34 per cent for thick bark, and 0.24 to 0.27 per cent for thin bark, the higher results being probably due to a more perfect exhaustion of the bark, owing to repeated distillation. The same authors found 4.12 per cent of amygdalin-like substance in thick bark. and 3.16 per cent in thin bark. (For an admirable review of the earlier chemical and the botanical history of wild cherry bark, see R. Bentley, *Pharm. Jour. Trans.*, Vol. V, 1863, p. 97.)

Action, Medical Uses, and Dosage.—Wild cherry bark has a tonic and stimulating influence on the digestive apparatus, and a simultaneous sedative action on the nervous system and circulation. It is, therefore, valuable in all those cases where it is desirable to give tone and strength to the system, without, at the same time, causing too great an action of the heart and blood vessels, as, during convalescence from *pleurisy, pneumonia, acute hepatitis,* and other *inflammatory* and *febrile diseases.* Its chief property is its power of relieving irritation of the mucous surfaces, making it an admirable remedy in many *gastro-intestinal, pulmonic,* and *urinary troubles.* Like lycopus, it lessens vascular excitement, though it does not control hemorrhages like that agent. It is best adapted to chronic troubles. It is also useful in *hectic fever, cough, colliquative diarrhœa,* some forms of *irritative dyspepsia, whooping-cough, irritability of the nervous system,* etc., and has been found an excellent palliative in *phthisis,* the syrup being employed to moderate the cough, lessen the fever, and sustain the patient's strength. It has likewise been of service in *scrofula* and other diseases attended with much debility and hectic fever. Wild cherry is an excellent sedative in *cardiac palpitation,* not due to structural wrongs. It is particularly useful in this disorder when there is nervous fever, *tuberculosis,* or the debility consequent upon *irritative dyspepsia, anemia, chlorosis,* or *nervous diseases.* Externally, it has been found useful, in decoction, as a wash to *ill-conditioned ulcers* and *acute ophthalmia.* Dose of the powdered bark, 1 or 2 drachms; of the infusion, 1 ounce of bark to 1 pint of cold water, and allowed to stand a few hours, from 1 to 4 fluid ounces, 4 or 5 times a day, and which is the best mode of using it; syrup of wild cherry, 1 fluid drachm. This agent may be used as a vehicle for Fowler's solution and other medicines. Specific prunus, 1 to 20 drops.

Specific Indications and Uses.—Rapid, weak circulation; continual irritative cough, with profuse muco-purulent expectoration; cardiac palpitation, from debility; dyspnœa; pyrexia; loss of appetite; and cardiac pain.

Related Species.—*Prunus virginiana* of Linné and Marshall (*Prunus obovata,* Bigelow; *Cerasus virginiana,* De Candolle; *Prunus demissa,* Walters), *Choke cherry.* Common in the United States and Canada, and, according to Prof. Sargent, "the most widely distributed of any American species of tree" (Prof. E. S. Bastin, *Amer. Jour. Pharm.*, 1895, p. 595). A small shrub, sometimes arborescent, usually from 6 to 10 feet high, having thin, oval, or obovate, sharply-serrate leaves, terminating in an abrupt point. The flowers are white, and borne in short, dense racemes. The fruit is a red, or purplish-red, bitterish, and exceedingly astringent berry. The latter is often employed, in combination with cider, in domestic medication.

Related Preparation.—*Elixir Pinus Compositus.* This is a *cough* mixture, representing the combined virtues of white pine (fresh bark), balm of gilead buds, spikenard, cherry bark, ipecac, sanguinarine nitrate, chloroform, morphine acetate, and ammonium chloride. It is an excellent preparation, was introduced under this name, and is prepared only by the Wm. S. Merrell Chemical Co., of Cincinnati, O.

The dried and powdered alcoholic extract known as the "concentration," "*prunin,*" or "*cerasin,*" prepared from both wild cherry and choke cherry, is an inefficient agent, seldom now used.

PSORALEA.—PSORALEA.

The root and leaves of *Psoralea melilotoides,* Michaux.

Nat. Ord.—Leguminosæ.

Botanical Source and History.—The genus Psoralea comprises an extensive family of plants, mostly found in America, and in the neighborhood of Cape of Good Hope. It consists, generally, of glandular-dotted herbs, with from 3 to 5 foliate leaves, and short, thick, indehiscent, 1-seeded legumes. The flowers, which are white or blue, are disposed, in all our indigenous species, in axillary spikes or racemes. The tubular calyx is 5-parted, with the lowest lobe longest.

Psoralea melilotoides, Michaux (*P. eglandulosa,* Elliott), is the most common native species, found in open woods from Ohio and Kentucky, southward. The plant is pubescent and nearly glandless. The pale-blue flowers are borne on peduncles about 4 inches long. The leaves are trifoliate, with entire lanceolate leaflets. The root is variously known as *Bob's root*, *Samson snake-root*, and *Congo root*. The fresh root has an agreeable, aromatic odor, and a bitterish, spicy, even acrid taste. Odor and taste are weaker after drying the root. It contains about 2 per cent of a volatile oil, starch, and a bitter principle, probably also a substance resembling tannin.

Psoralea esculenta, Pursh, is indigenous to the elevated plains of the northwest. It has 5 leaflets and capitate spikes of blue flowers. The root is bulbous, and is said to act as a diuretic, although, when boiled, it is used as food by the natives. It is called *Bread root*, *Prairie turnip*, and sometimes (erroneously) *Indian turnip*. According to Mr. Clifford Richardson, the root of this species contains nearly 70 per cent of starch (see Prof. J. M. Maisch's interesting report on useful plants of the genus Psoralea, in *Amer. Jour. Pharm.*, 1889, pp. 345–352).

Besides these, there are several other species of Psoralea, among them the following: *P. bituminosa*, Linné, of the south of Europe, a tonic emmenagogue; *P. glandulosa*, Linné, to which, at one time Paraguay tea or Yerva mate was erroneously referred (see J. M. Maisch, *loc. cit.*, and analysis by Lenoble, *Jour. d. Pharm.*, 1850); *P. pentaphylla*, Linné, of Mexico, the root of which is sometimes called *White contrayerva* (see analysis by Mariano Lozano y Castro, in Prof. Maisch's report, *loc. cit.*); and *P. corylifolia*, Linné, of India and Arabia. The seeds of this species (*bauchee seeds*) are employed as a tonic in cutaneous affections.

Action, Medical Uses, and Dosage.—The root and leaves of these plants appear to possess the properties of a mild, stimulating, bitter tonic, and have been advantageously employed in cases of languor or feebleness from mental or physical exertion, in certain forms of *chronic dyspepsia*, to relieve anorexia, and as a stimulating tonic in *strumous affections of the mesentery*, accompanied with *diarrhœa*, tumid abdomen, etc. The *Psoralea melilotoides* is the plant employed in this country, in infusion, or made into a tincture.

PTELEA.—WAFER ASH.

The bark of the root of *Ptelea trifoliata*, Linné.

Nat. Ord.—Rutaceæ.

Common Names: *Wafer ash*, *Shrubby trefoil*, *Hop tree*, *Swamp dogwood*, *Wingseed*.

Botanical Source.—This plant is a shrub from 6 to 8 feet in height, leaves trifoliate, marked with pellucid dots; leaflets sessile, ovate, short, acuminate, downy beneath when young, crenulate, or obscurely toothed; lateral ones inequilateral, terminal ones cuneate at the base, 3 to 4½ inches long by 1¼ to 1¾ inches wide. The flowers are polygamous, greenish-white, nearly ½ inch in diameter, of a disagreeable odor, and borne in terminal corymbose cymes. Stamens mostly 4; style short. The fruit is a 2-celled samara, nearly 1 inch in diameter, winged all around, and nearly orbicular (G.—W.).

Fig. 202.

Ptelea trifoliata.

History and Description.—Wafer ash, or ptelea, is a shrub common to this country, growing more abundantly west of the Alleghanies, in shady, moist hedges, and edges of woods, and in rocky places; it flowers in June. The bark of the root is medicinal, and yields its properties to boiling water, but alcohol is its best solvent. It is when dried, of a light, brownish-yellow color externally, in cylindrical rolls or quills, 1 or 2 lines in thickness, and from 1 to several inches in length, irregularly wrinkled and furrowed externally, with broad, transverse lines or rings at short but irregular intervals, and is covered with a thin epidermis; internally it is yellowish-white, but becomes darker on exposure, and is wrinkled longitudinally.

It is brittle, with an almost smooth, resinous fracture; granular under the microscope, resembling wax. It has a peculiar smell, somewhat similar to that of liquorice root, and a peculiar, bitter, resinous, pungent, acrid, and rather disagreeable taste, speedily and powerfully acting upon the mouth and fauces, and of persistent pungency, which is probably owing to its oleoresin. The leaves and fruit have also been used in medicine. A related species, *Ptelea angustifolia*, Bentham, is indigenous to Colorado.

Chemical Composition.—Mr. George M. Smyzer (*Amer. Jour. Pharm.*, 1862, p. 200) found the bark of the root to contain gum, albumen, starch, volatile oil, of disagreeable taste and odor, fixed oil, and probably potassium nitrate. No tannin was present. The active properties of the root he believes to be due both to the volatile oil and an acrid, soft resin, soluble in alcohol and ether; another brittle resin, soluble in ether, but insoluble in alcohol, is inert. The leaves yield to water a bitter infusion, resembling in taste that of hops, and containing tannic and gallic acids. The fruit is likewise bitter, and yields the same resins as the root. Justin Steer (*ibid.*, 1867, p. 337) believes the bitterness of the root-bark and its virtues, as a tonic, to be due to *berberine*. More recently (*Jahresb. der Pharm.*, 1896, p. 510). E. Schulze found the root of *Ptelea trifoliata*, to contain the base *arginine* ($C_6H_{14}N_4O_2$), a constituent of germinating *Lupinus luteus*, and other plants, and one of the decomposition products of horn, obtained when treating it with hydrochloric acid and stannous chloride (S. G. Hedin, *Chem. Centralblatt*, Vol. II, 1894, p. 993; and Vol. I, 1896, p. 118). It is characterized by a dark-blue crystallizable compound with copper nitrate ($[C_6H_{14}N_4O_2]_2.Cu[NO_3]_2.3H_2O$).

Action, Medical Uses, and Dosage.—Ptelea is tonic, and surpassed in this line only by hydrastis. Used after *intermittent fevers*, *remittent fevers*, and all cases of *debility* where tonics are indicated. Said also to be anthelmintic. Equal parts of ptelea and Euonymus atropurpureus, have been found very useful in *pulmonary affections*. A tincture of ptelea, made in whiskey, is reputed to have cured several cases of *asthma*, and is said to cause, in many instances where it has been used, a troublesome external *erysipelatous inflammation*, either general or local, but which, if the use of the tincture be persisted in, finally disappears, and the patient becomes, at the same time, permanently cured of the disease for which he was treated. This would certainly indicate other valuable properties in this plant, than those with which we are acquainted, which deserve a further and thorough investigation. Prof. I. G. Jones stated that this bark is a pure, unirritating tonic, having rather a soothing influence when applied to irritated mucous membranes. He has employed it advantageously in convalescence after fevers, and in debility connected with gastro-enteric irritation. It promotes the appetite, enables the stomach to endure suitable nourishment, favors the early reestablishment of digestion, and will be tolerated by the stomach when other tonics are rejected. He employed it in cold infusion, of which ½ fluid ounce may be given every 2, 3, or 4 hours, according to circumstances. It is also said to cure intermittent fever, and is considered by some to be equal to quinine. It may be used in powder, tincture, or extract. Dose of the powder, 10 to 30 grains, 3 or 4 times a day; of the tincture, 1 or 2 fluid drachms; of the extract, 5 to 10 grains; specific ptelea, 1 to 20 drops.

Specific Indications and Uses.—Asthmatic breathing; chronic diseases, with sense of constriction in the chest, and short breathing.

PTERIS.—PTERIS.

The whole plants of *Pteris atropurpurea*, Linné, and other species of *Pteris*.

Nat. Ord.—Filices.

COMMON NAMES: (1) *Rockbrake;* (2) *Common brake.*

Botanical Source.—Rockbrake is an indigenous perennial fern, with a frond 6 to 10 inches in height, twice as long as wide, of a grayish hue, pinnate, the two lower divisions consisting of 1 to 3 pairs of leaflets, with a large terminal segment. The stipe and rachis are dark-purple, shining, with dense, paleaceous hairs at base. The lower leaflets are ternate or pinnate, lanceolate, obtuse, distinct, obliquely truncate or subcordate at the base, with margins conspicuously revolute. The involucre is rather broad, and formed of the inflected margin of the frond, opening inwardly. The sori are in a broad, continuous line along the margin of the frond. The several varieties of this species possess similar properties, as the *Pteris venosa*, with the stipe angled, and the leaflets veined beneath; *P. punctata*, with the stipe terete, and the leaflets punctate beneath (W.—G.).

The *Pteris aquilina*, Linné, or *Common brake*, likewise possesses analogous virtues. It is a fern 2 to 5 feet in height, upon a smooth, dark-purple, erect stipe. The frond is pinnate, 3-parted, broad-triangular in outline; the branches bipinnate; the leaflets linear-lanceolate; the lower ones pinnatifid, upper ones entire; the segments oblong and obtuse. The sori are covered by the folding back of the margins of the segments (W.).

History, Description, and Chemical Composition.—Rockbrake is common to the United States, usually growing on limestone rocks; the common brake is found in great abundance in woods, pastures, waste grounds, and stony hills. The whole plant is used in medicine, and imparts its virtues to water. As found in commerce, the dried root consists of a long cylindrical caudex, of a dark-brown color externally, and a light brownish-red internally, of an astringent, leathery taste, and around which are closely arranged, overlapping each other like the shingles of a roof, the remains of the leaf-stalks or stipes, which are 1 or 2 inches in length, from 2 to 4 lines thick, somewhat curved and directed upward, angular, dark-brown, furrowed longitudinally, and from between which emerge numerous small, radical fibers. The dried leaves are of a light-grayish or greenish-yellow color, of an odor resembling that of sole-leather, and a leathery, astringent, not disagreeable taste. As sold, it is usually in broken fragments. According to Wackenroder, the root of the common brake contains a bitter substance, fatty oil, mucilage, starch (33.5 per cent), tannin, etc. It also contains volatile oil and *filicin*, a derivative of the phenol *phloroglucin* ($C_6H_3[OH]_3$).

Action, Medical Uses, and Dosage.—Rockbrake is astringent and anthelmintic. A decoction of it, taken moderately, has proved efficient in *diarrhœa*, *dysentery*, *night-sweats*, and *hemorrhages;* and, used as a local application, it is beneficial in obstinate and ill-conditioned *ulcers*, *ulcerations of the mouth and fauces*, and as a vaginal injection in *leucorrhœa*. A strong decoction is in repute as a remedy for *worms*. A powerful astringent infusion may be made by adding 4 drachms of the plant to 1 pint of boiling water, and which has been used in diarrhœa and dysentery, in ½ fluid ounce doses, repeated every 2 or 3 hours, with success. A tincture of the fresh entire plant (℥viii to alcohol, 76 per cent, Oj) is suggested in from 1 to 10-drop doses (Scudder). *Pteris aquilina* is sometimes called *Female fern*, and has been used to expel *tapeworm*.

A plant called *Winter fern*, or *Brake*, is much employed in *amenorrhœa* and in *suppression of the lochia;* it is used in infusion and taken freely. By some it is supposed to be the *Pteris atropurpurea*, but of this I am not positive, not having been able to obtain a perfect specimen of the plant for examination. Both the roots and tops are used, and are worthy the attention of the practitioner in the above-named derangements (J. King).

PULSATILLA (U. S. P.)—PULSATILLA.

"The herb of *Anemone Pulsatilla* and *Anemone pratensis*, Linné, collected soon after flowering. It should be carefully preserved, and not be kept longer than 1 year"—(*U. S. P.*).

Nat. Ord.—Ranunculaceæ.

COMMON NAMES: *Pasque flower*, *Passe flower*, *Wind flower*, *Meadow anemone.*

ILLUSTRATION: Meehan, *Native Flowers and Ferns*, Vol. I, 49.

Botanical Source.—ANEMONE PRATENSIS (*Pulsatilla nigricans*, *Pulsatilla pratensis*, Miller), *True* or *Small meadow anemone.* This is a handsome species of this genus of perennial plants, with simple, erect, rounded stems, from 3 to 5 inches high. The leaves are radical, pinnatifid, and downy; the segments many-parted, with linear lobes. The flowers are solitary, terminal, pendulous, deep-purple or violet-brown, having 6 sepals, somewhat narrow, pointed, reflexed at the point, erect and converging at the base. Stalked glands or sterile stamens are found between the fertile stamens and sepals (L.). The proximity of the involucre is such that it has a calyx like appearance.

ANEMONE PULSATILLA (*Pulsatilla vulgaris*, Miller).—This plant differs from the preceding by having the involucre more remote from the flower, at least in the mature plant, in being more hairy, and in possessing a scape curved above and more shaggy than that of the preceding plants. Its flower is but half the size and of a deeper color than that of *Anemone pratensis*.

Fig. 203.

Anemone Pulsatilla.

History.—Pulsatilla or Pasque flower grows in Turkey, in Russia, and in other parts of Europe, as in Germany, France, Denmark, Sweden, and southern England. It also grows in Asia, in open fields, plains, hills, sandy pasture grounds, and open pine woods, exposed to the sun, flowering early in the spring, and, according to some writers, again in the latter part of summer or early in the fall. Owing to its early blooming period, at about Eastertide, it has been named by the French *Pasque flower*, having reference to the Passover and Paschal ceremonies. The plant has a very slight odor, and an acrid, pungent taste. The leaves are not fully matured at the early flowering period. The whole plant is covered with soft, silky, white hairs, giving to it a lax, shaggy, woolly appearance. All species of Anemone wilt very quickly. An acrid, volatile constituent is emitted when the fresh plant is bruised, sufficiently powerful to produce lachrymation and even vesication. To give its best therapeutic action, the plant should be put into alcohol before being allowed to dry. Alcohol appears to be its best menstruum. The tincture may be prepared by macerating 2 pounds of the fresh plant in 4 pints of strong alcohol, then expressing and filtering. It has a brownish-green color, and an acrid, pungent taste. Even fluid preparations of pulsatilla become altered with age, consequently the physician should frequently renew his stock.

Description.—The *U. S. P.* thus describes the drug: "Leaves radical, petiolate, silky-villous, twice or thrice deeply 3-parted, or pinnately-cleft, with linear, acute lobes, appearing after the large, purple flowers; inodorous, very acrid"—(*U. S. P.*).

Chemical Composition.—Pulsatilla, in fresh condition, yields upon distillation with water, a colorless to yellow, acrid oil, from which chloroform abstracts crystallizable, acrid, vesicating *anemone camphor*. It is an unstable body and readily decomposes into *anemonin* and *isoanemonic acid*, especially when in moist condition. (For further details, see *Anemone patens* var. *Nuttalliana*.) The formula ($C_{10}H_8O_4$) given to *anemonin* by Beckurts (1892) was confirmed by Hans Meyer (*Jahresb. der Pharm.*, 1896, p. 509), who believes it to be related to *cantharidin* ($C_{10}H_{12}O_4$). Pulsatilla also contains iron-greening tannin.

Action, Medical Uses, and Dosage.—Topically applied, the fresh plant of pulsatilla is irritant, and, if kept long in contact with the skin, may produce vesication. When chewed, it produces a benumbing sensation and tingling formication, somewhat like that produced by aconite or prickly ash. Taken internally in overdoses, it acts as a gastric irritant, producing a sense of rawness, burning, pain in stomach, with endeavors to vomit, all accompanied with marked prostration. A case of poisoning with these symptoms is on record in the *Medical Gleaner*, Vol. IV, p. 173. A sense of constriction and tightness of the chest, with chilliness, marked weakness, and some congestion, has been produced by large doses. Full doses depress the action of the heart, lower arterial tension, and reduce temperature. Sensory and motor paralyses have followed large doses of pulsatilla, while toxic doses may produce mydriasis, stupor, coma, and convulsions. In medicinal doses, pulsatilla increases the power and regulates the action of the heart, and gives a better character to the pulse rate, particularly slowing the irritable, rapid and feeble pulse due to nervous depression. It improves the sympathetic system and cerebral functions, and especially strengthens sympathetic innervation, this action being very marked in troubles of the reproductive organs of male and female.

Pulsatilla forms an important remedy with the Eclectic physicians as well as with the Homœopaths, who make extensive use of it. According to the late Prof. J. M. Scudder, M. D., who used it largely in his practice, its most important use is to allay irritation of the nervous system in persons of feeble health, thus giving sleep and rest, preventing unnecessary expenditure of nerve force, and, by this means, facilitating the action of tonics and restoratives. In feeble women, and men who have become nervous from sedentary habits or mental over-exertion, as well as in the nervousness and restlessness of masturbators, or persons addicted to the excessive use of tobacco, he has found it very certain in its action. It is *the* remedy for nervous women, when there is debility and faulty nutrition of the nerve centers.

Pulsatilla is a remedy of wide applicability, but more particularly for those conditions in which the mind is a prominent factor. A gloomy mentality, a state of nerve depression and unrest, a disposition to brood over real or imagined trouble, a tendency to look on the dark side of life, sadness, mild restlessness, and a state of mental unrest generally denominated in broad terms "nervousness," are factors in the condition of the patient requiring pulsatilla. A pulsatilla patient weeps easily, and the mind is inclined to wander—to be unsettled. The pulse requiring pulsatilla is weak, soft, and open, and the tissues have a tendency to dryness (except when the mucous tissues are discharging a thick, bland material), and, about the orbits the parts appear contracted, sunken, and dark in color. The whole countenance and movements of the body depict sadness, moroseness, despondency, and lack of tone. Hysteria of the mild and weeping form may be a symptom. The whole condition is one of nervous depression, the nutrition of the nerve centers are at fault. With such symptoms, pulsatilla may be confidently prescribed in the conditions and disorders enumerated in this article. Pulsatilla may be given to produce sleep, when there is great exhaustion and opiates are inadmissible. If the insomnia depends upon determination of blood to the brain, pulsatilla will not relieve, but when due to nervous exhaustion it is a prompt remedy to give rest, after which sleep obtains. Where sleep is disturbed by unpleasant dreams, and the patient awakens sad and languid, pulsatilla should be given. Pulsatilla has a large field in troubles incident to the reproductive organs of both sexes. As an emmenagogue, it serves a useful purpose in *amenorrhœa* in nervous and anemic subjects, with chilliness a prominent symptom. When menstruation is suppressed, tardy or scanty from taking cold, or from emotional causes, pulsatilla is the remedy. In *dysmenorrhœa*, not due to mechanical causes, and with the above-named nervous symptoms, no remedy is more effective. *Leucorrhœa*, with a free, thick, milky, or yellow, bland discharge and pain in the loins, and particularly in scrofulous individuals, calls for pulsatilla. It is a remedy for mild forms of *hysteria*, where the patient is weak and weeps easily, has fears of impending danger, and passes large quantities of clear, limpid urine, and menstruation is suppressed.

The long-continued use of pulsatilla as an intercurrent remedy, is accredited with curative effects in *uterine colic*, but it is of no value during an attack. Pulsatilla frequently proves a good remedy in *ovaritis* and *ovaralgia* with tensive, tearing pain. Sluggish, ineffectual, and weak labor-pains are sometimes remedied by this drug. It is frequently a remedy for *pain*, when dependent on or associated with debility, and sometimes when due to acute inflammation. It is a leading remedy in *epididymitis* and *orchitis*, whether due to gonorrhœal infection or to metastasis from mumps. The dark-red, congested, enlarged, and sensitive testicle indicates it. It relieves the pains of *orchialgia*, and subdues *mammary swelling* from the metastasis of mumps. Pulsatilla increases sexual power, but lessens *morbid sexual excitement*. It is especially valuable in relieving urethral irritation and consequent *spermatorrhœa* and *prostatorrhœa*. In these troubles it overcomes the nervous apprehensions so frequently a troublesome feature. It also alleviates the nervous irritability accompanying or produced by *varicocele*. In *gonorrhœa*, particularly of the chronic type, pulsatilla is of value, when the urethral membrane is swollen. Pulsatilla has been used by some for the relief of *hydrocele*, but for this affection we possess better remedies. Many unpleasant conditions of the urinary apparatus are relieved by pulsatilla, as frequent but ineffectual attempts at urination, the bladder giving a sensation as if bloated; dribbling of urine from movement, the *dysuria of pregnancy*, and in involuntary micturition from colds or from nervous debility.

Pulsatilla frequently proves a useful remedy in *headache* of various types. It relieves the *frontal headache* from *nasal catarrh*, *nervous headache*, particularly when due to gastric disturbances, with greasy taste, *menstrual headache*, with chilliness and suppressed menses, *bilious* and *gastric headaches*, of a dull and heavy character, with greasy taste and nausea, and headaches due to uterine irregularities or to a rheumatic diathesis. These headaches are all of anemic character—the opposite of those relieved by gelsemium. Though ordinarily not a remedy for acute inflammations (contraindicated in gastro-intestinal inflammation), there are some conditions where small doses of pulsatilla are beneficial when the usual symptoms calling for the drug are present. These conditions are *acute inflammation of the nose, fauces, larynx*, or *bronchiæ*. It is especially effective in the secondary stage of *acute nasal catarrh*, when the naso-pharynx is affected and there is a sense of rawness and moisture, and an abundant discharge of thick, yellow, bland, inoffensive mucus or muco-pus. Pulsatilla frequently serves a good purpose in *asthma* superinduced by pregnancy, or by suppressed menses, and it favorably influences *whooping-cough* in properly selected cases. So-called "*stomach cough*" is frequently cured by pulsatilla.

Pulsatilla should be remembered as a remedy of much value to control the catarrhal symptoms of the *exanthemata;* it also controls the irritability frequently accompanying these disorders. In *measles*, it has done good service in checking the coryza and profuse lachrymation, as well as the dry, tight, painful cough, and when retrocession of the eruption has taken place, it has reversed this unpleasant condition. It relieves the irritable condition in *varicella*. Pulsatilla is very efficient in real and imaginary *cardiac affections*. It has proved useful in *cardiac hypertrophy* and in *dilatation of the venous heart*. It is especially effective in *functional heart disorders* with giddiness, imperfect voluntary motion, impaired vision, and with a symptom described as a sense of pressure over the larynx and trachea, with imperfect respiratory movement, and sense of impending danger; the symptoms just preceding are those not unfrequently associated with functional heart disease, dyspepsia, uterine disease, or over-excitation of the sexual system, and are generally very unpleasant and annoying. It often relieves that form of *venous congestion* which stops short of inflammation, as in threatened *ovaritis, orchitis, varicocele*, and *crural phlebitis. Varicocele* and other *varicoses* are frequently improved by its administration with other indicated remedies. Its chief advantage, outside of some control over the venous structure, is its relief of the nervous complications. It has been used to good advantage for the relief of *hemorrhoids*.

Constipation in the hysterical female yields to nux vomica and pulsatilla, and the latter has a pleasing action in some forms of *indigestion* and *dyspepsia*. These cases are those in which there is a thick, creamy paste upon the tongue and a greasy taste. Such troubles are frequently brought about by indulgence in pastries and fatty food. Pain is not marked, but there is pyrosis and greasy eructations, gastric distension, uneasy gnawing sensations in the stomach, and chilliness may be a pronounced symptom. The patient is nervous, sad, and may have a soft, yellow diarrhœa. For such cases pulsatilla is an excellent remedy. It is also said to relieve alternating *constipation* and *diarrhœa* with venous congestion. Pulsatilla is a prompt and decisive agent in *earache*, brought on by cold, wet, and exposure to winds. There is an absence of fever, the pulse is open and soft, the child sobs, the face is pale, the tissues full and waxen, the pain is intense and frequently paroxysmal and tearing in character—evidently a neuralgic condition, for physical signs of local disturbance are seldom observed. In *purulent otitis media*, with thick, yellow, bland discharge, and impaired hearing, and tinnitus aurium, pulsatilla is the indicated remedy.

One of the earliest uses of this plant was for the relief of "*amaurosis, cataract*, and *opacity of the cornea*," conditions in which the reputed value of pulsatilla is very much overrated. There is a condition, sometimes known as "*nervous blindness*," which has been benefited by pulsatilla, and this is probably the condition formerly referred to under the elastic term amaurosis. Pulsatilla stands out prominently as a remedy for *hordeolum* or "*stye*." It is also a prompt remedy when the conjunctiva is hyperemic and the vision weakened, especially after reading, or from sexual abuse or sexual excesses, and in *profuse lachrymation* from exposure to winds or when in the wind. It should be used locally (gtt. x to aqua ℥ij) and also given internally in small doses. In *chronic conjunctivitis*, with bland, yellow discharges, in scrofulous individuals, or due to the exanthemata, and in *ophthalmia* *neonatorum*, with like discharge, pulsatilla has been used with signal success. It relieves deep-seated, heavy pain in the globe of the eye, and has been recommended in *inflammation of the lachrymal sac*. Störck, who was one of the first to use pulsatilla, considered it useful in *secondary syphilis*, and in some forms of *cutaneous diseases*, as well as in amaurosis and other ocular affections.

This drug has been used with much success in *rheumatism*, when the pains were shifting and relieved by cold and aggravated by warmth. Depression of spirits is here a prominent feature. It has also aided in restoring the flow of milk in *agalactia* in nervous and fear-depressed women, whose breasts were painful and swollen. Prof. W. E. Bloyer emphasizes its value in "*jerking*" or "*jumping*" *toothache*, usually due to the formation of a pus cavity near the nerve. He applied the full strength specific pulsatilla, or diluted one-half with water, besides giving the drug internally. He also recommends this treatment as "especially useful in *inflammations* caused by dead teeth, and the inflammatory, painful, and unpleasant conditions of the pulp cavity in those in which the nerve has been destroyed" (*Ec. Med. Jour.*, 1895, p. 248). The dose of specific pulsatilla is from a fraction of a drop to 10 drops, administered in water; of the fluid extract, from 1 to 15 drops; of the extract, from $\frac{1}{6}$ to 1 grain; of anemonin, $\frac{1}{20}$ to $\frac{1}{4}$ grain.

Specific Indications and Uses.—Nervousness and despondency, sadness, unnatural fear, tendency to weep, morbid mental excitement, marked depression of spirits; pain, with debility, nervousness, headache, not dependent on determination of blood to the head; insomnia, from nervous exhaustion; neuralgia in anemic, debilitated subjects; pasty, white, or creamy, thick coating upon the tongue, with greasy taste; stomach disorders from indulgence in fats and pastries; thick, bland, inoffensive discharges from mucous surfaces; alternating diarrhœa and constipation, with venous congestion; amenorrhœa and dysmenorrhœa, with gloomy mentality and chilliness; severe pains in the ear, non-inflammatory and evidently neuralgic; pain from exposure to wind; jumping toothache, from abscess near the dental pulp; styes.

PULVERES.—POWDERS.

Medicines which have no nauseous or unpleasant taste, no acrid or destructive action, which are not deliquescent, and which can be given in not too bulky doses, are usually more advantageously administered in fine powder. When an article is reduced to powder, it has a much greater surface exposed to the influence of light and of the atmosphere than when in the crude, aggregate mass; and as most, if not all vegetable powders, are injured by the action of these agents, it is always better to keep them in well-closed tin cans, or in well-stoppered bottles, which are covered externally with a coat of black paint, varnish, or black paper. Some agents become damp or lose their virtues rapidly when in the state of powder; such should be pulverized in small quantities at a time, and only as they are required. As a general rule, the finer the powder, or the longer it is triturated, the more active it becomes.

M. Dorvault thinks that the operation of pulverization effects an actual change in the chemical and therapeutical properties of many agents. Sugar is less soluble in water, and less sweet, when long pulverized or triturated, and, he inquires, is this to be referred to an altered electrical condition of the sugar, as the phosphorescence developed during the act of pulverization in the dark would lead us to suppose? Gum Arabic, powdered, has not the same taste, nor the same solubility as when in the entire state. If a given quantity of water may be made to dissolve 40 parts of arsenous acid in the vitreous state, the same quantity of water can be made to dissolve only 14 parts after pulverization (*Annals of Pharmacy*, May, 1852). Changes of this kind may ensue from the action of light, the oxygen of the atmosphere, its nitrogen, or its electricity, etc., upon matter reduced to a state of great fineness.

When but one article is reduced to powder, it is termed a *simple powder*, when several articles in powder are rubbed together, the mixture is termed a *compound powder*. As the substances entering into the formation of a compound powder may be of various textures and densities, it is generally preferable to reduce each, separately, to a powder, and then mix and triturate them thoroughly together.

Some articles, however, require the intervention of another before they can be reduced to powder, as camphor, which is pulverized by the addition of a few drops of alcohol; others, again, are powdered with facility by the aid of a harder substance. Medicines that contain considerable fixed oil, or which are deliquescent, should never be prescribed in the form of powders, more especially when they are to be retained for any length of time, as the former may injure the powder in consequence of rancidity, while the latter may render it damp, moldy, and inert. Articles which are *incompatible* should never be united together, unless the decomposition product is required. When volatile or deliquescent substances are prescribed in powders, as camphor, carbonate of ammonium, or carbonate of potassium, they should be wrapped in wax papers, and enclosed in tin-foil, a tin box, or a wide-mouth vial. The paper used for powders of ordinary character, should be very smooth, or glazed, to prevent the powder from adhering to it, and sufficiently soft and yielding to be opened and closed readily, without springing, so as to throw out any portion of the powder. Some apothecaries fold their powders in foolscap paper, and these, when opened by the patient, in consequence of their stiffness, spill or throw out a very material proportion of the medicine. When a powder is prescribed in bulk, leaving it to the patient to apportion the dose, unless otherwise desired, it should always be put into a wide-mouthed vial.

The old absurd and unscientific style of combining eight or ten articles in one preparation is fortunately becoming unpopular, and, though a few preparations of the kind are retained, yet the major amount of our present compounds consist of but two or three, and rarely exceeding four substances. In the former the articles were too frequently thrown together without any guide or rule, or any regard to compatibilities, and, though benefit might have been, haphazardly, derived from these heterogeneous mixtures, it was always difficult to ascertain upon which article or articles the effect depended, or whether it was owing to a third agent, the result of decomposition.

In preparing powders, it will be best to dry the article, beat it in an iron or brass mortar for a time, then sift it through a fine sieve; again beat the coarser parts in a mortar for a short time, sift again; and so continue alternately pulverizing and sifting until the whole is reduced to fine powder, the product being well mixed. When very active articles, such as strychnine, chloride of gold, atropine, etc., are to be given in the form of powders, gum, sugar, sugar of milk, starch, or marsh-mallow should be triturated with them, in order to facilitate their reduction to minute division. Milk sugar is the most desirable diluent.

The usual vehicle for taking the lighter powders is an agreeable, thin liquid, as water, gruel, milk, etc. Heavy powders require a more consistent vehicle, as syrup, molasses, thick mucilage, etc.; always bearing in mind whether the vehicle be compatible with the active ingredients of the powder. Small amounts of powders of a disagreeable taste, may be conveniently administered in gelatin capsules. An elegant form of administration is that proposed, in 1862, by Limousin. This is by means of *wafer capsules*, or *Cachets de Pain*. These are wafers of unleavened bread, into which has been pressed a concavity. One wafer is filled with the powder, and the second wafer, wetted upon the inner surface, is pressed down upon the first with sufficient force to cause them to adhere. To administer, wet the capsule, place it upon the tongue posteriorly, and wash it down with a drink of water or other desired fluid. Similar receptacles are also made of rice flour.

Granular Powders.—Many methods have been suggested for the preparation of granular powders. Granules of vegetable and like powders were introduced by Dr. Thomas Skinner, in 1862. They were prepared by rubbing the desired powder with mucilage to form a non-adhesive, crummy mass, which, after drying and bruising, could be passed through sieves of any desired size. These granules were sometimes coated. *Granular effervescent powders*, now popular, may be prepared by pulverizing separately the acids, alkaline compounds, and sugar, mixing, and passing them through sieves, moistening with a little alcohol, to cause the particles to adhere, and then passing them with slight pressure through a sieve having suitable sized meshes. After drying, the granules are again passed through sieves of different sizes, to obtain the various sized granules.

General Formulas.—*Formula A* (*Fine powder*). "Medicinal agent, in fine powder, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; saccharated sodium bicarbonate

(F. 341), four hundred and seventy-five grammes (475 Gm.) [1 lb. av., 334 grs.]: saccharated tartaric acid (F. 8), four hundred and seventy-five grammes (475 Gm. [1 lb. av., 330 grs.]. Triturate the ingredients, previously well-dried, until a uniformly mixed powder is obtained.

Formula B (*Granular powder*).—"Medicinal agent, in fine powder, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; saccharated sodium bicarbonate (F. 341), four hundred and seventy-five grammes (475 Gm.) [1 lb. av., 330 grs.]; saccharated tartaric acid (F. 8), two hundred and thirty-seven and one-half grammes (237.5 Gm.) [8 ozs. av., 165 grs.]; saccharated citric acid (F. 5), two hundred and and thirty-seven and one-half grammes (237.5 Gm.) [8 ozs. av., 165 grs.]. Mix the ingredients in a mortar, transfer them to an evaporating dish, and heat upon a water-bath, keep at 60° to 71° C. (140° to 160° F.), under constant stirring with a wooden spatula, until dry and uniformly granular. The saccharated citric acid, being made from crystallized citric acid containing 1 molecule of water of crystallization, supplies the moisture necessary to cause the powder, when heated, to cake and adhere together. If the somewhat pasty mass is then stirred with the spatula, small granules are readily formed, and these become firm when completely dried. Throughout the process the contact of the powder with metals should be carefully avoided. Effervescent powders should be preserved in well-stoppered, wide-mouthed vials. *Note.*—To make these effervescent compounds it is not necessary to have the saccharated alkali and saccharated acids in stock. The quantities of sodium bicarbonate, of tartaric acid, of citric acid, and of sugar, required for each formula, are readily ascertained by simple calculation, according to the following rule: Multiply the number of grammes of the saccharate prescribed by the figures indicating the percentage of alkali or acid it contains, and divide the sum of this by 100. The quotient is the quantity of alkali or acid, expressed in grammes, and by deducting this quantity from the total quantity of the saccharate, the quantity of sugar necessary is ascertained. Applying this rule, by way of example, to *General Formula B*, we have the following result: (1 475 Gm. of saccharated sodium bicarbonate, containing 75 per cent, require 356.25 Gm. of sodium bicarbonate and 118.75 Gm. of sugar. (2) 237.5 Gm. of saccharated tartaric acid, containing 67.5 per cent, require 160.3 Gm. of tartaric acid and 77.2 Gm. of sugar. (3) 237.5 Gm. of saccharated citric acid, containing 62.5 per cent, require 148.4 Gm. of citric acid and 89.1 Gm. of sugar. And the formula would then be: Medicinal agent, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; sodium bicarbonate, three hundred and fifty-six and one-fourth grammes (356.25 Gm.) [12 ozs. av., 248 grs.]; tartaric acid, one hundred and sixty and three-tenths grammes (160.3 Gm.) [5 ozs. av., 286 grs.]; citric acid, one hundred and forty-eight and four-tenths grammes (148.4 Gm.) [5 ozs. av., 102 grs.]; sugar, two hundred and eighty-five and five one-hundredths grammes (285.05 Gm.) [10 ozs. av., 24 grs.]; to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]"—(*Nat. Form.*).

The *National Formulary* directs the preparation of *Effervescent Powders* as follows:

PULVERES EFFERVESCENTES, *Effervescent Powders.*—"The effervescent powders for which formulas are given in the Formulary, are most conveniently and efficiently dispensed in the form of *fine powders*, because in this condition they can be made extemporaneously and with assurance of their freshness and efficiency. The popular demand, however, seems to be for granular effervescent powders, the preparation of which requires certain modifications of the formulas, important only in so far as they enable the dispenser to granulate the powder in a convenient and expeditious manner.

GENERAL OBSERVATIONS AND DIRECTIONS.—"Effervescent powders are composed of the medicinal agent in admixture with an alkaline bicarbonate, an organic acid, and sugar. The proportion of the medicinal agent is dependent upon its dose, that of the alkaline bicarbonate and of the organic acid is dependent upon their molecular relation to each other, while the proportion of sugar is dependent upon the quantity necessary as a sweetening agent and diluent. The ingredients for making the *fine pulverulent form* of effervescent powders are: The medicinal agent, sodium bicarbonate, tartaric acid, and sugar, and it is necessary that these be well dried before mixing them. To make the *granular form* of effervescent powders the ingredients need not be dried, unless specially directed, and the ingredients are the same as for the pulverulent form, with the single *exception that one-half the molecule of tartaric acid is replaced by one-half a molecule of crystallized citric acid.* With the view to simplifying the formulas of effervescent powders, three new preparations have been embodied in this Formulary, viz.: *Acidum Citricum Saccharatum* (Saccharated Citric Acid), Formula No. 5; *Acidum Tartaricum Saccharatum* (Saccharated Tartaric Acid), Formula No. 8; *Sodii Bicarbonas Saccharatus* (Saccharated Sodium Bicarbonate), Formula No. 341. The proportion of sugar in these new saccharates is so adjusted that when either of the acid saccharates is mixed with an equal weight of the alkaline saccharate, the acid and alkali are in molecular relation to each other, and, when dissolved in water, will form the neutral tartrate and citrate of sodium respectively. With these three saccharates in stock, it becomes possible to make effervescent powders quickly with any medicinal agent that may be prescribed, while they simplify the formulas for the effervescent preparations now in the Formulary, their use being exemplified by the following *General Formulas:*"

Effervescent Powders of the National Formulary.—PULVIS FERRI ET QUININÆ CITRATIS EFFERVESCENS (N. F.), *Effervescent powder of citrate of iron and quinine, Effervescent citrate of iron and quinine.* "Soluble citrate of iron and quinine (*U. S. P.*), in very fine powder, ten grammes (10 Gm.) [154 grs.]; saccharated sodium bicarbonate (F. 341), four hundred and ninety-five grammes (495 Gm.) [17 ozs. av., 202 grs.]; saccharated tartaric acid (F. 8), four hundred and ninety-five grammes (495 Gm.) [17 ozs. av., 202 grs.]. Mix the ingredients, previously well dried, and triturate them until a uniform powder is obtained. To make *Granular Effervescent Citrate of Iron and Quinine*, substitute saccharated citric acid (F. 5), not dried, two hundred and forty-seven and one-half grammes (247.5 Gm.) [8 ozs. av., 320 grs.] for an equal weight of the saccharated tartaric acid, and prepare the granulated compound as directed under the general formula (F. 319, B.). Ninety (90) grains (or about a heaped teaspoonful) of this preparation represent about one (1) grain of citrate of iron and quinine"—(*Nat. Form.*).

PULVIS FERRI PHOSPHATIS EFFERVESCENS (N. F.), *Effervescent powder of phosphate of iron, Effervescent phosphate of iron.*—"Phosphate of iron (*U. S. P.*), in very fine powder, twenty-four grammes (24 Gm.) [370 grs.]; saccharated sodium bicarbonate (F. 341), four hundred and eighty-eight grammes (488 Gm.) [17 ozs. av., 93 grs.]; saccharated tartaric acid (F. 8), four hundred and eighty-eight grammes (488 Gm.) [17 ozs. av., 93 grs.]. Mix the ingredients, previously well dried, and triturate them until a uniform powder is obtained. To make *Granular Effervescent Phosphate of Iron*, substitute saccharated citric acid (F. 5), not dried, two hundred and forty-four grammes (244 Gm.) [8 ozs. av., 266 grs.] for an equal weight of the saccharated tartaric acid, and prepare the granulated compound as directed under the general formula (F. 319, B.). Ninety (90) grains (or about a heaped teaspoonful) of this preparation represent about two (2) grains of phosphate of iron"—(*Nat. Form.*).

PULVIS POTASSII BROMIDI EFFERVESCENS (N. F.), *Effervescent powder of potassium bromide, Effervescent potassium bromide.*—"Potassium bromide, in very fine powder, one hundred and ten grammes (110 Gm.) [3 ozs. av., 385 grs.]; saccharated sodium bicarbonate (F. 341), four hundred and forty-five grammes (445 Gm.) [15 ozs. av., 305 grs.]; saccharated tartaric acid (F. 8), four hundred and forty-five grammes (445 Gm.) [15 ozs. av., 305 grs.]. Mix the ingredients, previously well dried, and triturate them until a uniform powder is obtained. To make *Granular Effervescent Potassium Bromide*, substitute saccharated citric acid (F. 5), not dried, two hundred and twenty-two and one-half grammes (222.5 Gm.) [7 ozs. av., 370 grs.] for an equal weight of the saccharated tartaric acid, and prepare the granulated compound as directed under the general formula (F. 319 B.). Ninety (90) grains (or about a heaped teaspoonful) of this preparation represent about ten (10) grains of potassium bromide"—(*Nat. Form.*).

PULVIS POTASSII BROMIDI EFFERVESCENS CUM CAFFEINA (N. F.), *Effervescent powder of potassium bromide with caffeine, Effervescent potassium bromide with caffeine.*—"Potassium bromide, in very fine powder, one hundred and ten grammes (110 Gm.) [3 ozs. av., 385 grs.]; caffeine, in very fine powder, eleven grammes (11 Gm.) [170 grs.]; saccharated sodium bicarbonate (F. 341), four hundred and forty grammes (440 Gm.) [15 ozs. av., 228 grs.]; saccharated tartaric acid (F. 8), four hundred and forty grammes (440 Gm.) [15 ozs. av., 228 grs.]. Mix the ingredients, previously well dried, and triturate them until a uniform powder is obtained. To make *Granular Effervescent Potassium Bromide with Caffeine*, substitute saccharated citric acid (F. 5), not dried, two hundred and twenty grammes (220 Gm.) [7 ozs. av., 333 grs.] for an equal weight of the saccharated tartaric acid, and prepare the granulated compound as directed under the general formula (F. 319, B.). Ninety (90) grains (or about a heaped teaspoonful) of this preparation represent about ten (10) grains of potassium bromide and one (1) grain of caffeine"—(*Nat. Form.*). (See also under *Aquæ Minerales.*)

Other Powders.—The following powders are not employed in Eclectic medicine:

PULVIS HYDRARGYRI CHLORIDI MITIS ET JALAPÆ (N. F.), *Powder of mild chloride of mercury and jalap, Calomel and jalap.* "Mild chloride of mercury, thirty-four grammes (34 Gm.) [1 oz. av., 87 grs.]; jalap, in fine powder, sixty-six grammes (66 Gm.) [2 ozs. av., 143 grs.]. Mix them intimately. *Note.*—When 'Calomel and Jalap' is prescribed for an adult, without any specification of quantities, it is recommended that about 30 grains be dispensed as a dose"—(*Nat. Form.*).

Pulvis Antimonialis (*U. S. P.*), *Antimonial powder, James' powder, Pulvis Jacobi, Pulvis antimonii compositus, James' pulver.*—"Antimony oxide, thirty-three grammes (33 Gm. [1 oz. av., 72 grs.]; precipitated calcium phosphate, sixty-seven grammes (67 Gm.) [2 ozs. av., 159 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Mix them intimately"—(*U. S. P.*). The foregoing is the official substitute for a nostrum first prepared by Dr. James, of England, who died in 1776. The original secret powder, upon being analyzed, revealed its constituents sufficiently to lead Dr. Pearson, of London, to recommend to the *London College* the following formula: It is prepared by calcining, in an iron crucible, 1 part of tersulphide of antimony, and 2 parts of horn shavings, stirring constantly until vapors cease to rise. Then rub the residue to powder, put it in a crucible with a perforated cover, and raise it gradually to red heat, which must be maintained for 2 hours. Reduce the product, when cold, to fine powder. It forms a white, gritty, odorless, tasteless powder, partially soluble in boiling water, and which solution gives an orange-yellow precipitate with sulphuretted hydrogen. It possesses the general properties of the antimonials according to the doses in which it is administered, and, like them, is very uncertain in its operation. It was principally used as a sedative and diaphoretic in *febrile diseases*, in doses of from 1 to 4 grains, in powder or bolus, repeating them every 3 or 4 hours, as required. It is not employed in Eclectic practice.

PULVIS ACETANILIDI COMPOSITUS (N. F.)—COMPOUND POWDER OF ACETANILID.

Preparation.—"Acetanilid, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; caffeine, two grammes (2 Gm.) [31 grs.]; tartaric acid, three grammes (3 Gm.) [46 grs.]; sodium bicarbonate, forty-five grammes (45 Gm.) [1 oz. av., 257 grs.]. Reduce the ingredients, separately, to a fine powder, and mix them thoroughly. *Note.*—This preparation is popularly prescribed in New Orleans, under the name of 'Kamna-Fuga,' as an antipyretic, and is claimed to have some advantages over acetanilid itself"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—Analgesic and antipyretic. Considerably employed in *headache* (*megrim*), in doses of 5 to 10 grains. Uses practically those enumerated respectively under acetanilid and caffeine.

PULVIS AMYGDALÆ COMPOSITUS (N. F.)—COMPOUND POWDER OF ALMOND.

Preparation.—"Sweet almond, sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; sugar, in fine powder, thirty grammes (30 Gm.) [1 oz. av., 25 grs.]; acacia, in fine powder, ten grammes (10 Gm.) [154 grs.]. Blanch the sweet almond, then dry them thoroughly with a soft cloth, and rub them lightly in a mortar, until they form a mass of smooth consistence. Mix the acacia and sugar, add them to the mass previously prepared, and rub the whole to a coarse powder, which is to be preserved in a lightly-covered jar. *Note.*—If 820 grains of this preparation be thoroughly triturated with 17 fluid ounces of water, gradually added, and the mixture finally strained, the product will be about 16 fluid ounces of *Mistura Amygdalæ* (*U. S. P.*)"—(*Nat. Form.*).

Uses.—To prepare almond mixtures. For almond mixture use 2½ ounces (av.) to 1 pint of water.

PULVIS ANTICATARRHALIS (N. F.)—CATARRH POWDER.

Synonym: *Catarrh snuff.*

Preparation.—"Morphine hydrochlorate, forty-one centigrammes (0.41 Gm.) [6.8 grs.]; acacia, in fine powder, twenty-five grammes (25 Gm.) [386 grs.]; bismuth subnitrate, seventy-five grammes (75 Gm.) [2 ozs. av., 282 grs.]. Mix them intimately by trituration"—(*Nat. Form.*).

Action and Medical Uses.—As its name indicates, this powder is designed by the framers of the formula, as a soothing snuff for *nasal catarrh.*

PULVIS AROMATICUS (U. S. P.)—AROMATIC POWDER.

Synonyms: *Pulvis cinnamomi compositus, Compound powder of cinnamon.*

Preparation.—"Ceylon cinnamon, in No. 60 powder, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; ginger, in No. 60 powder, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; cardamom, deprived of the capsules and crushed, fifteen grammes (15 Gm.) [231 grs.]; nutmeg, in No. 20 powder, fifteen grammes (15 Gm.) [231 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Triturate the cardamom and nutmeg with a portion of the Ceylon cinnamon, until they are reduced to fine powder; then add the remainder of the cinnamon and the ginger, and rub them together until they are thoroughly mixed." (*U. S. P.*).

Confectio Aromatica, or Aromatic Confection (*Electuarium aromaticum*).—The *U. S. P.*, 1870, directed to rub with aromatic powder an equal quantity (or sufficient) of honey to obtain a uniform mass of proper consistence for confections. This is somewhat hygroscopic, and slowly becomes granular. It may be restored by the incorporation of additional honey.

Action, Medical Uses, and Dosage.—These preparations are employed for the relief of *flatulent colic*, *nausea*, and *diarrhœa*. Dose, 5 to 20 grains. The powder, enclosed in a bag and moistened with hot whiskey or other alcoholic liquids, may be employed as a fomentation in *painful affections of the bowels*. It indelibly stains the linen if allowed to come in contact with it.

PULVIS ASCLEPIADIS COMPOSITUS.—COMPOUND POWDER OF PLEURISY ROOT.

Preparation.—Take of pleurisy root, spearmint, and sumach berries, each, in powder, 2 ounces; bayberry bark, and skunk cabbage, each, in powder, 1 ounce; pulverized ginger, ½ ounce. Mix them.

Action, Medical Uses, and Dosage.—Very useful diaphoretic in *coughs*, *colds*, and as a drink in *febrile diseases*. Two drachms of the powder may be infused in ½ pint of boiling water, sweetened, and drank in wineglassful doses, every 1 or 2 hours. Or in *common colds*, the ½ pint of warm infusion may be taken at a draught, and repeated in an hour if necessary (Wm. S. Merrell).

PULVIS CAMPHORÆ COMPOSITUS.—COMPOUND POWDER OF CAMPHOR.

Preparation.—Take of tannic acid, kino, camphor, each, in powder, 20 grains; opium, in powder, 10 grains. Mix well together, and divide into 20 powders.

Action, Medical Uses, and Dosage.—These powders are stimulant, antispasmodic, anodyne, and astringent, and have proved highly successful in the treatment of *Asiatic cholera*, *cholerine*, and severe *cholera morbus*. They speedily check the discharges, and relieve the *pains* or *cramps*. The dose is 1 powder after each discharge from the bowels, or oftener, if the urgency of the case requires it. The powders may be given in molasses, quince syrup, or blackberry jelly. When more stimulus is required. 1 or 2 grains of capsicum may be added to each dose (J. King).

Related Powders.—Pulvis Catechu Compositus (N. F.), *Compound powder of catechu.* "Catechu, in fine powder, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; kino, in fine powder, twenty grammes (20 Gm.) [309 grs.]; krameria, in fine powder, twenty grammes (20 Gm. [309 grs.]; cinnamon, in fine powder, ten grammes (10 Gm.) [154 grs.]; nutmeg, in fine powder, ten grammes (10 Gm.) [154 grs.]. Mix them intimately, pass the powder through a fine sieve, and afterward rub it lightly in a mortar. Keep it in a stoppered bottle. *Note.*—This preparation is official in the *Br. Pharm.*"—(*Nat. Form.*). Dose, 10 to 60 grains.

Pulvis Kino Compositus (N. F.), *Compound powder of kino, Pulvis kino cum opio.*—"Kino, in fine powder, seventy-five grammes (75 Gm.) [2 ozs. av., 282 grs.]; powdered opium, five grammes (5 Gm.) [77 grs.]; cinnamon, in fine powder, twenty grammes (20 Gm. [309 grs.]. Mix them intimately, pass the mixed powder through a moderately fine sieve, and afterward rub it lightly in a mortar. Keep it in a stoppered bottle. Every 20 grains of this preparation contain 1 grain of powdered opium. *Note.*—This preparation is official in the *Br. Pharm.*"—(*Nat. Form.*). Dose, 5 to 20 grains.

PULVIS CARBONIS LIGNI COMPOSITUS.—COMPOUND POWDER OF CHARCOAL.

Preparation.—Take of charcoal, 2 ounces; rhubarb, in powder, 1 ounce; bicarbonate of sodium, ½ ounce. Mix together.

Action, Medical Uses, and Dosage.—This preparation is very beneficial in *dyspepsia*, attended with *acidity of the stomach*, loss of appetite, *constipation*, or *diarrhœa*, and distress of the stomach after eating. It will prove useful in all derangements of the digestive functions where acidity of the stomach is present. The dose is a teaspoonful in water or Indian-meal gruel, 3 or 4 times a day. If cream of tartar, 1 ounce, be substituted for the bicarbonate of sodium, it will form an excellent laxative powder for *piles* (J. King).

PULVIS CRETÆ AROMATICUS (N. F.)—AROMATIC POWDER OF CHALK.

SYNONYM: *Confectio aromatica* (*Lond.*).

Preparation.—"Cinnamon, eight grammes (8 Gm.) [123 grs.]; saffron, six grammes (6 Gm.) [93 grs.]; nutmeg, six grammes (6 Gm.) [93 grs.]; cloves, three grammes (3 Gm.) [46 grs.]; cardamom, two grammes (2 Gm.) [31 grs.]; prepared chalk, twenty-three grammes (23 Gm.) [355 grs.]; sugar, fifty-two grammes (52 Gm.) [1 oz. av., 365 grs]. Mix the ingredients and reduce them to a fine powder. Pass this through a fine sieve, and afterward rub it lightly in a mortar. Keep it in a stoppered bottle. *Note.*—This preparation is equivalent to the *Pulvis Cretæ Aromaticus* of the *Br. Pharm.* This authority adds the following note: "If a product of bright color be desired, the saffron may previously be moistened and triturated with a little water or alcohol, or the fresh and faintly damp mixture may be subjected to considerable pressure in the triturating process"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—This agent is employed in *diarrhœa* caused by offending material in the stomach, which should first be removed by gentle catharsis, after which the powder may be administered. It is also useful in diarrhœa produced by changes of temperature and water. Dose, 30 to 60 grains.

Related Powder.—PULVIS CRETÆ AROMATICUS CUM OPIO (N. F.), *Aromatic powder of chalk with opium.* "Aromatic powder of chalk (F. 317), ninety-seven and one-half grammes (97.5 Gm.) [3 ozs. av., 192 grs.]; powdered opium, two and one-half grammes (2.5 Gm.) [38.6 grs.]. Mix them intimately. Every 40 grains of this preparation contain 1 grain of powdered opium. *Note.*—This preparation is official in the *Br. Pharm.*"—(*Nat. Form.*). Used like the preceding. Dose, 10 to 20 grains.

PULVIS CRETÆ COMPOSITUS (U. S. P.)—COMPOUND CHALK POWDER.

Preparation.—"Prepared chalk, thirty grammes (30 Gm.) [1 oz. av., 25 grs.]; acacia, in fine powder, twenty grammes (20 Gm.) [309 grs.]; sugar, in fine powder, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Mix them intimately"—(*U. S. P.*).

Uses.—This powder is designed as a ready ingredient for the preparation of *chalk mixture.* Precipitated chalk should not be used. Dose, 10 to 40 grains.

PULVIS CYPRIPEDII COMPOSITUS.—COMPOUND POWDER OF YELLOW LADIES'-SLIPPER.

SYNONYM: *Nerve powder.*

Preparation.—Take of yellow ladies'-slipper root, pleurisy root, skunk cabbage root, and scullcap, each, in powder, 1 ounce. Mix them.

Action, Medical Uses, and Dosage.—This powder is useful to allay *irritability* or *excitability of the nervous system*, to relieve *spasms*, and to produce sleep in restless, wakeful, or excited conditions. When *acidity of the stomach* is present, it is common to add bicarbonate of sodium, 1 ounce. The dose is from ½ to 1 drachm, 3 times a day, or as required. It is usually administered in tea or water (J. King).

PULVIS EFFERVESCENS COMPOSITUS (U. S. P.)—COMPOUND EFFERVESCING POWDER.

SYNONYMS: *Seidlitz powder, Aperient effervescing powders, Pulveres effervescentes aperientes* (*U. S. P.*, 1870), *Effervescent tartrated soda powder, Pulvis sodæ tartaratæ effervescens, Pulvis aërophorus seydlitzensis.*

Preparation.—"Sodium bicarbonate, in fine powder, thirty-one grammes (31 Gm.) [1 oz. av., 41 grs.]; potassium and sodium tartrate, in fine powder, ninety-three grammes (93 Gm.) [3 ozs. av., 123 grs.]; tartaric acid, in fine powder, twenty-seven grammes (27 Gm.) [417 grs.]. Mix the sodium bicarbonate intimately with the potassium and sodium tartrate, divide the mixture into twelve (12) equal parts, and wrap each part in a separate paper of some pronounced color, as *blue*, Then divide the tartaric acid also into twelve (12) equal parts, and wrap each part in a separate paper of a color distinctly different from that used for wrapping the mixture, as *white*. Keep the powders in well-closed vessels"—(*U. S. P.*).

History.—This powder received its name from the Seidlitz Saline Springs of Bohemia, though the foregoing laxative constituents do not represent those of the springs named. As found upon the market, the Seidlitz powder is very variable in regard to proportion. To properly prepare them, each part should be weighed, strictly following the official directions, making the Seidlitz mixture of 3 parts of Rochelle salts and 1 part of sodium bicarbonate, and, as is directed, placing the alkaline powder in a blue paper. Then in a white paper place the tartaric acid. The *white paper* should contain, by weight, 35 grains of tartaric acid; the *blue paper*, 160 grains of Seidlitz mixture. When the powders are separately dissolved in water, and the solutions slowly mixed, the acid reacts with the sodium bicarbonate, liberating carbonic acid gas, and forming sodium tartrate, which adds somewhat to the laxative action of the Rochelle salt. The powders should be kept in a dry place, lest the acid should absorb sufficient moisture to dissolve it.

Action, Medical Uses, and Dosage.—The saline laxative, Seidlitz powder, is very popular as a laxative, especially where there is a slight rise of temperature, and particularly in warm weather. They should be used with care in very young children and the aged and debilitated. Preferably, the powders should be dissolved in separate glasses, using about 5 or 6 fluid ounces of water for the saline powder, and 1 or 2 fluid ounces for the acid powder. The two solutions should then be gradually mixed together and taken while effervescing. Under no circumstances should one solution be swallowed after the other, lest the liberation of carbon dioxide in the stomach should give rise to serious distension, if not rupture, of that organ. The usual dose for an adult is the contents of a white and blue paper (see also *Potassii et Sodii Tartras*).

Related Powder.—PULVERES EFFERVESCENTES (*U. S. P.*, 1870), *Effervescing powders, Soda powders.* "Take of bicarbonate of sodium, in fine powder, 360 grains; tartaric acid, in fine powder, 300 grains. Divide each of the powders into 12 equal parts, and keep the parts, severally, of the bicarbonate and of the acid in separate papers of different colors"—(*U. S. P.*, 1870). Each acid powder contains 25 grains; each alkaline powder 30 grains. They may be administered in water, both being dissolved at one time in one solution, or separate solutions may be prepared and mixed. The acid reacts upon the alkaline compound, producing sodium tartrate, while carbon dioxide escapes.

PULVIS GLYCYRRHIZÆ COMPOSITUS (U. S. P.)—COMPOUND POWDER OF GLYCYRRHIZA.

SYNONYM: *Compound liquorice powder.*

Preparation.—"Senna, in No. 80 powder, one hundred and eighty grammes (180 Gm.) [6 ozs. av., 153 grs.]; glycyrrhiza, in No. 80 powder, two hundred and thirty-six grammes (236 Gm.) [8 ozs. av., 142 grs.]; washed sulphur, eighty grammes (80 Gm.) [2 ozs. av., 360 grs.]; oil of fennel, four grammes (4 Gm.) [62 grs.]; sugar, in fine powder, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]; to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Mix the oil of fennel thoroughly with about one-half of the sugar, then add the remainder of the sugar and the other ingredients, and mix thoroughly. Finally pass the powder through a No. 60 sieve, and keep it in well-closed vessels"—(*U. S. P.*).

Formerly powdered fennel was employed in the preparation of this powder. It has now been replaced with oil of fennel, which renders the powder less liable to take on an unpleasant odor. Moreover, the proportion of liquorice is increased over that of the *U. S. P.* (1880) formula, giving a pleasanter and more easily prepared preparation.

Action, Medical Uses, and Dosage.—A very efficient laxative, operating kindly in doses of 30 to 60 grains, administered in plenty of cold water.

PULVIS HYDRASTIS COMPOSITUS.—COMPOUND POWDER OF GOLDEN SEAL.

Preparation.—Take of golden seal, blue cohosh, and helonias, each, in powder, ½ ounce. Mix together.

Action, Medical Uses, and Dosage.—This powder is tonic and antispasmodic. It is very efficient in *dyspepsia, chronic inflammation of the mucous membrane of the stomach*, and will afford much relief in cases of distress of the stomach after eating, and in *aphthous inflammations of the mouth*. It may also be administered, to prevent a relapse, in *bilious colic*. The dose is from ½ to 1 drachm, 3 or 4 times a day, in water, tea, or wine, as the case may require (J. King).

PULVIS IODOFORMI COMPOSITUS (N. F.)—COMPOUND POWDER OF IODOFORM.

SYNONYM: *Iodoform and naphthalin.*

Preparation.—"Iodoform, in fine powder, twenty grammes (20 Gm.) [309 grs.]; boric acid, in fine powder, thirty grammes (30 Gm.) [1 oz. av., 25 grs.]; naphthalin, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; oil of bergamot, two and one-half cubic centimeters (2.5 Cc.) [41 ♏]. Triturate the naphthalin with the oil of bergamot, then mix it with the iodoform and boric acid, and triturate until a homogeneous powder is produced. *Note.*—This powder is used in many cases where a *diluted* preparation of iodoform, for external purposes, is desired. The odor of the iodoform is masked both by the oil of bergamot and by the naphthalin"—(*Nat. Form.*).

Medical Uses.—The object of this powder is sufficiently set forth in the preceding note.

PULVIS IPECACUANHÆ COMPOSITUS.—COMPOUND POWDER OF IPECACUANHA.

Preparation.—Take of pleurisy root, bloodroot, ipecacuanha, nitrate of potassium, each, in powder, 1 drachm. Mix them.

Action, Medical Uses, and Dosage.—This powder has diuretic and diaphoretic effects upon the system. It is useful in *febrile* and *inflammatory diseases*, and especially in cases where, from idiosyncrasy or other causes, opium is inadmissible. The dose is 5 or 10 grains, every 1 or 2 hours.

PULVIS IPECACUANHÆ ET OPII (U. S. P.)—POWDER OF IPECAC AND OPIUM.

SYNONYMS: *Dover's powder, Compound powder of ipecacuanha, Pulvis ipecacuanhæ compositus.*

Preparation and History.—"Ipecac, in No. 60 powder, ten grammes (10 Gm.) [154 grs.]; powdered opium, ten grammes (10 Gm.) [154 grs.]; sugar of milk, in No. 30 powder, eighty grammes (80 Gm.) [2 ozs. av., 360 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Rub them together into a very fine powder"—(*U. S. P.*).

Each 10 grains of Dover's powder contain of opium and ipecacuanha, each, 1 grain, and sugar of milk, 8 grains. Formerly potassium sulphate was employed in the place of milk sugar. The potassium salt is still directed in the *British Pharmacopœia*, giving to the preparation of the latter a somewhat saline taste. The sugar of milk in this preparation is employed simply as a diluent. By triturating it in coarse powder, it serves to further divide the vegetable constituents. For its mechanical effects, however, the sulphate of potassium is preferable on account of the greater hardness of its particles. Dover's powder was named from its introducer, Dr. Dover. As originally proposed by him, and as now directed in the *French Codex*, with but little modification, potassium nitrate and sulphate (4 parts each) were mixed in a crucible, at red heat, and cooled; sliced opium (1 part) was added and thoroughly rubbed to a powder, after which ipecacuanha and liquorice, both powdered (1 part each), were incorporated with the other ingredients. Dover's powder is a light-brown powder, having the odors of both opium and ipecac, and a bitterish and nauseous taste.

Action, Medical Uses, and Dosage.—Dover's powder, according to the dose administered, is an excellent stimulant, sedative, anodyne, and narcotic. It has a better action than either of its chief ingredients administered separately. It is a very good agent to improve the quality of the skin, the necessary moisture being induced by the ipecac to ensure the favorable action of opium, for the specific indication for the latter is a moist skin and tongue, and soft, open pulse. As a pain-relieving agent and to promote sleep, it may be used where opium alone would not be tolerated. Though profuse perspiration may be produced by it, it is also capable of checking that secretion as shown by the favorable action of 5-grain doses of the powder given to control the *colliquative sweats of phthisis*. It should be given a half hour before the sweating begins. Dover's powder sometimes causes sickness at the stomach, and should never be followed immediately after its administration with warm drinks, but they may be used later, if desired. As a pain-reliever, or stimulant to the internal organs, or as a hypnotic, it is admissible when there is no nausea, inflammation of the brain, or high temperature. It is an efficient drug in *rheumatism*, *the incipient stage of inflammations*, and to control *cough*. Hot applications to the abdomen and 5-grain doses of Dover's powder with 1 grain of camphor, every ½ or 1 hour, give marked relief in *dysmenorrhœa*. Without the camphor, it is very efficient in *amenorrhœa* from cold, being used together with external heat. It allays nervous excitation in cases of *abortion*, and assists in controlling *uterine* and *pulmonary hemorrhages;* 2 or 3 grains of the powder, with a like quantity of quinine, forms an efficient treatment in *neuralgia*, with hot, dry skin. In *dysentery*, it assists the action of other remedies, as well as controlling peristaltic movements, while in *irritative diarrhœa*, after a mild laxative, it controls any *spasmodic bowel complications* that may supervene. It may be used in *enteritis*, both to control the inflammation and the movements of the bowels. It is useful in the early stage of *renal catarrhal inflammations* and in *granular degeneration of the kidneys*, chiefly for the purpose of maintaining a good circulation and a moist condition of the skin. Dose, 2 to 10 grains, preferably in capsules.

PULVIS IPECACUANHÆ ET OPII COMPOSITUS.—COMPOUND POWDER OF IPECACUANHA AND OPIUM.

SYNONYM: *Diaphoretic powder.*

Preparation.—Take of opium, in powder, 10 grains; camphor, in powder, 40 grains; ipecacuanha, in powder, 20 grains; bitartrate of potassium, 160 grains; Mix them (Beach's *Amer. Prac.*).

In preparing the powder, the camphor must first be reduced to powder by trituration with a few drops of alcohol, then add a small portion of the bitartrate of potassium, continue the trituration until the camphor has been still further divided, add the opium in powder, then the ipecacuanha, and, lastly, the remainder of the bitartrate, and triturate all together for 15 or 20 minutes.

Action, Medical Uses, and Dosage.—This powder is an excellent anodyne and diaphoretic, and is, perhaps, superior to any other preparation in its diaphoretic effects upon the system. It is of great efficiency in all *febrile* and *inflammatory diseases*, *diarrhœa*, *dysentery*, *cholera morbus*, *gout*, *rheumatism*, *after-pains*, all cases of *nervous irritability* or *excitement*, and whenever an anodyne conjoined with a diaphoretic is indicated. It favors perspiration without augmenting the heat of the body. The above is the original formula, but practitioners vary in preparing it according to their favorite views; thus some omit the cream of tartar and substitute nitrate of potassium or bicarbonate of sodium, while others omit the opium, substituting in its place lactucarium or twice the quantity of oleoresin of cypripedium, rendered dry by the addition of magnesia. Dose, 3 to 5 grains every

3 or 4 hours in febrile or inflammatory diseases, and, in some cases, 10 grains, 3 times a day. Its action may be materially promoted as a diaphoretic by warm drinks, such as catnip, balm, or sage tea, lemonade, etc., which, however, should not be given immediately after the administration of the powder, lest vomiting be provoked. In *rheumatism*, *pneumonia*, *cerebral affections*, *hepatic diseases*, etc., it is frequently combined with small doses of resin of podophyllum.

PULVIS JALAPÆ COMPOSITUS (ECLECTIC).—COMPOUND POWDER OF JALAP.

SYNONYM: *Antibilious physic.*

Preparation.—Take of Alexandria senna, in powder, 2 ounces; jalap, in powder, 1 ounce; cloves or ginger, in powder, 1 drachm. Mix them (Beach's *Amer. Prac.*).

Action, Medical Uses, and Dosage.—This forms an excellent purgative, useful in nearly all cases where such action is required. It acts with mildness and efficiency, influencing the whole alimentary tract, cleansing it of all abnormal accumulations, and stimulating the whole biliary apparatus to healthy action. It may be given to either sex, and at all ages, and is used in all *febrile*, *inflammatory*, or *chronic diseases*, being contraindicated in severe gastric or intestinal inflammation, and requires to be used cautiously and in moderate doses during pregnancy, menorrhagia, and certain other diseases. Dose, 1 drachm, put into a gill of boiling water, and allowed to stand till cold, then sweeten, if desired, stir, and drink the whole contents. Milk, wine, cider, lemonade, or coffee, etc., may be substituted, in proper cases, for the water. In febrile diseases, its utility will be much increased by adding about 10 grains of bitartrate of potassium to each dose.

Related Preparations.—PULVIS JALAPÆ COMPOSITUS (*U. S. P.*), *Compound powder of jalap*, *Pulvis purgans*, *Pulvis catharticus*, *Pulvis jalapæ tartaratus*. "Jalap, in No. 60 powder, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; potassium bitartrate, in fine powder, sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Rub them together until they are thoroughly mixed"—(*U. S. P.*). This preparation is employed as a hydragogue cathartic in *ascites*, associated with portal and splenic obstructions. Dose, 10 to 30 grains.

PULVIS ALOES ET CANELLÆ (N. F.), *Powder of aloes and canella*, *Hiera picra.*—"Purified aloes (*U. S. P.*), in fine powder, eighty grammes (80 Gm.) [2 ozs. av., 360 grs.]; canella, in fine powder, twenty grammes (20 Gm.) [309 grs.]. Mix them intimately"—(*Nat. Form.*). Dose, 3 to 12 grains.

PULVIS LEPTANDRÆ COMPOSITUS.—COMPOUND POWDER OF LEPTANDRA.

Preparation.—Take of dried alcoholic extract of leptandra, in powder, 1 drachm; resin of podophyllum, in powder, ½ drachm; sugar of milk, 5 drachms. Mix and triturate well together.

Action, Medical Uses, and Dosage.—This preparation is a cholagogue cathartic, and was formerly regarded of immense benefit in *epidemic dysentery*, in doses of 8 grains, repeated every 1 or 2 hours, until it operates freely, after which it may be given 2 or 3 times a day. It was also used with asserted advantage in *typhoid*, *remittent*, and *intermittent fevers*, with or without the addition of quinine sulphate; also in *biliary derangements*. The addition of 3 grains of santonin to each dose, and given twice a day, forms an admirable anthelmintic (J. King).

PULVIS LOBELIÆ COMPOSITUS.—COMPOUND POWDER OF LOBELIA.

SYNONYM: *Emetic powder.*

Preparation.—Take of lobelia, in powder, 6 drachms; bloodroot and skunk cabbage, in powder, each, 3 drachms; ipecacuanha, 4 drachms; capsicum, in powder, 1 drachm. Mix them.

Action, Medical Uses, and Dosage.—This is an excellent emetic, and may be employed in all cases where an emetic is indicated. It vomits easily and promptly, without causing cramps or excessive prostration. The dose is 2 drachms, $\frac{1}{4}$ of which ($\frac{1}{2}$ drachm) must be given every 15 minutes, in an infusion of boneset. Warm boneset, drank freely during the time of taking it, will very much facilitate its operation, and it will also be found that, in many cases, temperate water (at 60° F.) will be equally as effective in assisting the induction of emesis as an infusion, and much more agreeable (J. King). Compound powder of lobelia is an exceedingly efficient local application to the chest in *colds* and *broncho-pulmonic troubles* in general. For this purpose it should be sprinkled upon a larded or petrolated cloth and applied warm.

PULVIS MORPHINÆ COMPOSITUS (U. S. P.)—COMPOUND POWDER OF MORPHINE.

SYNONYMS: *Tully's powder, Pulvis camphoræ compositus Tully.*

Preparation and History.—"Morphine sulphate, one gramme (1 Gm.) [15.4 grs.]; camphor, nineteen grammes (19 Gm.) [293 grs.]; glycyrrhiza, in No. 60 powder, twenty grammes (20 Gm.) [309 grs.]; precipitated calcium carbonate, twenty grammes (20 Gm.) [309 grs.]; alcohol, a sufficient quantity to make sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]. Rub the camphor with a little alcohol, and afterward with the glycyrrhiza and precipitated calcium carbonate, until a uniform powder is produced. Then rub the morphine sulphate with this powder, gradually added, until the whole is thoroughly mixed. Finally, pass the powder through a No. 40 sieve, and transfer it to well-stoppered bottles"—(*U. S. P.*).

One grain of this powder contains $\frac{1}{60}$ grain of sulphate of morphine and about $\frac{1}{3}$ grain of camphor. It was introduced by Dr. William Tully, of New Haven, Conn., as a substitute for Dover's powder. The directions of the formula should be rigidly followed, as great care is necessary that the morphine salt may be uniformly distributed. It is best to prepare small amounts only, as by age the volatile camphor is likely to become dissipated, leaving the powder of uncertain strength. Keep in well-closed bottle, in a cool situation.

Action, Medical Uses, and Dosage.—This powder is used for the same purposes as Dover's powder and morphine sulphate. The dose is from 5 to 10 grains, representing respectively $\frac{1}{12}$ and $\frac{1}{6}$ grain of morphine sulphate.

PULVIS MYRICÆ COMPOSITUS (ECLECTIC).—COMPOUND POWDER OF BAYBERRY.

SYNONYM: *Cephalic powder.*

Preparation.—Take of bayberry bark and bloodroot, each, in powder, 1 drachm. Mix them (Beach's *Amer. Prac.*).

Action, Medical Uses, and Dosage.—This powder is used either alone or combined with an equal part of common snuff, as a snuff, in *catarrh, headache, polypus,* etc. In *obstinate affections of the nasal mucous membrane,* it is frequently combined with sesquicarbonate of potash, 1 or 2 drachms, and golden seal, $\frac{1}{2}$ ounce; or, with finely-powdered chloride of ammonium, 1 drachm. This powder should not be confused with the composition powder bearing the same name (see *Related Powder*).

Related Powder.—PULVIS MYRICÆ COMPOSITUS (N. F.), *Compound powder of bayberry, Composition powder.* "Bayberry, bark of the root, sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; ginger, thirty grammes (30 Gm.) [1 oz. av., 25 grs.]; capsicum, five grammes (5 Gm.) [77 grs.]; cloves, five grammes (5 Gm.) [77 grs.]. Reduce the substances to a moderately fine powder. *Note.*—Bayberry root bark is derived from *Myrica cerifera,* Linné (Wax myrtle, Candleberry)" (*Nat. Form.*). This powder is practically the same as the *Thomson Composition Powder,* or *Number Six.* It is a valuable diaphoretic when given in teaspoonful doses, in warm infusion. Useful in breaking up *acute colds* and in the consequences arising therefrom.

PULVIS NIGRUM.—BLACK POWDER.

SYNONYM: *Emmenagogue powder.*

Preparation.—Take of flowers of sulphur, myrrh, steel filings, loaf sugar, each, in fine powder, 1 ounce; white wine, $\frac{1}{2}$ pint. Mix together, and, by means of a gentle heat, evaporate till nearly dry. Pulverize the mass when cold, and keep it in well-stoppered bottles (Beach's *Amer. Prac.*). Reduced iron may be substituted for the steel filings.

Action, Medical Uses, and Dosage.—This not very scientific compound has been used with much success in the treatment of primary or idiopathic *amenorrhœa, chlorosis*, etc. The dose is ½ drachm, to be repeated 3 times a day; it may be taken in syrup, or molasses, or in the form of pills. It will also be found an excellent remedy in several forms of *cutaneous disease.*

PULVIS OPII COMPOSITUS.—COMPOUND POWDER OF OPIUM.

Preparation.—"Take of opium, in powder, 1½ ounces (av.); black pepper, in powder, 2 ounces (av.); ginger, in powder, 5 ounces (av.); caraway fruit, in powder, 6 ounces (av.); tragacanth, in powder, ½ ounce. Mix them thoroughly, pass the powder through a fine sieve, and finally rub it lightly in a mortar. Keep it in a stoppered bottle"—(*Br. Pharm.*, 1885 and 1898). This contains the dry constituents of confection of opium, 10 per cent of the latter being present.

Action, Medical Uses, and Dosage.—Used like confection of opium. Dose, 2 to 5 grains.

PULVIS PODOPHYLLI COMPOSITUS.—COMPOUND POWDER OF MANDRAKE.

Preparation.—Take of blue flag, mandrake, bitter root, swamp milkweed, each, in powder, 1 ounce; bloodroot, ½ ounce. Mix together.

Action, Medical Uses, and Dosage.—This powder is cathartic and alterative, and is useful in cases of *obstinate constipation, hepatic derangements, dyspepsia, worms*, and in *scrofulous, rheumatic*, and *syphilitic affections.* The dose is ½ or 1 drachm, repeated 3 times a day. It may be administered in water or tea (J. King).

PULVIS QUININÆ COMPOSITUS.—COMPOUND POWDER OF QUININE.

Preparation.—Take of sulphate of quinine, ferrocyanide of iron, each, 1 drachm. Mix thoroughly together.

Action, Medical Uses, and Dosage.—This powder is tonic, febrifuge, and antiperiodic. It was formerly much employed by American practitioners in *febrile* and *inflammatory diseases*, and in all diseases in which there is a least tendency to periodicity. As a tonic, it is either used alone, or frequently in combination with other tonics, as hydrochlorate of berberine, etc. The dose is from 3 to 6 grains of the powder, repeated 2, 3, or 4 times a day, according to symptoms. It was introduced to the profession, as an agent in the above diseases, by the late Prof. I. G. Jones, M. D., of Columbus, Ohio.

PULVIS RESINÆ PODOPHYLLI COMPOSITUS.—COMPOUND POWDER OF RESIN OF PODOPHYLLUM.

SYNONYM: *Hydragogue powder.*

Preparation.—Take of resin of podophyllum, 4 grains; bitartrate of potassium, 3 drachms. Mix intimately together.

Action, Medical Uses, and Dosage.—This is an active hydragogue, and may be employed in *dropsy, obstructed menstruation*, etc. Dose, 20 grains, administered every 2 hours, until it operates sufficiently. The addition of about 1 or 2 grains of capsicum to each dose, will render it much more speedy in its operation.

Related Powder.—SWEET'S RED POWDER. A preparation termed *Sweet's red powder*, has been considerably employed by many practitioners. It causes emesis as well as catharsis, and, as an alterative, is reputed of considerable efficacy in many chronic diseases. It is prepared as follows: Take of mandrake root, in fine powder, 5 ounces; bloodroot, in fine powder, 1 ounce. Place the powders in a percolator and thoroughly exhaust with alcohol. Evaporate the tincture obtained to the consistence of molasses, and, while hot, add to it finely-powdered white sugar, 6 ounces; croton oil, to which a little salt of tartar has been added to neutralize the acrid principle, 1 drachm; and oil of cloves, ½ drachm. Mix thoroughly together, spread on glass or on a plate to dry, finely powder, and bottle. The dose is from 5 to 30 grains. Probably this powder might be prepared as follows: To 6 ounces of finely-powdered white sugar, add 1 drachm of croton oil, prepared as above, and ½ drachm of oil of cloves; mix, triturate thoroughly together, and, continuing the trituration, add, gradually, 160 grains of resin of podophyllum and 46 grains of sanguinarine.

PULVIS RHEI COMPOSITUS (ECLECTIC).—COMPOUND POWDER OF RHUBARB.

SYNONYM: *Neutralizing powder.*

Preparation.—Take of rhubarb, bicarbonate of potassium, and peppermint leaves, each, in powder, 1 ounce. Mix together (Beach's *Amer. Prac.*).

Action, Medical Uses, and Dosage.—This powder is an invaluable remedy in *diarrhœa, cholera morbus, dysentery, summer complaint of children, acidity of stomach, heartburn*, and as a mild cathartic during *pregnancy*. The dose is from ½ to 2 drachms, every 1, 2, or 3 hours, as may be required (see *Syrup of Rhubarb and Potassa*).

Related Preparations.—PULVIS RHEI COMPOSITUS (*U. S. P.*), *Compound powder of rhubarb, Gregory's powder, Magnesia and rhubarb, Pulvis antacidus, Pulvis infantum, Pulvis magnesiæ cum rhei.* "Rhubarb, in No. 60 powder, twenty-five grammes (25 Gm.) [386 grs.]; magnesia, sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.]; ginger, in No. 60 powder, ten grammes (10 Gm.) [154 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Rub them together until they are thoroughly mixed"—(*U. S. P.*). To properly prepare this powder, the rhubarb and ginger should first be rubbed together, and the magnesia, on account of its lightness, be gradually added and incorporated, after which the whole should be put through a bolting-cloth sieve. When fresh and dry the powder is of a yellowish color; upon absorbing moisture, or in aqueous or alcoholic suspension, a deep-red color ensues, owing to a reaction between the magnesia and rhubarb constituents. Dose, 5 to 60 grains.

PULVIS RHEI ET MAGNESIÆ ANISATUS (N. F.), *Anisated powder of rhubarb and magnesia, Compound anise powder.* "Rhubarb, in fine powder, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; heavy magnesia, calcined, sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.]; oil of anise, eight cubic centimeters (8 Cc.) [130 ♏]; alcohol, ten cubic centimeters (10 Cc.) [162 ♏]. Mix the powders, add the oil of anise, previously dissolved in the alcohol, and triturate until a uniform mixture results"—(*Nat. Form.*).

PULVIS SPIGELIÆ COMPOSITUS.—COMPOUND POWDER OF SPIGELIA.

SYNONYM: *King's entozoic powder.*

Preparation.—Take of pink root, bitter root, swamp milkweed, mandrake, each, in very fine powder, 2 ounces; balmony, in very fine powder, 4 ounces. Mix intimately together.

Action, Medical Uses, and Dosage.—This is a very bitter, but certain remedy for any kind of *worms* that may exist in the human alimentary canal. It not only destroys the worms, but also removes the morbid mucous secretion in which they abound, and which is so favorable to their production. The dose for a child a year old is from 5 to 8 grains, in a teaspoonful of molasses or syrup; for an adult, from 10 to 20 grains, in ½ tablespoonful of molasses. The dose is to be repeated every 1 or 2 hours until it operates freely, after which repeat the dose only 3 times a day for several days in succession. When worms are present, the stools produced by this powder will be mucous or slimy, often whitish, containing particles resembling the external integuments of the entozoa, or the appearance of worms cut up. An infusion of this powder, to which a small portion of tincture of asafœtida has been added, forms an excellent injection for the removal of *ascarides* or *thread worms;* it may be repeated whenever desired (see *Compound Fluid Extract of Spigelia*).

PULVIS STYPTICUS.—STYPTIC POWDER.

Preparation.—Take of sulphate of iron, in powder, 2 ounces; alum, in powder, 1 ounce. Mix them, and calcine, by a red heat until a reddish substance is formed. It undoubtedly contains a portion of acid. When cold, pulverize the mass, and keep it in well-stopped bottles.

Action, Medical Uses, and Dosage.—This powder is styptic, and is frequently employed in the treatment of *external hemorrhages* and *bleeding piles*, either alone, or in combination with stramonium ointment, poke ointment, oil of fireweed, etc. Given internally, in doses of 3 grains, combined with capsicum, 1 grain, it has proved effectual in *passive hemorrhages from the lungs and uterus.*

PULVIS TALCI SALICYLICUS (N. F.)—SALICYLATED POWDER OF TALCUM.

Preparation.—"Salicylic acid, thirty grammes (30 Gm.) [1 oz. av., 25 grs.]; boric acid, in fine powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; talcum, in fine powder, eight hundred and seventy grammes (870 Gm.) [1 lb. av., 14 ozs., 301 grs.]. Mix them intimately. *Note.*—The corresponding preparation of the *German Pharmacopœia* has the title *Pulvis Salicylicus cum Talco*, and contains 10 parts of wheat starch in place of boric acid"—(*Nat. Form.*).

Medical Uses.—This agent is used as a dusting powder for *irritated surfaces, intertrigo, excoriations*, etc. (see *Talcum*, under *Liquor Sodii Silicatis*).

PULVIS TRAGACANTHÆ COMPOSITUS.—COMPOUND POWDER OF TRAGACANTH.

Preparation.—"Take of tragacanth, gum acacia, starch, each, in powder, 1 ounce (av.); refined sugar, in powder, 3 ounces. Rub them well together"—(*Br. Pharm.*, 1885 and 1898).

Uses.—This preparation forms a good pill excipient, especially for ferrous carbonate, and may be used to form a mucilage in which to suspend the heavier powders.

Related Preparation.—PULVIS ACACIÆ COMPOSITUS (N. F.), *Compound powder of acacia, Pulvis gummosus* (*Ger. Pharm.*). "Acacia, in fine powder, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; glycyrrhiza, in fine powder, thirty-four grammes (34 Gm.) [1 oz. av., 87 grs.]; sugar, in fine powder, sixteen grammes (16 Gm.) [247 grs.]. Mix them intimately"—(*Nat. Form.*).

PULVIS XANTHOXYLI COMPOSITUS.—COMPOUND POWDER OF XANTHOXYLUM.

Preparation.—Take of oleoresin of prickly ash bark, hydrochlorate of berberine, and sulphate of quinine, each, 1 drachm; sugar of milk, a sufficient quantity. Mix together, adding just enough sugar of milk to form the mass into a powder, and then divide into 60 powders.

Action, Medical Uses, and Dosage.—This is a valuable stimulating tonic and alterative, and may be employed in cases requiring such action, as in *debility of the digestive functions, dyspepsia, convalescence from fevers, diarrhœa*, and *dysentery, hepatic torpor, periodical headache, scrofula*, and other chronic diseases accompanied with excessive *debility*. The dose is 1 powder, to be repeated 3 or 4 times a day. It may be given in water, milk, molasses, syrup, or wine, as symptoms may indicate. One powder contains a grain, each, of the three medicinal agents entering into its composition (J. King).

PYCNANTHEMUM.—PYCNANTHEMUM.

The plant *Pycnanthemum pilosum*, Nuttall.

Nat. Ord.—Labiatæ.

COMMON NAMES: *Basil*, or *Wild basil.*

Botanical Source.—This is an indigenous perennial plant, with long and soft whitish hairs, and a subsimple stem, from 1 to 2 feet in height. The leaves are sessile, nearly entire, lanceolate, acute at both ends, pilose beneath; floral ones not whitened. The flowers are white, in large, terminal, sessile heads. Calyx teeth ovate-lanceolate, acute, and with the lanceolate bracts canescently villous and awnless. Corolla pubescent; stamens exserted (G.—W.).

History.—This plant is found in low grounds, dry hills, and plains, from Ohio and Illinois extending southward, and flowering in July and August. The whole plant is used, and yields its virtues to boiling water. It has the taste and odor peculiar to the mint family.

Action, Medical Uses, and Dosage.—Pycnanthemum is diaphoretic, stimulant, antispasmodic, carminative, and tonic. A warm infusion is very useful in *puerperal*, *remittent*, and other forms of *fever*, *coughs*, *colds*, *catarrhs*, etc., and is of much benefit in *spasmodic diseases*, especially *colic*, *cramp of the stomach*, and *spasms of infants*. The cold infusion is a good tonic and stimulant during convalescence from exhausting diseases. Dose of the infusion, either warm or cold, from 1 to 4 fluid ounces, 3 or more times a day.

Related Species.—There are several species of this genus, which possess similar medicinal properties, as the *Pycnanthemum clinopoiodes*, Torrey and Gray; *Narrow-leaf Virginian thyme*, or *Prairie hyssop*, a pubescent plant with white flowers, sessile, lance-linear, entire, and punctate leaves, terminal and corymbed heads, and acuminate bracts. Also the *P. aristatum*, Michaux, or *Wild basil*, with lance-ovate, subserrate, pubescent, acuminate, and short petiolate leaves; hirsute, terminal, capitate, and subterminal verticils; bracts lance subulate, the calyx terminated by awns (G.—W.). *P. incanum*, also called *Wild basil*, *Mountain mint*, and sometimes *Horsemint*, is used like *Monarda*. *P. linifolium*, Pursh, is a smooth plant, also called *Virginia thyme*. This, as well as the *P. lanceolatum*, Pursh, which resembles it in its bitter, resinous taste, has been employed in *dyspepsia* and *hydrophobia*. Dr. Charles Mohr found in *P. linifolium* volatile oil, a caoutchouc-like resin, a bitter, greenish-yellow resin, soluble in 65 per cent alcohol, gum, some sugar, and tannin closely related to *caffeotannic acid;* no alkaloid (*Proc. Amer. Pharm. Assoc.*, 1876, p. 515). Mr. Harold C. Barker, making a complete analysis of this species collected while in flower, confirmed the absence of alkaloids or glucosids (*Amer. Jour. Pharm.*, 1894, p. 169). The same author found *P. lanceolatum* to contain at least 1.5 per cent of volatile oil, the odor of which resembles that of pennyroyal. Alkaloids, glucosids, and starch were absent, while tannin and small amounts of inulin and sugar were present (*ibid.*, 1894, pp. 65 and 172).

PYRETHRUM (U. S. P.)—PYRETHRUM.

The root of *Anacyclus Pyrethrum* (Linné), De Candolle (*Anthemis Pyrethrum*, Willdenow; *Matricaria Pyrethrum*, Baillon).

Nat. Ord.—Compositæ.

COMMON NAMES: *Pellitory*, *Pellitory root*, *Pellitory of Spain*, *Spanish chamomile.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 151.

Botanical Source, History, and Description.—This is the *Anthemis Pyrethrum* of Willdenow, the name of which has been changed by De Candolle, and the plant placed in a new genus on account of a difference in the structure of its seeds. The stems are numerous, procumbent, somewhat branched, and pubescent. The radical leaves are spreading, petiolated, smoothish, and pinnately divided; the segments much-cleft into linear, subulate lobes; and the cauline leaves sessile. Branches 1-headed. Receptacle convex, with oblong-obovate, obtuse paleæ; ray sterile, ligulate, and white; of the disk, fertile, with 5 callous teeth, and yellow (L.). Pellitory of Spain, or Spanish chamomile, inhabits Barbary, Arabia, Syria, etc. The root is the official part, and is officially described as "from 5 to 10 Cm. (2 to 4 inches) long, and 1 to 2 Cm. ($\frac{1}{4}$ to $\frac{3}{4}$ inch) thick, somewhat fusiform, nearly simple, annulate above, wrinkled below; externally dark grayish-brown; internally brownish-white; fracture short; bark rather thick, containing 2 circles of resin cells, and surrounding the slender wood-bundles and medullary rays, the latter having about 4 circles of shining resin-cells; inodorous, pungent, and very acrid"—(*U. S. P.*). The root, when chewed, produces a peculiar sensation of pricking in the lips and tongue, and a glow of heat, with an increase of the salivary discharge. It may be readily distinguished from *False pellitory root*, identified by Mr. E. M. Holmes (*Amer. Jour. Pharm.*, 1892, p. 90), as derived from *Corrigiola telephiifolia*, a Morocco plant, chiefly by the appearance of its cross-section (see illustration, *loc. cit.*).

Chemical Composition.—In 1835, Koene found it to contain a brown acrid resin, insoluble in caustic potash; an acrid, brown fixed oil, soluble in caustic potash; a yellow, acrid oil, also soluble in this solvent; a trace of tannic acid; gum, inulin, various salts, and lignin. Alcohol or ether dissolves its active principle. This is claimed by Buchheim (1876) to be an alkaloid, *pyrethrine*, a body splitting into *piperidine* and an acid, resembling *piperic acid*, called *pyrethric acid*, when treated with alcoholic solution of caustic potash (see *Piperinum*). The *pyrethrin* of Thompson (*Pharm. Jour. Trans.*, Vol. XVII, 1887, p. 567) is an ether-extract, composed of acrid fat and resin. This author found the cortical portion of the root to contain 5 per cent of pyrethrin. Volatile oil is likewise present. Dunstan and Garnett (*Jahresb. der Pharm.*, 1895, p. 64) isolated from the resin crystallizable *pellitorin*, insoluble in water, diluted acids, and alkalies, soluble in alcohol. It resembles *piperovatin* ($C_{16}H_{21}NO_2$), the non-basic, active principle isolated by the same authors from the resin obtained from the leaves of *Piper ovatum*. Both are pyridine derivatives.

Action, Medical Uses, and Dosage.—It is an energetic local irritant and sialagogue, and acts as a rubefacient when applied externally. Its ethereal tincture relieves *toothache*. The root chewed has been found useful in some *rheumatic* and *neuralgic affections of the head and face*, and in *palsy of the tongue*. The decoction has been used as a gargle in *relaxation of the uvula*. Severe acronarcotic symptoms, with inflammation of the alimentary tract and bloody stools, were produced in a young child by less than a drachm of the tincture. The dose is from 30 to 60 grains as a masticatory. Oil of pellitory is made by evaporating the ethereal tincture; it is an excellent remedy for *toothache*.

Related Species and Drugs.—*Anacyclus officinarum*, Hayne, *German pellitory*. A cultivated plant of Germany. By some considered an annual form of *Anacyclus Pyrethrum*. Its action is the same as, but weaker than, the latter.

SWEET PELLITORY, ascertained by Dr. Dymock to be derived from *Tanacetum umbelliferum*, Boissier, is a Persian drug, imported into Bombay, of a sweetish taste and an odor resembling that of Chaulmoogra oil. It contains only a small amount of *pyrethrin* (see D. Hooper, *Amer. Jour. Pharm.*, 1890, p. 504).

INSECT POWDERS.—These are yellowish or drab-colored powders, obtained chiefly from the flowers of two plants—*Chrysanthemum* (*Pyrethrum*) *roseum*, with rosy flowers, a native of the Caucasus, and yielding the *Persian insect powder* (*Persian pellitory*, Guirila); and *Chrysanthemum cinerariæfolium*, Visiani, with white flowers, yielding *Dalmatian insect powder*.

The Persian insect powder is now almost entirely displaced in commerce by the superior Dalmatian powder, which is exported from Trieste. When well kept, free from moisture, the powder retains its activity for years. The mode of its cultivation and collection, in Dalmatia, is jealously guarded as a secret. The powder destroys aphides, house flies, mosquitoes, and, in the form of a dust spray, is applied to keep insects from hot-house plants. The powder, in order to be effectual, must come into actual contact with the insect. The class of hemiptera (true bugs) spiders, hairy caterpillars, and other insects, are proof against it (*Kew Bulletin*, through *Pharm. Jour. Trans.*, Vol. VII, 1898, p. 505). Insect powders are considerably subject to adulterations. A bright-yellow color indicates the presence of curcuma, fustic, chrome yellow, etc. (For detection, see W. L. Howie, *Amer. Jour. Pharm.*, 1883, p. 361.) The addition of 10 per cent of powdered quillaja bark in commercial powder, while it produces sneezing in man, merely dilutes the powder with inert matter as far as its action on insects is concerned (Cæsar and Loretz, 1898). Another adulteration consists in substitution by the Hungarian daisy. The latter yields 9.30 per cent of ash, while the flowers of *C. cinerariæfolium* yield only 6.5 per cent. (For botanical and chemical distinctions, see G. M. Beringer, *Amer. Jour. Pharm.*, 1889, p. 1; also J. Schrenk, *ibid.*, p. 295.) According to George R. Durrant (*ibid.*, 1897, pp. 359-366), the insect powders of commerce are grossly adulterated. The toxic properties are due partly to volatile oil (0.5 per cent in picked specimens of closed flowers, less in open flowers), but principally to a soft acid resin, 4.8 per cent of which is found in selected closed, less than 4 per cent in half open, and still less in fully open flowers. The whole plant contains but traces. Admixture with the inert stems is recognized by the presence of chlorophyll—0.5 per cent of the latter was found in a mixture of flowers, but commercial powders yielded from 50 to 80 per cent of chlorophyll, referred to total ether extract. Thus the powders may be assayed by determining the weight of ether-extract obtainable therefrom; good powders should yield not less than 3.75 per cent of a pure yellow color and the pleasant and characteristic odor of the flowers. The best powders examined yielded 5.5 per cent of pure extract. Prof. J. M. Francis (*Pharm. Jour. Trans.*, from *Bull. of Pharm.*, Vol. XII, 1898, p. 5) contends that this standard of purity, while correct, is too strict, and would have the effect of increasing the price of the powders. Samples, of which one-third consists of stems, are stated to yield practically the same effect. (For a résumé of the chemical history of the powders, which is contradictory, probably owing to the difficulty of obtaining pure specimens, see G. R. Durrant, *loc. cit.*) A tincture of the flowers is said, by Maisch, to cause vesication like Rhus Toxicodendron. Insect powder is not poisonous to man, but, as stated above, is destructive to certain insect pests. It may be used in powder, in aqueous solution, and in fumigations. (For a list of less active plants, see H. Kalbrunner, *Amer. Jour. Pharm.*, 1875, pp. 25 and 399.)

PYROGALLOL (U. S. P.)—PYROGALLOL.

FORMULA: $C_6H_3(OH)_3$. MOLECULAR WEIGHT: 125.7.

"A triatomic phenol obtained chiefly by the dry distillation of gallic acid. Pyrogallic acid should be kept in dark amber-colored bottles"—(*U. S. P.*).

SYNONYMS: *Pyrogallic acid, Acidum pyrogallicum.*

Preparation.—Pyrogallol was first obtained by Scheele, in 1786, by the dry distillation of gallic acid, hence the name pyrogallic acid. Upon heating well-dried gallic acid, in a retort, to a temperature of from 200° to 210° C. (392° to 410° F.), by means of an oil-bath, the yield will be only 30 per cent, while the theoretical yield should be 74 per cent, according to the equation: $C_6H_2(OH)_3.CO_2H + C_6H_3(OH)_3 + CO_2$. A quantitative yield is obtained on heating gallic acid with water, for half an hour, to the temperature of from 210° to 220° C. (410° to 428° F.), in a closed vessel, with provision for the carbon dioxide to escape. The resultant solution of pyrogallol is purified by boiling with animal charcoal; it is then filtered and evaporated to crystallization. An absolutely pure product is obtained by sublimation under reduced pressure. Prof. T. E. Thorp's process (*Amer. Jour. Pharm.*, 1881, p. 236) consists in heating 10 Gm. of gallic acid with 30 Cc. of pure glycerin, on a sand-bath, to a temperature of from 190° to 200° C. (374° to 392° F.). When carbonic acid gas is no longer given off, all the gallic acid will be quantitatively converted into pyrogallol. This method is especially adapted for photographic needs; the final product, when diluted with water, to make one liter, is ready for use. P. Cazeneuve (*ibid.*, 1892, p. 604) heats a mixture of gallic acid (1 part) and aniline (2 parts) to 120° C. (248° F.) until carbonic acid gas ceases to be given off; on cooling, aniline pyrogallate crystallizes. Benzol or toluol dissolves its aniline constituent, while pyrogallol remains.

Description and Tests.—Pyrogallol consists of "light white, shining laminæ, or fine needles, odorless, and having a bitter taste; acquiring a gray or darker tint on exposure to air and light. Soluble, at 15° C. (59° F.), in 1.7 parts of water, and in 1 part of alcohol; very soluble in boiling water, and in boiling alcohol; also soluble in 1.2 parts of ether. When heated to 131° C. (267.8° F.), pyrogallol melts, and may be sublimed unchanged. When ignited, it is consumed, leaving no residue. The aqueous solution, which is at first neutral and colorless, gradually acquires, by exposure to the air, a brown color and an acid reaction, due to absorption of oxygen. The same change of color takes place very rapidly if the solution contains a caustic alkali"—(*U. S. P.*). On account of this property, an alkaline solution of pyrogallol is made use of in gas analysis, for the purpose of absorbing oxygen. "The aqueous solution (1 in 10) of pyrogallol reduces solutions of the salts of silver, gold, and mercury, even in the cold. When freshly prepared, 1 Cc. of the aqueous solution (1 in 20) is colored brownish-red by a few drops of ferric chloride T.S., and this color is changed to deep bluish-black on the addition of 1 or 2 drops of ammonia water. A bluish-black color is also produced in the aqueous solution of pyrogallol by freshly prepared ferrous sulphate T.S."—(*U. S. P.*). By the latter reaction, pyrogallol is distinguished from gallic acid, which remains unaltered by ferrous sulphate, if the air be excluded. Agitated with lime-water, pyrogallol gives a purple coloration, changing to brown and, finally, to black, at the same time becoming turbid. Chemically, pyrogallol is a triatomic phenol, the three hydroxyl groups being in consecutive position, while in its isomer, *phloroglucin*, these groups are symmetrically arranged. As stated above, pyrogallol is distinguished by its affinity for oxygen, to which is due its reducing action upon salts of metals. It is much used in photography to develop the latent image upon the collodion film after it has been exposed to the action of light. It is also employed in dyeing hair black. Pyrogallol is intensely poisonous.

Action and Medical Uses.—That pyrogallol is an intense poison, has been demonstrated by experiments upon animals and accidental poisoning by its absorption when used locally upon man. Hepatic changes, similar to those produced by phosphorus, have been observed in lower animals. In man, Danilevsky states that doses of 5 to 10 grains, twice daily, appeared to produce no serious symptoms, but cases of death are on record from its absorption, when used topically in skin affections. The chief symptoms have been rigor, followed by headaches, general malaisé and fever, vomiting of mucus, diarrhœa, black or brown urine of an acid character and containing albumins, pallid, cyanotic lips, greenish skin, rapid action of heart and lungs, restlessness, sleeplessness, coma, and death from collapse. Disorganization of the red corpuscles also takes place. Pyrogallol stains clothing permanently and the skin transiently. It is not used as an internal medicine, but in ointments and solutions of from 5 to 20 per cent strength, it has been very successfully applied to *psoriasis*, *lupus*, *epithelioma*, and similar *disorders of the skin.* It should be applied only to the lesions and not to the sound skin, and but limited areas should be treated at a time, lest absorption of sufficient of the drug to produce poisoning takes place. In psoriasis, of course, only benefit is derived, for the disease is not wholly a local one. In lupus, it acts best in the diffuse superficial forms, causing the nodules to become destroyed and separate from the sound tissues. In epithelioma its action is slow. Warm poultices, repeatedly applied, hasten its action, and hydrochloric acid, internally, tends to prevent or lessen its liability to produce toxic effects. An ointment of it (20 per cent) is said to have served well in *syphilitic phagedena.*

Derivative of Pyrogallol.—GALLACETOPHENONE, *Trioxyacetophenone*, *Alizarin yellow* ($C_6H_2.[OH]_3C_2H_3O$). This substitution compound may be considered as pyrogallol, in which 1 atom of hydrogen of the benzene ring is replaced by the acetyl group (CH_3CO). It was prepared by Nencki and Sieber by heating together a mixture of glacial acetic acid, pyrogallol, and zinc chloride. The substance forms a yellow, crystalline powder, melting at 168° C. (334.4° F.), or 170° C. (338° F.). It dissolves easily in boiling water, ether, alcohol, and glycerin. Its reaction is neutral or but feebly acid. Cold water sparingly dissolves it (1 in 600). This substance is not so poisonous as pyrogallol, produces no stains, and has been used as a substitute for that body. A solution (10 per cent) has been employed with success in *psoriasis.*

PYROLA.—PYROLA.

The herb of *Pyrola rotundifolia*, Linné.

Nat. Ord.—Ericaceæ.

COMMON NAMES: *Canker lettuce*, *Shin-leaf*, *False wintergreen*, *Pear-leaf wintergreen.*

Fig. 204.

Pyrola rotundifolia.

Botanical Source.—This is a perennial, low, scarcely suffruticose evergreen herb. The leaves are radical, or nearly so, orbicular-ovate, nearly 2 inches in diameter, smooth, shining, thick, entire, or crenulate, usually shorter than the petiole, with conspicuous, reticulate veins. The petioles are margined, and as long as, and usually much longer than the leaf. The scape is mostly racemose, 3-angled, 6 to 12 inches high, with scaly bracts at the base and in the middle. The flowers are many, large, fragrant, white, drooping, about ¾ inch broad, and borne in an oblong, terminal raceme. Calyx 5-parted, persistent; lobes lanceolate, acute, with somewhat spreading tips, ½ or ⅓ the length of the petals. Petals 5, roundish-obovate, nearly spreading, concave, deciduous. Stamens 10, ascending; filaments awl-shaped, naked; anthers large, pendulous; stigmas exserted beyond the ring; style declining and curved, and longer than the petals. The capsule is 5-celled, 5-valved, opening at the angles, and many-seeded (W.—G.).

History and Chemical Composition.—This plant is common in damp and shady woods throughout various parts of the United States, bearing numerous white flowers in June and July. The whole plant is used, and imparts its medicinal properties to water. *P. elliptica*, Nuttall; *P. secunda*, Linne; and *P. chlorantha*, Swartz, possess like properties. Mr. E. N. Smith (*Amer. Jour. Pharm.*, 1881, p. 549) found the leaves of *P. elliptica*, *P. chlorantha*, and *P. rotundifolia* var. *asarifolia*, Michaux, to contain *arbutin*, *ericolin*, *urson*, tannic, gallic, and malic acids, gum, sugar, albumen, little volatile oil, and some coloring matter.

Action, Medical Uses, and Dosage.—Round-leaved pyrola is tonic, astringent, diuretic, and antispasmodic. Used in decoction, both internally and externally, in various *cutaneous eruptions*, likewise in a *carcinomatous* or *scrofulous taint of the system*, and in *leucorrhœa*, and some *uterine diseases*. As a local application, it will be found of service in *sore throat*, and *ulcerations of the mouth*, *indolent ulcers*, *ophthalmia*, etc., and forms an excellent soothing poultice for *boils*, *carbuncles*, and all *painful tumors* or *swellings*. The decoction, taken internally, is valuable in many *urinary affections*, relieving irritation, and is reputed very useful in *gravel*, *hematuria*, and *ulceration of the bladder*, and in some *nervous diseases*. The decoction and extract have been used with success in *convulsions*, and once formed a large portion of a popular nostrum for *epilepsy*. Dose of the decoction, 1 or 2 fluid ounces, 3 or 4 times a day; of the extract, from 2 to 5 grains. A strong tincture of the fresh plant (℥viii to alcohol, 76 per cent, Oj) may be given in doses of from 1 to 30 drops.

Specific Indications and Uses.—To relieve irritation of the urinary tract.

PYROXYLINUM (U. S. P.)—PYROXYLIN.

SYNONYMS: *Soluble gun-cotton*, *Colloxylin*, *Collodion cotton*, *Lana collodii.*

Preparation.—"Purified cotton, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; nitric acid, fourteen hundred cubic centimeters (1400 Cc.) [47 fl℥, 163 ♏]; sulphuric acid, twenty-two hundred cubic centimeters (2200 Cc.) [74 fl℥, 187 ♏]; alcohol, ether, water, each, a sufficient quantity. Mix the acids gradually in a glass or porcelain vessel, and, when the temperature of the mixture has fallen to 32° C. (90° F.), add the purified cotton. By means of a glass rod imbue it thoroughly with the acids, and allow it to macerate, until a sample of it, taken out, thoroughly washed with a large quantity of water, and subsequently with alcohol, and pressed, is found to be soluble in a mixture of one (1) volume of alcohol and three (3) volumes of ether. Then remove the cotton from the acids, transfer it to a larger vessel, and wash it, first, with cold water, until the washings cease to have an acid taste, and then with boiling water, until they cease to redden blue litmus paper. Finally, drain the pyroxylin on filtering paper, and dry it in small, detached pellets, by means of a water-bath or steam-bath, at a temperature not exceeding 60° C. (140° F.). Keep the pyroxylin, loosely packed, in well-closed vessels containing not more than about 25 Gm., in a cool and dry place, remote from lights or fire"—(*U. S. P.*).

In this process, the cellulose of the cotton is converted into cellulose nitrates of variable composition. If nitric acid of the highest concentration (specific gravity 1.48 to 1.5) be used, a *cellulose hexa-nitrate* ($C_{12}H_{14}[NO_3]_6O_{10}$) is formed, which, together with the *penta-nitrate*, constitutes gun-cotton proper. These nitrates are insoluble in a mixture of alcohol and ether, also in methyl alcohol and acetic ether, hence can not be used in the preparation of *collodium* (which see). When the nitric acid is allowed to act upon the cotton for a shorter time, or if a weaker acid be used for a correspondingly longer time, as in the above *U. S. P.* process, the *di-*, *tri-*, and *tetra-nitrates of cellulose* are formed, which are soluble in the above alcohol-ether mixture, also in acetic ether and in methyl alcohol. It is important regarding the keeping qualities of both gun-cotton and pyroxylin, that the nitric acid or the potassium nitrate (which is sometimes employed in the place of the acid) be free from chlorides, and the cotton be absolutely deprived of its fatty and waxy matter previously, otherwise slow decomposition, with evolution of red, nitrous vapors, or even dangerous explosions will occur. For the same reason the finished product must be absolutely freed from its adhering acid by thorough washing.

Description and Uses.—Pyroxylin does not materially differ in appearance from ordinary cotton. It is, perhaps, somewhat rougher to the touch. Pyroxylin and gun-cotton were formerly termed *nitro-cellulose*, which name is inappropriate, because these products do not contain the nitro group (NO_2) as does, for example, nitrobenzol ($C_6H_5NO_2$). They are cellulose ethers of nitric acid 2, 3, or 4 atoms of hydrogen of the cellulose molecule ($C_{12}H_{20}O_{10}$) being replaced by the nitric radical; thus the tri-nitrate has the formula $C_{12}H_{17}(NO_3)_3O_{10}$. Cellulose hexa-nitrate differs from cellulose also by being insoluble in cupric ammonium sulphate (Schweitzer's reagent).

The various cellulose nitrates, when treated with warm alkalies, are gradually deprived of their nitric acid. Cold, concentrated sulphuric acid also expels nearly all nitric acid. Treatment of these nitrates with reducing agents, such as potassium sulphydrate (KSH) or ferrous acetate, etc., likewise denitrates these compounds with regeneration of cellulose (see Durand Woodman, *Amer. Jour. Pharm.*, 1892, p. 481). When the nitrate is boiled with ferrous sulphate and hydrochloric acid, all of the nitrogen is expelled in the form of nitric oxide (NO), the volume of which may be measured (Schloesing's method) by means of this reaction; the degree of nitration of pyroxylin or gun-cotton may, therefore, be determined.

Pyroxylin should be kept free from moisture, and should be put *loosely* into the container. Gun-cotton, when subjected to a sudden percussion, especially by the intervention of fulminating mercury, explodes violently. When ignited in small quantities, it quietly, although rapidly, burns off; when thoroughly saturated with water, it is perfectly harmless. The chief products of its combustion are nitrogen, nitric oxide, carbon monoxide, carbon dioxide, water vapor, methane, etc. As it leaves no residue upon burning, the combustion may be said to be practically smokeless; for this reason gun-cotton is used in the preparation of smokeless powder. Gun-cotton has also been recommended as a filtering medium for strong oxidizers, such as solution of potassium permanganate, nitric acid, chromic acid, etc. Pyroxylin is not used in medicine, but is chiefly employed in preparing collodion (which see).

PYRUS.—APPLE TREE.

The bark of *Pyrus malus*.

Nat. Ord.—Rosaceæ.

COMMON NAME: *Common apple tree.*

Botanical Source.—This is a well-known tree, growing from 20 to 40 feet high, with rigid, crooked, spreading branches, and a rough, blackish bark. The leaves are from 2 to 3 inches long, about $\frac{2}{3}$ as wide, ovate, or oblong-ovate, serrate, acute, or short-acuminate, pubescent above, tomentose beneath, and on petioles from $\frac{1}{2}$ to 1 inch in length. The flowers are large, fragrant, expanding with the leaves, of pale-rose color, and borne in subumbellate corymbs. The calyx-tube is urn-shaped, with limb 5-cleft; the pedicels and calyx villose-tomentose. Petals 5, roundish, or obovate, with short claws. Stamens numerous; styles 5, united, and villose at base. Fruit or pome globose (W.).

History and Chemical Composition.—The apple tree is a native of Europe, naturalized in this country, and flowers from April to June. There are, probably, nearly 1000 varieties cultivated in the United States, and all of which are said to be derived from the *Wild crab* (*Pyrus coronaria*, Linné). From the fruit cider is manufactured, and both the fruit and its cider are much used for domestic and medicinal purposes. The percentage composition of non-dried apples, according to the average of 36 analyses communicated by J. König (*Chemie der Menschl. Nahrungs und Genussmittel*, 3d ed., 1893) is as follows: Water (84.79), nitrogenous matter (0.36), free acid (chiefly in ripe fruits; *malic acid*, 0.82), sugar (invert sugar, with notable amounts of cane sugar, 7.22), nitrogen-free matter (starch, gum, pectin matter, 5.81), woody fiber and seeds (1.51), ash (0.49). Apples are used in the preparation of *Extractum Ferri Pomatum* and *Tinctura Ferri Pomata*, which are official in the *German Pharmacopœia*. The bark of the apple tree is bitter, and has also been employed in medicine. It contains a principle called *phloridzin*. The root bark is the most active, and yields its virtues to boiling water. Rochleder obtained a yellow coloring matter, which he named *quercetin*. The leaves, according to Rochleder, contain a well-crystallizable body, isomeric with phloridzin, called *isophloridzin*. The seeds contain *amygdalin* (about 0.6 per cent).

Phloridzin, *phlorizin*, or *phloridzite* ($C_{21}H_{24}O_{10}.2H_2O$), was discovered, in 1835, by De Koninck and Stas. It is a bitter glucosid which exists in the bark of the trunk and roots of the apple, pear, cherry, and plum trees. The fresh root-bark of the apple tree contains about 3 to 5 per cent, the leaves about 0.8 per cent of this principle, while the dry root-bark does not contain it. To prepare it, the fresh bark of the root of the apple tree is boiled for 2 hours in a quantity of water sufficient to cover it. This water is decanted off, and the boiling repeated with a second portion. This last decoction must be kept separate from the first. It commonly deposits in 24 hours a considerable quantity of granular crystals of phloridzin, which, when dissolved in distilled water and treated with animal charcoal, are rendered quite pure. Another process is to digest the fresh bark of the root in weak alcohol at about the temperature of 50° C. (122° F.), continuing the digestion for 8 or 10 hours. The greater part of the alcohol is then distilled off, and the residue set aside to crystallize. Purify as in the other process.

Phloridzin forms small, white, silky needles, has a bitter taste, followed by sweetishness, is soluble in 1000 parts of cold water, but at temperatures from 24.4° to 100° C. (76° to 212° F.), it dissolves in all proportions. It is very soluble in absolute alcohol, but little soluble in ether, has a neutral reaction, and a specific gravity of 1.4298. Its alcoholic solution is optically lævo-rotatory. At 100° C. (212° F.), it loses its water of crystallization, which is not absorbed again even in a moist atmosphere. It melts at about 107° C. (224.6° F.), solidifying upon further heating at 130° C. (266° F.), and melting again at 160° C. (320° F.). Its aqueous solution is precipitated by basic acetate of lead. Boiling with diluted mineral acids converts it into dextrose and crystallizable *phloretin* ($C_{15}H_{14}O_5$), hardly soluble in water and ether, easily soluble in alcohol and alkalies. Boiling with concentrated alkali converts it into *phloroglucin* ($C_6H_3[OH]_3$) and *phloretic acid* ($C_9H_{10}O_3$). (For further details, see Husemann and Hilger, in *Pflanzenstoffe*, 1884, p. 1001.)

Action, Medical Uses, and Dosage.—Apple tree bark is tonic and febrifuge, and a decoction of it has been used with advantage in *intermittent*, *remittent*, and *bilious fevers*, and in convalescence from exhausting diseases. It may be given in doses of 1 to 4 fluid ounces, 3 times a day. A strong decoction or syrup of the sweet apple tree bark has been employed with success in some cases of *gravel*. The fruit, or apple, contains both malic and acetic acids, has a pleasant and refreshing flavor, and is a useful and healthy article of diet. However, it should not generally be eaten by dyspeptics, or patients afflicted with *gout*, *rheumatism*, *renal*, and *cutaneous diseases*. If indications for an acid are present, however, it is not especially contraindicated by *rheumatism* and *dyspepsia*. When baked, stewed, or roasted, it becomes valuable as an agreeable and healthy diet in *febrile diseases*, *exanthemata*, etc., and is more easily digested than when raw; it is also slightly laxative, and is beneficial in cases of *habitual constipation*. Raw apples should always be well masticated before being swallowed, as otherwise, they may become a source of serious difficulties, especially with children. An apple tea may be made for fever patients, by boiling a tart apple in ½ pint of water, and sweetening with sugar.

Cider forms not only a refreshing and agreeable drink for patients with fever, but actually exerts a salutary medicinal influence, especially where the tongue is coated deep-red, brown, or black. I have used cider, in which horseradish has been steeped, as an efficient remedy in *dropsy*, for many years; and it is now used in the preparation of a valuable agent for this disease, the *Compound Infusion of Parsley*. Cooked apples form an excellent local application in *ophthalmic inflammation*, *erysipelatous inflammations*, *sore* and *swelled throat* in *scarlatina*, *ulcers*, etc. (J. King).

Phloridzin is tonic and antiperiodic, and has cured cases of *intermittent fever*, even where quinine has proved ineffectual; its dose is from 5 to 20 grains. Unlike quinine, it does not cause gastralgia.

Related Species.—*Cratægus oxyacantha*, Linné (*Nat. Ord.*—Rosaceæ), *Haw*, *Hawthorn*, *English hawthorn*. The fruit and bark of this shrub, or small tree, have been introduced into medicine as a heart remedy. The shrub grows abundantly in woods and thickets throughout Europe, central and northern Asia. In England it is cultivated for hedging purposes, and is familiarly known as Hawthorn. The fresh bark of the young branches contains a bitter crystallizable principle, soluble in water, insoluble in ether, little soluble in alcohol. Claims are made for this drug as a curative remedy for *organic and functional heart disorders*, including *cardiac hypertrophy*, with *mitral regurgitation* from valvular insufficiency, and *angina pectoris*. Sometimes *spinal hyperæmia* is associated with the latter, when both are said to be relieved by the drug. The drug should be studied with a view to its adaptability to cases "characterized by pain, præcordial oppression, dyspnœa, rapid and feeble heart-action, evidence of cardiac hypertrophy, valvular insufficiency, and marked anemia" (*Ec. Med. Jour.*, 1898, p. 176). Prof. J. A. Jeançon, M. D., employs it for *venous stasis*. The dose is from 1 to 20 drops, 3 or 4 times a day.

QUASSIA (U. S. P.)—QUASSIA.

"The wood of *Picræna excelsa* (Swartz), Lindley"—(*U. S. P.*) (*Picrasma excelsa*, Planchon).

Nat. Ord.—Simarubeæ.

COMMON NAMES: *Quassia wood*, *Bitter wood*, *Bitter ash*, etc.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 57.

Botanical Source.—This is the *Quassia excelsa* of Linnæus, and the *Simaruba excelsa* of De Candolle, and is known by the various names of *Lofty quassia*, *Bitter wood*, *Bitter ash*, etc. This is a tree, growing from 50 to 100 feet high, with an erect stem, 3 feet or more in diameter at the base, gradually becoming smaller as it ascends. The bark is grayish and smooth. Leaves alternate and unequally pinnate; leaflets opposite, short-petioled, oblong, acuminate, unequal at the base, blunt at the apex, and veiny-glabrous. Flowers small, pale or yellowish-green, polygamous; racemes toward the end of the branchlets, axillary, very compound, panicled, sub-corymbose, dichotomously branched, spreading, and many-flowered. Peduncles compressed, downy, and rufescent. Sepals 5, minute. Petals 5, longer than the sepals. Filaments of the male flowers much longer than the petals; in the fertile of the same length. In the male, merely the rudiments of the pistil; in the fertile, ovaries 3; style longer than the stamens, triquetrous, and trifid. Anthers roundish. Stigmas simple and spreading. Fruit, 3 drupes, one only being perfected, size of a pea, black, shining, fixed on a hemispherical receptacle; nut solitary and globose, with the shell fragile (L.).

Fig. 205.

Picræna excelsa.

History and Description.—Picræna excelsa is common on the plains and lower mountains of Jamaica and other neighboring islands. It flowers in October and November, and in the two succeeding months matures its fruit. The wood of this tree furnishes the quassia of commerce, being substituted for the true Surinam quassia (*Quassia amara*). Though the Pharmacopœia retains the genus name, *Picræna*, the latter has now been united to the genus *Simaruba* (Lloyd, *West. Drug.*, Jan., 1897, p. 7). It is imported in logs and sticks, varying from 2 inches to 1 foot in diameter, and from 1 to 6 or 8 feet in length, occasionally larger than a man's body, and split into quarters, and frequently retaining a friable and feebly attached cortex, which has similar medicinal powers with the wood. These are undoubtedly obtained from portions of the tree itself, instead of from its root. The wood is white, but changes to yellow under the action of the air. The bark is thin, dark-brown, or thick, grayish-brown, wrinkled, and traversed by reticulating lines. The wood is often turned into cups and sold as *quassia* or *bitter cups*, for when water is poured into them, it partakes of the bitterness of the wood. The *U. S. P.* describes it as occurring "in billets of various sizes, dense, tough, of medium hardness, porous, with a minute pith, and narrow, medullary rays; inodorous, and intensely bitter. In the shops it is usually met with in the form of chips or raspings of a yellowish-white color"—(*U. S. P.*). Quassia was introduced into medicine by Dr. John Lindsay, of Jamaica, in 1791. It was used on that island as a domestic remedy for fluxes and fevers, and yields its medicinal virtues to water and alcohol.

Chemical Composition.—The chief constituent of quassia is the bitter *quassiin* or *quassin*. It was first obtained by Winckler, in 1835, from the wood of *Quassia amara*. Subsequently, it was studied by Wiggers (1837) who gave a detailed method for its preparation (see this *Dispensatory*, preceding edition).

A. Christensen (*Archiv der Pharm.*, 1882, p. 481) obtained pure quassiin by precipitating an aqueous infusion, concentrated by evaporation, with tannic acid, decomposing the precipitate with lead carbonate, and extracting with alcohol. The yield from *Picræna excelsa*, in one instance, was 0.06 per cent. *Quassiin* thus obtained, crystallizes in thin, rectangular scales, of an intensely bitter taste, permanent in the air, and forming neutral solutions with water. It melts at 205° C. (401° F.), and is soluble in 735 parts of water, at 15° C. (59° F.), when saturated at a higher temperature. It is more soluble in boiling water, easily soluble in boiling alcohol, and in warm alkalies, also in chloroform, in 30 parts of 84 per cent alcohol at 15° C. (59° F.), soluble, with difficulty, in ether and petroleum ether. It is not a glucosid. Pure solutions of quassiin are not fluorescent. Fried. Massute (*Archiv der Pharm.*, 1890, pp. 147–171) pronounces the quassiins of different observers, including those obtained by himself, to constitute an homologous series, the bitter principles of *Quassia amara* (*quassiin*) and of *Picrasma excelsa* (*picrasmin*) probably belonging to different groups. Both are mixtures of several quassiins (see also formulæ in *Amer. Jour. Pharm.*, 1890, p. 338). The precipitates obtained in solutions of quassiin, with alkaloidal reagents, are due to the presence of a crystallizable base discovered in the wood of *Quassia amara*. This substance is insoluble in chloroform and ether, soluble, with difficulty, in water and cold alcohol, readily soluble in acidulated alcohol, with ultramarine-blue fluorescence. It seems to occur also in the bark of *Picræna excelsa* in comparatively large quantity. Oliveri and Denaro (1885) established *quassiin* ($C_{32}H_{44}O_{10}$) to be a derivative of the hydrocarbon *anthracene* ($C_{14}H_{10}$). Merck (*Jahresb. der Pharm.*, 1895, p. 457) obtained crystallizable, tasteless *quassol* in the manufacture of quassiin.

Action, Medical Uses, and Dosage.—Quassia is tonic, febrifuge, and anthelmintic. The stomach is deranged by its long-continued use. A strong infusion, by enema, produced serious narcotic symptoms and collapse in a child of 4 years. It is used sometimes in *remittent* and *intermittent fevers;* likewise in *dyspepsia*, *debility* during convalescence from exhausting diseases, and for *worms*. It preserves animal matters from decay, which is a property possessed more or less by all simple bitters. The decoction, administered by way of injection, will remove *ascarides*. An infusion may be made by macerating for 12 hours 3 drachms of the rasped or ground quassia in a pint of cold water; the cold water does not dissolve the extractive matter. Of this a wineglass half full may be taken 3 times a day, either alone, or with some ginger tea, and will be found useful for feeble, emaciated persons, with impaired digestive organs. Or an extract, made by evaporating the decoction to a pilular consistence, may be given in doses of 1 grain, 3 or 4 times a day, and which will be found less offensive to the stomach than the infusion or decoction. Quassia, in connection with sulphuric acid, enters largely into the composition of an anti-bacchanalian elixir, for the cure of *drunkenness*.

Dr. W. Ferguson gave to Dr. John King the following formula for the preparation of this elixir, which he has used with much advantage: Take of tincture of calumba, compound tincture of gentian, tincture of cascarilla, each, 1 fluid ounce; infusion of quassia, 1 pint; elixir of vitriol, 2 fluid drachms and 40 minims. Mix. The dose is a tablespoonful every 1 or 2 hours, or it may be taken every 4 or 6 hours, in doses of 2½ fluid ounces. Frequent bathing of the head in cold water is a valuable auxiliary. It acts as a tonic; in some cases its first action is that of emesis. Its use must be persisted in for some time, that the stomach may retain tone and vigor. It frequently destroys the appetite for alcoholic drinks.

On flies and other insects, quassia acts as a powerful narcotic poison, and the alcoholic extract when introduced into the cellular tissue kills small animals. Mr. Brande, in his work on chemistry, recommends a strong decoction of quassia, well sweetened with brown sugar or molasses, as an effectual poison for flies, and far preferable to the poisonous articles generally used to destroy them. It is certainly worth the trial. A very excellent injection for ascarides (thread-worms), is a strong infusion of 3 parts of quassia, and 1 of mandrake root, to every ounce of which a fluid drachm of tincture of asafœtida may be added. For a child 2 years old, 2 fluid ounces may be injected into the rectum twice a day. Diluted carbolic acid may be substituted for the asafœtida, if desired. Dose of the powder, 30 grains; of the infusion, from 1 to 3 fluid ounces; of the tincture, 1 or 2 fluid drachms; of the extract, from 2 to 10 grains; and of quassiin, ½ to 1 grain.

Related Species and Drugs.—*Quassia amara*, Linné, *Bitter quassia*, is a shrub, or moderately-sized branching tree, having a grayish bark. Leaves alternate, unequally pinnate; leaflets in 2 pairs, opposite, entire, smooth, elliptical, acute at each end; petiole winged, joined, with the joints obovate. Flowers large, scarlet, distant, hermaphrodite, in long, 1-sided, simple, terminal, rarely branched racemes. Pedicels bracteate at the base, jointed below the apex, and there having 2 little bracts. Calyx short, 5-parted. Corolla of 5 petals, longer than the sepals, arranged in a tubular manner. Stamens 10, longer than the petals. Ovaries 5, placed on a receptacle broader than themselves; styles 5, distinct at the base, there united into a very long one, terminating in a nearly equal, 5-furrowed stigma. Fruit drupaceous (L.). Quassia amara inhabits Surinam, Guiana, Colombia, Panama, and the West Indian Islands, flowering in November and December. A negro, residing in Surinam, named Quassi, had obtained a very great reputation in the cure of epidemic malignant fevers of that place. His remedy was kept secret, until 1756, when he was induced to make it known to Daniel Rolander and to C. G. Dahlberg (see account in *Western Druggist*, 1897, p. 7). The bark, wood, and root are intensely bitter, and have proved very efficient in *malignant fevers*. The medicinal parts of this tree seldom reach this country at present, and the wood of *Picræna excelsa* is now substituted for it. Its bitter principle is probably *quassiin*, though Massute (1890) states that there are four principles, all differing from those of *Picræna excelsa*, and varying in solubility and fusing points (see *Picræna excelsa* above for further details).

SURINAM QUASSIA BARK and JAMAICA QUASSIA BARK are both possessed of the bitterness of the woods.

Samadera indica, Gaertner, a tree belonging to the same order as the quassia tree; it is indigenous to Ceylon, and has a very bitter bark; also the wood and the seeds are bitter. The bark is used as a febrifuge on the Malabar coast; the leaves are externally applied in erysipelas (Dymock, Warden, and Hooper, *Pharmacographia Indica*, Vol. I, 1890, p. 294). De Vrij, in 1872, obtained from the seeds 33 per cent of a bitter, light-yellow, non-drying fixed oil, and a bitter principle, *samaderin*, which is amorphous, soluble in water and alcohol, and can be removed from its aqueous solution by animal charcoal. It turns violet-red with sulphuric acid. Tonningen (1858) had obtained a scaly, bitter substance, giving the same reaction. Flückiger believes it to be identical with *quassiin*.

Simaba cedron, Planchon.—CEDRON SEED is the fruit of *Simaba cedron*, a species of *Simarubeæ*, closely allied to the tree that produces quassia bark. This is a small tree, native of New Granada and neighboring parts of South America. It is characterized by having large pinnate leaves, consisting of numerous narrow leaflets and very large panicles of flowers. All parts of the tree are bitter. The fruit is about the size of a "swan's egg," and contains a single seed. The seeds are intensely bitter, and are esteemed by the natives as an antidote in the *bites of poisonous snakes, insects*, etc. The seeds appear to possess tonic and febrifuge properties, and are recommended for *malarial diseases*, and to improve the conditions of the digestive powers when enfeebled, and in *dyspepsia*. For these purposes, an infusion may be employed, or a fluid extract may be taken, in doses of from 1 to 10 minims, repeated 3 or 4 times a day. *Cedrin*, in bitter, silky, acicular crystals, was obtained by Lewy, in 1851, from the seeds, by removing the fat with ether and extracting the residue with alcohol. Tanret (1880) believes it identical with an emetic principle obtained by him from the seed of *Simaba Valdivia*, Planchon, which he named *valdivin* ($C_{36}H_{48}O_{20}+5H_2O$). It is crystalline, neutral, soluble in chloroform and alcohol, and sparingly soluble in cold water (1 in 600), insoluble in ether. The aqueous solution foams when shaken. The principle is decomposed by alkalies.

Simaba ferruginea, St. Hilaire, of Brazil and Central America, is similar to the preceding (see *Amer. Jour. Pharm.*, 1880, p. 326).

Simaruba officinalis, De Candolle.—*Simaruba*, called in Jamaica *Mountain damson*, is a tree with long, horizontal, creeping roots, and a trunk about 60 feet in height, alternately branched at the summit; the old bark is grooved and blackish; the young smooth, ash-colored, spotted yellow. Leaves alternate and abruptly pinnate, with a long, naked petiole, sometimes nearly 14 inches long; leaflets alternate, 2 to 9 on each side, about 2 inches long, oval, smooth, firm, mucronate, on short footstalks, and whitish underneath. Flowers yellowish-white, some male, others female, mixed upon branched, scattered panicles, very small (Dr. Wright states that the male and female flowers, in Jamaica, are on different trees, or diœcious). Calyx small, cup-shaped, 5-parted. Petals stiff, sharp-pointed, whitish, fixed between a membranous disk and the calyx. Stamens 10, nearly equal; filaments each arising out of a small, rounded, velvety scale; anthers oblong, incumbent. Capsules 5, ovate, blackish, disjointed, placed on a fleshy disk, with a rather fleshy pericarp (L.—Wi.). Simaruba grows in Jamaica, Guiana, and other parts of South America. It is found in sandy places, flowering from October to January. The root bark is the medicinal part. The bark is rough, scaly, tuberculated, light, tough, yellowish-brown in its substance, but tinged with gray externally, odorless, not easily powdered, and intensely bitter (C.—Ed.). Water or alcohol takes up its properties. Morin found it to contain bitter *quassiin*, gummy matter, resin, and traces of a volatile oil, having a benzoic odor. *Simaruba medicinalis*, Endlicher, has a similar root bark, and is similarly employed. Simaruba is apt to excite vomiting and purging when taken in large doses. In smaller doses it is tonic, and may be used in infusion in all cases where simple bitter tonics are indicated. It may be used in all cases as a substitute for quassia. It was at first introduced to the profession as a calmative astringent in *chronic dysentery* and *diarrhœa*. However, it merely acts as a tonic, proving very useful in weakened conditions of the digestive apparatus, but injurious in dysentery when improperly administered. The infusion is the best form for exhibition; a drachm or so may be added to ½ pint of boiling water, and given in doses of a tablespoonful every 2 hours. Foy recommends a compound infusion, made by placing in 1 pint of boiling water, 2 drachms, each, of coarsely-bruised simaruba and wormwood; digesting for 15 or 20 minutes, then straining, and adding 1 fluid ounce of syrup of gentian. The dose is a wineglassful, 2, 3, or 4 times a day, and may be used in *dyspepsia, anorexia*, and in convalescence from *intermittents*. Simaruba is seldom used at present.

Picrasma quassioides.—A Himalayan tree, resembling ailanthus, and possessing a very bitter wood and bark, in which Dymock and Warden (*Pharm. Jour. Trans.*, Vol. XX, 1889, p. 41) found a crystallizable principle, probably *quassiin*, a fluorescing, bitter, resin-like principle, and at least one other amorphous, bitter substance, probably the amorphous quassiin of Adrian and Moreaux (*Jahresb. der Pharm.*, 1883, p. 298). The wood yielded 1.7 per cent of ash. They also intimated the probable presence of an alkaloid. The bark has been suggested as a substitute for quassia.

Cascara Amarga.—This is the Honduras Bark, supposed to come from a species of *Picrasma*. Mr. F. A. Thompson (*Therapeutic Gazette*, 1884, p. 8; also see J. Moeller and A. Atkinson, in *Jahresb. der Pharm.*, 1883–84, p. 299) found it to contain 3 per cent of a brownish-yellow, amorphous alkaloid of a sweetish, afterward bitter, taste. He gave it the name *picramnine*. Honduras bark has been recommended for *syphilitic affections*.

Byttera febrifuga, or *Bitter ash*, of M. Bélanger, West Indies, is now thought to be the *Quassia excelsa* of Linné.

Chaparro amargoso (*Nat. Ord.*—Simarubaceæ).—This is a small, thorny bush growing on thin mesquite land in southwestern Texas. The flowers are pink and the fruit, when ripe, cherry-red. All parts of the shrub have a peculiar and intensely bitter taste, and possess medicinal properties, though the tendrils are selected for use, as they contain the most active constituents. It yields its virtues fully to water on prolonged boiling (2 hours). Chaparro was introduced into medicine by Sharp & Dohme, of Baltimore, Md., upon the statement of Dr. J. W. Nixon, of Wrightsboro, Texas, and indorsed by numerous other physicians who have used it in private as well as hospital practice, that it was an efficient antidysenteric remedy, especially applicable to those intractable forms of *Mexican dysentery* or "*camp flux*." It is applicable to both acute and chronic conditions. Under the names of *Bisbi* and *Amargosa*, it has long been used by the natives in *bowel disorders*. A plain and aromatic fluid extract have been put upon the market by Sharpe & Dohme, the dose of which is 15 drops to 2 fluid drachms.

QUERCUS ALBA (U. S. P.)—WHITE OAK.

The bark of *Quercus alba*, Linné.

Nat. Ord.—Cupuliferæ.

Common Name: *Oak bark*.

Illustrations: White oak and others in Bentley and Trimen's *Medical Plants*, 248, 250, 251.

Botanical Source.—*Quercus alba* is a forest tree, varying in size according to the climate and the soil, attaining the height of from 60 to 90 feet, with a diameter of 3 to 6 feet. It is covered with a whitish bark, often interspersed with dark spots. The leaves are oblong, pinnatifid, sinuate, smooth, bright-green above, pale or glaucous beneath, dilated above, and obliquely divided into from 3 to 5 lobes, which are oblong, or linear, obtuse, mostly entire, and sometimes tapering at their base. The flowers are monœcious and amentaceous. Cup hemispherical, naked, much shorter than the acorn, deep, and tuberculate. Acorns are large, ovate, coriaceous, 1-celled, 1-seeded, surrounded at base by the cup, and are solitary, or borne in pairs upon long peduncles (W.—G.).

History and Description.—Quercus is a very extensive and valuable genus, consisting of many species, a large proportion of which grow in the United States. Their usual character is that of astringents, and the one above described, also *Quercus rubra* and *Quercus tinctoria*, are those which have been more particularly employed in medicine. The bark of the tree is the official portion. White oak grows throughout the Union, but is more abundant in the middle states. Its wood is strong and durable, and is extensively employed in ship-building, cooperage, carriage-making, etc. (W.). Tanners occasionally make use of its bark, but that of the *Q. rubra*, Linné (*Red oak*), *Q. tinctoria*, Bartram (*Black oak*), *Q. coccinea*, Wangenheim (*Scarlet oak*), and *Q. elongata*, Willdenow, are commonly used. White-oak bark is the one chiefly used in medicine. Its epidermis contains no astringency, and should, therefore, be removed. The bark thus prepared is of a pale-brownish color, faintly odorous, very astringent, with a slight bitterness, tough, breaking with a stringy or fibrous fracture, and not readily powdered. Its astringency is imparted to water or alcohol. The best time for gathering the bark is in the spring, when it contains the most tannic acid.

The bark of *Quercus alba* is described by the *U. S. P.* as "in nearly flat pieces, deprived of the corky layer, about 5 Mm. ($\frac{1}{5}$ inch) thick; pale-brown; inner surface with short, sharp, longitudinal ridges; tough; of a coarse, fibrous fracture, a faint, tan-like odor, and a strongly astringent taste. As met with in the shops, it is usually an irregularly coarse, fibrous powder, which does not tinge the saliva yellow"—(*U. S. P.*). The latter provision aims to exclude black oak (*Quercus tinctoria*). The bark of *Quercus Robur*, Linné, is official in the *German Pharmacopœia*, and was official in the *British Pharmacopœia*, 1885, but is excluded in the present edition (1898).

Chemical Composition.—In addition to the chief constituent, *quercitannic acid*, and its decomposition product, *oak-red*, oak bark contains terpene-resin, fat, wax, chlorophyll, bitter matter, ellagic and gallic acids; all of the latter substances are soluble in ether. *Pectin*, the carbohydrate *lævulin* ($C_6H_{10}O_5$), and the sugar, *quercit* ($C_6H_{12}O_5$), are also present. *Quercitannic acid* ($C_{17}H_{16}O_9$, Etti, *Amer. Jour. Pharm.*, 1884, p. 135; $C_{28}H_{28}O_{14}$, water-soluble; and $C_{28}H_{26}O_{11}$, much less soluble, Löwe, 1881) is not identical with gallotannic acid, and is an unstable substance, having a tendency to give off water, forming anhydrides, which are coloring matters (*phlobaphenes*), one of which is *oak-red* ($C_{28}H_{22}O_{11}$). According to Prof. Trimble (*The Tannins*, Vol. II, p. 49), each species of oak has its characteristic phlobaphene, *e. g.*, *quercitrin* is that which characterizes *Quercus tinctoria*. Prof. Trimble (*loc. cit.*) found the dried inner bark of white oak, collected in March, to contain 6.96 per cent of tannin, while a specimen of galls from leaves of the same species yielded 17.89 per cent. The highest percentage of oak-bark tannin recorded is 14.21, found in the bark of *Quercus bicolor*. (Also see investigation on the tannin of *Quercus alba*, by Prof. Henry Kraemer, *Amer. Jour. Pharm.*, 1890, p. 236.)

Action, Medical Uses, and Dosage.—Oak bark is slightly tonic, powerfully astringent, and antiseptic. It is useful internally in *chronic diarrhœa*, *chronic mucous discharges*, *passive hemorrhages*, and wherever an internal astringent is required. In *colliquative sweats*, the decoction is usually combined with lime-water. It is, however, more generally used in decoction, as an external agent, which forms an excellent gargle for *relaxed uvula* and *sore throat*, a good stimulating astringent lotion for *ulcers* with spongy granulations, and an astringent injection for *leucorrhœa*, *prolapsus ani*, *hemorrhoids*, etc. The ground bark, made into a poultice, has proved useful in *gangrenous* or *mortified conditions*. In sickly, debilitated children, and in severe *diarrhœas*, especially when the result of *fevers*, the decoction, given internally, and used as a bath to the body and limbs, 2 or 3 times a day, will be found very efficient. When given for *diarrhœa* or *dysentery*, it should be combined with aromatics, and sometimes with castor oil. A bath is often advantageous in some *cutaneous diseases*. The green bark of elder and white oak bruised together, or in strong decoction, forms a very useful and valuable application to *abrasions*. Dose of the decoction, 1 to 2 fluid ounces; of the extract, from 5 to 20 grains. A coffee made from roasted acorns, has been highly recommended in the treatment of *scrofula*.

Specific Indications and Uses.—Relaxation of mucous membranes, with unhealthy discharge; ulcerations, with spongy granulations.

Related Species.—*Quercus rubra*, Linné, or *Red oak*, is a lofty, wide-spreading tree, attaining the height of about 70 feet, with a diameter of 3 or 4 feet. Leaves 6 to 10 inches in length, on long petioles, oblong, smooth on both sides, pale beneath, obtusely sinuate, with short and entire, or sparingly dentate, mucronate lobes, 4 to 6 on each side. Fructification biennial. Acorns oblong-ovoid, about an inch long, surrounded at base by a saucer-shaped, shallow, even cup, very much shorter than the acorn, of very small and close scales, and subsessile (G.—W.). *Red oak* is more common in the northern states and Canada; its wood is reddish and coarse-grained, and used principally for fuel. Its bark is extensively used in tanning. It contains considerable tannin, and is generally employed as an external agent. An extract of the bark, as well as the potash obtained from its ashes, were both formerly much employed as local applications in the treatment of *cancer*, *indolent ulcers*, etc. Prof. Scudder valued a combination of rumex, red-oak bark, and alnus, both locally and internally, in *eczema*, and obstinate *scrofula*, with "*old ulcers*, feeble tissues, and cicatrices."

Quercus tinctoria, Bartram (*Q. velutina*, Lamarck), *Quercitron*, or *Black oak*, is one of the loftiest trees in the forest, frequently attaining the height of 80 to 100 feet, with a diameter of 4 or 5 feet. Bark deeply furrowed, black or deep-brown. Leaves 6 to 8 inches long, obovate, oblong, more or less rusty-pubescent beneath, finally glabrous, slightly or sometimes deeply sinuate-lobed, with oblong, obtuse, mucronate, somewhat toothed lobes. Acorns brown, nearly spherical or depressed-globose, about one-half immersed in a deep, thick, flat, conspicuously scaly cup, which is subsessile. The leaves turn dark-red after frost (G.—W.). This species was regarded by Prof. Asa Gray as a variety of the *Scarlet oak* (*Q. coccinea*, Wangenheim).

Black oak is common to the United States; the bark of this forest tree is much used in tanning and for dyeing. It has a strong odor, a very bitter, styptic taste, and when masticated imparts a yellow tinge to the saliva (compare *Quercus alba*). It is seldom employed internally on account of its disposition to derange the bowels, but is valuable as an external astringent. It contains tannin, *quercitrin*, and *quercetin*. The dye-stuff, called *quercitron*, is the inner bark of this tree, and is much used in Europe as a yellow dye-stuff. Chevreul obtained therefrom the coloring principle, which he named *quercitron;* it has since been named *quercitric acid* (*quercitrin*), on account of its forming salts with bases. It is obtained by allowing a concentrated aqueous infusion or decoction to crystallize; the substance is purified by recrystallization from diluted alcohol. By another, method, the bark is exhausted with alcohol, and the tannin removed by means of a moistened animal membrane; after filtering, the alcohol is distilled, and the residue recrystallized. *Quercitrin* $C_{36}H_{38}O_{20}$, Liebermann and Hamburger, 1879; $C_{21}H_{22}O_{12}$, J. Herzig, 1893) forms sulphur-yellow, microscopic plates, in aqueous or alcoholic solution of neutral reaction and faintly bitter taste. It is little soluble in ether and cold water (2485 parts), more soluble in hot water (143 parts; 425 parts by another statement). Soluble in 23 parts of cold, 3.9 parts of boiling alcohol, readily soluble in alkalies and aqua ammoniæ. Neutral lead acetate precipitates it from solution. Its solution is colored dark-green by ferric chloride. It is a glucosid, being hydrolyzed, by boiling with diluted acids, into crystallizable *quercetin* ($C_{24}H_{16}O_{11}$, Liebermann and Hamburger; $C_{15}H_{10}O_7$, J. Herzig, 1891) and *isodulcite* ($C_6H_{14}O_6$), *Quercitrin*, or similar principles, occurs also in the leaves and cotyledons of the horse-chestnut, in the leaves of the ash tree, in *Rhus Coriaria*, or sumach, in *Sophora japonica* (*sophorin*), *Viola tricolor*, *Thuja occidentalis* (*thujin*), etc. These all stand in close chemical relationship to one another (see Rud. Wachs, *Amer. Jour. Pharm.*, 1894, p. 35; also see graphic formula of quercitrin given by J. Herzig, in *Chem. Centralblatt*, 1893, p 433). *Quercetin* is likewise frequently found in nature, *e.g.*, in the horse-chestnut, in *Podophyllum*•(which see), in the outer skin of the onion (Perkin and Hummel, 1893), in fustic wood (from *Rhus cotinus*), in the bark of the apple tree, in Gambier catechu (A. G. Perkin, *Chem. Centralblatt*, Vol. II, 1897, p. 1047), etc.

Quercus Robur, Linné, is the species official in the *British Pharmacopœia*, 1885, the bark being collected in the spring time. *Quercin*, a neutral bitter principle, obtained from the European oak bark (*Quercus Robur*), by Gerber (1831), was probably impure *quercite* (see (*Quercus alba*).

Quercus suber, Linné.—The *Live oak*, growing in the Mediterranean region, especially Algeria and Spain. Its suberous layer furnishes commercial *cork*. According to K. Kügler (*Dissert.*; see *Amer. Jour. Pharm.*, 1884, p. 240; also *Archiv der Pharm.*, 1884, pp. 217–230), air-dry cork leaves about 0.58 per cent of ash, one-fourth of which is manganese, and another fourth is lime. Chloroform extracts about 12.5 per cent of soluble matter, of which one-third consists of *cerin* ($C_{20}H_{32}O$) (not the cerotic acid or cerin of beeswax). It is imbedded in the cork-cells in the form of small prisms (Höhnel, 1877). Boiling alcohol now takes up from 5 to 6 per cent of *tannin* and *phlobaphene* (coloring matters due to altered tannin). Alcoholic caustic potash now dissolves the peculiar fat, *suberin*, which is saponifiable, upon heating the solvent, into glycerin (2.65 per cent) and fatty acids (30 per cent), the latter consisting of stearic and *phellonic acids* ($C_{22}H_{42}O_3$); a little *coniferin* was also extracted and converted into vanillin. Water now extracted from the cork 8 per cent of *humin compounds* and left 22 per cent of cellulose. Gilson 1890; see Flückiger, *Amer. Jour. Pharm.*, 1890, p. 367) finds that solution of sodium carbonate abstracts the coloring matter of cork, while it leaves *suberin* unaffected. The latter may then be extracted by a hot, 3 per cent alcoholic potash solution. By oxidation of cork with nitric acid, a mixture of acids, possessing a waxy appearance, is obtained (*cerinic acid*), from which *suberic acid* ($C_6H_{12}[COOH]_2$) was isolated by Brugnatelli. The fat, *suberin*, should not be confounded with the cork, reduced to a fine powder, sold under the name *suberin*. This tree has been introduced into our southern states. Suberin has been used as a dusting powder for *intertrigo*, *chapped surfaces*, etc.

Quercus virens, Aiton, *Live oak*, and *Quercus falcata*, Michaux, *Spanish oak*, yield bark very rich in tannin.

Quercus agrifolia, Née; *Quercus chrysolepsis*, Liebman; and *Quercus oblongifolius*, Torrey, all of the Pacific slope, are known as *Live oaks*.

SEMEN QUERCUS, *Acorns.*—Contain fixed oil, volatile oil, bitter substance, starch (about 38 per cent ,citric acid, uncrystallizable sugar, and a crystallizable sugar, called by Dessaignes (1851) *quercit* $C_6H_7[OH]_5$). Roasted acorns (*Semen Quercus Tostum*) were formerly used to check *hemorrhage*, and to cure *scrofula* and *indigestion*.

QUILLAJA (U. S. P.)—QUILLAJA.

"The inner bark of *Quillaja Saponaria*, Molina"—(*U. S. P.*).

Nat. Ord.—Rosaceæ.

COMMON NAMES AND SYNONYM: *Soap-tree bark*, *Soap bark; Quillaia* (*Pharm.*, 1880).

Botanical Source.—The soap-bark tree is a medium-sized tree, bearing alternate, entire, or subdenticulate, oval, or oblong leaves. The flowers are pedunculate and axillary, have no corolla, the same branch bearing both male and female flowers. Thick bark and a very hard wood are furnished by it.

History and Description.—This tree is a native of Chili, and is known as Cullay, Quillilia, Quillaja, and Soap tree. The bark is the part employed; it is rough, dark-colored externally, and very tough. It has no odor, but workmen dislike to powder it, in consequence of the irritating properties of the dust. The taste is acrid and disagreeable. Quillaja bark is said to be used in its native country for washing clothes, and removing grease spots, and in this country it is employed for cleaning delicate ribbons, garments, and wool. It depends upon *saponin* for its value in this respect, foaming when rubbed with water. It is also used by the natives of Chili and Peru for washing the hair, thus: Soap-tree bark, in powder, 100 parts; alcohol, 400 parts; essence of bergamot, 20 drops. Mix. Saponin is a very energetic sternutatory, and acts as an emeto-cathartic and diuretic. This tree has been introduced in Hindustan. The *U. S. P.* describes the bark as in "flat, large pieces, about 5 Mm. (⅕ inch) thick; outer surface brownish-white, often with small patches of brown cork attached, otherwise smooth; inner surface whitish, smooth; fracture splintery, checkered with pale-brownish bast fibers imbedded in white tissue; inodorous; taste persistently acrid; the dust very sternutatory. The infusion of quillaja foams like soap-water"—(*U. S. P.*). (On the microscopical appearance of powdered quillaja, see L. E. Sayre, *Amer. Jour. Pharm.*, 1897, p. 438.)

Chemical Composition.—The foaming properties of an aqueous infusion of quillaja bark are partly due to *saponin* ($C_{19}H_{30}O_{10}$, E. Stütz, 1884). It is a non-poisonous, tasteless, amorphous, white powder, and does not cause sneezing. It is readily soluble in water, insoluble in pure ether and alcohol. It is a glucosid, and is decomposed into sugar and crystallizable *sapogenin*, upon boiling with diluted acids. Stütz found 2 per cent of saponin in the bark. The poisonous irritant and sternutatory properties of the latter are due to amorphous *quillajic acid* (also $C_{19}H_{30}O_{10}$, R. Kobert, *Amer. Jour. Pharm.*, 1889, p. 142) and *sapotoxin* (Kobert and Pachorukow, 1888). *Quillajic acid* is insoluble in ether, quite soluble in cold alcohol and in chloroform, soluble in water. It is precipitated from solution both by neutral and basic lead acetate, while *sapotoxin* is precipitated only by basic lead acetate. The latter constituent is soluble in water, insoluble in ether, and soluble only in boiling alcohol. Its aqueous solution foams upon shaking. The total quantity of saponin-like bodies is about 8.8 per cent. The bark also contains small quantities of *tannic acid* and a bitter principle. Upon incineration, the bark yields not less than 13 per cent of ash, the wood only 1.48 per cent; the bark contains 11.5 per cent of calcium oxalate with some tartrate (Flückiger, *Pharmacognosie des Pflanzenreichs*, 3d ed., 1891, p. 616).

Action, Medical Uses, and Dosage.—Powdered soap bark, when inhaled, provokes violent sneezing. Internally, it acts somewhat like senega, rendering expectoration easy, while upon the gastro-intestinal tract, it does not produce irritating effects. Being less acrid than senega, it is more agreeable to administer, and may be used in infusion or syrup (fluid extract, 2 parts; syrup, 10 parts). It has been employed to quiet *cough*, with tenacious secretions; in *chronic bronchitis*, with bronchial dilatation; *emphysema*, etc. *Dropsy* is also reputed to have been cured with it. Locally, a saponaceous aqueous solution is valued for use upon the skin where soap is objectionable, to correct fetid exhalations of the axilla, feet, etc., and to remove the greasiness of the skin in treating *cutaneous ulcers* and *eruptions*. The scalp may be cleaned with it, and a tincture of it is reputed useful in *alopecia*. A snuff of powdered quillaja is said to be useful in *coryza*, and to have effected a permanent cure in *chronic rhinitis*. A watery solution of the dried aqueous extract is considerably used in pharmacy as an emulsifying agent for oils—castor oil, cod-liver oil, etc.—and as a froth-producer for soda-water syrups. Dose of infusion (bark ℥ss to water Oj), ½ to 1 ounce, several times a day; of the syrup, fl℥i to fl℥ij.

QUINIDINÆ SULPHAS (U. S. P.)—QUINIDINE SULPHATE.

FORMULA: $(C_{20}H_{24}N_2O_2)_2H_2SO_4+2H_2O$. MOLECULAR WEIGHT: 780.42.

"The neutral sulphate of an alkaloid obtained from the bark of several species of Cinchona (*Nat. Ord.*—Rubiaceæ). Quinidine sulphate should be kept in well-stoppered bottles, in a dark place"—(*U. S. P.*).

SYNONYMS: *Chinidinum sulfuricum*, *Sulphate of conquinine*, *Conchininum sulphuricum*.

Source and History.—The base, *quinidine*, occurs in the bark of *Cinchona Calisaya*, in *Pitaya barks* (as much as 1.6 per cent, Hesse), and in other species of

Cinchona. The alkaloid was discovered by Henry and Delondre, in 1833, but was subsequently regarded by them as a hydrate of quinine. Later (1847), Winckler applied the name quinidine to a base which, through the researches of Pasteur (1853), is now known as *cinchonidine*. Pasteur also established the physical and chemical characteristics of *quinidine*, pronouncing it isomeric with quinine. It was previously (1849) called *beta-chinin* by van Heijningen, and subsequently received the names *cinchotine* (Hlasiwetz), *beta-chinidine* (G. Kerner), and the much contested name *conchinine* (Hesse, 1865). (For interesting historical details, see G. Kerner, *Archiv der Pharm.*, 1880, p. 259.) The sulphate of this base is the official salt. The older *Chinidinum sulphuricum* of commerce was a variable mixture, mostly containing cinchonidine sulphate.

Preparation.—Quinidine is prepared from the mother liquors resulting from the preparation of quinine sulphate, especially from the mixture of alkaloids known as *chinoidine* (see *Chinoidinum*). De Vrij (1857) isolated it by means of the characteristic hydriodate, which is little soluble in alcohol, and very little in water (1 in 1200 at ordinary temperature). O. Hesse (1865) removed quinine and cinchonidine by means of the insoluble tartrate, and precipitated quinidine from the filtrate in the form of the hydriodate. (For details, see Husemann and Hilger, *Pflanzenstoffe*, 1884, p. 1467.)

Description and Tests.—Quinidine ($C_{20}H_{24}N_2O_2$) crystallizes from alcohol with 2½ molecules of water, in the form of monoclinic prisms, which effloresce upon exposure to the air, losing ½ molecule of water. From ether, quinidine crystallizes with 2 molecules of water, in the form of rhombohedra, which are permanent in the air. From a hot, aqueous solution, it also falls out in the form of efflorescent crystals (De Vrij, 1856). The water of crystallization is expelled at a temperature of 120° C. (248° F.). Quinidine is bitter to the taste, and has an alkaline reaction. It has the same formula as quinine, and, like the latter, forms a fluorescent solution with diluted sulphuric acid; but is optically dextrorotatory, while quinine is lævo-rotatory. It is soluble in 2000 parts of water at 15° C. (59° F.), and in 750 parts at 100° C. (212° F.); it is likewise dissolved by 26 parts of 80 per cent alcohol, by 22 parts of ether at 20° C. (68° F.), and by 3.7 parts of boiling absolute alcohol. It is hardly soluble in chloroform. With acids it forms two series of crystallizable salts, viz.: neutral and acid salts. They are, as a rule, more soluble than the quinine salts. With chlorine water, followed by ammonia, it gives the green *thalleioquin* reaction like quinine (see *Tests* below), but it differs from the latter by forming a rather soluble mono-tartrate, and a characteristic, nearly insoluble hydriodate (see *Preparation* above).

Quinidine Sulphate (the neutral salt) is officially described as follows: "White, silky needles, odorless, and having a very bitter taste; permanent in the air. Soluble, at 15° C. (59° F.), in 100 parts of water, and in 8 parts of alcohol; in 7 parts of boiling water, and very soluble in boiling alcohol; also in 14 parts of chloroform, and in acidulated water; almost insoluble in ether. When heated to 120° C. (248° F.), the salt loses its water of crystallization (4.6 per cent). Upon ignition, it is slowly consumed, leaving no residue. The salt is neutral or faintly alkaline to litmus paper. An aqueous solution of the salt, when acidulated with sulphuric acid, has a decided blue fluorescence. On treating 10 Cc. of an aqueous solution (about 1 in 1600) of the salt with 2 drops of bromine water, and then with an excess of ammonia water, the liquid will acquire an emerald-green color. With proper adjustment of the reagents, more dilute solutions will give a paler tint, while more concentrated ones will acquire a deeper color, or deposit a green precipitate. A cold, saturated, aqueous solution of the salt yields a white precipitate with potassium iodide T.S. (difference from quinine sulphate). An aqueous solution of the salt yields, with barium chloride T.S., a white precipitate, insoluble in hydrochloric acid. Quinidine sulphate should not impart more than a faintly yellowish tint to concentrated sulphuric acid (limit of readily carbonizable, organic impurities), nor produce a red color with nitric acid (difference from morphine). If a small quantity of ammonia water be added to 3 Cc. of an aqueous solution of the salt saturated at 15° C. (59° F.), a white precipitate (quinidine) will be produced, which requires more than 30 Cc. of ammonia or more than 30 times its weight of ether to dissolve it (absence of more than small proportions of other cinchona alkaloids)" (*U. S. P.*). (Compare *Quinina.*)

Action, Medical Uses, and Dosage.—Quinidine appears to possess similar medicinal properties to quinine, in similar doses, being regarded, however, a little less powerful. Its salts (as the sulphate) appear to be best adapted for medicinal use, principally on account of their ready solubility. Dose, from 1 to 5 grains, 3 times a day, or oftener, if required. In severe *intermittents*, as high as 10 grains may be administered for a dose. In malignant cases, 40 grains may be given in divided amounts.

Related Salts.—Quinidinæ Bisulphas ($C_{20}H_{24}N_2O_2.H_2SO_4.4H_2O$), *Acid quinidine sulphate*. This salt is produced by dissolving neutral quinidine sulphate in the equivalent quantity of diluted sulphuric acid, and slowly evaporating the solution. It forms long, asbestos-like, colorless crystals, readily soluble in water, and losing their water of crystallization (14.5 per cent) at a temperature near 120° C. (248° F.).

Quinidinæ Hydriodas ($C_{20}H_{24}N_2O_2.HI$), *Quinidine hydriodate*.—Neutral solutions of potassium iodide and quinidine sulphate react upon each other, producing a crystalline, white precipitate; or, if the solutions be dilute and warm, scale-like, colorless prisms. Cold water sparingly dissolves it (1 in 1270, at 10° C. [50° F.]), hot water and alcohol but little more freely. It does not crystallize with water, and the proportion of iodine is a little over 28 per cent.

Quinidinæ Bihydriodas ($C_{20}H_{24}N_2O_2.[HI]_2.3H_2O$), *Quinidine bihydriodate*.—A salt containing nearly 44 per cent of iodine and 8.5 per cent of water, produced like the preceding, excepting that the quinidine sulphate is employed warm and acidulated with diluted sulphuric acid. It forms an orange-colored, crystalline powder, or shining, crystalline prisms of a golden-yellow color. It is quite freely soluble in hot water and alcohol, and in cold water (90 parts). When heated to 120° C. (248° F.), the water of crystallization is expelled, and the color changes to brownish-yellow. If the salt be exposed to moist air, part of the water will be reabsorbed.

QUININA (U. S. P.)—QUININE.

Formula: $C_{20}H_{24}N_2O_2+3H_2O$. Molecular Weight: 377.22.

"An alkaloid obtained from the bark of various species of Cinchona (*Nat. Ord.*—Rubiaceæ). Quinine should be kept in well-stoppered bottles, in a dark place"—(*U. S. P.*).

Source, History, and Preparation.—Quinine was first identified and differentiated from cinchonine by Pelletier and Caventou, in 1820. It always occurs together with cinchonine, and frequently also with quinidine and cinchonidine, in the barks of all species of *Cinchona*, especially *C. Calisaya*, *C. officinalis*, and *C. Ledgeriana*. A hybrid of the latter species, and *C. succirubra*, grown in Java, are remarkably rich in quinine (see J. B. Nagelvoort, *Amer. Jour. Pharm.*, 1898, pp. 345 and 424; also see table, p. 549). The alkaloids are combined in the bark with kinotannic acid, and can not be extracted by means of a cold, aqueous infusion (see *Quininæ Sulphas* for the isolation of quinine from Cinchona barks). From aqueous solutions of quinine salts, the anhydrous base may be precipitated in the form of a curdy, amorphous mass, by the careful addition of aqua ammoniæ; when allowed to remain in contact with the precipitant fluid, the amorphous precipitate absorbs 3 molecules of water, and becomes crystalline. From solution in diluted alcohol, quinine likewise crystallizes with combination of water in the form of fine needles.

Description.—Quinine, as demanded by the *U. S. P.*, is "a white, flaky, amorphous, or crystalline powder, odorless, and having a very bitter taste; permanent in the air. Soluble, at 15° C. (59° F.), in 1670 parts of water, and in 6 parts of alcohol; in 760 parts of boiling water, and in 2 parts of boiling alcohol; in 23 parts of ether, 5 parts of chloroform, and 200 parts of glycerin; also soluble in carbon disulphide, benzin, benzol, ammonia water and diluted acids"—(*U. S. P.*). Quinine is less soluble in diluted fixed alkalies than in water, which is shown by the turbidity produced when a solution of sodium hydroxide is added to a saturated solution of quinine in water. It dissolves in about 2150 parts of lime-water, and crystallizes from benzol solution with benzol chemically combined. The *U. S. P.* makes for quinine the further requirements: "When heated to about 57° C. (134.6° F.), it melts; at 100° C. (212° F.), it loses about 9 per cent (or about 2 molecules) of its water of crystallization, the remainder being expelled at 125° C. (257° F.). The anhydrous alkaloid, when pure, melts at 173° C. (343.4° F.). Upon ignition, it is consumed, leaving no residue"—(*U. S. P.*). When heated in a dry glass tube, either by itself, or together with sugar, starch, etc., quinine salts yield a tar of carmine-red color (compare Grahe's test, p. 550; also see Flückiger, *Pharm. Chemie*, Vol. II, 1888, p. 558). "Quinine has an alkaline reaction upon litmus paper. A solution of quinine in diluted sulphuric acid has a vivid, blue fluorescence"—(*U. S. P.*).

The fluorescence is probably the most delicate test for quinine, and may still be observed in a solution of 1 in 50,000 (T. G. Wormley, *Amer. Jour. Pharm.*, 1894, p. 570); but its sensitiveness is impaired by the presence of small quantities of sodium chloride or hydrochloric acid, also by potassium ferrocyanide, potassium thiocyanate, sodium hyposulphite, and by phenacetine (Sestini and Campani 1892). Solutions of quinine are optically lævo-rotatory, the rotation being increased by acids.

Chemically, quinine ($C_9H_6[OCH_3]N.C_9H_{11}[OH]N.CH_3$) is a derivative of the base *quinoline* (*chinoline*, C_9H_7N), comprising 2 molecules of the latter, both of unequal basicity. As a strongly diacid base, quinine forms, with acids, two series of salts—*neutral* (in reaction) and *acid* salts—or, according to the French nomenclature, which assumes two equally basic nitrogen atoms in the quinine molecule—*basic* and *neutral* (the really acid) salts. Thus the normal quinine sulphate of the *U. S. P.* (which see) is called basic quinine sulphate, or quinine sub-sulphate in the *French Codex*. At water-bath heat, quinine expels ammonia from ammonium sulphate with formation of quinine sulphate. Some of the quinine salts, *e. g.*, the neutral tartrate, are characterized by being sparingly soluble in water. The neutral quinine sulphate is less soluble in water than the sulphates of the related alkaloids (see *table*, p. 1625). Quinine solutions exposed to direct sunlight, quickly turn yellow, and gradually deposit a brown flocculent body, which is devoid of alkaloidal characteristics. Flückiger, who first observed it, named this precipitate *quiniretin*. Heated with glycerin to 190° C. (374° F.), quinine is converted into an isomeric, amorphous body, *quinicine*. Its solutions are dextrorotatory. By distilling quinine or cinchonine with caustic potash, quinoline, pyridine, its homologues are formed. By oxidation of quinine with chromic acid or potassium permanganate, a series of compounds is formed, viz.: the weak base *quitenine* ($C_{19}H_{22}N_2O_4$), *quininic acid* ($C_{11}H_9NO_3$), and, ultimately, *cinchomeronic acid* ($C_7H\ NO_4$), which is a dibasic pyridine acid ($C_5H_3N[COOH]_2$).

Tests.—Quinine and quinine salts, in aqueous solution, form amorphous precipitates with alkaloidal reagents, *e. g.*, tannin, iodine in solution of potassium iodide, Mayer's solution, picric acid, phosphomolybdic acid, etc. A characteristic test for quinine, which, however, is also given by quinidine, consists in the formation of *herapathite*, or *iodo-sulphate of quinine*, discovered by Bouchardat (1845), and further studied by Dr. W. B. Herapath, in England (1852). It is obtained by adding an alcoholic solution of iodine, drop by drop, to a warm solution of quinine sulphate in glacial acetic acid. A black precipitate is formed, which, when washed with cold alcohol and recrystallized from warm alcohol, is deposited in large, rectangular plates, which are brilliant green and of a metallic lustre by reflected light, and olive-green by transmitted light. They have the property possessed by tourmaline, of polarizing the light passing through it. Its composition, according to Jörgensen, is $(C_{20}H_{22}N_2O_2)_2.3H_2SO_4.2IH.4I$. It is soluble in acetic acid, and in 650 parts of cold, and 50 parts of hot alcohol. A. Christensen finds that quinine may be determined quantitatively by converting it into this compound, as suggested by De Vrij (*Amer. Jour. Pharm.*, 1882, p. 58).

Another characteristic test for quinine, which, however, is also obtained with quinidine, consists in the formation of the emerald-green compound, *thalleioquin*, by the action of chlorine, followed by ammonia, upon quinine. The reaction was first observed by Alexander Roper, in London (1832), and rediscovered by J. J. Andre, in Metz (1835), and by H. A. Meeson, in London (1835). Brandes and Leber (1838) gave it the above name (Flückiger, *Pharm. Chemie*, Vol. II, 1888, p. 564). The test was modified by Flückiger (bromine being used instead of chlorine), and is given by the *U. S. P.* as follows: "On treating 10 Cc. of an aqueous, acidulated solution (about 1 in 1500) of quinine with 2 drops of bromine water, and then with an excess of ammonia water, the liquid will acquire an emerald-green color. With proper adjustment of the reagents, more dilute solutions will give a paler tint, while more concentrated ones will acquire a deeper color, or deposit a green precipitate"—(*U. S. P.*). Prof. Flückiger (*loc. cit.*) places the sensitiveness of this test at more than 1 in 20,000. This test is interfered with by phenacetine (Sestini and Campani, 1892). Vogel's test consists in the formation of a rich-red color, which is obtained when chlorine water is added to the quinine solution, followed by potassium ferrocyanide, and, lastly, aqua ammoniæ. (For further details regarding these tests, see T. G. Wormley, *loc. cit.*) The *U. S. P.* further directs: "Quinine should not impart more than a faintly yellowish tint to concentrated sulphuric acid (limit of readily carbonizable, organic impurities), nor produce a red color with nitric acid (difference from morphine)"—(*U. S. P.*). The absence of morphine may also be established by allowing the substance to act upon a mixture of potassium ferricyanide and ferric chloride; if no blue precipitate (Prussian blue) is formed, morphine can not be present. However, the formation of a blue precipitate may be due to the presence of some reducing substances other than morphine; therefore, additional tests for morphine must be applied (*Amer. Jour. Pharm.*, 1872, p. 540). To test quinine for the presence of other Cinchona alkaloids, the *U. S. P.* gives the following directions, which are based on *Kerner's test* for Cinchona alkaloids: "If 2 Gm. of quinine be mixed, in a small mortar, with 1 Gm. of ammonium sulphate and 10 Cc. of distilled water, the mixture thoroughly dried on a water-bath, the residue (which should be strictly neutral to test-paper) agitated with 20 Cc. of water, then allowed to macerate for half an hour at 15° C. (59° F.), with occasional agitation, and filtered through a pellet of glass-wool, 5 Cc. of the filtrate, transferred to a test-tube, and gently mixed, without shaking, with 7 Cc. of ammonia water (specific gravity 0.960), should produce a clear liquid. If the temperature during the maceration has been 16° C. (60.8° F.), 7.5 Cc. of ammonia water may be added; if 17° C. (62.8° F.), 8 Cc. In each case, a clear liquid indicates the absence of more than small proportions of other Cinchona alkaloids"—(*U. S. P.*). This test depends on the fact that those Cinchona alkaloids whose sulphates are soluble in water, are themselves insoluble, or nearly so, in ammonia water; quinine, which forms a very little soluble, neutral sulphate, is quite soluble in ammonia water. The above directions, especially with regard to the temperatures and the strength of ammonia, must be strictly observed, in order to arrive at trustworthy results (see comment on Kerner's as well as other tests, by E. Jungfleisch, *Amer. Jour. Pharm.*, 1887, pp. 136–146; and O. Hesse, *ibid.*, pp. 404–414). Hesse's test differs from Kerner's in the employment of ether, instead of ammonia, as a precipitant of the Cinchona alkaloids other than quinine. Shimoyama (*Amer. Jour. Pharm.*, 1885, p. 630) and L. Schaefer (*ibid.*, 1887, p. 153) make use of the comparative insolubility of quinine oxalate in water, in order to determine the quantity of the latter alkaloid. (See review of this and other processes, by W. Lenz, *ibid.*, 1889, p. 146.) The following table (page 1625) gives the principal distinctive characteristics of the alkaloids quinine, quinidine, cinchonine, and cinchonidine.

Uses.—(See *Quininæ Sulphas.*) The alkaloid quinine is used in practical medicine in the form of its salts, the sulphate and hydrochlorate being mostly employed.

Quinine Salts.—QUININÆ ACETAS, *Quinine acetate* ($C_{20}H_{24}N_2O_2.C_2H_4O_2$). Mix a hot solution of 17 parts of quinine sulphate (dried by spontaneous efflorescence) with a hot solution of 6 parts of sodium acetate, and allow to cool. Long, white needles of the salt will form, containing 84 per cent of quinine. They are freely soluble in hot water and diluted acids, but not readily soluble in cold water. The salt loses acetic acid when warmed on the water-bath. (See also remarks on quinine acetate, by Prof. Maisch, *Amer. Jour. Pharm.*, 1858, p. 385.)

QUININÆ BENZOAS, *Quinine benzoate* ($C_{20}H_{24}N_2O_2.C_7H_6O_2$).—Obtained by allowing a hot alcoholic solution of quinine (8 parts) and benzoic acid (3 parts) to crystallize. Small prismatic crystals, containing about 72.5 per cent of base, and sparingly soluble in water (1 in 373 parts, at 10° C. [50° F.]).

QUININÆ ARSENAS, *Quinine arsenate, Quiniæ arsenias, Arseniate of quinia* ($[C_{20}H_{24}N_2O_2]_2H_3AsO_4.8H_2O$).—In a glass vessel place arsenic acid, $1\frac{1}{2}$ drachms; quinine, 5 drachms; distilled water, 6 fluid ounces. Boil till all is dissolved, filter, and allow to crystallize spontaneously. To purify, redissolve, and again crystallize. This salt was introduced, in 1845, by Bourieres, and recommended in *fever and ague*, and other *periodical diseases;* also used in *obstinate cutaneous affections.* Its dose is $\frac{1}{5}$ grain, 2, 3, or 4 times a day. The above formula is that of O. Hesse, who obtains the salt in the form of long, white prisms, sparingly dissolved by cold water, but readily soluble in hot water. It contains 12.3 per cent of arsenicum (counted as arsenic pentoxide, As_2O_5) and 69.4 per cent of quinine.

QUININÆ ARSENIS, *Quinine arsenite* ($[C_{20}H_{24}N_2O_2]_3H_3AsO_3.4H_2O$).—For Dr. Ringdon's old process (1847), see this *Dispensatory*, preceding edition. O. Adler (1879) obtains this salt in the form of white needles by digesting, for 24 hours, a mixture of quinine hydrochloride (3 parts

ALKALOIDS	SOLUBILITY IN				SOLUBILITY IN WATER OF				Thalleioquin Test
	Water	Alcohol	Ether	Aqua Ammoniæ	Neutral Sulphate	Hydriodate	Neutral Tartrate	Oxalate	
QUININE, $C_{20}H_{24}N_2O_2$ Lævo-rotatory Sulphate fluorescent	1670 parts 1960 parts (Merck's *Index*)	6 parts	23 parts	Soluble	$B_2.SO_4H_2.7H_2O$ Water, 740 parts Alcohol, 65 parts Chloroform, 680 parts Chloroform, 1000 parts, if alcohol-free (Rice) (Insoluble)	Quite soluble	Insoluble	Insoluble (1446 parts)	Gives Thalleioquin and Herapathite tests.
QUINIDINE, $C_{20}H_{24}N_2O_2$ Dextro-rotatory Sulphate fluorescent	2000 parts	26 parts of 80 per cent	35 parts	Little soluble	$B_2.SO_4H_2.2H_2O$ Water, 100 parts Alcohol, 8 parts Chloroform, 14 parts	Insoluble in water (1270 parts) and diluted alcohol Characteristic	Soluble in 30 to 40 parts	Soluble in 151 parts, at 15° C.	Analogous to quinine.
CINCHONINE, $C_{19}H_{22}N_2O$ Dextro-rotatory Sulphate non-fluorescent	3760 parts	116 parts	526 parts	Insoluble	$B_2.SO_4H_2.2H_2O$ Water, 66 parts Alcohol of 80 per cent, 6 parts Chloroform, 78 parts Ether, insoluble	Quite soluble	Soluble in 30 to 40 parts	Soluble in 104 parts, at 10° C.	White precipitate.
CINCHONIDINE, $C_{19}H_{22}N_2O$ Lævo-rotatory Sulphate non-fluorescent	1680 parts	20 parts	76 parts	Insoluble on standing	$B_2.SO_4H_2.3H_2O$ Water, 70 parts Alcohol, 66 parts Chloroform, 1316 parts (Insoluble)	Soluble	Insoluble (1200 parts)	Soluble in 228 parts, at 15° C.	

and silver arsenite (1 part), in the presence of diluted alcohol (of 70 per cent). This compound is soluble in alcohol (cold, 15; hot, 6), chloroform (8), benzene (20), ether (25), and boiling water (150 parts).

Quininæ Citras, *Quinine citrate* ($[C_{20}H_{24}N_2O_2]_2.C_6H_8O_7.7H_2O$, O. Hesse).—This salt may be obtained either by double decomposition of solution of quinine hydrochlorate and an acidulated solution of sodium citrate, or by simply saturating a heated, aqueous solution of citric acid with the theoretical quantity of quinine. Upon cooling, white, prismatic crystals are obtained, which are very sparingly soluble in cold water (see K. F. Mandelin, on the citrates of quinine, *Archiv der Pharm.*, 1879, pp. 129–144).

Quininæ Lactas, *Quinine lactate.*—Obtained by dissolving quinine in lactic acid to saturation, and evaporating the solution. Silky, acicular crystals are produced, soluble in water and alcohol (see Vigier, *Pharm. Jour. Trans.*, Vol. XIX, 1889, p. 862). This salt is adapted for hypodermatic uses, and has been used locally in *gonorrhœa*.

Quininæ Phosphas, *Quinine phosphate* ($[C_{20}H_{24}N_2O_2]_2H_3PO_4.8H_2O$, O. Hesse).—Prepared by saturating warm, diluted phosphoric acid with quinine, or by double decomposition between sodium phosphate and quinine hydrochlorate. From hot, aqueous solution, it forms long, silky, acicular crystals, containing 72.7 per cent of base, and is very sparingly soluble in water.

Quininæ Phenyl-Sulphas, *Phenylated* or *Carbolated quinine sulphate* ($[C_{20}H_{24}N_2O_2]_2.SO_3.C_6H_6O.2H_2O$, O. Hesse, 1889).—Dissolve crystallized quinine sulphate (10 parts) in alcohol, and add to the solution carbolic acid (nearly 1 part), also dissolved in alcohol. Colorless needles are precipitated which contain over 75 per cent of base. By washing with alcohol and ether, the taste and odor of phenol may be entirely removed. The salt is somewhat soluble in cold water, but insoluble in alcohol. An acid phenol-sulphate ($C_{20}H_{24}N_2O_2.SO_3.C_6H_6O.3H_2O$) was similarly obtained by O. Hesse, by adding to a hot, aqueous solution of quinine bisulphate ($C_{20}H_{24}N_2O_2.H_2SO_4+7H_2O$) an equivalent quantity of carbolic acid.

Quininæ Carbolas, *Carbolate of quinine* ($C_{20}H_{24}N_2O_2.C_6H_6O$), was prepared by J. Jobst (1875), by bringing together molecular quantities of quinine and carbolic acid in aqueous or alcoholic solution. Crystals are obtained, which, when dried at 130° C. (266° F.), have the above composition. It dissolves in 400 parts of water at 16° C. (60.8° F.), in 80 parts of 90 per cent alcohol at 13° C. (55.4° F.), and slightly in ether. By an earlier formula, a carbolate in pills was made as follows: Twelve parts of carbolic acid and 20 parts of quinine are dissolved in 60 parts of stronger alcohol. The solution is then filtered, distilled, and evaporated to the consistence of turpentine, when some extract of acorus, or gentian, and some pulverized cinnamon may be added to it, to form it into a pill mass. This may be made into pills containing, each, 1 grain of carbolic acid and $\frac{6}{10}$ of a grain of quinine, of which from 3 to 6 pills may be given daily in *puerperal diseases*, *furunculi*, *carbuncles*, *typhous conditions*, and *pyæmia* (Braun). It is found that the irritating properties of carbolic acid are much diminished when in combination with bases, and even when combined with a base as weak as quinine, it can be given in much larger relative doses than when administered in its isolated form (*Jahrbücher der Gesammten Medizin*, Aug., 1867).

Iodide of Quinine.—The iodide of quinine is obtained by adding a solution of 24 parts of iodide of potassium (4 molecules) in 8 parts of water, by drops, to a strong solution of 20 parts (1 molecule) of bisulphate of quinine ($C_{20}H_{24}N_2O_2.H_2SO_4+7H_2O$). Wash the precipitate quickly, and dry it, avoiding operation in the light. It is tonic, alterative, and resolvent, and has been found efficient, in doses of from $\frac{1}{2}$ to 2 grains, in *scrofulous enlargements of the glands;* or it may be made by decomposing a solution of 1 molecule of hydrochlorate of quinine with a solution of 4 molecules of iodide of potassium. When dry, iodide of quinine, thus prepared, has the properties of a resin, is easily reduced to a white, inodorous powder, extremely bitter, and permanent in the air. It is soluble in warm water, alcohol, or ether, forming clear and colorless solutions, which deposit the iodide of quinine on evaporation. Concentrated sulphuric and nitric acids, and chlorine, decompose it instantly, with elimination of iodine (compare *Amer. Jour. Pharm.*, Vol. IX, 1837–38, p. 353). The composition of these iodides is variable. The substance known as Herapathite (see *Quinina*), is related to this class.

Quininæ Iodas, *Quinine iodate* ($C_{20}H_{24}N_2O_2.HIO_3$).—To a warm, aqueous solution (1 in 10) of iodic acid, add the molecular proportion of freshly precipitated, moist quinine, with continued agitation. Evaporate the mass at a temperature not exceeding 15.5° C. (60° F.), and place it in a vacuum over sulphuric acid to dry. White, pearly needles, soluble in boiling water without decomposition, sparingly soluble in cold water (1 in 700), in ether and chloroform, readily dissolved by alcohol (C. A. Cameron, *Amer. Jour. Pharm.*, 1882, p. 417). A *bijodate* ($C_{20}H_{24}N_2O_2.[HIO_3]_2$), prepared by E. Merck, is easily soluble in water (*Jahresb. der Pharm.*, 1897).

Quininæ Hydriodas Acidus, *Acid quinine hydriodate* ($C_{20}H_{24}N_2O.[HI]_2.5H_2O$).—Transparent, glossy, prismatic, or scale-like crystals are formed when potassium iodide is added to an acidulated, warm solution of quinine in molecular proportion. At 120° C. (248° F.) the salt becomes anhydrous, but when exposed to a moist atmosphere, $2H_2O$ are again taken up. The salt may also be obtained by dissolving quinine in excess of aqueous hydriodic acid.

Quininæ Hydriodas, *Quinine hydriodate* ($C_{20}H_{24}N_2O_2.HI$).—This salt may be obtained by dissolving quinine in the molecular quantity of aqueous hydriodic acid, and allowing the solution to evaporate spontaneously. These hydriodides (hydriodates) must not be confused with the *iodides of quinine*, which are addition products of iodine and quinine (see above).

Quininæ Salicylas, *Quinine salicylate* ($C_{20}H_{24}N_2O_2.C_7H_6O_3$).—This salt may be obtained by double decomposition of ammonium salicylate with quinine hydrochloride; a curdy precipitate of this salt is formed, while from alcoholic solution it forms prismatic anhydrous crystals. Soluble in alcohol of 90 per cent (20 parts), ether (120), and water (225 parts). M. Yvon prepares the salt by dissolving 1.6 Gm. of sodium salicylate in 50 Cc. of water, heating to boiling, and adding 4.36 Gm. of quinine sulphate. After boiling a few minutes, decomposition is complete. Cool to 35° C. (95° F.), and filter rapidly, wash with luke-warm, then with cold water, until all sodium sulphate is washed out (*Jahresh. der Pharm.*, 1879, p. 174).

Quininæ Quinas, *Quinine quinate (kinate)*.—Obtained by double decomposition of barium kinate and quinine sulphate, and evaporating to dryness. It is neutral, non-crystalline, and readily soluble in water. A solution in water (1 in 4) has been recommended by Collier for hypodermatic use (*Amer. Jour. Pharm.*, 1878, p. 487).

Quininæ Sulphovinas, *Quinine sulphovinate.* Prepared by mixing a solution of sodium sulphovinate (16.6 parts) in 90 per cent alcohol (200 parts), and a solution of quinine sulphate (42.8 parts) in alcohol of the same strength (600 parts). Filter from the precipitated sodium sulphate, and evaporate. It forms, with difficulty, prismatic crystals, very bitter, readily soluble in alcohol and water (1 in 3), as well as in glycerin and acetic ether, insoluble in ether, benzol, and fixed oils, and perfectly neutral (P. Carles, *Amer. Jour. Pharm.*, 1878, p. 343). The sulphovinate of sodium employed herein, is prepared by carefully adding to 1000 Gm. of strong alcohol 1000 Gm. of sulphuric acid, with continuous agitation, setting aside for several hours, diluting with 4 liters of distilled water, neutralizing with barium carbonate, and decomposing the filtrate with sodium carbonate, evaporating on a water-bath, and allowing to crystallize (*ibid.*, 1877, p. 443).

Quininæ Tannas, *Quinine tannate* (*Chininum tannicum*).—The *Ger. Pharm.* (1870) directed: Take of quinine sulphate, 1 part; dissolve it with a few drops of diluted sulphuric acid in distilled water, 30 parts; and add gradually a solution, previously made, of tannic acid, 3 parts; cold water, 30 parts. Let the precipitate subside in a cool place, collect it on a filter, wash with a small quantity of water, and dry it at a very gentle heat. The product is a yellowish, amorphous powder, of a peculiar odor, and bitter, astringent taste. It is sparingly soluble in alcohol, and very sparingly in water. In hot water it melts into a mass. The product, by analysis of J. Jobst (*Archiv der Pharm.*, 1878, p. 334), corresponds to the formula $C_{20}H_{24}N_2O_2.3C_{14}H_{10}O_9+8H_2O$, and contains about 22.5 per cent of quinine, while a neutral tannate, prepared by the author, had 31 per cent of quinine, corresponding to the formula $C_{20}H_{24}N_2O_2.2C_{14}H_{10}O_9+4H_2O$. A tasteless quinine tannate was introduced by M. Rozsnyay (1875). It is prepared by dissolving the quinine sulphate in boiling water, and adding to the solution the tannin, neutralized with diluted ammonia. The product is entirely tasteless. (For the process of the *Hungarian Pharmacopœia*, see *Amer. Jour. Pharm.*, 1888, p. 515.) J. Jobst (*loc. cit.*) found some tasteless quinine tannates deficient in quinine, probably owing to the employment of boiling water in preparing them. De Vrij (*Amer. Jour. Pharm.*, 1892, p. 142) obtains quinine tannate, containing 20 per cent of quinine, by triturating pure quinine (1 part) with tannic acid (4 parts), and water (10 parts), and evaporating to dryness at a temperature not exceeding 60° C. (140° F.) (also see R. Rother, *Amer. Jour. Pharm.*, 1883, p. 173). Quinine tannate is much less bitter than the other quinine salts. Its administration should be at once followed by some acidulous draught, as lemonade, etc., in order to insure its solution in the stomach. It is subastringent.

Quininæ Ferrocyanas, *Quinine ferrocyanate.*—Four parts of quinine sulphate and enough distilled water to form not too thick a mixture, are mixed with a concentrated solution of one part of potassium ferrocyanide; the whole is heated to boiling for a few seconds, then allowed to cool. The mother liquor, which yields more of the salt upon concentration, is poured off from the resin-like mass, the latter washed with hot water and crystallized from boiling alcohol. Small, yellowish needles, bitter, slightly soluble in water, freely in alcohol, efflorescent in the air (J. M. Maisch, *Amer. Jour. Pharm.*, 1877, p. 442).

Allied Principles.—Lantanine, an alkaloid from *Lantana brasiliensis*, *Brazilian verbena*, *Yerba sagrada*, said to resemble quinine in action, has been isolated from this plant by Negrete (1885). From 15 to 30 grains are administered in a day as an antiperiodic, preferably immediately after a paroxysm.

Vieirin.—A body obtained from the bark of a Brazilian tree, *Remijia vellozii*. Substituted, in doses of 1 to 4 grains, in Brazil, for quinine as an antiperiodic and tonic.

Bergenin, a crystallizable, bitter principle, has been isolated from *Saxifraga cordifolia*, *S. sibirica*, and *S. crassifolia*, by Garreau and Machelart (1881). It is sparingly soluble in alcohol (165 parts) and water (830 parts, at 15° C. [59° F.]). Said to be a valued nerve tonic, its action being intermediate between quinine and salicin. It occurs together with tannin and starch. *Saxifraga ligulata* contains an abundance of tannic and gallic acids (Hooper). In India, it is used as a remedy for *dysentery*.

QUININÆ BISULPHAS (U. S. P.)—QUININE BISULPHATE.

Formula: $C_{20}H_{24}N_2O_2H_2SO_4+7H_2O$. Molecular Weight: 546.88.

Synonyms: *Acid quinine sulphate*, *Quininæ sulphas acidus*, *Chininum bisulfuricum*, *Sulfate de Quinine neutre* (*French Codex*).

"Quinine bisulphate should be kept in well-stoppered bottles, in a dark place"—(*U. S. P.*).

Preparation.—In warm distilled water (1000 grains), suspend quinine sulphate (200 grains). Then to the mixture add of diluted sulphuric acid (official) 230 grains. Filter and set aside in a warm place. The crystals which form should then be dried over sulphuric acid, at a temperature of from 10° to 15° C. (50° to 59° F.). The yield is 250 grains. This corresponds about to the theoretical yield according to the equation: $(C_{20}H_{24}N_2O_2)_2.H_2SO_4+7H_2O+H_2SO_4=2C_{20}H_{24}N_2O_2.H_2SO_4+7H_2O$. Keep the product in a dark, cool, place, in a well-stoppered vial (see *Quininæ Bisulphas*, under *Related Compounds*).

Description and Tests.—"Colorless, transparent or whitish, orthorhombic crystals, or small needles, odorless, and having a very bitter taste. Efflorescing on exposure to the air. Soluble at 15° C. (59° F.), in 10 parts of water, and in 32 parts of alcohol; very soluble in boiling water and in boiling alcohol. When heated at 100° C. (212° F.), the salt loses all its water of crystallization (nearly 23 per cent); at 135° C. (275° F.), it is converted into quinicine sulphate, which dissolves in diluted sulphuric acid with a yellow color without any blue fluorescence. On ignition, the salt is slowly consumed, leaving no residue. The aqueous solution of the salt has a strongly acid reaction, and a blue fluorescence"—(*U. S. P.*).

"On treating 10 Cc. of an aqueous solution (about 1 in 1000) of the salt with 2 drops of bromine T.S., and then with an excess of ammonia water, the liquid will acquire an emerald-green color. With proper adjustment of the reagents, more diluted solutions will give a paler tint, while more concentrated ones will acquire a deeper color, or throw down a green precipitate"—(*U. S. P.*). (See *Thalleioquin reaction*, under *Quinine.*) "Ammonia water added to the aqueous solution of the salt throws down a white precipitate, soluble in an excess of ammonia water, and also in about 20 times its weight of ether. The aqueous solution of the salt yields, with barium chloride T.S., a white precipitate insoluble in hydrochloric acid. Quinine bisulphate should not impart more than a faintly yellowish tint to concentrated sulphuric acid (limit of *readily carbonizable, organic impurities*). If 1 Gm. of the salt be dried at a temperature of 100° C. (212° F.), until it ceases to lose weight, the remainder, cooled in a desiccator, should weigh not less than 0.77 Gm. (corresponding to 7 molecules, or 23 [22.98] per cent of water of crystallization). If 2 Gm. of the salt, dried at 100° C. (212° F.), be agitated with 16 Cc. of water, the mixture made exactly neutral with ammonia water, then brought to the volume of 20 Cc. by the addition of water, and macerated for half an hour at 15° C. (59° F.), upon proceeding further as directed for the corresponding test under Quinine (see *Quinina*), the results there given should be obtained"—(*U.S.P.*).

Action, Medical Uses, and Dosage.—Same as *Quinine Sulphate*. When the latter is made into solution by means of diluted sulphuric acid or aromatic sulphuric acid and water a solution of quinine bisulphate is formed.

Related Compound.—*Quininæ tetrasulphas, Quinine tetrasulphate, Quininæ bisulphas, Quinine bisulphate*, according to the French nomenclature (see *Quinina*). Quinine tetrasulphate obtained by Hesse (*Lieb. Ann.*, 1875), has the composition $C_{20}H_{24}N_2O_2(H_2SO_4)_2.7H_2O$. When exposed to light the crystals assume a brownish-red color. Water readily dissolves them with marked blue fluorescence. When boiled in alcohol and the solution cooled a gelatinous magma is formed, which, when dried, produces very small prismatic crystals containing 5 molecules of water.

QUININÆ HYDROBROMAS (U. S. P.)—QUININE HYDROBROMATE.

FORMULA: $C_{20}H_{24}N_2O_2HBr+H_2O$. MOLECULAR WEIGHT: 422.06.

SYNONYMS: *Chininum hydrobromicum, Chininum hydrobromatum.*

"Quinine hydrobromate should be kept in well-stoppered bottles, in a dark place"—(*U. S. P.*).

Preparation.—This salt, the neutral hydrobromate of quinine, may be prepared by adding ten grammes (10 Gm.) [154 grs.] of quinine sulphate to eighty cubic centimeters (80 Cc.) [2 fl℥, 339 ♏] of water, boiling, and slowly adding a solution of three and four-tenths grammes (3.4 Gm.) [54 grs.] of barium bromide in twenty cubic centimeters (20 Cc.) [325 ♏] of water. A precipitate of barium sulphate is formed, according to the equation: $(C_{20}H_{24}N_2O_2)_2.H_2SO_4+7H_2O+BaBr_2=2C_{20}H_{24}N_2O_2.HBr+H_2O+BaSO_4+6H_2O$. The supernatant solution which should rather contain a very slight excess of quinine sulphate than barium bromide (tested by quinine sulphate solution), is then evaporated to crystallization. M. Boille (*Amer. Jour. Pharm.*, 1874, p. 563) obtains the salt in the same manner, except by operating with alcoholic instead of aqueous solutions; barium bromide is soluble in alcohol while any admixed chloride would remain undissolved.

Description and Tests.—This salt is officially described as occuring in "white, light, silky needles, odorless, and having a very bitter taste. The salt is liable to lose water on exposure to warm or dry air. Soluble at 15° C. (59° F.), in 54 parts of water, and in 0.6 part of alcohol; very soluble in boiling water and in boiling alcohol; also soluble in 6 parts of ether, and in 12 parts of chloroform. When heated at 100° C. (212° F.), the salt loses its water of crystallization (4.25 per cent). At 152° C. (305.6° F.), it begins to fuse, and becomes a syrupy liquid at 200° C. (392 F.). Upon ignition, it is slowly consumed, leaving no residue. The salt is neutral or faintly alkaline to litmus paper. An aqueous solution. when acidulated with sulphuric acid, has a vivid, blue fluorescence"—(*U. S. P.*). "On treating 10 Cc. of an aqueous solution (about 1 in 1300) with 2 drops of bromine water, and then with an excess of ammonia water, the liquid will acquire an emerald-green color. With proper adjustment of the reagents, more diluted solutions will give a paler tint, while more concentrated ones will acquire a deeper color, or throw down a green precipitate"—(*U. S. P.*). (See *Thalleioquin reaction*, under *Quinine*.) "Ammonia water added to the aqueous solution throws down a white precipitate, soluble in an excess of ammonia water, and also in about 20 times its weight of ether. On precipitating a saturated aqueous solution of the salt with sodium hydrate T.S., filtering, supersaturating the filtrate with acetic acid, adding chloroform and a little chlorine water, and shaking, the chloroform will separate with a yellow color. If 1 Gm. of the salt be dried at 100° C. (212° F.) until it ceases to lose weight, the residue should not weigh less than 0.957 Gm. (corresponding to 1 molecule, or 4.24 per cent of water of crystallization). Quinine hydrobromate should not impart more than a faintly yellowish tint to concentrated sulphuric acid (limit of readily carbonizable, organic impurities), nor produce a red color with nitric acid (difference from morphine). If 3 Gm. of the salt (which must have been previously ascertained to be strictly neutral, or have been rendered so) be mixed, in a small capsule, with 1.2 Gm. of crystallized sodium sulphate and 30 Cc. of water, the mixture thoroughly dried on a water-bath, the residue agitated with 30 Cc. of water, and allowed to macerate for half an hour at 15° C. (59° F.), with occasional agitation, upon proceeding further as directed under Quinine (see *Quinina*) the results there given should be obtained"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This salt may be administered in *neuralgia* of congestive form, with tendency to congestion of the brain, and especially to females during the menstrual period. The dose is from 4 to 6 grains, in pill form, given 6 hours before the expected paroxysm; or 1 grain every hour. The dose of this salt is the same as that of the sulphate.

Related Salts.—QUININÆ HYDROBROMAS ACIDUS, *Acid quinine hydrobromate* ($C_{20}H_{24}N_2O_2[HBr]_2.3H_2O$). Dissolve quinine sulphate (10 Gm.) in water (80 Cc.), add of a 10 per cent sulphuric acid a sufficient quantity (about 11.8 Gm.) to convert the neutral into the acid sulphate; then precipitate with solution of 6.80 Gm. of barium bromide in 25 Cc. of water. Care must be taken that barium bromide be not in excess (see *Quininæ hydrobromas*). Filter out the barium sulphate formed and evaporate the solution to crystallization. The crystals are freely soluble in alcohol and in water (1 in 6). This salt was introduced as a preferable form for hypodermatic use. It may also be prepared by dissolving quinine in an excess of hydrobromic acid.

QUININÆ BROMAS, *Quinine bromate* ($C_{20}H_{24}N_2O_2.HBrO_3$).—Prepared either by neutralization of quinine with bromic acid, or by double decomposition of barium bromate and quinine sulphate (C. A. Cameron, *Amer. Jour. Pharm.*, 1882, p. 418; also see C. G. Johnson, *ibid.*, 1889, p. 119). It forms long needles aggregated into asbestos-like masses. Freely soluble in warm water, alcohol and diluted acids; sparingly soluble in cold water (1 in 250). In contact with concentrated sulphuric acid it detonates.

QUININÆ HYDROCHLORAS (U. S. P.)—QUININE HYDROCHLORATE.

FORMULA: $C_{20}H_{24}N_2O_2HCl+2H_2O$. MOLECULAR WEIGHT: 395.63.
SYNONYM: *Muriate of quinine.*

"Quinine hydrochlorate should be kept in well-stoppered bottles, in a dark place"—(*U. S. P.*).

Preparation.—This salt (the normal hydrochlorate) may be prepared by dissolving quinine in warm hydrochloric acid and allowing to crystallize. It has also been prepared by the double decomposition of quinine sulphate with barium- or calcium chloride. In order to avoid contamination with barium salt, quinine sulphate in alcoholic solution and sodium chloride are allowed to react with each other (R. Rother, *Amer. Jour. Pharm.*, 1883, p. 173). D. Vitali (*ibid.*, 1899, p. 231) prepares the normal hydrochlorate by warming 17 parts of potassium chloride with an aqueous solution of 100 parts of normal quinine sulphate, and evaporating to dryness on a water-bath; the residue is then extracted with 95 per cent alcohol which dissolves the quinine salt while potassium sulphate remains undissolved. The yellow solution is decolorized by animal charcoal and evaporated to crystallization. Similarly, the acid salt is obtained (see *Related Salts*).

Description and Tests.—"White, silky, light and fine, needle-shaped crystals, odorless, and having a very bitter taste. The salt is liable to lose water when exposed to warm air. Soluble, at 15° C. (59° F.), in 34 parts of water, and in 3 parts of alcohol; in 1 part of boiling water, and very soluble in boiling alcohol; also soluble in 9 parts of chloroform. When heated to 120° C. (248° F.), the salt loses its water of crystallization. At about 156° C. (312.8° F.), it begins to melt, but it is not fully melted until the temperature reaches 190° C. (374° F.). On ignition, it is slowly consumed, leaving no residue. The aqueous solution of the salt is neutral or faintly alkaline to litmus paper. The saturated aqueous solution of the salt does not give any blue fluorescence, which, however, appears to some extent upon diluting the solution with water, and markedly so upon addition of diluted sulphuric acid"—(*U. S. P.*). "On treating 10 Cc. of an aqueous solution (about 1 in 1400) of the salt with 2 drops of bromine water, and then with an excess of ammonia water, the liquid will acquire an emerald-green color. With proper adjustment of the reagents, more dilute solutions will give a paler tint, while more concentrated ones will acquire a deeper color, or throw down a green precipitate. Ammonia water added to the aqueous solution throws down a white precipitate, soluble in an excess of ammonia water, and also in about 20 times its weight of ether. The aqueous solution of the salt yields, with silver nitrate T.S., a white precipitate insoluble in nitric acid"—(*U. S. P.*). Dr. Vulpius (*Amer. Jour. Pharm.*, 1882, p. 409) reports that 10 Gm. of a 1 per cent silver nitrate solution, added drop by drop to 50 Gm. of a 1 per cent quinine hydrochloride solution, did not produce a silver chloride precipitate when the quinine solution was kept in a rotating motion; but the first drop precipitated immediately when the solution was at rest. The possible formation of a soluble double salt is suggested. The *U. S. P.* further directs: "If 1 Gm. of the salt be dried at 100° C. (212° F.) until it ceases to lose weight, the residue should not weigh less than 0.9 Gm. (corresponding to 2 molecules, or 9 per cent of water of crystallization). Quinine hydrochlorate should not impart more than a faintly yellowish tint to concentrated sulphuric acid (limit of readily carbonizable, organic impurities), nor produce a red color with nitric acid (difference from morphine). The aqueous solution of the salt should not be rendered turbid by diluted sulphuric acid (absence of barium), and should not be rendered more than slightly turbid by barium chloride T.S. (limit of sulphate). If 3 Gm. of the salt (which must have been previously ascertained to be strictly neutral, or have been rendered so) be mixed, in a small capsule, with 1.5 Gm. of crystallized sodium sulphate and 30 Cc. of water, the mixture thoroughly dried on a water-bath, the residue agitated with 30 Cc. of water, and allowed to macerate for half an hour at 15° C. (59° F.), with occasional agitation, upon proceeding further as directed under Quinine (see *Quinina*), the results there given should be obtained"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—On account of its ready solubility this agent is eligible for hypodermatic employment, the dose so administered being from 1 to 4 grains. For general use by mouth it is not inferior to quinine sulphate and may be given in about $\frac{1}{6}$ less dose than that salt.

Related Salts.—QUININÆ HYDROCHLORAS ACIDUS, *Acid quinine hydrochlorate*, *Bimuriate of quinine* ($C_{20}H_{24}N_2O_2.[HCl]_2$). This salt may be obtained by Vitali's process for *quinine hydrochlorate* (which see); only instead of 17 parts take 25 parts of potassium chloride. Mr. G. M. Beringer (*Amer. Jour. Pharm.*, 1891, p. 117) advises: Take of quinine, precipitated, washed and dried at a temperature not exceeding 50° to 52° C. (120° to 125° F.), 37.8 Gm., hydrochloric acid (specific gravity 1.16) 22.82 Gm.; water, 60 Cc. Mix the acid and water, add the quinine, filter if necessary, and carefully evaporate to dryness. The salt is very readily soluble in water.

CHLORHYDRO-SULPHATE OF QUININE.—This represents a line of double salts containing quinine chemically combined with hydrochloric and sulphuric acids, *e. g.*, $(C_{20}H_{24}N_2O_2)_2 2HCl.H_2SO_4+3H_2O$. They are very easily soluble in water (see *Amer. Jour. Pharm.*, 1883, pp. 174 and 492).

QUININÆ SULPHAS (U. S. P.)—QUININE SULPHATE.

FORMULA: $(C_{20}H_{24}N_2O_2)_2H_2SO_4+7H_2O$. MOLECULAR WEIGHT: 870.22.

SYNONYMS: *Sulphate of quinia, Sulfas quinicus, Quiniæ sulphas* (formerly called *Disulphate of quinine*), *Basic sulphate of quinine of the French Codex, Diquinine sulphate.*

"Quinine sulphate should be kept in well-stoppered bottles, in a dark place"—(*U. S. P.*).

Preparation.—From barks containing relatively small amounts of cinchonine, quinine sulphate is obtained by boiling the powdered barks with water acidulated with sulphuric or hydrochloric acid, precipitating the bases with caustic soda, whereby kino-tannic acid, kino-red, etc., remain in solution, boiling out the quinine and small amounts of cinchonine, with 75 to 80 per cent alcohol, and adding to the solution dilute sulphuric acid to a very slight excess. After the alcohol is distilled off, the residue consists of a crystalline mass of crude quinine sulphate, which is pressed off and purified by washing with a little water, and treated with animal charcoal, then recrystallized from hot water. Drying the salt must be effected in the shade to prevent coloration. When barks are employed containing relatively large amounts of cinchonine, most of this base will be precipitated in the above process upon cooling the solution of the crude bases in 85 to 90 per cent alcohol. The mother liquor, upon distilling off part of the alcohol, yields an additional quantity of cinchonine; the mother liquor now resulting, is treated as above. In order to obtain quinine as much as possible free from quinidine, the latter is precipitated from alcoholic solution by means of hydriodic acid (see table under *Quinina*). Other methods of obtaining quinine sulphate are detailed in Husemann and Hilger, *Pflanzenstoffe*, Vol. II, 1884, p. 1421, and the preceding edition of this *Dispensatory*. In more recent years, preference is given to the following process: The powdered bark is intimately mixed with caustic lime, the mixture moistened with water, and the liberated bases extracted with such solvents as amyl alcohol, petroleum hydrocarbons and paraffin oils. These solvents do not take up the coloring and tannin substances of the barks. From the solution thus obtained, diluted acid abstracts the cinchona bases which are then precipitated by sodium carbonate, and subjected to further purification (see B. Hirsch and A. Schneider, *Commentar f. d. Arzneibuch*, Göttingen, 1895; also Flückiger and Power, *Cinchona Barks*, 1884, p. 79).

Description.—Two sulphates of quinine are official, that under present consideration being the neutral salt, or *diquinine sulphate* (compare *Quinina*). Pure quinine sulphate forms hard, heavy crystals, while the commercially preferred quinine sulphate occurs in feathery, light crystals, a quality which was long believed to be due to the presence of a small quantity of cinchonidine sulphate. P. Carles (*Amer. Jour. Pharm.*, 1892, p. 314) finds, however, that the salt may also be obtained in the feathery form by allowing it to crystallize in the presence of ammonium sulphate. The official salt is described as occuring in "white, silky, light and fine, needle-shaped crystals, fragile and somewhat flexible, making a very light and easily compressible mass, lustreless from superficial efflorescence after being for some time exposed to the air, odorless, and having a persistent, very bitter taste. The salt is liable to lose water on exposure to warm air, to absorb moisture in damp air, and to become colored by exposure to light. Soluble, at 15° C. (59° F.), in 740 parts of water, and in 65 parts of alcohol; in 30 parts of boiling water, and in 3 parts of boiling alcohol; also in 40 parts of glycerin, in about 680 parts of chloroform, and freely in dilute acids. When long exposed to the air, or when kept at 50° to 60° C. (122° to 140° F.) for some hours, it loses most of its water of crystallization (all except 2 to 3 molecules, or about 4.1 to 6.2 per cent), the last portion being slowly expelled at 100° C. (212° F.), more rapidly at 115° C. (239° F.). Upon ignition, the salt is slowly consumed, leaving no residue"—(*U. S. P.*). Mr. A. J. Cownley (*Pharm. Jour. Trans.*, Vol. III, 1896, p. 525) recommends that the air-dry (effloresced) salt $(C_{20}H_{24}N_2O_2)_2H_2SO_4.2H_2O$, containing 4.6 per cent of water, be recognized as the official salt; a definite standard would thus be established. "The aqueous solution of the salt is neutral to litmus paper, and has, especially when acidulated with sulphuric acid, a vivid, blue fluorescence"—(*U. S. P.*). (See also *Quinina.*)

Quinine sulphate is incompatible with alkalies and alkaline earths, such as caustic potash and soda, aqua ammoniæ, lime-water, magnesia, etc., on account of the precipitation of quinine produced by these agencies. It is also precipitated by the carbonates of alkalies and alkaline earths; by soluble barium and lead salts (insoluble sulphates being formed); it is likewise incompatible with potassium iodide, potassium chromate, oxalate, and all soluble tartrates, mercuric chloride (*Amer. Jour. Pharm.*, 1887, p. 403), tannic and gallic acids and a number of other compounds. (See enumeration in E. A. Ruddiman, *Incompatibilities in Prescriptions*, New York, 1897.)

Adulterations and Tests.—The former high price of quinine sulphate (see interesting list of prices since 1823 in *Druggists' Circular*, 1896, p. 32) has occasionally led to adulterations or substitutions, such as the addition of sugar, starch, salicin, or inorganic material such as calcium phosphate, gypsum ("tasteless quinine," *Druggists' Circular*, 1896, p. 297), magnesia, potassium nitrate (*Amer. Jour. Pharm.*, 1876, p. 571), sodium sulphate (J. Biel, *ibid.*, 1872, p. 540), etc. Substitution by cinchonine hydrochlorate has been repeatedly noted (*ibid.*, 1871, p. 92; 1880, p. 473). The presence of inorganic impurities is readily recognized by the residue left upon incineration. Treatment with boiling alcohol likewise leaves them undissolved, as well as sugar and starch. The latter is recognized by the iodine test, the former by precipitating the quinine with ammonia; the filtrate upon concentration should not possess a sweet taste. Starch and sugar also would carbonize with concentrated sulphuric acid. Salicin if present, would form a blood-red solution with the latter reagent (see *U. S. P. Tests* below). The presence of other cinchona bases (cinchonine and quinidine) may be ascertained by the tests of the *U. S. P.* subsequently given, in conjunction with those under *Quinina.* "On treating 10 Cc. of an aqueous solution (about 1 in 1300) of the salt with 2 drops of bromine water, then with an excess of ammonia water, the liquid will acquire an emerald-green color. With proper adjustment of the reagents, more dilute solutions will give a paler tint, while more concentrated ones will acquire a deeper color, or throw down a green precipitate"—(*U. S. P.*). This is the *thalleioquin* test already recorded under *Quinina.* According to Hyde, this reaction succeeds best when calcium hypochlorite is used instead of bromine or chlorine. Acidulate the quinine solution with 1 drop of dilute sulphuric acid (1:4), filter the hypochlorite solution into the quinine solution until the blue fluorescence is just discharged. Now add to the faintly golden-yellow liquid a few drops of dilute ammonia (1:3); a brilliant emerald color will then appear (*Digest of Criticisms on the U. S. P.*, Part II, 1898). The *U. S. P.* further directs for quinine sulphate: "A cold, saturated aqueous solution of the salt remains unaffected by potassium iodide T.S. (difference from *quinidine sulphate*)"—(*U. S. P.*). (Compare table under *Quinina.*) "Ammonia water added to the aqueous solution of the salt throws down a white precipitate, soluble in an excess of ammonia water, and also in about 20 times its weight of ether. The aqueous solution of the salt yields, with barium chloride T.S., a white precipitate insoluble in hydrochloric acid. Quinine sulphate should not impart more than a faintly yellowish tint to concentrated sulphuric acid (limit of readily carbonizable, organic impurities), nor produce a red color with nitric acid (difference from morphine)"—(*U. S. P.*). (Also see *Quinina.*) "If 1 Gm. of the salt be dried at a temperature of 115° C. (239° F.), until it ceases to lose weight, the residue should not weigh less than 0.838 Gm. (absence of more than 8 molecules, or 16.18 per cent of water)"—(*U. S. P.*). This test for the presence of water is quite necessary, because the light powder, even when effloresced and seemingly dry, is capable of mechanically holding quite large quantities of water; thus Dr. Kerner records 18 per cent in an apparently dry sample (see *Amer. Jour. Pharm.*, 1880, p. 425). "If 2 Gm. of the salt (which must have been previously ascertained to be strictly neutral to litmus paper, or have been rendered so) be dried, as far as possible, at 100° C. (212° F.), the residue then agitated with 20 Cc. of water, and the mixture macerated for ½ an hour at 15° C. (59° F.), with occasional agitation, upon proceeding further as directed under Quinine (see *Quinina*) the results there given should be obtained"—(*U. S. P.*). B. Hirsch (*Pharm. Rundschau*, 1893, p. 240) points out that the employment of 7 Cc. of ammonia in this test indicates an allowance of about 4 per cent of alkaloids other than quinine (*Digest. loc. cit.*). The *British Phar-*

copœia (1898) demands the absence of more than traces of cinchonine, quinidine, cupreine, and amorphous alkaloid, and makes an allowance of 3 per cent of total bases, chiefly cinchonidine, as obtained by Liebig's test (precipitation with ether and ammonia) for which detailed directions are given, as well as for the determination of quinidine, cinchonine, amorphous alkaloid, and cupreine (see *Cinchona*). In this connection, see scheme of analysis of quinine sulphate and hydrochlorate, by C. Hielbig, in *Amer. Jour. Pharm.*, 1888, p. 411.

Action, Medical Uses, and Dosage.—(Compare *Cinchona*.) To the taste, quinine sulphate is extremely bitter. It does not fully represent Cinchona, whose associated principles possess properties not present in quinine alone. In small doses, quinine is a nervous and vascular stimulant. In large doses, it is a sedative and muscular and cardiac depressant, and, if given in suficient amounts, which, however, must be very large, it is capable of producing death. Upon denuded surfaces, quinine acts as an irritant. It is antiseptic and antiputrefactive, and for these purposes Cinchona bark was applied to ulcers by Sir John Pringle as early as 1765. In various strengths, quinine checks fermentation in milk, urine, alcoholic fluids, etc., and prevents decomposition of the same. Upon entering the stomach, quinine is dissolved by the gastric fluid, such portions as are not dissolved passing into the intestines, where the alkaline juices also precipitate such portions of the dissolved salt as may come into contact with them. In small doses, the movements of the stomach are increased, and the flow of gastric juice augmented. Large doses check the flow of the latter and cause irritation of the stomach. If the stomach be already irritable, even small doses of quinine or cinchona increase the difficulty. In immoderate quantities, it first constipates and then causes diarrhœa. Upon the blood, quinine appears to impress the hæmoglobin, impairing its function, with the result of lessening the oxidizing (ozonizing) powers of the blood. The activity of the white blood-corpuscles are also said to be inhibited or lessened, and the discs even destroyed by this salt. It has also been shown that the amœboid movements of these bodies are inhibited. Small doses increase the action of the heart, while large doses depress it. The feeble cardiac movements, from large doses, are due to its action upon the cardiac motor ganglia; the vaso-motor system is also depressed by it. In health, very little effect is produced upon the body-heat by quinine, though, in febrile conditions, it tends to bring down the temperature. It has a tendency to restrain the cutaneous secretions. The cerebrum is stimulated by small doses, and a hyperemic state of the brain induced. Large doses, however, produce a partial anemia of the organ, due to contraction of the arteries and feeble heart-action. After death, however, the brain is found to be engorged with blood. Deafness is a common result after the injudicious use of quinine, but it is seldom permanent. The optic nerve and retina, through ischæmia, become perfectly white, resembling white atrophy, and temporary blindness results. Occasionally, permanent atrophy of the nerve, with blindness, remains. Upon the spinal cord, the chief effects are a lessening or abolishment of reflex excitability. This is attributed, not to a primary action upon the cord, but to stimulation of Setschenow's center of inhibition, situated at the base of the brain. Quinine first stimulates the lungs, increasing the respiratory functions. Toxic doses, however, produce dyspnœa and a variety of abnormal respiratory movements, finally ending in death, with symptoms of asphyxiation. The spleen is contracted by quinine, and, upon the uterus, it probably has no power to originate contractions, though it appears to assist normal uterine contractions when they have once begun. For this purpose it is valued in feeble and intermittent uterine action during labor. Notwithstanding this, it is the general opinion that it is a perfectly safe agent to administer in *threatened abortion*, due to miasmatic influence, or occurring in malarial districts.

Quinine rapidly diffuses itself into the blood in proportion to the quantity taken. It is found in all the secretions, the tears, the saliva, milk, sweat, and urine. Though some of it is probably eliminated by the bowels, the chief amount—at least one-half—passes out by way of the kidneys, hence the irritant effects sometimes produced upon the urinary tract. In acute inflammation of the renal organs, it increases the difficulty and may give rise to complete suppression, or to retention of urine. Small doses increase the elimination of urea, uric acid, and creatinin, while the excretion of these products is diminished by larger doses. Quinine occasionally produces skin eruptions, among which may be mentioned erythema, urticaria, herpes, roseola, and rarely purpura. The physiological action of quinine throws but little light upon the practical applications of the drug. No absolute explanation can be given of its mode of action in malarial and other periodical fevers. That it antagonizes the miasmatic poison is accepted, this poison probably consisting of low forms of organic life—micro-organisms (*Plasmodium malariæ*)—the multiplication of which it prevents, and the destruction of which it accomplishes. Quite recent investigations give weight to the opinion that it destroys the plasmodium in the system, for, when isolated, these micro-organisms have been destroyed by so dilute a solution as 1 part of quinine in 20,000 parts of water.

Sulphate of quinine is febrifuge, tonic, and antiperiodic. Small doses, frequently repeated, act as a stimulant tonic, strengthening the pulse, increasing muscular force, and invigorating the tone of the nervous system. In some persons it induces headache, sickness, or irregular action of the bowels, which effects are generally obviated by combining it with morphine, extract of stramonium, or both, and these effects will be almost certain to follow if gastro-enteritic irritation preexists. Large doses, as 20 grains, or ½ drachm, produce many unpleasant symptoms, and ought never to be used, except in the malignant conditions hereafter mentioned. Among these may be named sickness and pain at the stomach, mental confusion, giddiness, flushed countenance, palpitation, a sense of fullness, throbbing, and distension in the head, intense weighty headache, ringing in the ears, vomiting, numbness in the feet, twitchings of the limbs, deafness, blindness, delirium, and nervous excitation and restlessness. If this amount be administered for several days, muscular debility, with tremulousness, unsteady gait, somnolence or apathy, obtuse sensibility, and dilated pupils, may also be present. In toxic doses, deafness and blindness may be complete, the limbs become powerless, and unconsciousness supervenes. Upon discontinuing the use of the salt, the effects gradually pass off, occasionally, however, the aural and ocular disturbances persist for some time if the drug has been long administered. It is seldom that the severer symptoms, above mentioned, are observed, for, as soon as slight cinchonism has been produced, known by giddiness, a buzzing or ringing in the ears, slight headache, etc., the drug is usually discontinued.

"The evil results following large doses, or the injudicious administration of quinine, has caused many physicians to reject it altogether in their practice. This is wrong. Quinine is a safe and very superior remedy, in proper hands, and when the specific indications are observed. As well might we reject all active and useful agents, because, when improperly used, they produce deleterious consequences. It must also be remembered, that many of the symptoms following the use of quinine, are the legitimate results of disease itself, as an enlarged spleen, a deranged condition of the nervous system, etc., or were formerly the deplorable consequences of a combined mercurial treatment, which has been and still continues to be a fashionable practice in many portions of this section of the country. No sensible or well educated physician will ever object to the proper employment of the pure sulphate of quinine" (J. King).

Since the development of specific medication, a better understanding of the uses of quinine has been established. While the earlier Eclectic physicians recognized *periodicity* as its unquestionable indication, and, while they recognized the fact that "symptoms of irritability, wakefulness, or restlessness, must be first subdued," they carried the effect of the drug to such an extent as to "affect the head" daily. This would indicate that they did not always employ it in the same conditions in which it is now recognized with us as a specific agent. When quinine is specifically indicated, it will act kindly, and the head need not necessarily be impressed. The indications for the agent, and which they closely approached, as now understood by us, and followed with prompt results, are: *Periodicity*, the fever taking the form of *remittent* or *intermittent;* the *pulse is open and soft, the skin soft and moist, the tongue moist and cleaning, and the nervous system free from marked irritation*. To act kindly, the stomach must not be irritable, and must be in a condition to receive and absorb the drug. If the general condition of the system be such that there is marked nervous excitation, as dry tongue and skin, and a frequent, hard pulse, an aggravation of the existing condition is likely to take place under the use of quinine and its salts. When, however, these unfavorable conditions can be rectified by other agents, then the quinine salt will be kindly received, and will do good work. Generally, when such untoward conditions are present, there is some unrecognized complication of the liver, spleen, or stomach. The following excerpt from the last edition of this work, will serve to illustrate the manner in which the drug was used by the earlier Eclectics:

"Sulphate of quinine, in American practice, is used in all febrile diseases, without regard to the violence of the fever, or the degree of congestive enlargement of the liver or spleen; it is usually given during the intermissions or remissions, in doses sufficient to affect the head, each day; when, for that day, its administration is omitted; but should there be no apparent remissions, it is then given daily to produce the same influence upon the head, without, as before said, regard to the violence of the fever, etc. Previous to its administration, however, any symptoms of irritability, wakefulness, or restlessness, must be first subdued. It is frequently given in these cases, as well as in many other forms of disease, in combination with ferrocyanide of iron; which was first introduced to the profession, as a safe and efficient remedy in this class of maladies, by Prof. I. G. Jones. In typhus and typhoid fevers, it will be found of much service, in conjunction with small doses of extract of leptandra, or resin of podophyllum, sufficient to produce a daily alvine evacuation. In febrile relapses, acute rheumatism, neuralgia, dyspepsia, debility, convalescence from most acute and chronic diseases, dysentery, and in all epidemic diseases, and every disease characterized by periodicity, it may be given with every expectation of success. Combined with morphine, I have used it successfully in epilepsy, delirium tremens, and the convulsive diseases of intemperate persons. In dysmenorrhœa, in conjunction with extract of stramonium or belladonna, and resin of black cohosh, it proves almost a specific. It is generally contraindicated during the presence of gastric inflammation, or unusual irritation of the stomach, though the addition of morphine, in such cases, will sometimes prevent any hurtful consequences" (J. King).

Quinine is the great remedy for *malarial fevers.* It is seldom now employed in other fevers without periodicity, except as a tonic to prevent prostration. The rule for the administration of quinine, as an antiperiodic, is as follows: "Whenever an acute disease exhibits periodicity, we administer the agent during the intermission, or when there is the least excitement of the circulation; but if this can not be done, owing to the shortness of the intermission, we give it during the reaction" (Scudder, *Materia Medica*, p. 436). In all cases the specific indications, as given above, are to be observed. If given when a chill is on, it is likely to aggravate it, while, during the sweating stage, it is neither necessary nor productive of much good. As to the manner of administration, there is some difference of opinion—some preferring broken doses, others the single dose. Probably, if the indications are correct, the manner of administering it does not make any material difference, as the effect of the drug seems to have been as certain when given in either manner. Prof. Scudder, after getting the patient in the proper condition, preferred to give a single dose of 10 grains in 1 or 2 ounces of water, using sufficient sulphuric acid to effect a solution. This he believed to be the most certain and pleasantest mode of administration. Prof. Locke advises from 15 to 30 grains, depending upon the condition of the patient, 5-grain doses being administered during the intermission, every 3 hours, so that the last dose may be taken an hour before the expected chill. The following solution is recommended by Prof. Locke: ℞ Quinine sulphate, ʒi; diluted hydrochloric acid, gtt. xxx; water, fl℥ii. Mix. Dose, a teaspoonful or more, every 3 hours; each teaspoonful contains about 4 grains of quinine. Fluid extract of liquorice may be added, if desired. It must be remembered that all cases of *ague* are not cured by quinine; but, as a rule, uncomplicated ague yields to it, and for *congestive chill* it is the best remedy in use. In *malignant intermittent*, it is the remedy which gives the best results. But in some of these cases the stomach is not in a condition to receive the medicine. When such is the case a sinapism may be applied to the epigastrium, and capsicum or black pepper may be freely given with the quinine. The latter must be used in large quantities, and without regard to time. From 10 to 20-grain doses may be given until 40 to 60 grains are taken (Locke). In *remittent fever*, give it in the larger or smaller doses during the remission, accordingly, as the disease is of a malignant or non-malignant type. In *typhoid fever*, quinine is not, as a rule, indicated. In fact, as ordinarily prescribed in this affection, it does much harm to the vascular and nervous systems, as well as to the stomach. When, however, the specific indications for it are present, and prostration is imminent, it may be given in 1 or 2-grain doses, about 4 times a day, and usually with the mineral acids, unless the latter are otherwise contraindicated. The mixed type of fever, known as *typho-malarial fever*, is benefited by quinine, in proportion to the predominance of the malarial infection, provided the indications for the drug are present. It is less effective as the typhoid element predominates.

Quinine and its salts are not always curative in the so-called *malarial cachexia;* it often fails here, when arsenic, ceanothus, boletus, eupatorium, etc., succeed. Generally, however, it proves useful in many troubles depending upon a malarial origin. It is useful in *ague-cake.* It is frequently of value in children's diseases occurring in malarial districts, particularly when periodic in type. Other diseases supervening in one subject to ague, are often benefited by the judicious use of quinine. Thus it forms the whole or a part of the treatment in *muscular pain, rheumatism*, etc. We have had excellent results in severe rheumatic conditions of the shoulders, wrist, and fingers in several instances, from the use of a weak, hydrochloric acid solution of quinine sulphate, to which is added specific capsicum. Here it will aid macrotys and other antirheumatics. It is a remedy for *periodical neuralgiæ* and *periodical headaches.* There is no doubt that quinine possesses prophylactic powers in preventing malarial manifestations.

In *obstetrical practice*, quinine is frequently serviceable. Here it may be employed to remedy irregular and ineffective pains, and in cases where complications of a periodical nature arise. As with its antiperiodic virtues, small doses of opium associated with it, increase its oxytocic power. By its tonic and contractile action, it minimizes the danger of *post-partum hemorrhage.* In ocular therapeutics, it meets *periodical neuralgic pain*, and, locally applied, occasionally relieves *follicular conjunctivitis* and *trachoma.* Quinine is, with some physicians, the remedy most relied upon in *sunstroke.*

That the nervous system is pronouncedly affected by quinine, is evident from the great damage done by the improper and untimely administration of the drug. When indicated, however, it is one of the most important of stimulants of the cerebro-spinal centers. Thus, in many chronic forms of disease, with impaired nutrition and functional torpor, we find that quinine, administered according to its indications, will, in small doses (½ to 2 grains), restore the proper innervation and aid in a cure. In fact, in chronic affections there are two main conditions in which it always does good, and those are cases with enfeebled innervation, as mentioned, and those of malarial infection, with "obscure periodicity" (Scudder). Not only does it stimulate the cerebro-spinal centers, but so impresses the sympathetic ganglia, that waste and excretion are better performed and digestion, nutrition, and blood-making are improved. Thus it is frequently combined with iron and strychnine in cases of *general debility.* An exceedingly useful preparation for this purpose is the "compound tonic mixture." Quinine, in small doses, is effectual in *dyspepsia*, depending upon a nervous derangement of the stomach. It counteracts the poison of *erysipelas.* In *intermittent neuralgia*, with severe pain, and particularly when affecting the fifth nerve, quinine, combined with small doses of morphine, is one of the most certain of drugs. The *colliquative sweating* of pulmonary affections is checked by the following: ℞ Quinine sulphate, grs. xxx; aromatic sulphuric acid, flʒss; water, fl℥iv. Mix. Dose, a teaspoonful 3 times a day, the last dose being taken at bedtime (Locke). Quinine is occasionally of value in *puerperal fever*, *septicæmia*, and *diphtheria.* It is particularly useful for the debility following *surgical diseases*, where the discharges are copious and exhausting. It also tends to check the formation of pus. Sometimes it is indicated in *pneumonia*, but not for antipyretic effects. As a tonic, sulphate of quinine will be found useful in all diseases connected with an enfeebled state of the system, and especially in the debility resulting from exhausting diseases; in *chlorosis*, and in *anemic conditions* it should be given in union with chalybeates. Externally, sulphate of quinine, in solution, has formed a valuable application to *indolent ulcers*, *buboes*, *chancres*, and *chronic mucous inflammations.*

We have received good results in the treatment of *hay fever*, by the internal administration of a solution of quinine in water and hydrochloric acid, each dose containing 2 grains of the salt, and being administered 4 times a day. A solution of ½ grain of quinine sulphate in an ounce of water, is recommended by some as a douche in this affection. Quinine solution is often of service in *diphtheria*, being applied locally to the membrane, and in *gonorrhœa*, it has done good service by injecting it into the urethra.

Many times quinine, even when indicated, is not well borne by the stomach. In such cases, and particularly in children's diseases, most excellent results are obtainable from an inunction of quinine and lard or petrolatum, applied to the abdomen, groin, and arm-pits. Some physicians never employ it in any other manner in the disorders of childhood.

The dose of quinine sulphate, internally, is from ½ to 3 grains, repeated every 1, 2, 3, or 4 hours, as the urgency of the case may require. Large doses are improper, except in remittent and intermittent fevers, when the dose may range from 5 to 20 grains. A popular mode of administering quinine is in capsules. This, while pleasanter, is less effectual than the acidulated solutions. A solution of quinine sulphate may be made by adding 20 grains of the salt to 1 fluid drachm of elixir of vitriol, and, when dissolved, add 2 fluid ounces of water. The dose of this solution is 20 drops every hour, in about ½ ounce of water, or syrup of ginger. Another solution may be made by dissolving sulphate of quinine, tartaric acid, of each, 20 grains, in 2 fluid ounces of water. The dose is as above. A number of agents have been employed to mask the taste of quinine. Among these are liquorice, yerba santa, and yerbazin. The practice of using tannic acid is to be condemned, as it converts the most of the quinine into an insoluble and practically inert quinine tannate. The acetate, nitrate, phosphate, ferrocyanide, citrate, and hydrochlorate of quinine, possess similar properties, but are not usually preferred in practice.

Specific Indications and Uses.—Periodicity, pulse soft and open, tongue moist and cleaning; skin soft and moist, and nervous system free from irritation; intermittent and remittent fevers; periodical neuralgia; enfeebled innervation.

YERBAZIN, a preparation prepared by Eli Lilly & Co., is said to be free from many of the objections of other quinine maskers. It is a syrupy preparation, containing the quinine masking principle of yerba santa. It perfectly disguises the bitter taste of quinine without decomposing that salt, or converting it into a tannate. Twenty or more grains of quinine are rendered palatable by a fluid ounce of yerbazin, the salt being suspended in the latter by rubbing in a mortar, or violently shaking in a partially filled vial. Yerbazin is a specialty of the above-named firm.

QUININÆ VALERIANAS (U. S. P.)—QUININE VALERIANATE.

FORMULA: $C_{20}H_{24}N_2O_2C_5H_{10}O_2+H_2O$. MOLECULAR WEIGHT: 443.07.

SYNONYMS: *Chininum valerianicum, Quiniæ valerianas, Valerianate of quinia.*

"Quinine valerianate should be kept in well-stoppered bottles, in a dark place"—(*U. S. P.*).

Preparation.—Quinine valerianate may be prepared by warming moist quinine with a solution of valerianic acid in water (for Wittstein's directions, see this *Dispensatory*, preceding edition). Another process consists in the double decomposition between quinine hydrochlorate and sodium valerianate in aqueous solution (process of the old *Dublin Pharmacopœia*). R. Rother recommends as the most advantageous process the double decomposition of quinine sulphate and calcium valerianate in the presence of weak alcohol (see formula and details in *Amer. Jour. Pharm.*, 1883, p. 177).

Description and Tests.—Valerianate of quinine is described by the *U. S. P.* as occurring in "white, or nearly white, pearly, lustrous, triclinic crystals, having a slight odor of valerianic acid, and a bitter taste. Permanent in the air. Soluble, at 15° C. (59° F.), in 100 parts of water, and in 5 parts of alcohol; in 40 parts of boiling water, and in 1 part of boiling alcohol"—(*U. S. P.*). The salt is readily soluble in ether. According to Dr. Landerer (1875) the dry salt when triturated in a mortar, exhibits in the dark a beautiful phosphorescence. "When heated to about 90° C. (194° F.), the salt melts, forming a colorless liquid. At 100° C.

(212° F.), it loses its water of crystallization, and also begins to lose valerianic acid. On ignition, it is slowly consumed, leaving no residue. The aqueous solution of the salt is neutral or slightly alkaline to litmus paper. The aqueous solution, when acidulated with sulphuric acid, exhibits a blue fluorescence, and emits the odor of valerianic acid"—(*U. S. P.*). A spurious valerianate has been met with, made by adding a few drops of oil of valerian to sulphate of quinine. This dissolves in about 30 parts of boiling water, depositing crystals of the sulphate on cooling. A thin film of oil will be seen on the surface of the water. "On treating 10 Cc. of an aqueous solution (about 1 in 1300) of the salt with 2 drops of bromine water, and then with an excess of ammonia water, the liquid will acquire an emerald-green color. With proper adjustment of the reagents, more diluted solutions will give a paler tint, while more concentrated ones will acquire a deeper color, or throw down a green precipitate. Ammonia water added to the aqueous solution throws down a white precipitate, soluble in an excess of ammonia water, and also in about 20 times its weight of ether. Quinine valerianate should not impart more than a faintly yellowish tint to concentrated sulphuric acid (limit of readily carbonizable, organic impurities). The aqueous solution of the salt should not be rendered more than slightly turbid by barium chloride T.S. (limit of sulphate)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Valerianate of quinine is tonic, febrifuge, and sedative, and may be employed similarly to the tartrate of quinine and morphine. It was highly recommended by the late Prof. I. G. Jones in *hemicrania*, and in *febrile* or *other diseases*, to relieve restlessness, wakefulness, and nervous irritability. It is, however, an unstable and disagreeable salt and is but little employed. The dose is from ½ grain to 2 grains, every 1, 2, 3, or 4 hours, according to the nature of the case.

RANUNCULUS.—CROWFOOT.

The fresh bulbous base and flowering tops of *Ranunculus bulbosus*. Linné.

Nat. Ord.—Ranunculaceæ.

Common Names: *Crowfoot*, *Bulbous crowfoot*, *Buttercup*.

Illustration: Lloyd's *Drugs and Medicines of North America*, Vol. I, Plate VII.

Botanical Source.—Ranunculus bulbosus has a perennial, solid, fleshy, roundish, depressed bulbous base, resembling a cormus, sending out radicles from its under side; in autumn it gives off lateral bulbs near its top, which afford plants for the following year, while the old bulb decays. The root sends up annually, several erect, round, hairy, and branching stems, from 6 to 18 inches in height, which are furrowed, hollow, and bulbous at the base. Radical leaves on long petioles, ternate, sometimes quinate; segments variously cut, lobed and toothed and hairy. Cauline leaves sessile and ternate; upper ones more simple. Each stem supports several solitary, golden-yellow flowers, upon furrowed, angular, and hairy peduncles. Sepals oblong, hairy, reflexed against the peduncle. Petals 5, inversely cordate, longer than the sepals, and arranged so as to represent the shape of a small cup. At the inside of the claw of each petal is a small cavity, which is covered with a minute wedge-shaped emarginate scale. The stamens are numerous, and yellow, with oblong, erect anthers. Ovaries numerous, with reflexed stigmas. Receptacles spherical. Carpels acute, naked, diverging, tipped with very short recurved beaks (L.—G.—W.).

History.—This plant is common to Europe and the United States, growing in fields and pastures, and flowering in May, June and July. There are several species, possessing similar properties, and designated by the general name of *Buttercup;* among these the *R. acris*, Linné, *R. repens*, Linné, *R. sceleratus*, Linné, and *R. Flammula*, Linné, may be indifferently substituted, the one for the other. The leaves and unripe germens of these species are acrid, occasioning, when chewed, a singular, intense cutting sensation in the point of the tongue, which quickly ceases when the plant is removed. This acrid principle is entirely lost by drying, however carefully this process be managed; and it also disappears in the germens as the seeds, which are themselves bland, ripen. It passes over in the distillation of the fresh plants with water. When any part of these plants is chewed, it occasions much pain, inflammation, and sometimes excoriation of the several parts of the mouth, and much heat and pain in the stomach, if it be taken internally. The distilled water of *R. Flammula*, Linné, is said to act as an instantaneous emetic.

Chemical Composition.—The acrid principle of these plants resides in a yellow volatile oil having the pungency of oil of mustard or horseradish. Ether and chloroform extract its active principle, crystallizable *anemonol* or *anemone camphor*, an unstable body, decomposing spontaneously into inert *anemonin* and *anemonic* (*isoanemonic*) *acid* (see *Pulsatilla* and *Anemone;* also *Drugs and Medicines of North America*, Vol. I, p. 59).

Action, Medical Uses, and Dosage.—The above-named plants are too acrid to use internally, especially when fresh; but when applied externally, are powerfully rubefacient and epispastic. *Ranunculus bulbosus* is employed, in its recent state, in *rheumatic*, *neuralgic*, and *other diseases* where vesication and counter-irritation are indicated. Its action, however, is so uncertain, and sometimes so violent, causing very obstinate ulcers, that it is seldom used. It is sometimes used by the beggars of Europe to produce and keep open sores, for the purpose of exciting sympathy. "I have cured two obstinate cases of *nursing sore-mouth*, with an infusion made by adding 2 drachms of the recent root, cut into small pieces, to 1 pint of hot water; when cold, a tablespoonful was given 3 or 4 times a day, and the mouth frequently washed with a much stronger infusion" (J. King). Prof. Scudder suggested a fraction of a drop largely diluted of a tincture of the fresh root (℥viii to alcohol, 76 per cent, Oj) as a stimulant to the vegetative process. Acting upon homœopathic principles it has been employed with asserted benefit in *herpes* and *eczema*. The dose is a fraction of a drop, well diluted, every 2 to 4 hours.

RESINA (U. S. P.)—RESIN.

Synonyms: *Colophony, Rosin.*

Source.—The term *Resin* (see *Resinæ*) here has a special meaning, being applied to "the residue left after distilling off the volatile oil from turpentine"—(*U. S. P.*). It is better known by the names of *Rosin* or *Colophony*. The manufacture of this article is one of the leading industries of the southern states (see *Terebinthina* and *Oleum Terebinthinæ*). *Resina flava*, or *Yellow rosin*, contains some moisture, in consequence of the distillation not being carried to dryness; if this, while in a melted state, be shaken with water, it forms a lighter colored resin, termed *Resina alba*, or *White resin*. *Fiddlers' rosin*, or *Colophony*, is a translucent, brownish-yellow substance, the result of the distillation being continued until all water is expelled, or without the use of water.

Description and Chemical Composition.—As officially required, resin is "a transparent, amber-colored substance, hard, brittle, pulverizable; fracture glossy and shallow-conchoidal; odor and taste faintly terebinthinate. Specific gravity 1.070 to 1.080. Soluble in alcohol, ether, and fixed or volatile oils; also in solution of potassium or sodium hydrate"—(*U. S. P.*). It is heavier than water and melts at a moderate heat. When kept in powdered condition, it is liable to undergo spontaneous combustion (H. Hager, *Amer. Jour. Pharm.*, 1888, p. 455). When melted, it can be united with wax, fats, spermaceti, etc. Prof. Olmstead (*Amer. Jour. Pharm.*, 1850, p. 325) states that rosin added to lard gives it a degree of fluidity not before possessed by the lard, and also prevents the latter from forming those acids which corrode metals. A compound of 1 part of rosin to 4 of lard, may be used for various purposes; by incorporating a certain amount of black-lead, and applying a thin coating to iron stoves and grates it prevents them from rusting, forming a complete protection. The principal constituent of rosin is *abietic anhydride* ($C_{44}H_{62}O_4$, Maly, 1861-64) which dissolves in warm 70 per alcohol with absorption of water and formation of *abietic acid* ($C_{44}H_{62}O_5$), which falls out upon cooling. This acid forms colorless small crystals soluble in alcohol, wood alcohol, chloroform, ether, benzene, carbon disulphide and glacial acetic acid. It also dissolves readily in caustic alkali with formation of a resin soap (*e. g.*, sodium abietate). The acid absorbs oxygen upon exposure to the air. A series of esters (ethyl, methyl and glyceryl esters) of abietic acid has been prepared which have been used in the preparation of varnishes. By destructive distillation of the acid with reducing agents (zinc dust), homologues of benzene, naphtalene, and anthracene are formed.

Action, Medical Uses, and Dosage.—Rosin is seldom given internally. Its principal use is to form plasters and ointments, to which it is an excitant ingredient, and renders them more adhesive. Internally, pulverized rosin will be found very useful in doses of 30 to 60 grains in molasses, or linseed oil, 3 or 4 times a day, in *bleeding piles*. Applied locally, on lint or cotton, it will be found a very valuable styptic. The vapor from rosin has been inhaled in *chronic bronchitis*, and certain atonic *affections of the lungs* with benefit; and the fumes of burning rosin, if received upon the parts, will, it is said, remove the irritation attending *piles* and *prolapsus ani*. Half a drachm of powdered rosin, dissolved in a sufficient quantity of chloroform, so as to make a thick solution, will relieve *neuralgia of the teeth*, or *toothache*, by introducing a piece of cotton, which has been impregnated with the solution, into the hollow teeth.

RESINÆ.—RESINS.

Medicinal resins, sometimes termed *resinoids* or *concentrations*, are a class of agents obtained from medicinal plants or roots, etc., by precipitation from their alcoholic tinctures, either by means of water alone, or aided by distillation. Those at present in use are generally impure, and contain one or more, but not all, of the therapeutic virtues of the plants from which they are made. *Note.*—The "Strong Tincture" of the different resins, referred to in their *preparation*, is usually made by exhausting any quantity of the root, or bark, etc., of the crude agent, by percolation with official alcohol. The subsequent evaporation is to be carried on by distillation until the residue is of a syrupy consistence. Most of the Eclectic resinoids are now discarded in favor of liquid preparations of the drugs yielding them, but, for obvious reasons, it is best to record again the processes to be found in former editions of this work. Resinoids, as a rule, are no longer of importance to Eclectic physicians. The exceptions to the above remarks are resins of cimicifuga and podophyllum, and the alkaloids found in hydrastis and sanguinaria, which were introduced originally as Eclectic resinoids.

RESINA CAULOPHYLLI.—RESIN OF CAULOPHYLLUM.

SYNONYM: *Caulophyllin.*

Preparation.—Take of strong tincture of blue cohosh root, 1 pint; water, 1 gallon. Distill off the alcohol, and pour the syrupy residue into the water, allow the mixture to stand for 24 hours, or until there is no further precipitate, collect the precipitate on a filter, and then allow it to dry in a moderately warm place.

History, Description, and Chemical Composition.—As blue cohosh root contains but very little resin, this preparation is not deserving the name of resin, but as it has been heretofore considered the resinous principle of the root, I give it a place, for the present, among the resins. Mr. W. S. Merrell first manufactured this article. Mr. A. E. Ebert found it to consist of two resins, both soluble in alcohol, but one only of them soluble in ether, and an extractive body analogous to saponin, which, when shaken with water, produced a very thick and persistent froth, was freely soluble in alcohol and in alkaline solutions, and the aqueous solution of which reddened litmus (*Amer. Jour. Pharm.*, 1864, p. 206).

Dr. T. L. A. Greve states in relation to this agent: "Caulophyllin is the name given by our pharmaceutists to the dried and powdered alcoholic extract of blue cohosh root. It can hardly be termed a resinoid, as the root contains but little, if any, resin, nor would it be proper to name it the active principle in the sense that this term is applied to strychnine, santonin, and other proximate principles of a definite chemical constitution. It is simply a *concentrated medicine*, representing the medicinal activity of the crude drug in a condensed and convenient form." It will be seen from these remarks, coming from a reliable source, that the article now prepared for the profession as "*Caulophyllin*," is simply the dry alcoholic extract of the root (J. King).

Action, Medical Uses, and Dosage.—Resin of caulophyllum appears to exert a direct influence upon the uterus, acting as an alterative, uterine tonic, and parturient, according to the periods in which it is employed. In the more common unhealthy conditions of this organ and its appendages, known as *amenorrhœa*, *dysmenorrhœa*, *passive menorrhagia*, *leucorrhœa*, *congested cervix*, etc., it is equal to, if not surpassing, the resin of black cohosh. A combination of equal parts of resins of blue and black cohosh, and carbonate of ammonium, will be found especially valuable, not only in the above-named affections, but likewise in *epilepsy*, *hysteria*, in which diseases it is recommended as an antispasmodic, and in *rheumatism* and *dropsy*. This resin may also be advantageously combined with alcoholic extract of aletris, oleoresins of asclepias, senecio, etc., in many forms of disease of the female generative organs. It has been spoken of as a parturient, but we have no personal knowledge of its influence as such, though we are aware that the root from which it is prepared does exert a parturient effect. Added to resin of podophyllum, or other active purgatives, it prevents tormina, and is, probably, the best agent that can be employed for this purpose. I have found it of decided benefit in severe *after-pains*, *neuralgic dysmenorrhœa*, and in several *derangements of the menstrual function*. The ordinary dose is from ¼ to 1 grain, 2, 3, or 4 times a day. As a parturient, it should be given in doses of from 2 to 4 grains, and repeated at intervals of 15 to 30 or 60 minutes, after actual labor has commenced. Resin of caulophyllum may be advantageously combined with extract of dioscorea in *bilious colic* and *flatulence*. With resin of podophyllum and chloride of ammonium, it forms an excellent combination for some *nephritic diseases*, accompanied with pains of a spasmodic character (J. King). It is but little used at the present time.

RESINA CIMICIFUGÆ.—RESIN OF CIMICIFUGA.

SYNONYMS: *Resin of black cohosh*, *Cimicifugin*, *Macrotin*.

Preparation.—Take of strong tincture of black cohosh root, 1 pint; water, 1 gallon. Distill the alcohol from the tincture, and pour the syrupy residue into the water, allow the mixture to stand 24 hours, or until there is no further precipitate, collect the precipitate on a filter, wash it with water, and then allow it to dry in a cool place.

History and Description.—This valuable and useful remedy I have used with much success in my practice since 1835, and had the honor of calling the attention of practitioners to it in 1844, and again in the *Western Medical Reformer*, of 1846, but it was not received into general use among practitioners until its preparation on a large scale by Mr. W. S. Merrell. Resin of cimicifuga is a dark-brown or yellow substance, lighter colored after pulverization, of a faint, narcotic odor, a slightly bitter, feebly nauseous taste, and soluble in alcohol (J. King).

Action, Medical Uses, and Dosage.—The resin of black cohosh possesses alterative, nervine, and antiperiodic properties, without having the narcotic virtues of the root, which are to be had in the alcoholic or the ethereal extract. It also appears to exert a peculiar influence upon the uterus, on which account it has been termed a "uterine tonic." Prof. T. V. Morrow, M. D., during his life, expressed himself as having made an extensive use of this preparation in various affections peculiar to the female sex, and with success. Prof. Morrow writes: "My experience in the use of the resin of black cohosh, has demonstrated to my mind that there is a slight difference in the *modus operandi* of this form of the medicine, when compared with the usual forms in which the Cimicifuga racemosa has been used. That difference principally consists in the increased liability of the latter to produce a heavy, dull, and aching sensation in the forehead, in connection with a feeling of dizziness, while the former appears to manifest a greater tendency to produce aching, and somewhat painful sensations in the joints and limbs generally." Resin of cimicifuga has been employed advantageously in *intermittent fever*, *periodic diseases*, *leucorrhœa*, *amenorrhœa*, *dysmenorrhœa*, *menorrhagia*, *threatened abortion*, *sterility*, *rheumatism*, *scrofulous affections*, and in *prolapsus uteri*, not accompanied with an inflammatory condition of that organ or of its ligaments. It has also been successfully used in *dyspepsia*, *chronic gonorrhœa*, *gleet*, *smallpox*, etc., and its tincture has been found an excellent local application in *chronic conjunctivitis.* It may be advantageously combined with other uterine tonics and alteratives—as, extract of aletris, resin of caulophyllum, oleoresins of senecio, or asclepias, etc.; with extract of dioscorea it often improves the action of this agent in *flatulency*, and in *bilious colic*, rendering its influence more prompt and certain in certain obstinate cases. Made into a pill, with equal parts of extracts of dioscorea and cramp bark, it will be found highly beneficial in *flatulency*, *bilious colic*, *cramps of pregnant women*, *painful dysmenorrhœa*, *spasmodic affections*, *borborygmi*, and in *cholera morbus*, to remove the cramps. As a parturient, it is inferior to the powdered root, or to the resin of caulophyllum. In *pulmonary*, *rheumatic*, and *dyspeptic affections*, where there is a want of tone in the nervous system, it will prove a most valuable medicine, especially as an adjunct of other remedies. Its usual dose is from ½ to 3 grains, and, in some cases, even to 6 grains, repeated 3 times a day (J. King). It is but little used at the present day, but when employed, the specific indications for its use, practically those given under *Cimicifuga* (which see), should be regarded.

The preparation obtained by Prof. Wayne's process (see previous editions of this *Dispensatory*) appears to possess more of the active properties of the root than the ordinary resin, and may be used in all cases where the root or its tincture is indicated, in doses varying from ¼ to 1 grain (J. King).

RESINA COPAIBÆ (U. S. P.)—RESIN OF COPAIBA.

"The residue left after distilling off the volatile oil from copaiba"—(*U. S. P.*).

Synonyms: *Copaivic acid, Acidum copaibicum.*

Description.—"A yellowish or brownish-yellow, brittle resin, having a slight odor and taste of copaiba. Soluble in alcohol, ether, chloroform, carbon disulphide, benzol, or amyl alcohol"—(*U. S. P.*). This is a mixture of copaivic acid and neutral resinous matter. Its solution in alcohol reddens litmus, and has an acrid, bitterish taste. (For further details, see *Copaiba.*)

Action, Medical Uses, and Dosage.—(See *Copaiba.*) Dose, 1 to 15 grains, preferably in emulsion.

RESINA DRACONIS.—DRAGON'S BLOOD.

A resin derived from the fruit of *Calamus Draco*, Willdenow (*Dæmonorops Draco*, Blume).

Nat. Ord.—Palmæ.

Botanical Source.—*Calamus Draco* is a small palm growing in the islands of the Indian archipelago. While the plants are young the trunk is erect, and resembles an elegant, slender palm tree, armed with innumerable dark-colored, flattened elastic spines, often disposed in oblique rows, with their bases united. By age they become scandent, and overrun trees to a great extent. The leaves are pinnate, their sheaths in petioles armed as above described; leaflets single, alternate, ensiform, margins remotely armed with stiff, slender bristles, as are also the ribs; 12 to 18 inches long and about ¾ inch broad. The spadix of the female is hermaphrodite and inserted by means of a short, armed petiole on the mouth of the sheath opposite to the leaf, and is oblong and decompound, resembling a common oblong panicle. Spathes several, one to each of the 4 or 5 primary ramifications of the spadix, lanceolate and leathery; all smooth except the exterior or lower one, which is armed on the outside. Calyx turbinate, ribbed, mouth 3-toothed, by the swelling of the ovary split into 3 portions, and in this manner adhering, together with the corolla, to the ripe berries. Corolla 3-cleft; divisions ovate-lanceolate, twice as long as the calyx, and permanent. Filaments 6, very broad, and inserted into the base of the corolla. Anthers filiform, and seemingly abortive. Ovary oval; style short; stigmas 3-cleft; divisions revolute and glandular on the inside. The berry is round, pointed, and of the size of a cherry (L.—Roxb.).

History and Description.—Dragon's blood is a dark-red substance, which is imported from the East Indies, and which is procured from the berries of the *Calamus Draco*, by rubbing or agitating them in a bag, softening by heat the resinous exudation obtained, and making this up into masses. An inferior grade is obtained by boiling the crushed fruits in water (*Pharmacographia*). There are several sorts of it, one (*Red dragon's blood*), occuring in dark reddish-brown sticks, a foot or more in length, and from 3 to 6 lines in diameter, enveloped with palm leaves, and bound with narrow slips of cane; another occurs in reddish-brown lumps of the size and shape of an olive, also covered with leaves in a moniliform row; another, of very fine quality, is a reddish powder; a fourth occurs in large, irregular pieces or tears, while an inferior kind is in very large masses or lumps, *Lump dragon's blood*, presenting a heterogeneous fracture (P.). Dragon's blood is brittle, feebly sweetish, or almost tasteless, and odorless. It is not acted upon by water, but is almost all dissolved by alcohol, wood alcohol and ether, only impurities being left undissolved; partly soluble in chloroform and benzene. It fuses by heat, and emits a benzoic-acid-like fume on burning. Its solution stains marble a fine deep-red color.

Chemical Composition.—Herberger found dragon's blood to consist chiefly of a red resin (90.7 per cent) which he called *draconin*. He also established the presence of benzoic acid. Hlasiwetz and Barth by fusing dragon's blood with caustic potash obtained *benzoic*, *para-oxy-benzoic*, *oxalic* and probably *protocatechuic acids* E. Hirschsohn (*Jahresb. der Pharm.*, 1877, pp. 54 and 404) established the behavior of genuine dragon's blood toward solvents and reagents. It is soluble in alcohol and ether with red color, less so in chloroform; if the article is derived from *Pterocarpus Draco* of the West Indies, it will be but little soluble in chloroform. Petroleum ether abstracted only from 1 to 7 per cent of soluble matter. Dragon's blood, in connection with other resins, was investigated in recent years by Prof. Tschirch and his pupils. K. Dieterich (*Jahresb. der Pharm.*, 1896, p. 159) examined a specimen derived from *Dæmonorops Draco* (Java and Sumatra) and found it to contain: (1) *Dracoalban* (2.5 per cent) an amorphous indifferent, not fusible body, abstracted by ether and precipitated by alcohol; it has the formula, $C_{20}H_{40}O_4$; (2) *dracoresin* (13.58 per cent) soluble in petroleum ether, alcohol, and ether, of the formula, $C_{20}H_{44}O_2$, fusing at 74° C. (165.2° F.); (3) *red resin* (56.8 per cent), a mixture of two esters, namely, compounds of the alcohol, $C_8H_{10}O_2$ (*draco-resino-tannol*) with *benzoic acid* ($C_6H_5.COOH$) and with *benzoyl acetic acid* ($C_6H_5.CO.CH_2.COOH$); (4) a *resin* soluble in alcohol, insoluble in ether (0.33 per cent); (5) *phlobaphenes* (0.03 per cent); (6) woody fragments, etc. (18.40 per cent); (7) ash (8.30 per cent). *Draco-resino-tannol* yields, upon dry distillation, benzene (benzol), toluene, styrol, phenyl acetylene, phenol, resorcin, pyrogallol, phloroglucin, acetic acid and creosote.

Action, Medical Uses, and Dosage.—Dragon's blood was formerly considered an astringent, and used in doses of from 10 to 30 grains in *passive hemorrhages*, *diarrhœa*, etc. Its principal use is to color tooth powders, plasters, tinctures and varnishes, and to produce a mahogany wood-stain (aloes 1 part, dragon's blood 1 part, alcohol 15 parts).

Related Drugs.—SOCOTRA DRAGON'S BLOOD, or *Katir*, is the product of *Dracæna Schizantha*, Baker, or, according to Hunter, the *Dracæna Ombet* of Kotschy. It is produced in Socotra. It differs from the Sumatra drug in the absence of scales, and in not evolving benzoic acid vapors when heated (*Pharmacographia*).

CANARY ISLAND DRAGON'S BLOOD is the product obtained by incising the stem of *Dracæna Draco*, Linné, of the Canary Isles. *Pterocarpus Draco*, Linné, of West Indies and South America, yields a resin known also as dragon's blood, as does *Croton Draco*, Schlechtendal, the product of the latter, however, being more of the nature of kino (*Pharmacographia*). According to Prof. H. Trimble (*Amer. Jour. Pharm.*, 1895, p. 516), a specimen received from Jamaica was for the most part soluble in warm water and contained 46.7 per cent of tannin, referred to dry substance, hence it closely resembled kino. The foregoing are not in general commerce. For an analytical study of the various red resins known as dragon's blood, see J. J. Dobbie and G. G. Henderson, *Amer. Jour. Pharm.*, 1884, p. 327).

RESINA JALAPÆ (U. S. P.)—RESIN OF JALAP.

Preparation.—"Jalap, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity. Moisten the powder with three hundred (300) cubic centimeters [10 fl℥, 69 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed. gradually adding alcohol, until twenty-five hundred (2500) cubic centimeters [84 fl℥, 257 ♏] of tincture are obtained, or until the tincture ceases to produce more than a slight turbidity when dropped into water. Distill off the alcohol, by means of a water-bath, until the tincture is reduced to four hundred (400) grammes [14 ozs. av., 48 grs.], and add the latter, with constant stirring, to nine thousand (9000) cubic centimeters [304 fl℥, 155 ♏] of water. When the precipitate has subsided, decant the supernatant liquid, and wash the precipitate twice. by decantation, with fresh portions of water. Place it upon a strainer, and, having pressed out the liquid, dry the resin with a gentle heat, stirring occasionally until the moisture has evaporated"—(*U. S. P.*). The yield by this process is officially required to be not less than 12 per cent (see *Jalapa*), but this figure is now seldom attained with jalap imported from Mexico, about 7 to 8 per cent being the average yield. Prof. Flückiger ascribes the decrease in yield to fraudulent abstraction of resin by means of alcohol, probably practiced by some Mexican dealers. He advocates the cultivation of jalap in Europe, pointing out that the tubers in one instance where jalap was cultivated, yielded 22.7 per cent of resin, referred to dry material (*Amer. Jour. Pharm.*, 1890, p. 141; also see E. R. Squibb, *Ephemeris*, Vol. III, pp. 1095 and 1248). Mr. F. H. Alcock proposes an assay of jalap for resin by means of amyl alcohol (*Amer. Jour. Pharm.*, 1892, p. 534).

Description and Tests.—As officially demanded resin of jalap should be in "yellowish-brown, or brown masses or fragments, breaking with a resinous, glossy fracture, translucent at the edges, or a yellowish-gray or yellowish-brown powder, having a slight, peculiar odor, and a somewhat acrid taste. Permanent in the air. Its alcoholic solution has a faintly acid reaction. Soluble in alcohol in all proportions; insoluble in carbon disulphide, benzol, and fixed or volatile oils. Not more than about 10 per cent of it is soluble in ether. On evaporating the ethereal solution, and dissolving the residue in potassium hydrate T.S., a reddish-brown liquid is formed, from which the resin is reprecipitated by acids. If that portion of resin of jalap which remained undissolved by ether be dissolved in potassium hydrate T.S., the addition of an acid does not precipitate it"—(*U. S. P.*). The resinous portion, not soluble in ether, is usually called *convolvulin* (W. Mayer). (For details regarding the chemistry of the resin, see *Jalapa*.) "Resin of jalap should not suffer any material loss of weight when heated at 100° C. (212° F.) (absence of water). Water triturated with it should neither become colored, nor take up anything soluble from it (absence of soluble impurities). On digesting 1 Gm. of resin of jalap for about an hour, with frequent agitation, in a glass-stoppered vial, with 10 Cc. of ammonia water, at a temperature of about 80° C. (176° F.), it should yield a solution which does not gelatinize on cooling (absence of common resin)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Jalap owes its cathartic powers to its resin; while its mucilage or gum has been reputed diuretic. The dose of the resin prepared, as stated above, is from 1 to 6 or 8 grains; it is apt to occasion much pain and griping, which may be frequently obviated by trituration with castile soap, resin of caulophyllum, or loaf-sugar.

RESINA PODOPHYLLI (U. S. P.)—RESIN OF PODOPHYLLUM.

SYNONYMS: *Podophyllin, Resin of mandrake, Resin of May-apple.*

Preparation.—The *U. S. P.* process for preparing podophyllin is as follows: "Podophyllum, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; hydrochloric acid, ten cubic centimeters (10 Cc.) [162 ♏]; alcohol, water, each, a sufficient quantity. Moisten the powder with four hundred and eighty cubic centimeters (480 Cc.) [16 fl℥, 111 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then add enough alcohol to saturate the powder and leave a stratum above it. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 48 hours. Then allow the percolation to proceed, gradually adding alcohol, until sixteen hundred cubic centimeters (1600 Cc.) [54 fl℥, 49 ♏] of tincture are obtained, or until the tincture ceases to produce more than a slight turbidity when dropped into water. Distill off the alcohol, by means of a water-bath, until the tincture is reduced to a syrupy consistence, and pour it slowly, with constant stirring, into one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of water, previously cooled to a temperature below 10° C. (50° F.), and mixed with the hydrochloric acid. When the precipitate has subsided, decant the supernatant liquid, and wash the precipitate twice, by decantation, with fresh portions of cold water. Spread it, in a thin layer, upon a strainer, and dry the resin by exposure to the air in a cool place. Should it coalesce during the drying, or aggregate into lumps having a varnish-like surface, it should be removed, broken in pieces, and rubbed in a mortar. As this is liable to happen during warm weather, resin of podophyllum is preferably made during the cold season"—(*U. S. P.*).

The original process of this *Dispensatory* directs us to take of strong tincture of mandrake root (see *Resinæ*), 1 pint; water, acidulated with 18 fluid drachms of hydrochloric acid, 1 gallon. Mix the tincture and the acidulated water together, allow the mixture to stand for 24 hours, or until there is no further precipitate, collect the precipitate on a filter, wash it with water, and then allow it to dry in a warm place not exceeding 26.6° or 29.4° C. (80° or 85° F.). Or, the alcohol may first be removed by evaporation in a warm bath; and the resin then be allowed to precipitate. The resin has also been obtained by precipitation without heat, by adding a solution of alum to a saturated tincture of the root. This makes a yellow alum lake. Podophyllin prepared by means of alum has never been popular with Eclectic physicians.

History.—The resin of podophyllum has enjoyed a far more extensive use in medicine than the crude drug from which it is prepared. Though official in the *U. S. P.*, and, strange to say, now more extensively used by members of the regular school of medicine than by our own practitioners, *podophyllin* is an Eclectic drug, having been first discovered and introduced to the profession by Prof. John King.* The practitioners of the old school employ this resin in nearly all of their vegetable cathartic pills. Of its introduction, Prof. John King says: "This valuable agent I had the honor of introducing to the profession 26 years since. In 1835, I was first led to an examination of the resinous principle of this plant, as well as of the iris, cimicifuga, aletris, and several other plants, in consequence of some information given me by Prof. Tully, of Yale College, New Haven, Conn., relative to the resinous constituent of the Cimicifuga racemosa. And since August, 1835, I have prepared and used, more or less in my practice, in the treatment of various forms of disease, the resins of podophyllum, iris, cimicifuga, alcoholic extract of aletris, and several other medicinal plants. In July, 1844, I first called public attention to the resins of podophyllum and iris, in the *New York Philosophical Medical Journal*, Vol. I, No. 7, pp. 157-161, in which I recommended the mandrake resin in combination with an alkali, for hepatic diseases, scrofula, dropsy, leucorrhœa, syphilis, gonorrhœa, gleet, obstructed menstruation, etc., but of which it appears but little notice was taken by the profession. In April, 1846, I again called the attention of the profession to this, as well as many other concentrated preparations, in the *Western Medical Reformer*, Vol. V, No. 12, pp. 175-178. Now, as dates are the only reliable source of correct information in such matters, unless some one can show an earlier notice of these articles, and of their practical utility, than the above, their claims will naturally be considered doubtful. The credit of first preparing resin of podophyllum, and other concentrated preparations, for the use of the profession generally, it being part of his avocation, belongs to Mr. W. S. Merrell, druggist and chemist, of Cincinnati, who first manufactured it in June, 1847, since which time it has become an indispensable and highly important American remedy, and is used by all classes of physicians, being generally preferred to mercurials by those who have fairly tested it" (J. King, in *College Journal*, 1857, p. 557).

---

* Podophyllin was the first of the "Eclectic" resinoids, being discovered by Prof. John King, in 1835, and quickly followed by him with cimicifugin and the oleoresins of iris and aletris. These substances were introduced to commerce by the late W. S. Merrell, who took pains to at once bring them before the commercial world. The firm of B. Keith & Co., of New York, followed, and made a specialty of "resinoids." Grover Coe contributed to the movement by his widely-distributed book—*Concentrated Organic Medicines*. But the history of "American resinoids" would make a volume, and can not be undertaken herein. We have therefore, carried from former editions of this work, Prof. King's remarks verbatim, and append this note only.

Prof. King further adds: "I am indebted to the late F. D. Hill & Co., of Cincinnati (A. D., 1852), for the following process of manufacturing resin of podophyllum. Exhaust coarsely powdered mandrake root with alcohol, by percolation. Place the saturated tincture in a still, and distill off the alcohol; the residue will be a dark fluid of the consistence of molasses; sometimes it is thicker, and when this is the case add a small portion of it to some water, and if it does not form a yellow-whitish precipitate, a small quantity of alcohol must be added to it, or enough to cause the light precipitate. Then warm the thick residual fluid, and slowly pour it into three times its volume of cold water, which must be constantly agitated during the process. If poured in too fast, or without agitation, the fluid will fall to the bottom unchanged. Allow it to stand for 24 hours, at which time nearly all the resin of podophyllum will be precipitated, the addition of a sufficient quantity of muriatic acid will precipitate the remainder. The precipitated resin of podophyllum, of a whitish-yellow color, is now to be removed and placed on a linen filter, and washed several times with water, to remove any remaining acid, gum, etc., after which it is to be placed in thin layers on paper, and dried in a room of a temperature between 65° aud 90° F., or, if in summer, at the natural atmospheric temperature. It becomes a shade or two darker by drying in this manner, but if artificial heat be employed to hasten the process, or a higher temperature, the resin becomes quite dark."

Description.—Resin of podophyllin varies in color according to its mode of precipitation, being, when precipitated by heat, dark-brown; and when by acid, a light brownish-yellow; or greenish-olive if by alum. It is insoluble in water, oil of turpentine, and diluted nitric acid; soluble in alcohol. By partial oxidation of the resin, soon after its preparation, a portion of podophyllum resin ceases to be dissolved by alcohol. From 3 to 6 per cent of resin is obtained from the mandrake root.

J. U. Lloyd has previously printed the following description of podophyllin: "As made by precipitation of the residue of a pure alcoholic tincture in cold distilled water it presents the following characteristics: If alcohol is present, the resin separates as a light-colored, porous powder. If it be not present, the resin precipitates in a dark, nearly black, resinous cake. This, when powdered, is of a dark-gray, or often nearly brown color, and is the description preferred by Prof. King. If the alcoholic percolate be poured into alum water instead of pure water, the resin precipitates of a bright-yellow color, and dries easily. This yellow podophyllin is in reality an alum lake, and, while it is easier to make it (for it dries like chalk) than to make the pure resin, it has been strongly opposed by Prof. King, and has never been recognized by the *Pharmacopœia of the United States*. Podophyllin has a strong odor of May-apple, and is intensely active when made without alum."

As described by the *U. S. P.*, resin of podophyllin occurs as "an amorphous powder, varying in color from grayish-white to pale-greenish-yellow or yellowish-green, turning darker when exposed to a heat over 35° C. (95° F.); having a slight, peculiar odor, and a peculiar, faintly bitter taste. Permanent in the air. Its alcoholic solution has a faintly acid reaction. Soluble in alcohol in all proportions; ether dissolves 15 to 20 per cent of it; boiling water dissolves about 80 per cent, and deposits most of it again on cooling, the remaining, clear, aqueous solution having a bitter taste, and turning brown on the addition of ferric chloride T.S. Resin of podophyllum is also soluble in potassium or sodium hydrate T.S., forming a deep-yellow liquid, which gradually becomes darker, and from which the resin is reprecipitated by acids"—(*U. S. P.*). Mr. G. M. Beringer (*Amer. Jour. Pharm.*, 1894, p. 9) points out that the pharmacopœial statement regarding the solubility of the resin in ether is erroneous, and the statement of its solubility in boiling water (adopted from experiments by Prof. F. B. Power, 1877), due to abnormal experimentation. The solubility of the resin in ether is about 80 per cent, and in boiling water about 23 per cent. These conclusions are confirmed by Nagelvoort (*ibid.*, 1894, p. 279). According to Beringer, chloroform dissolves about 80 per cent of the resin.

Chemical Composition.—For details regarding the chemistry of resin of podophyllum (*podophyllin*), we refer the reader to the article *Podophyllum*. The name *podophyllin* was not coined by Eclectics, but was suggested by Mr. J. P.

Hodgson. Podophyllin may be assayed for *podophyllotoxin* by extracting 1 Gm. with cold chloroform, evaporating the greater portion of the solvent, and pouring the solution into 20 volumes of petroleum ether. The podophyllotoxin is collected on a tared filter, dried, and weighed. A. Kremel found commercial samples of resin of podophyllum to yield from 20 to 30 per cent of podophyllotoxin (*Amer. Jour. Pharm.*, 1889, p. 177).

Action, Medical Uses, and Dosage.—Podophyllin possesses the cathartic properties of the crude drug in an exalted degree. While it is slow in action, it is certain in its results. Some persons are so susceptible to the action of the drug, that a dose of $\frac{1}{2}$ grain will actively purge them. The ordinary cathartic dose of this resin generally requires from 4 to 8 hours to act, but this action is quite persistent, often producing copious alvine discharges for 1 or 2 days, and when over leaves the intestines in a normal condition, seldom being followed by the after-constipation so common from the use of ordinary purgatives. As with the crude drug the cathartic action of podophyllin is increased by common salt. From 4 to 8 grains operate as an active emeto-cathartic, with griping, nausea, prostration, and watery stools; from 2 to 4 grains, as a drastic cathartic, with nausea and griping; from $\frac{1}{2}$ to 2 grains generally operates as an active cathartic, leaving the bowels in a soluble condition; in very small doses, it is gently aperient and alterative. In doses of $\frac{1}{2}$ or 1 grain, it is one of our most valuable cholagogue cathartics, operating mildly, yet effectually, arousing the whole biliary and digestive apparatus to a normal action, and which is very persistent in its character. "The action of this resin in affections of the liver has been doubted or denied by some practitioners, but, as we think, on erroneous grounds, judging from the beneficial results following its use in these affections, whether those results be due to direct influence upon the liver, or to an indirect one. Certainly, its effects in this class of diseases, are superior to those of the so-termed cholagogue mercurials" (J. King). It likewise exerts a favorable influence on the cutaneous functions, producing and maintaining a constant moisture on the skin. In doses of from $\frac{1}{8}$ to $\frac{1}{2}$ grain, or rather in sufficient doses not to purge, it acts as a powerful alterative, and will induce ptyalism in some persons. This drug should not be given in bulk, but should be combined with ginger, hyoscyamus, leptandra, or resin of caulophyllum, or some form of alkali, which renders it less liable to nauseate or gripe. Should catharsis be too severe, an alkaline solution, with aromatics, by mouth or enema, will check it. A popular and good method of preparation is that of triturating it with milk sugar (*lactin*). This not only obviates, to a certain extent, its irritant action, but singularly increases its purgative qualities. During its administration, all articles of food difficult of digestion should be avoided. According to Prof. Locke, podophyllin prepared by alum water is apt to gripe. Eclectics long made use of this agent in those cases where mercurials were used by other practitioners, and found the result vastly in favor of resin of podophyllum. It appeared to fulfil all the indications for which mercurials were recommended and used.

It is not, however, for its cathartic use that podophyllin is most valued by the Eclectic profession, but rather for its specific effect when given in small doses. Properly administered it is a stimulant to the sympathetic nervous system, acting principally upon the parts supplied by the solar plexus. It improves digestion and blood-making and stimulates normal excretion. For its action upon the liver, repeated small doses of the trituration (1 to 100), or a daily pill of podophyllin ($\frac{1}{20}$ grain) and hydrastin ($\frac{1}{4}$ grain) is much to be preferred to its cathartic dose. It should be given in the same manner when its action on the pancreas and spleen is desired.

Few physicians appreciate the action of this drug, in small doses, in *gastric* and *intestinal disorders*. It exerts a peculiarly specific action on all forms of stomach and bowel trouble with atony, characterized by full and relaxed tissues, with mucous discharge. The case is never one of loss of function from irritability, but from atony. In the *summer disorders of children*, especially *cholera infantum*, it will be often indicated, and is quick to restore normal action when the bowels are loose, with passages of mucoid, slimy material. The movements of the child are sluggish, the tongue is coated a dirty yellowish-white, the superficial veins are full, and the countenance is dull and expressionless. In many cases of chronic disease, associated with feeble digestive power, which is but little improved by the ordinary stomach tonic, this remedy will render excellent service. The trouble is usually atony of the upper part of the small intestines, and the stimulant dose of triturated podophyllin overcomes the difficulty. Podophyllin is a favorite anti-constipation remedy. It is equally valuable in *costiveness* of the young child and in the aged. In very young babies this trouble will yield to: R Podophyllin, 2d dec. trit., grs. xxx; brown sugar, ʒii; aqua, ℥iv. Mix. Sig. Teaspoonful, 4 times a day. For adults the daily use of from 1 to 2 of the podophyllin and hydrastin pills ($\frac{1}{20}$ and $\frac{1}{4}$ grain) will generally be sufficient to overcome the trouble. The cathartic dose should never be employed for the relief of costiveness, or when a cholagogue action is required. When the stools are hard and grayish-white or clay-colored, and float upon water, the remedy is peculiarly effective, as it is also in dry stools, with tympanitic abdomen and wandering, colicky pains. *Flatulent colic* of children, when associated with constipation, will readily yield to small doses of this drug, while, as a remedy for *dysentery* and both *acute* and *chronic diarrhœa*, accompanied by portal sluggishness and hepatic torpor, few remedies will excel it. *Dyspepsia*, with atony and thickened mucous membranes secreting abundantly, calls for stimulant doses of podophyllin. The head feels full, the tissues and veins appear full and doughy, the skin is sodden, and a dirty coating covers the tongue from tip to base. R Podophyllin, $\frac{1}{20}$ grain, 3 times a day. *Cardialgia*, accompanied with constipation, yields to the trituration (1 to 100). This drug has been justly valued in *hepatic disorders.* In that state ordinarily known as "*biliousness*," this drug or specific iris can usually be depended upon. Indeed, they act very nicely in combination. There is dizziness, a bitter taste, the stools show an absence of bile, and greenish, bitter material is vomited. The remedy is often indicated in both *acute* and *chronic hepatitis*, though usually contraindicated in inflammations of the gastro-intestinal tract. Fullness in the region of the liver, with aching under the scapulæ and in the back of the neck, with dizziness, usually calls for this drug. In *icteric states*, with clay-colored stools, it may be alternated with chionanthus. The unpleasantness attendant upon the retention or passage of *biliary calculi*, is frequently relieved by this agent. There is great pain in the region of the gall bladder coursing to the left and downward. Sometimes there is constipation, as often diarrhœa. There is a bad taste, and the patient is often jaundiced. R Podophyllin, gr. ij, at night, followed in the morning with a large quantity of olive oil. In *hemorrhoids*, dependent on biliary insufficiency with portal inactivity, it may be given in alternation with sulphur, the podophyllin being particularly desired when there is constipation with tenesmus. The small dose alone is required, from $\frac{1}{20}$ to $\frac{1}{10}$ grain, 3 or 4 times a day.

Podophyllin may do good service in those forms of *cough* characterized by *bronchorrhœa*, especially if it be associated with *gastric catarrh.* Here minute doses of sulphur are also valuable. In *heart disease*, when aggravated by hepatic inactivity and portal torpor, the cardiac remedy will be rendered more efficient if associated with minute doses of this drug. It has long been recognized as a remedy for *rheumatism*, when the patient is sallow and inactive, presents fullness of tissue, and complains of dull pain and heaviness in the right hypochondrium. In *renal disorders*, when the general specific indications for its use are present, it will restore the secretory power of the kidneys. Podophyllin has long enjoyed the reputation of exerting a powerful action upon the whole glandular system. For a long time it was, and is still with many, a favorite remedy in *syphilitic manifestations.* For persistent *pustular conditions*, *eczema*, and *cracked* or *fissured skin*, Ellingwood declares it a good remedy. It acts powerfully as an alterative, one of the best in the whole domain of medicine, at the same time aiding and improving the digestive process.

Podophyllin is a remedy for *pain*, according to Prof. Scudder—that deep-seated pain in the ischiatic notches. It has served a good purpose in *inflammations* (when not of the digestive tract), accompanied with great constipation. Here the cathartic action is required, as it is also in the forming stage of *febrile diseases*, with the exception of typhoid fever. Still, if indicative fullness be present, the small dose will assist very materially in overcoming these disorders. For its derivative action in *brain disorders*, large doses will be necessary, as is also the case in *dropsy*. In *malarial troubles*, small doses of podophyllin should be alternated, or given with cinchona. For all of the preceding uses specific podophyllum may also be used, but the dose must be correspondingly larger. For the gastric disorders many prefer it to the resin. Cathartic doses are required in *biliary calculi*, *apoplexy*, *dropsy*, and in some forms of *inflammation*. Younkin advises cathartic doses ($\frac{1}{6}$ grain, every 2 hours, with 10 grains of potassium bitartrate) for the relief of *gonorrhœal epididymitis*. The dose of podophyllin, as a cathartic, is from $\frac{1}{2}$ to 2 grains; as an alterative and stimulant, $\frac{1}{100}$ to $\frac{1}{10}$ grain; as a cholagogue, $\frac{1}{20}$ to $\frac{1}{10}$ grain. A good form in most disorders requiring the small dose, is the following: ℞ Podophyllin trituration (1 in 100), grs. v to xxx; aqua, ℥iv. Dose, 1 teaspoonful, every 1 to 3 hours.

Specific Indications and Uses.—Podophyllin is specifically indicated by fullness of tissues, fullness of veins, sodden, expressionless countenance, dizziness, tongue coated dirty yellowish-white, heavy headaches, indisposition to bodily exertion, intestinal atony, with sense of weight and fullness, full open pulse; "pain deep in ischiatic notches," and as an ideal cholagogue; clay-colored stools, floating upon water; stools, hard, dry, and accompanied with distended abdomen and colicky pain. It is contraindicated by pinched features, and small, wiry pulse, or when the pulse has a sharp stroke.

RESINA SCAMMONII (U. S. P.)—RESIN OF SCAMMONY.

Preparation.—"Scammony, in No. 60 powder, one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]; alcohol, water, each, a sufficient quantity. Digest the scammony with successive portions of boiling alcohol until it is exhausted. Mix the tinctures, and reduce the mixture to a syrupy consistence by distilling off the alcohol. Then add the residue in a thin stream, with active stirring, to twenty-five hundred (2500) cubic centimeters [84 fl℥, 257 ♏] of water, separate the precipitate formed, wash it thoroughly with water, and dry it with a gentle heat"—(*U. S. P.*). The resin of the *British Pharmacopœia* differs in regard to the source, being prepared from the root direct instead of the resin, though the final product is essentially the same, except that, as found by Hess (1875), it contains some tannin (compare *Scammonium*).

Description.—"Yellowish-brown or brownish-yellow masses or fragments, breaking with a glossy, resinous fracture, translucent at the edges; or a yellowish-white or grayish-white powder, having a faint, peculiar odor, and a slight, peculiar taste. Soluble in alcohol in all proportions; also wholly soluble in ether and in oil of turpentine. Ammonia water and solutions of alkalies dissolve it with the aid of a gentle heat; from these solutions the resin is not reprecipitated by acids"—(*U. S. P.*). (For report on commercial resins of scammony, see *Amer. Jour. Pharm.*, 1892, p. 122; and 1882, p. 543.)

Action, Medical Uses, and Dosage.—Uses same as for scammony (see *Scammonium*), the pure resin being about twice the strength of the latter. Dose, 3 to 8 grains, rubbed up with milk, or in combination in pills.

RESORCINUM (U. S. P.)—RESORCIN.

FORMULA: $C_6H_4(OH)_2$. MOLECULAR WEIGHT: 109.74.

SYNONYMS: *Resorcinol*, *Metadioxybenzol*.

"A diatomic phenol. Resorcin should be kept in dark amber-colored vials"—(*U. S. P.*).

Source, History, and Preparation.—This substance was discovered in 1864 by Hlasiwetz and Barth in the process of fusing galbanum resin (see *Galbanum*) with caustic potash, neutralizing with sulphuric acid and extracting with ether. The ethereal extract yielded upon distillation besides fatty acids an oily body which crystallized in the retort. Owing to its similarity to *Orcin*, the mother substance of several lichen coloring matters (see *Lacmus*), discovered in 1829 by Robiquet, the authors named the new substance *resorcin*. This process yielded

6 per cent. Similarly, resorcin may be obtained from other resins, such as ammoniacum, guaiacum, sagapenum, asafœtida, acaroid, etc., and by the dry distillation of *brasilin* or dry extract of brazil wood. It is now prepared on a large scale by fusing the sodium salt of benzene-meta-disulphonic acid ($C_6H_4[SO_3H]_2$) with caustic soda, neutralizing with acid and extracting with ether. The following reaction takes place: $C_6H_4(SO_3Na)_2+2NaOH=C_6H_4(OH)_2+2SO_3Na_2$ (sodium sulphite).

Description and Tests.—Resorcin forms "colorless or faintly reddish, needle-shaped crystals or rhombic plates, having a faint, peculiar odor, and a disagreeable, sweetish and afterward pungent taste. Resorcin acquires a reddish or brownish tint by exposure to light and air. Soluble, at 15° C. (59° F.), in 0.6 part of water, and in 0.5 part of alcohol; very soluble in boiling water, or in boiling alcohol; also readily soluble in ether or glycerin; very slightly soluble in chloroform. When heated to a temperature between 110° and 119° C. (230° and 246.2° F.), resorcin melts, a higher melting point indicating a greater degree of purity. At a higher heat it is completely volatilized. The aqueous solution is neutral or only faintly acid to litmus paper"—(*U. S. P.*). Resorcin is meta-diphenol, *i. e.*, benzene, substituted by two hydroxyl groups in the meta position (1, 3). It is isomeric with *pyrocatechin* (ortho-diphenol, 1, 2) and *hydroquinone* (para-diphenol, 1, 4). The name *resorcinol* was also given to resorcin to indicate its phenol nature; it must not be confused, however, with the noncrystalline, brown substance introduced by Bielaiew (see *Pharm. Centralhalle*, 1892, p. 714) under the same name. This new resorcinol is obtained by heating together resorcin and iodoform, to the point of fusion. It has an unpleasant taste, and somewhat the odor of iodine, and is said to be efficient in certain skin diseases, etc. Resorcin is chemically very active. It reduces both silver nitrate and Fehling's solution upon boiling. When bromine water is added to its aqueous solution, small colorless needles of *tribromresorcin* ($C_6HBr_3[OH]_2$) are precipitated, which are sparingly soluble in cold, more readily in hot water and in alcohol (see analogous reaction with phenol under *Acidum Carbolicum*). Unlike pyrogallol (which see), resorcin is not precipitated by ferrous sulphate, or by neutral lead acetate; it is precipitated, however, by basic lead acetate. *Resorcin black*, a dye for wool and silk, is obtained in the form of a black solution by adding sulphate of copper to an aqueous solution of resorcin, then sufficient ammonia to redissolve the precipitate. *Lacmoid*, a possible substitute for litmus as indicator, is obtained by heating resorcin with sodium nitrite; for use as indicator, dissolve lacmoid (0.5 Gm.) in water (100 Cc.) and alcohol (100 Cc.). Resorcin produces some characteristic color reactions. The *U. S. P.* enumerates the following: "On adding a few drops of ferric chloride T.S. to 10 Cc. of a diluted aqueous solution (1 in 200) of resorcin, the liquid assumes a bluish-violet color. If 0.1 Gm. of resorcin be dissolved in 1 Cc. of potassium hydrate T.S. and a drop of chloroform added, the mixture, upon being heated, will assume an intense crimson color. If a slight excess of hydrochloric acid be then added, the color will change to a pale straw-yellow. On cautiously heating 0.05 Gm. of resorcin with 0.1 Gm. of tartaric acid and 10 drops of concentrated sulphuric acid, a thick, carmine-red liquid will be formed, becoming pale yellow when diluted with water"—(*U. S. P.*). When the latter test is carried out with oxalic acid, a blue mixture is obtained which turns red upon dilution with 10 Cc. of water and 20 Cc. of alcohol of 91 per cent (by volume). Upon now adding aqua ammoniæ, the solution is carmine-red in transparent light, and greenish-yellow in reflected light. Citric acid gives a blue-green fluorescence (Flückiger, *Pharm. Chemie*, Vol. II, 1888, p. 329). These coloring matters are analogous to those known as *phtaleines* (see *Aniline Dyes* and *Fluorescein*, page 1652). Resorcin should wholly volatilize, without residue, when heated in a platinum or porcelain vessel. "A concentrated aqueous solution (1 in 2) of resorcin should be colorless (absence of empyreumatic bodies), and when gently heated should not emit the odor of phenol"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Resorcin has been compared to carbolic acid in physiological effects. Though regarded as less valuable than the latter as an antiseptic, a 1 per cent solution will preserve the normal acidity of the urine for weeks, and will prevent changes in animal structures and solutions of organic material. Applied to the skin in 1 or 2 per cent solutions it does not induce irritation of the integument and is free from the toxic effects which sometimes follow the local use of carbolic acid. It may also be applied to corneal wounds, the conjunctiva and gums and favors the union of wounds by first intention. Upon animals it has proved a narcotic and convulsive poison producing death. No lethal effects have been reported from its use upon man, though it has induced decided narcosis and convulsions. In the case of a woman who took 120 grains (Murrell, 1881) no spasms occurred, the patient first becoming dizzy, and then losing consciousness. Relaxation of the limbs, almost imperceptible pulse and respiration, subnormal temperature, pallor, olive-green urine, and excessive cold sweating were the other symptoms. Complete recovery took place in a day's time. The larger therapeutic doses may occasion a flushed face, tinnitus aureum, dizziness, acceleration of the pulse and respiration, and profuse sweating. Sixty grains have produced the added symptoms of collapse and insensibility. Andeer's two experiments distinctly show the effects of the drug. Deep narcosis was produced by 160 grains of resorcin, in a quart of water, taken in the course of a couple of hours. Upon a second trial a like amount was dissolved in 1 pint of water and taken within 15 minutes. He experienced ocular disturbances, such as light flashes with dimness of sight and palpebral heaviness. Loss of smell and hearing followed; the tongue became thick, extremities cold, a profuse cold sweat bathed his body and he fell in epileptiform convulsions, with irregular respiratory movements; the limbs flexed spasmodically, and finally opisthotonos occurred. Deep unconsciousness prevailed from which he was aroused after five hours' treatment, with the result of absolute lapse of memory as to what had taken place. No after-effects were observed after 24 hours. Alcohol is the antidote for poisoning by resorcin.

Resorcin has been used as an antipyretic but has been abandoned for the purpose by the majority of physicians as a dangerous agent. It is, however, at the present day, given for its antiseptic and healing effects in destructive diseases of the stomach, such as *gastric ulcer*, *cancer*, etc. It is also said to control *vomiting* produced by various causes, such as *sea-sickness*, *gastric ulcers*, *pregnancy*, *drunkenness*, *menstrual disorders* and *renal* and *hepatic colic*. It has also been used in *typhoid fever*, *pneumonia*, *inflammatory fevers* during the pus-forming stage, in *bronchorrhœa*, *gastric catarrh*, and advised in *diphtheria* (Andeer). These uses of the drug (except in gastric ulcer) have not been generally imitated by eclectic practitioners, and about the only internal use of the drug made by them has been the following: In 1 to 2-grain doses every 6 hours in *gastric irritation* from fermentation, in ½ grain doses in *cholera infantum*, and in 2 grain doses in *gastric ulcer*, the drug always being administered well diluted with water.

Locally, however, resorcin is a valued remedy. In spray it may be used in *whooping-cough*, *hay fever*, *laryngeal tuberculosis* and *ulceration of the larynx*. Washes of from 1 to 3 per cent strength have proved useful in catarrhal profluvia, as *ozœna*, *otorrhœa*, *fetid leucorrhœa* and *gonorrhœa*. A 10 per cent solution applied directly to the membrane has been lauded in *non-laryngeal diphtheria*, but probably it possesses no marked advantages over other antiseptic applications, none of which can be relied upon to the exclusion of internal treatment. In *eye diseases* a 3 per cent ointment of resorcin, or an ointment containing an addition of 3 per cent of sulphur, or a 1 to 3 per cent solution is useful in *non-ulcerative blepharitis*, in *corneal wounds*, and in *conjunctivitis* in both the acute and chronic forms. The solutions are beneficial in *suppuration of the middle ear* and have the advantage over many other agents in not causing maceration of the drum membrane (Foltz). A petrolatum resorcin ointment (equal parts) has been reported efficient in *carcinoma*. The chief use that has been made of resorcin is in *skin diseases*. Here it gives its best results. It is used very much in the same disorders as those benefited by carbolic acid. In from 5 to 30 per cent ointment it has been successfully applied in *pityriasis capitis*, *alopecia pityroides*, *squamous eczema of the scalp* and *seborrhœal eczema*. A 10 to 20 per cent ointment has acted well in *psoriasis*. It is useful in *parasitic eczema*, resembling psoriasis and pityriasis versicolor, the papules being depressed and itching severely. *Acneiform eczema*, *eczema flavum* and *lichen circumscriptus*, particularly if facial, are well treated with a weak ointment of resorcin (Thin's *Report;* see *Eclectic Medical Journal*, 1888, p. 37). *Frost-bite*, *fissures*, *erythema*, and *erysipelas* are conditions relieved by resorcin, applied in solution or ointment.

The internal dose of pure resorcin should range from 1 to 5 grains well diluted with water, though larger doses have been given without danger. As a rule its internal employment is contraindicated by cardiac affections, diphtheria, menstrual disorders, pneumonia, pulmonary œdema, last stages of continued fevers, typhoid fever, tuberculosis (last stages), arterio-sclerosis, and all exhaustive and debilitating diseases (Blake, *Ec. Annual*, Vol. IV, p. 18). Solutions may be used from 1 to 20 per cent in strength; ointment, 2 to 50 per cent.

Resorcin, in the form of ointment or solution, has been successfully employed upon diseases about the feet of horses.

Specific Indications and Uses.—Gastric irritation from fermentative food-changes; gastric ulcer. Locally in fetid mucous profluvia; eczematous and parasitic skin affections, with pruritis, and in papules with depressed center and much itching.

Related Compounds.—Thioresorcin ($C_6H_4O_2S_2$), a yellowish amorphous powder soluble in caustic alkalies, and their carbonates and sulphides. It is prepared by heating resorcin (1 molecule), sulphur (3), and sodium hydroxide (3), in the presence of water. It is precipitated from this solution by an acid. This agent is used like iodoform but has not superseded that article, and it is reputed not wholly innocuous.

Resopyrine.—Rhombic crystals produced by severally dissolving antipyrine (30 parts and resorcin (11 parts) in water (3 parts in each case). A crystalline mass results which is dissolved in alcohol and crystallized. It is odorless and has a feebly pungent taste. Alcohol (5 parts), chloroform (30), and ether (100) dissolve it; it is insoluble in water.

Pyrocatechin, *Catechol, Orthodioxy-benzene.*—This substance occurs in the products of the dry distillation of wood and of iron-greening tannins, *e. g.*, catechin, kino, while the iron-bluing tannins yield dioxy-benzene, or pyrogallol. It crystallizes in needles, soluble in alcohol, water and ether. It melts at 104° C. (219.2° F.), and boils at 245° C. (473° F.). It is best prepared from its methyl ether guaiacol (which see) by heating it with hydriodic acid. The reaction is as follows: $C_6H_4(OCH_3).OH+IH=C_6H_4OH.OH+ICH_3$ (methyl iodide). Pyrocatechin strikes emerald-green with ferric chloride, the color changing to a handsome violet-red upon treatment with sodium bicarbonate. Introduced as an antipyretic but discarded on account of its pernicious effects.

Hydrochinone, *Hydroquinone, Hydroquinol, Paradioxy-benzene.* This body is generally prepared by oxidizing aniline with a mixture of potassium bichromate and sulphuric acid, whereby quinone ($C_6H_4O.O$) is formed. The latter is then reduced to hydroquinone by means of sulphurous acid. It was first obtained in 1844 by Wöhler by destructive distillation of quinic (kinic) acid and may be prepared in like manner from oxysalicylic and succinic acids. It is isomeric with resorcin and pyrocatechin. It forms long, dimorphous crystalline leaflets without color or odor. Alcohol, ether and hot water readily dissolve it; cold water less readily. In concentrated solution it forms dark green crystals of *quinhydrone* when ferric chloride is added; if the latter be in excess yellow quinone results, the crystals being redissolved. Hydrochinone is largely employed to develop photographic plates. A 1 per cent solution checks alcoholic fermentation and putrefactive processes. Upon man the symptoms produced by doses of 40 or more grains are cerebral fullness, giddiness and ringing in the ears, accompanied with a reduction of the frequency and force of the heart action. It is decidedly antipyretic in the smaller doses (3 to 10 grains), but larger amounts tend to produce nervous phenomena, chills, and profuse perspiration. Its power of quickly reducing the temperature is marked and has been taken advantage of in the febrile exacerbations of *phthisis* and in the excessive temperature of *septicæmia, erysipelas, acute rheumatism of the joints* and *general tubercular affections.* Its employment in *pneumonia, pleurisy, scarlatina*, etc., is not to be commended. Occasionally it is used as a gastro-intestinal antiseptic. The urine is colored deep brown or greenish-brown by hydrochinone taken internally, and the drug, when mixed with solution of urea rapidly decomposes the latter. Dose, 2 to 20 grains.

Fluorescein, *Fluorescin* ($C_{20}H_{12}O_5$), *Resorcin-phtalein.*—This body is formed when phtalic anhydride (5 parts) and resorcin (7 parts) are melted together. It forms a deep red or brownish powder or crystals. It is not easily soluble in cold water, but dissolves in alcohol with a yellowish-red color and in ammonia with a red color, both solutions exhibiting a beautiful green fluorescence. This substance is analogous to phenolphtalein (see *Aniline Dyes;* also see *Eosin*, below). Used in ophthalmic practice to diagnose *corneal abrasions* and to locate *foreign bodies* imbedded in the surface of the eyeball. It does not affect the corneal epithelium, but wherever this is absent it produces a green spot; and around foreign bodies it shows a green encircling line. Recent corneal abrasions may be differentiated from old ones, the latter taking no stain; also in *corneal infiltration* the stain may be produced, while no discoloration occurs in *hypopyon keratitis* (Foltz).

Eosin, *Tetrabrom-Fluorescein* ($C_{20}H_8Br_4O_5$).—This body is formed by acting upon *resorcin-phthalein* (fluorescein) with bromine, and it is the potassium salt of this substance ($C_{20}H_6Br_4O_5K_2$) that is used under the name *soluble eosin.* It is a bronze-colored crystalline powder with a greenish reflection. In water it dissolves red with a green fluorescence which is destroyed by hydrochloric acid, the fluid assuming a yellow color. Eosin is largely used as a dye material and as a coloring reagent in microscopy. Eosin 5 grains, gum acacia 10 grains, and water 1 fluid ounce make a fine red ink.

RHAMNUS CATHARTICA.—BUCKTHORN.

The fruit (berries) of *Rhamnus cathartica*, Linné (*Cervispina cathartica*, Moench). *Nat. Ord.*—Rhamnaceæ.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 64.

Botanical Source.—Buckthorn is a shrub from 6 to 15 feet in height. Its branches are alternate or nearly opposite, spreading, straight, round, smooth, hard, and rigid, each terminating in a strong spine, after the first year. The leaves are 1 to 2 inches long, about two-thirds as wide, deciduous, bright-green, smooth, simple, and ribbed; the young ones downy; the earlier ones in tufts from the flowering buds; the rest opposite, on the young branches. Petioles downy. Stipules linear. Flowers yellowish-green, on the last year's branches, and numerous; the fertile ones with narrow petals, rudiments of stamens, and a deeply 4-cleft style; the barren ones with an abortive ovary and broader petals. The berries are globular, bluish-black, nauseous, with 4 cells, and as many elliptical, plano-convex seeds (L.).

Fig. 206.

Rhamnus cathartica.

History and Description.—Buckthorn is indigenous to Europe, and has been observed in this country as an introduced plant. It flowers from April to July, and matures its fruit about the middle of autumn. The parts used are the berries; they are globular, 3 or 4 lines in diameter, slightly compressed at the apex, black, glossy, and inclose a green pulp in which the seeds are imbedded. The juice becomes gradually red, owing to the development of acetic acid, and may be preserved long unchanged in the form of a syrup. It is soluble in water. When evaporated to dryness with alum, or lime and gum Arabic, it forms the color called *sap-green*. Carbonate of sodium and caustic potash change the solution of sap-green to yellow. Sulphuric, nitric, and hydrochloric acids turn it red. Hence, paper tinged with sap-green might be used as an indicator in place of litmus.

Chemical Composition.—The cathartic principle of this shrub is *rhamnocathartin*, a bitter, amorphous substance, isolated from the juice of the berries by Binswanger (1849), and previously by Hubert and Winckler. Mr. George W. Kennedy (*Amer. Jour. Pharm.*, 1885, p. 497) observed the same substance as a brownish deposit from a fluid extract of the bark. It was amorphous, soluble in caustic alkali with deep-purplish-red color, reprecipitated by acids, soluble in diluted and strong alcohol, insoluble in chloroform and ether, nearly so in water, and possessing strongly laxative properties in 3-grain doses. The resin, held in solution by the fluid extract, differed from that mentioned, by being soluble in ether and chloroform. *Rhamnotannic acid* was also isolated from the berries by Binswanger. The coloring matters of the berries were frequently investigated, and consist of the crystallizable glucosid *rhamnin* (Stein, 1868 and 1869; *rhamnegin* of Lefort and Schützenberger), and especially its decomposition product, *rhamnetin* (*rhamnin* of Fleury and Lefort), which is also crystallizable. This substance is likewise a constituent of the unripe berries of *Rhamnus infectoria* (see *Related Species*). *Rhamnin* crystallizes in pale-yellow, or golden-yellow, tasteless needles, readily soluble in water, diluted alcohol, and boiling alcohol, nearly insoluble in ether, chloroform, benzol, and carbon disulphide. Soluble, with yellow color, in caustic alkalies. *Rhamnetin* (*methyl quercetin*, J. Herzig, 1891) crystallizes in small, golden-yellow plates, nearly tasteless, hardly soluble in water, soluble in boiling alcohol (58.5 parts), and in ether (76 parts). It is soluble, with yellow color, in alkalies, and reduces Fehling's solution and silver nitrate solution in the cold. (For details regarding the earlier chemistry of the constituents of rhamnus, see Husemann and Hilger, *Pflanzenstoffe*, Vol. II, 1884, pp. 889–896.)

Action, Medical Uses, and Dosage.—Buckthorn berries (*Rhamni baccæ*) are powerfully cathartic; 20 of the recent berries cause brisk, watery purging, with nausea, dryness of the throat, thirst, and tormina. These effects are partly removed by giving the juice (*Rhamni succus*) in the form of syrup, and which formerly enjoyed much reputation as a hydragogue in *gout*, *rheumatism*, and *dropsy;* at present it is seldom employed in practice, but is occasionally employed as an adjunct to other cathartic and diuretic mixtures. Prof. Scudder suggests a trial of small doses of a tincture (berries, ℥viii, to alcohol, 76 per cent, Oj) as a stimulant to the vegetative processes, for its influence on the digestive tract, and in *diseases of the nose, throat, and lungs.* Dose of the syrup, from ½ to 1 fluid ounce. Dose of the tincture, 2 to 30 drops, well diluted with water. A tincture of the bark, made in the same proportions as that of the berries, may be given in doses of from 6 to 30 drops.

Related Species.—*Rhamnus infectoria*, Linné. Berries resemble in appearance buckthorn berries, except that their color is green-brown or brown. They are known as *French berries*, and yield several yellow coloring matters. According to Liebermann and Hörmann (*Jahresb. der Pharm.*, 1878, p. 433; and 1879, p. 195) the berries of *R. infectoria* and *R. tinctoria* contain about 12 per cent of glucosidal coloring matters. One of these glucosids is Kane's *xanthorhamnin* (*rhamnin* of Stein; see *R. cathartica*). Diluted acids split it into *rhamnetin* ($C_{12}H_{10}O_5$) and *isodulcit* ($C_6H_{14}O_{10}$). The decomposition is also brought about by ferments existing in the berries, hence rhamnetin is a prominent constituent of the latter. More recently, J. Herzig (*Chem. Centralblatt*, Vol. II, 1891, p. 306) established rhamnetin to be the *methyl ether of quercetin*, and to have the formula $C_{16}H_{12}O_7$, or $C_{15}H_9O_6(OCH_3)$.

Persian Berries, the fruit of several species of Rhamnus (*R. amygdalina*, Desfontaines; *R. saxatalis*, Linné, etc.) skirting the Mediterranean, also yield these color pigments.

RHAMNUS PURSHIANA (U. S. P.)—CASCARA SAGRADA.

The bark of *Rhamnus Purshiana*, De Candolle (*Rhamnus alnifolius*, Pursh; *Frangula Purshiana*, Cooper).

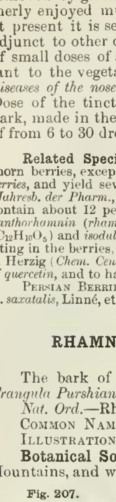
Nat. Ord.—Rhamnaceæ.

Common Names: *Chittem bark, Sacred bark.*

Illustration: Hooker, *Flora Bor. Amer.*, Vol. I, Plate 43.

Botanical Source and History.—This is a small tree, found in the Rocky Mountains, and westwardly to the Pacific Ocean, and extending north into British America. According to Mr. James G. Steele, the country producing the tree extends over 1000 miles in length. The branches are round and pubescent. The leaves are from 3 to 5 inches long, about one-half as broad, and are borne on leaf-stalks nearly an inch in length. When young they are covered with a dense pubescence on the under surface, but become glabrous and bright-green when old. In outline, they are broadly elliptical, obtuse, and entire at the base, and generally with a blunt, acute apex. The margin of the leaf is regularly dentate, with numerous small, serrate teeth, except at the base. The lateral veins are many, subparallel, prominent underneath, and proceed from the midrib at an acute angle. The leaves closely resemble, but are not so slender as those of the Alder buckthorn, or Southern buckthorn, of our southern states (*Frangula caroliniana*, Gray, or *Rhamnus caroliniana*, Walter). The flowers are small, white, and appear after the leaves have matured; they are borne in close, umbellar clusters, on pubescent peduncles, slightly longer than the leaf-stalks. The pedicels are short, about ¼ inch in length when in flower, but, in fruit, elongate to an inch or more. The calyx is small, 5-cleft, and pubescent on the outer surface. The petals are 5, minute, white, shorter than the calyx lobes, and 2-cleft at the apex. The stamens are 5, opposite, and embraced by the concave petals. The pistil, which is much shorter than the calyx-tube, consists of a free, 3-celled, and 3-ovuled ovary, a short style, and a 3-lobed stigma. The fruit is a small black drupe, obtusely 3-angled, about the size of a large pea, and contains 3 black, shining seeds. The genus Rhamnus is represented by 6 native species, and all, excepting *R. lanceolata*, Pursh, and *R. alnifolia*, L'Heritier, are found on the Pacific coast.

Fig. 207.



Genuine Cascara sagrada.

A few of the western species have evergreen coriaceous leaves. *Rhamnus californica*, Eschscholtz (*Frangula californica*, Gray), known as California buckthorn, or California coffee tree, probably furnishes a portion of the Cascara sagrada of commerce (see *Related Species*). The bark of *California mountain holly* (*Rhamnus crocea*) is aromatic and bitterish, and has both tonic and laxative qualities.

Cascara sagrada was discovered by an Eclectic physician, Dr. J. H. Bundy, its virtues being first extolled in "*New Preparations*," Detroit, 1877. Parke, Davis & Co. introduced the fluid extract to the medical profession and gave it great conspicuity. It may be confidently said that to their efforts is due the widespread celebrity of this drug and its preparations.

Description.—The bark is the part used in medicine, and has long been known in domestic practice among western people as a mild cathartic. Cascara sagrada is officially described as "in quills or curved pieces, about 3 to 10 Cm. (1⅕ to 4 inches) long, and about 2 Mm. ($\frac{1}{12}$ inch) thick; outer surface brownish-gray and whitish; the young bark having numerous, rather broad, pale-colored warts; inner surface yellowish to light brownish, becoming dark-brown by age; smooth or finely striate; fracture short, yellowish, in the inner layer of thick bark somewhat fibrous; inodorous; taste bitter"—(*U. S. P.*).

Chemical Composition.—Prof. Prescott (*Amer. Jour. Pharm.*, 1879, p. 165) described the microscopical structure and the chemical composition of the bark, which he finds to contain: (1) A *brown resin*, bitter to the taste, soluble in alcohol, chloroform, benzol, and carbon disulphide; insoluble in ether; slightly soluble in water. Solution of caustic alkalies dissolve it with purple-red color, from which solution acids precipitate it. Charcoal removes it from its alcoholic solution. It occurs chiefly in the middle and inner layers of the bark. (2) A *red resin*, nearly tasteless, insoluble in water; slightly soluble in ether, chloroform, and carbon disulphide; soluble in alcohol, and in caustic alkali with a brown color. Animal charcoal does not remove it from its solution in alcohol. It occurs in the corky layer of the bark. (3) A *light-yellow resin*, neutral, tasteless, insoluble in water; soluble in hot alcohol, chloroform, and carbon disulphide; not colored by potassium hydroxide solution.

In addition, Prof. Prescott obtained a tannic acid, oxalic acid, malic acid, a yellow fixed oil, volatile oil, wax, starch, and a neutral crystallizable body. The latter substance, from solution in absolute alcohol, crystallized in the form of white, double pyramids, which were almost insoluble in ether, chloroform, and petroleum ether; soluble in benzol. They melt and sublime, unchanged, at a temperature little above the heat of a water-bath, condensing into crystalline form. The substance does not give alkaloidal reactions. Prof. Prescott believes that some of these substances are closely related to constituents of *Rhamnus frangula*. P. Schwabe (*Archiv der Pharm.*, 1888, p. 591) found the bark to contain *emodin* ($C_{15}H_{10}H_5$) (see *Rhubarb*), but was unable to confirm the statement of Prof. W. T. Wenzell (1886), that a crystallizable glucosid (not identical with *frangulin*) is present in the bark (see *Frangula*). A. R. L. Dohme and H. Engelhardt (*Proc. Amer. Pharm. Assoc.*, 1897, p. 198) succeeded, however, in isolating from cascara sagrada a glucosid, which they named *purshianin*. Leprince, in 1892, obtained an orange-red substance, which he named *cascarin* ($C_{12}H_{10}O_5$), and which F. L. Phipson (*Comptes Rendus*, 1892) believes identical with *rhamnoxanthin* of Buchner (see *Frangula*). Messrs. H. F. Meier and J. LeRoy Webber (*Pharmacology of the Newer Materia Medica*, Detroit, 1892) found the bark to contain a ferment, occurring especially in recent bark, and being destroyed by heat. To this principle, it is claimed, the unpleasant griping and vomiting effects of recent bark are due. The authors also state that a glucosid is present, which is not bitter, but yields a bitter principle upon hydrolysis with acids or the gastric juice. Dr. R. G. Eccles (*Druggists' Circular*, 1888, p. 54) reported the presence of an alkaloid in cascara bark.

Action, Medical Uses, and Dosage.—Cascara sagrada, when introduced as a medicine, was highly recommended as a certain remedy in cases of *habitual constipation*, and in some forms of *indigestion*. Further trial has substantially sustained these assertions, and it is, undoubtedly, a valuable addition to our list of therapeutical agents. It does not, however, succeed in all cases, but acts best where a tonic to the intestines is required. As it tones the whole intestinal tract, it is valuable in doses of 10 drops, after meals, for that dyspeptic condition which depends most largely upon constipation, and is due to intestinal weakness. Administered in large doses, it has served us nicely in *sick headache*, due to like causes. Loss of tone in the rectum, with constipation, giving rise to *hemorrhoids*, is benefited by it. In *chronic constipation* it may be necessary to begin with the larger doses, and gradually reduce the quantity to a few drops, 3 times a day, though, as a rule, it is better to give repeated small doses, gradually increased, until the desired action is obtained, and then to gradually withdraw the drug. It acts kindly without irritating or griping, and produces stools of a semifluid consistence. Occasionally, but rarely, have reports of harsh action been made, such as cramps, colic, vomiting, and inordinate catharsis, while a soreness of the bowels, persistent in character, has been attributed to it. These effects, however, are not common. The remedy, in 10 to 15-drop doses, has been used with asserted success in *rheumatism*. *Chronic diarrhœa*, when due to hepatic sluggishness, has been checked by this agent, and it is said to be of some value in *gastric*, *duodenal*, and *biliary catarrh*, with *jaundice*. It is commonly prepared in the form of a fluid extract, the dose of which is from 10 to 60 minims, repeated, as required, 2 or 3 times a day. The powder may be given in 5-grain doses; the solid extract in 2 or 3-grain doses.

Specific Indications and Uses.—Constipation, due to neglect or to nervous and muscular atony of the intestinal tract; lesser ailments, depending solely upon constipation, with intestinal atony.

Related Species and Pharmaceutical Preparations.—*Rhamnus californica*, Eschscholtz (*Frangula californica*, Gray), *California coffee tree*, *California buckthorn*. This agent constitutes a portion of some commercial lots of cascara sagrada. (For its differentiation from other species of Rhamnus, in powder, see *Amer. Jour. Pharm.*, 1897.) It was introduced as a remedy for *rheumatism* by Prof. H. T. Webster, M. D., of California, who contributed an article—"*Rhamnus Californica in Rheumatism*"—to the *Eclectic Medical Journal*, in July, 1895. Prof. Webster (*Ec. Ann. of Med. and Surg.*, 1895, p. 30) says of it: "Rhamnus californica is commonly known as the *California coffee tree*. It is a shrub, which grows to the height of 20 feet in some instances, and bears a berry which is first green, then red, and finally, when ripened, black in color. This berry contains 2 seeds, resembling coffee-beans in shape, the flattened and grooved sides of the two lying in apposition, and being covered with a thin, sweetish-bitter pulp, resembling the choke cherry in taste, though the berry is as large as a marrowfat pea. It grows in the Sierras, in the coast range, and along the coast from Santa Barbara as far north as southern Oregon." In this connection, Dr. Rusby states (*Amer. Jour. Pharm.*, 1890, p. 532) that *Rhamnus californica* grows sparingly in northern California, but becomes more abundant southward and eastward, through Mexico and Arizona, while *Rhamnus Purshiana* is abundant from northern California northward, so that the place of collection forms presumptive evidence of the botanical origin of the bark. "It has been used in domestic practice as a substitute for *Rhamnus Purshiana*, and it has, doubtless, been a common practice to sophisticate the latter with the bark of *Rhamnus californica*, the resemblance between the two barks being very great, except that the bark of Rhamnus californica is thinner. California wholesale druggists designate the bark of the Rhamnus californica as '*thin cascara bark*.' Rhamnus californica (the bark) seems to me to be the most positive remedy for *rheumatism* and *muscular pain of rheumatoid character* that I have ever employed. A saturated tincture of the fresh bark, made in alcohol, may be administered in 15 or 20-drop doses, every 3 or 4 hours, in ordinary cases of *acute rheumatism*; 3 or 4 doses a day will answer in chronic cases. The preferable form of administration is that of a decoction of the recently dried bark. A heaping tablespoonful of the finely-broken bark is covered with a pint of cold water and steeped over a slow fire, it being allowed to simmer 15 or 20 minutes after reaching the boiling point. Of this 1 or 2 tablespoonfuls may be administered every 3 or 4 hours. If a laxative effect follows this dose, the amount to be administered must afterward be reduced until the cathartic effect is avoided. Catharsis is not necessary for its effective action. I have found it very effectual in long-standing and obstinate *dysmenorrhœa* (not requiring surgical interference). It may be administered in the manner already described, and should be continued 3 or 4 months, about 4 times a day. The dose of specific Rhamnus californica ranges from 10 to 30 drops. A variety of this plant, with white, tomentose leaves, is said to grow in New Mexico and Arizona" (Webster).

KASAORA.—This is a palatable preparation of cascara sagrada (a mild laxative), prepared exclusively by Messrs. Frederick Stearns & Co., Detroit, and was introduced by this firm under the name of "Cascara Aromatic."

ELIXIR PURGANS.—This compound is prepared exclusively by Eli Lilly & Co., Indianapolis, Ind., and is extensively used as a pleasant purgative and laxative. It contains and fully represents Rhamnus Purshiana, Euonymus atropurpureus, Cassia acutifolia (purified), Iris versicolor, and Hyoscyamus leaves combined with aromatics.

Colubrina reclinata, Brongn., *Mabee bark*.—South America. Contains 9.7 per cent of a bitter glucosid (W. Elborne and H. Wilson, *Pharm. Jour. Trans.*, Vol. XV, 1885, p. 831), and is employed in the West Indies as a gastric stimulant.

Colubrina asiatica, Brongn. (*Ceanothus asiatica*, Linné; *Rhamnus lævigatus*, Sol.).—Fiji Islands and Australia. The leaves are used by natives of the Fijis to cleanse the hair and destroy vermin (Maiden).

Alphitonia excelsa, Reissek (*Colubrina excelsa*, Fenzl), *Red ash*, *Leather jacket.*—Australia. Used occasionally in tanning (Maiden).

RHEUM (U. S. P.)—RHUBARB.

"The root of *Rheum officinale*, Baillon"—(*U. S. P.*).

Nat. Ord.—Polygonaceæ.

COMMON NAMES: *Rhubarb root* (*Rhei radix, Br.*).

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 213, 214, 215.

Botanical Source and History.—The botanical origin of the species which yielded the best rhubarb, formerly known in commerce as the Russian rhubarb, imported from China via Kiachta, in Siberia, is not known; no competent observer has ever been able to see the growing plant in its native habitat, the mountainous country Tangut, in Chinese Tartary, near the source of the Hoang-ho River. Chinese rhubarb is probably derived from more than one species; the closest approach to it is that described by Baillon, in 1872, as *Rheum officinale*, the description being taken from a plant successfully grown at Montmorency. This originated from leaves and cuttings forwarded to Dr. Soubeiran, of Paris, in 1867, by the French Consul at Hankow, China, Mr. Dabry de Thiersant, who obtained them from southeastern Thibet through French missionaries. Offsets of the French plant were also forwarded to England, in 1876, and cultivated with success by Rufus Usher, in Bodicote, in Oxfordshire. The common garden rhubarb (from *R. rhaponticum* and *R. undulatum*) had been in cultivation in England since 1608. The official rhubarb is that from *Rheum officinale*, which grows in southeastern Thibet, and probably other localities of the Chinese Empire.

RHEUM OFFICINALE, Baillon, according to *Pharmacographia*, is a "perennial, noble plant, resembling the common garden rhubarb, but of larger size. It differs from the latter in several particulars. The leaves spring from a distinct crown, rising some inches above the surface of the ground; they have a sub-cylindrical petiole, which, as well as the veins of the under side of the lamina, is covered with a pubescence of short, erect hairs. The lamina, the outline of which is orbicular, cordate at the base, is shortly 5 to 7-lobed, with the lobes coarsely and irregularly dentate. It attains 4 to 4½ feet in length, and rather more in breadth. The first leaves in spring display, before expanding, the peculiar, metallic-red hue of copper" (p. 492).

In addition, we quote from Mr. W. Elborne (*Pharm. Jour. Trans.*, Vol. XV, 1884–85, p. 136): "The best distinguishing character of *Rheum officinale* is the strong development of the sympodium or root-stalk, a large portion of which projects conically above the ground, being provided with a few lateral roots, about the thickness of a finger. Also the first epidermis of the radical portion is remarkable for the bright brownish-red color, the roots of the other species being yellowish-brown."

The *microscopical structure* of the official root is described by Mr. W. Kirkby (see W. Elborne, *loc. cit.*) as follows: "The outer layer, immediately beneath the epidermal portion, consists of about 8 rows of the tabular parenchyma, extended tangentially. Within this is a broad zone of loose parenchyma, containing starch, into which the medullary rays entered about half way across. Next comes the dark cambial line, made up of several rows of closely compacted, oblong parenchyma, exhibiting the radial arrangement of the medullary rays. Between the medullary rays are seen groups of large, reticulated vessels, consisting of from 1 to 5 vessels, arranged, for the most part, in a radial manner. They are surrounded by unthickened, elongated parenchyma. The coloring matters are found in the medullary rays. The center of the root shows no definite arrangement of the tissues, being a mass of parenchymatous cells, interspersed irregularly by the medullary rays. The whole root is loaded with starch. The granules are generally compound. The larger single granules have a diameter of about 20 micro-millimeters. The hilum is generally, but only slightly, eccentric, and is seen as a small, black dot. When mounted in Canada balsam, the black cross is distinctly visible with polarized light. Raphides (crystals of calcium oxalate) are fairly numerous, and vary considerably in size. In the loose tissue of the root, just within the zone of radial medullary rays, are found scattered the stars so characteristic of Chinese rhubarb; these exhibit all the anatomical features of the root. *R. officinale* differs chiefly from Chinese rhubarb in that it contains more starch, and from *R. rhaponticum* in the vessels and cells of the medullary rays being larger, and the arrangement of the various tissues being less distinct and regular." (Also see microscopical study of several species of Rhubarb, by Prof. L. E. Sayre, *Amer. Jour. Pharm.*, 1898, pp. 129–135.)

Cultivation and Collection.—Little is known about the cultivation and collection of Chinese rhubarb, the best of which seems to be obtained from wild varieties (Flückiger, *Pharmacognosie des Pflanzenreichs*, 3d ed., 1891, p. 399). According to Pereira, "the method of curing or preparing Asiatic rhubarb for the market varies somewhat in different localities. In China it is as follows: The roots are dug up, cleansed, cut in pieces, and dried on stone tables, heated beneath by fire. During the process, the roots are frequently turned. They are afterward pierced, strung upon cords, and further dried in the sun. In Tartary the roots are cut in small pieces, in order that they may dry the more readily, and a hole is made in the middle of every piece, through which a cord is drawn, in order to suspend them in any convenient place. They hang them, for the most part, about their tents, and sometimes on the horns of their sheep. Sievers, however, states that the roots are cut in pieces, strung upon threads, and dried under sheds, so as to protect them from the rays of the sun. He also tells us that sometimes a year elapses from the time of their collection until they are ready for exportation." The best grade is that known as *Shensi rhubarb*.

As regards cultivation in Europe, Mr. Elborne remarks (*loc. cit.*) that, as a general principle, forced cultivation produces a plant inferior in medicinal value, because it is chiefly inert tissue which is benefited by such cultivation. Propagation is effected from offsets or lateral shoots of 4-year-old plants, set at distances of 6 to 8 feet apart, and left to grow from 5 to 7 years, then the roots are ready for collection. They are dug up in dry weather, between July and September, peeled, sliced into pieces, known in trade as "flats" and "rounds." The rootlets furnish "small rounds," or "sticks." They are then exposed to a current of dry air in an open bedding for several days, and the drying is completed by exposure to artificial heat of 90° F., or, preferably, 80° F. for *Rheum officinale*.

Description and Commercial History.—As described by the *U. S. P.*, rhubarb occurs "in cylindrical, conical, or flattish segments, deprived of the dark-brown, corky layer, smoothish or somewhat wrinkled, externally covered with a bright, yellowish-brown powder, marked with white, elongated meshes, containing a white, rather spongy tissue, and a number of short, reddish-brown or brownish-yellow striæ; compact, hard; fracture uneven; internally white, with numerous red, irregularly curved and interrupted medullary rays, which are radially parallel only near the cambium line; odor somewhat peculiar, aromatic; taste bitter, somewhat astringent. When chewed, rhubarb feels gritty between the teeth, and imparts a yellow color to the saliva. Rhubarb which is very porous, or has a prominently mucilaginous taste, or is of a dark-brown color internally, should be rejected"—(*U. S. P.*). The grittiness observed when rhubarb is chewed is due to the oxalate of calcium present. Commercial rhubarbs, according to their geographical and botanical origin, may be classed as follows (Elborne, *loc. cit.*):

ASIATIC RHUBARBS.—*Chinese* (Russian, Muscovy or Turkey; Canton or East Indian; Batavian or Dutch-trimmed), yielded by *R. palmaticum* var. *tanguticum* and *R. officinale* (?). *Siberian*, from *R. rhaponticum*. *Himalayan* (*large*), from *R. Emodi*; *small*, from *R. Webbianum*. *Bucharian*, from *R. undulatum*.

EUROPEAN RHUBARBS.—*English*, from *R. rhaponticum* and *R. officinale*. *French*, from *R. rhaponticum*, *R. compactum*, and *R. undulatum*. *Austrian* (*Moravian*), from *R. rhaponticum*.

The former trade in *Russian rhubarb* was a government monopoly and the article, called *crown rhubarb*, has disappeared from commerce. It was collected in Chinese Tartary and sold to the Russian government, at the frontier town of Kiachta, where it was sorted by especially appointed apothecaries, and only the best grade accepted, the inferior grade being destroyed. It came to Europe by way of Asia Minor, and for this reason the term, *Turkey rhubarb*, established itself.

Since the opening of the Chinese ports to European commerce in the '60s, the trade via Kiachta rapidly declined. (For interesting details regarding Russian rhubarb and its trade, see A. Fero, *Amer. Jour. Pharm.*, 1867, p. 212; also *Druggists' Circular*, 1897, p. 278.) *Chinese* or *East Indian rhubarb* is that now mostly in use. It is the official kind of rhubarb. It was formerly brought from Canton, but is now collected in Hankow and exported from Tien-Tsin (see *Amer. Jour. Pharm.*, 1866, p. 153, for details regarding this grade). The *European rhubarb* (see *English Rhubarb* above) is produced in quite considerable quantity. Mr. Elborne (1884) reports that 12,000 pounds of English rhubarb were being gathered annually.

In selecting rhubarb, roots only should be taken which are sound and hard, of a bright-yellow color, of a strong rhubarb-aromatic smell, of a bitterish, slightly astringent taste, without viscidity, which feel gritty under the teeth, and which communicate a bright-yellow color to the saliva; they should present, when fractured, a marbled appearance of red and whitish veins, and be easily reduced to a bright-yellow powder, sometimes tawny-tinged (*Ed.*—T.). Inferior rhubarb is sometimes colored with turmeric, which may be detected by placing the rhubarb in powder on filtering paper, and moistening with chloroform, drop by drop. The turmeric color is thus transferred to the paper; dry the latter, moisten with solution of borax, then with hydrochloric acid. A brown-red tinge is formed if turmeric is present (see E. L. Howie, *Amer. Jour. Pharm.*, 1874, p. 16).

Rhubarb, if boiled in water till it becomes soft, then crushed and agitated in the water, deposits pale-gray sandy crystals of oxalate of calcium. Continued boiling injures its virtues. Proof-spirit is a more ready solvent of the active ingredients of rhubarb than water. Solution of caustic potash is colored blood-red by rhubarb. Lime-water causes at first a pale cherry-red haze, which slowly gives place to a red precipitate. Ferric chloride produces a green precipitate, and solution of isinglass a yellow, curdy deposit, owing to the presence of tannin.

Chemical Composition.—G. Dragendorff (*Jahresb. der Pharm.*, 1878, p. 74) analyzed 5 species of rhubarb, partly historical specimens, and found them to contain moisture (8.7 to 11.3 per cent), ash (3.2 to 24 per cent), mucilaginous matters (11 to 17 per cent), starch (6.2 to 16.5 per cent), sugar (3.7 to 5.5 per cent), cellulose, pectose, lignin, etc. (21 to 30 per cent), *cathartic acid* (2.03 to 5.25 per cent), oxalic acid (occurring as calcium oxalate, 1.12 to 4.6 per cent), malic acid (a trace to 1.24 per cent), free *chrysophanic acid* soluble in petroleum ether, absent or traces—in one instance 1.01 per cent—*chrysophan* and *tannin* (4.8 to 17.1 per cent), *emodin*, and resins soluble in alcohol, *e. g.*, *erythroretin*, *phæoretin*, etc. (1.15 to 6.29 per cent), white crystalline resin soluble in ether, insoluble in alcohol (0.15 to 2.32 per cent), fatty matter (traces, to 0.32 per cent), albuminous bodies (3.17 to 4.39 per cent). The results of an analysis of the species *Rheum officinale*, *R. rhaponticum* (both being *English rhubarbs*) and *East Indian* and *Russian rhubarbs*, by Mr. William Elborne (*Pharm. Jour. Trans.*, Vol. XV, 1884, p. 137) practically agree with those of Dragendorff. The latter considers *cathartic acid*, a glucosidal, nitrogenous substance, to be the purgative principle of rhubarb, greatly resembling that occurring in the leaves of senna and the bark of frangula. Quite recently, A. B. Stevens (*Proc. Amer. Pharm. Assoc.*, 1898, p. 339) again laid stress upon cathartic acid, and gave a method for its preparation. The tonic action of rhubarb, Dragendorff considers due to the tannin present (*rheo-tannic acid* [$C_{26}H_{26}O_{14}$] of Kubli), and the unmistakable antiseptic action, in cases of catarrhal affections of the intestines, due to the coloring matters *chrysophanic acid*, *emodin* and allied substances. Tschirch, however, finds the action of even chrysophanic acid to be decidedly purgative (*Archiv der Pharm.*, 1899, p. 632). *Chrysophanic acid* ($C_{15}H_{10}O_4$) was first isolated by Rochleder and Heldt, in 1843, from the wall-lichen *Parmelia parietina*. In 1844 its presence in rhubarb was recognized by Schlossberger and Dœpping, who also isolated several resins, *aporetin*, *phæoretin*, and *erythroretin*, all soluble in alkalies. Chrysophanic acid likewise occurs in the roots of certain species of Rumex (which see) and in goa powder (see *Acidum Chrysophanicum*). It crystallizes from alcohol in orange-yellow needles, soluble with yellow color in ether, alcohol (in 224 parts of 86 per cent); in petroleum benzin and amylic alcohol, almost insoluble in cold water. It dissolves in caustic alkali with beautiful dark-red color, but is insoluble in solution of sodium carbonate. According to M. Kubli (*Amer. Jour. Pharm.*, 1885, p. 614), chrysophanic acid usually does not exist as such in rhubarb, but occurs in the form of a glucosid called *chrysophan* (also see Dragendorff, previous page). Treatment of rhubarb with water seems to dissolve a ferment capable of converting chrysophan into chrysophanic acid. The same conversion with liberation of sugar in both cases, takes place upon boiling with diluted acids. Chrysophan is soluble in warm water, insoluble in ether and benzin. Chrysophanic acid is gradually deposited when a tincture of rhubarb weak in alcohol is allowed to stand. Warren de la Rue and Müller, in 1857, discovered in rhubarb a substance analogous to chrysophanic acid which they called *emodin* (compare *Frangula* and *Rhamnus Purshiana*). It crystallizes in long, red, monoclinic prisms, more easily soluble in alcohol than chrysophanic acid, but less soluble in benzol. It also differs by being soluble in solution of sodium carbonate. It has the formula $C_{15}H_{10}O_5$, and is *trioxy-methyl-anthra-quinone*, while chrysophanic acid is *dioxy-methyl-anthra-quinone*, both derivatives of the hydrocarbon *anthracene* ($C_{14}H_{10}$) (Liebermann and Waldstein, 1876).

In addition, J. O. Hesse (*Amer. Jour. Pharm.*, 1895, p. 615) obtained a third crystallizable principle *rhein* ($C_{15}H_{10}O_6$), which seems to be *tetra-oxy-methyl-anthraquinone.* Like emodin, it dissolves in sodium carbonate solution at ordinary temperature with deep purple-red color, but differs from it in being insoluble in hot toluene. It is physiologically inert. Hesse finds the purgative principle of rhubarb to reside in that portion of its ether extract which is dissolved by 80 per cent alcohol and from the latter extract dissolved by a weaker alcohol. The principle thus obtained is resinous, non-glucosidal, not yielding chrysophanic acid upon boiling with acids. It is somewhat acrid and bitter, acid in alcoholic solution, and strongly purgative.

These results, however, do not seem to be final (see J. O. Hesse, *Lieb. Annalen* Vol. CCCIX, 1899, p. 32; also A. Tschirch, *Archiv der Pharm.*, 1899, p. 632). Tschirch takes the ground that in the group of Frangula, Rheum, Senna and Aloe the purgative action is due to the presence of glucosids which are decomposed by the alkaline fluid of the intestines, whereby sugar and oxy-methyl-anthraquinones are formed. Of the latter, *emodin* in particular is decidedly active. In rhubarb, this glucosid is *chrysophan* (see above), the presence of which is confirmed also by Gilson (1898).

Action, Medical Uses, and Dosage.—Rhubarb is cathartic, astringent and tonic; as a cathartic, it acts by increasing the muscular action of the intestines, rather than by augmenting their secretions, and affects the whole intestinal canal, especially the duodenum. Its cathartic effect is succeeded by a mild astringency, which has gained for rhubarb the reputation of being secondarily a calmative, as well as a stimulant of the digestive canal; with its astringent influence, it likewise exerts for the most part, a tonic action on the stomach, improving the appetite and digestive powers. It is absorbed in the course of its operation, making the serum of the blood yellow, the sweat tawny, and the urine red, which may be distinguished from bloody urine by heating it. If blood be present it will coagulate, and remove the red color, which will not happen if the tint be owing to rhubarb. Rhubarb applied moist to the skin, or when used to dress ulcers, as it sometimes is, has produced its peculiar purgative effects. Rhubarb is much used as a laxative for infants, in many infantile diseases; its mildness and tonic qualities rendering it peculiarly applicable, especially when enfeebled digestion and irritation of the alimentary canal are present. In *acute* or *chronic diarrhœa* or *dysentery*, in convalescence from exhausting diseases, and in some irritable habits, where the mildest of all other laxatives are apt to excite hypercatharsis, rhubarb is an appropriate medicine. Its combination with soap or an alkali tends to counteract its astringent effects, and it thus becomes valuable in cases of *constipation.* It is useful in all cases of *fecal accumulations*, as it produces fecal, more than watery discharges. Sometimes it produces griping, which may be obviated by aromatics. The following pill I have found very beneficial in *dyspepsia* attended with constipation, *chronic diarrhœa* and *dysentery*, *habitual constipation*, *hepatic derangements*, *piles*, etc.: Take extract of rhubarb, extract of leptandra, hydrochlorate of berberine, and castile soap, of each, $\frac{1}{2}$ drachm. Mix them well together, and divide into 30 pills. Of these, 1, 2, 3, or 4 may be taken daily, sufficient to keep the bowels regular, without causing catharsis. When more than 1 are required daily, they should be given in doses of 1 pill at a time at regular intervals through the day (J. King). Prof. Locke recommends it in the *constipation of dyspeptics* with hepatic torpor, combining the neutralizing cordial with specific podophyllum or aloes. He also recommends it in *gout* and *rheumatism* with constipation, and as a gentle laxative after parturition. The cordial is recommended in the *nursing sore mouth of infants*. Rhubarb is efficient in the bowel disorders following the excessive use of alcoholics. The following is efficient during convalescence from *delirium tremens*: ℞ Leptandra, rhubarb, gentian āā, in powder, ℥i; ginger, ʒii; diluted alcohol, Oj. Macerate. Sig. Dose, 1 teaspoonful (Locke). Rhubarb is generally contraindicated in severe febrile or inflammatory affections. Toasting dissipates its purgative property considerably, but without diminishing its astringency, and it is, thus prepared, recommended by some practitioners in *diarrhœa*, *dysentery*, *cholera morbus*, and other diseases where astringents are indicated. In the ordinary *summer diarrhœa* of both children and adults, and particularly when an acid condition presents, the neutralizing cordial (Locke's formula preferred) is a most excellent corrective.

Specifically rhubarb is employed for a different action from that given above which represents the old but excellent uses of the drug. The specific object sought is the control of *gastro-intestinal irritation*, and this is nicely accomplished by the use of small doses of specific rheum. The red-pointed tongue, evidencing gastro-intestinal irritation, is the direct indication for its use. Add to this vomiting, nervous irritability as manifested by restlessness, screaming and convulsive muscular contractions, and the specific field of rhubarb is clearly set forth. The common method of administration is as follows: ℞ Specific rheum, ʒi; water, ℥iv. Dose, a teaspoonful every ½ or 1 hour. The same doses given less often act as an excellent gastro-intestinal tonic, giving better digestion and controlling the *papescent diarrhœa of indigestion* when present. In *chronic constipation* with a sense of constriction in stomach and bowels and contraction of the abdominal muscles, 10 drops of specific rheum may be given in a full glass of cold water in the morning. Fatty inunction of the abdomen adds to its efficacy. In conjunction with cod-liver oil and phosphorus preparations Prof. Scudder administered rhubarb where an "increased nutrition of nerve tissue" was demanded.

Dose of the powder as a purgative, from 10 to 30 grains; as a laxative, from 5 to 10 grains; as a tonic, from 1 to 5 grains; of the tincture or syrup, 1 or 2 fluid drachms; of neutralizing cordial, 1 to 4 fluid drachms. For specific effects, from $\frac{1}{10}$ to 5 drops of specific rheum.

Specific Indications and Uses.—Gastric irritation, nausea, vomiting, elongated tongue reddened at tip and edges; irritative diarrhœa with tenderness on pressure; sour smelling discharges imparting to the child a sour odor; gastro-intestinal irritation with nervous irritability, restlessness, screaming and convulsive muscular contractions; constipation, with a sense of intestinal constriction and abdominal contraction; light-colored fecal discharges.

Related Species.—*Rheum Emodi*, Wallich (*R. australe*, Don.) *R. Moorcroftianum*, *R. speciforme* and *R. Webbianum* are Himalayan species of rhubarb. (For description of these and the following species see Lindley, *Flora Medica*, p. 354.)

Rheum palmatum, Linné.—This plant inhabits the country near the great wall of China. It was cultivated in Russia soon after 1750, when a Tartarian merchant supplied Dr. Boerhaave, physician to the emperor of Russia, with what were believed to be the seeds of genuine rhubarb. Guibourt strongly held that *R. palmatum* was the botanical sonrce of genuine rhubarb of China, a view supported by the Russian Colonel Przewalski, who observed this species and collected specimens thereof in 1872-73 in the Chinese province of Kansu. The specimens, however, by analysis of Dragendorff (see *Rheum*) proved to be different from authentic specimens of the genuine root.

Rheum hybridum, Murray, and its variety *Colinianum* are cultivated, the former in Europe and the latter in Asia. Their roots agree with rhubarb.

Rheum undulatum (*Bucharian rhubarb*) and *R. compactum* are two species cultivated in France. The petioles of the latter species are used for pies.

Rheum rhaponticum, Linné, *Common garden rhubarb.*—This plant inhabits the borders of the Black Sea and is more abundant north of the Caspian, in the deserts between the Volga and the Yaik; also on the mountains of Krasnojar in Siberia. This has a more disagreeable smell than rhubarb, and is not so gritty to the taste. It is cultivated in this country and Europe, for pies, etc. The prepared root has the resemblance of true rhubarb, but not its medicinal properties. R. Otto believes the continued use of the petioles of rhubarb for pies, etc., to be injurious to health owing to the oxalic acid (0.2 to 0.3 per cent) it contains in soluble form in addition to insoluble calcium oxalate (*Drug. Cir.*, 1895, p. 150).

Perezia adnata, Gray (*Trixis Pipitzahoac*, Schaffner) (*Nat. Ord.*—Compositæ.—The rhizome of this plant is employed as a laxative and contains a violently purgative acid, which also imparts to the urine a greenish color. *Pipitzahoic acid* ($C_{15}H_{10}O_3$) is obtained by extracting the roots with alcohol of 82 per cent and precipitating with water. It forms beautiful yellow or reddish scales (*vegetable gold*) soluble in alcohol, ether, chloroform and carbon disulphide, nearly insoluble in water. It is sublimable. In alkali it dissolves with beautiful violet color. It has also been obtained from *Perezia Wrightii*, Gray, and *Perezia nana*, Gray, both from southwestern Texas. As a drastic cathartic the dose is from 4 to 8 grains. The acid is an oxyquinone (Anschütz).

Rhinacanthus communis, Nees (Acanthaceæ).—India and China. Root-bark of this shrub contains viscous, tasteless, *rhinacanthin* ($C_{14}H_{18}O_4$), not a glucosid (Liborius). In some respects it resembles chrysophanic acid. The leaves and woody root have been employed in *ringworm* and other *skin affections* (see complete analysis, by P. Liborius, in *Jahresb. der Pharm.*, 1883-84, p. 152).

RHODODENDRON.—ROSEBAY.

The leaves of *Rhododendron chrysanthum*, Linné.

Nat. Ord.—Ericaceæ.

COMMON NAMES: *Yellow-flowered rhododendron*, *Rosebay*, *Snow rose.*

Botanical Source.—This is a small bush, with the stem from 1 to 1½ feet high, spreading, very much branched, often almost hidden among moss, from which the tips only of its shoots are protruded. The leaves are alternate, of the texture of a laurel leaf, ovate, somewhat acute, tapering into the stalk, reticulated and very rough above, and paler and smoother underneath. The flowers are large, showy, nodding, and borne on clustered, terminal, loose peduncles, emerging from among large downy scales. Corolla campanulate, 5-cleft, with rounded segments, of which the three upper are rather the largest, and streaked with livid dots next the tube, the lower unspotted. Stamens 10, unequal, and deflexed; the anthers oblong, incumbent, and without appendages, opening by two terminal pores. Capsule ovate, rather angular, 5-celled, 5-valved, and septicidal; seeds numerous and minute (L.).

History, Description, and Chemical Composition.—Rhododendron is an elegant evergreen shrub, inhabiting the mountains of Siberia, with large, yellow flowers, which appear in June and July. The leaves are the parts used in medicine, and should be gathered as soon as the capsules have ripened. They have a faint odor when recent, which is lost by drying; their taste is somewhat bitter, slightly acrid and astringent. Water or alcohol extracts their properties. Besides tannic acid and the other usual plant constituents, a small amount of essential oil is present, as well as the poisonous *andromedotoxin* (Plugge and De Zaayer, *Amer. Jour. Pharm.*, 1889, p. 361).

Action, Medical Uses, and Dosage.—Yellow rhododendron contains a stimulant, narcotic principle; for it increases the heat of the body, excites thirst, and produces diaphoresis, or an increased discharge of the other secretions or excretions, and which are generally followed by a decrease of action of the arterial system. With some persons it causes emeto-catharsis, inebriation, and delirium. The Siberians use a decoction of it in *chronic rheumatism* and *gout*. They put about 2 drachms of the dried shrub in an earthen pot, with about 10 ounces of boiling water, keeping it near a boiling heat for a night, and this they take in the morning. Beside its other effects, it is said to produce a sensation of prickling or creeping in the painful parts; but in a few hours the pain and disagreeable symptoms are relieved, and 2 or 3 doses generally complete the cure. The use of liquids is not allowed during its operation, as this is apt to induce vomiting (*Ed.*—Coxe). It is a valuable remedy, used in Russia, Germany, and sometimes in France and England, but scarcely at all in this country. That it possesses a decided control over the circulation, acting like the special sedatives, slowing the quickened pulse by giving increased heart power and removing capillary obstruction, seems well established. *Myalgic pains*, whether rheumatic or not, but especially of the facial and ocular region, appear to be the special indication for its use. It has been employed in *acute testicular*, and *ovarian affections*, as well as in *chronic orchitis* and *hydrocele*. The dose should be minute, from a fraction of a drop to a drop of a saturated tincture. Probably our native species would be fully as effective.

Specific Indications and Uses.—Myalgic pain, particularly of the face; "face-ache;" pain in the ocular muscles.

Related Species.—Our native species, the *R. maximum* and *R. punctatum*, according to Barton, possess properties similar to the *R. chrysanthum*, but milder. According to Bigelow, they are astringent, but not narcotic.

Rhododendron maximum, Linné, *Rosebay tree*, or *Great laurel*, is a tall, evergreen shrub, or small tree, found growing along mountainous streams in the eastern section of the United States. The leaves are very thick and leathery, entire, oblong, acute, smooth, and borne on short wrinkled stalks. The flowers appear in midsummer, and are very large and showy, in terminal, umbellate clusters. Tannin, gallic acid, wax, resin, albumen, a little essential oil, and several bodies peculiar to the Ericaceæ—viz.: *arbutin, ursone, ericolin*, etc.—were found in the leaves by Kuehnel (*Amer. Jour. Pharm.*, 1885, p. 164). *Andromedotoxin* was isolated by Plugge, in 1889. This agent was introduced to the profession by Dr. J. M. Mulholland, of Pennsylvania, in 1877, as a remedy for *obstinate cough* in elderly persons, in *diphtheritic croup*, and for the cure of those *cutaneous affections* in which arsenic is frequently prescribed. In cough, he found it more efficacious, when this was severe without expectoration, and was accompanied with a sweetish or mawkish odor of the breath, and a tremulous pulse. The dose is a teaspoonful every hour, of a mixture of 20 minims of the fluid extract with 4 fluid ounces of water.

Rhododendron ferrugineum, Linné, of Europe, has bitter, astringent leaves, which contain tannin as well as *ericolin* and *arbutin*. Said to contain no andromedotoxin (Dragendorff, *Heilpflanzen*).

RHŒADOS PETALA.—RED-POPPY PETALS.

The fresh petals of *Papaver Rhœas*, Linné.

Nat. Ord.—Papaveraceæ.

Common Names and Synonym: *Corn poppy*, *Corn rose; Flores rhœados.*

Illustration: Bentley and Trimen, *Med. Plants*, 19.

Botanical Source.—This is an annual, herbaceous plant, growing to a height of about 2 feet, beset with diverging hairs, and having deeply 5-cleft leaves, the segments being cut-toothed and lance-shaped. The flowers are red and showy. The capsules are truncate at the top, smooth, short, obovate in shape and contain many, very small, blackish seeds.

History and Description.—The red poppy grows in Europe, North Africa, and western half of Asia, thriving in grain fields. The petals are the parts employed, being used in the preparation of syrup of red poppy. They are 2 or more inches in width, roundish, and in 2 pairs, one of which is always larger than the other, a rich-scarlet in color, and, when dry, becoming purplish. They are thin, marked near their base with a deeper-colored spot, and are attached by a short claw. When dried the heavy, rather narcotic odor is dissipated. They are feebly bitter and mucilaginous to the taste.

Chemical Composition.—Red-poppy petals contain dark-red, amorphous *rhœadic acid*, which is dissolved by water and alcohol, but not by ether, dissolving with violet color in alkaline liquids; and bright-red, deliquescent *papaveric acid*, soluble in water and diluted alcohol, insoluble in strong alcohol and ether. With alkalies, the latter acid likewise produces a violet solution (L. Meier, 1846). The alkaloid, *rhœadine*, was found in the fresh petals by Hesse, in 1865 (see *Opium*). One kilo of old and dry petals yielded Hesse no alkaloid whatever (*Amer. Jour. Pharm.*, 1890, p. 179), while the expressed juice of 300 grammes of fresh petals yielded a small quantity of crystallized alkaloid, not morphine, and containing but little *rhœadine*.

Uses.—Used in preparing syrup of red poppy.

RHUS AROMATICA.—FRAGRANT SUMACH.

The bark of the root of *Rhus aromatica*, Aiton.

Nat. Ord.—Anacardiaceæ.

Common Name: *Fragrant sumach*, *Sweet sumach.*

Illustration: Gray's *Genera*, Plate 160.

Botanical Source.—This is a small, bushy shrub, growing from 2 to 6 feet high, and found in clumps throughout sections of the eastern United States, in rocky situations. The leaves are trifoliate, and on stalks about 1 inch in length. The 3 leaflets are sessile, and covered with a short velvety pubescence when young. The terminal leaflet is considerably larger than the lateral leaflets, from 1 to 2 inches in length, and about two-thirds as wide. They are entire and tapering at the base, acute, and have 8 or 10 crenate teeth at the apex. The flowers are small, greenish-yellow, and open in April before the leaves; they are in stalked, spiked, ament-like clusters, and, before flowering, have the appearance of an unexpanded catkin. The sepals, petals, and stamens are in fives, and the pistil is a 1-ovuled ovary, with 3 short styles. The fruit is a small red drupe, about the size of a pea, covered with dense, white pubescence. They are produced in clusters of about a dozen, and are on stalks about ½ inch long; each one contains a single flattened seed. A variety (var. *trilobiata*, Gray) with small, smooth leaflets, generally less than an inch in length, is common throughout Texas and the western states and territories.

History, Description, and Chemical Composition.—The part employed in medicine is the root, or the bark of the root. It has attained some little local reputation heretofore, but was unknown to the medical profession until introduced by Dr. McClanahan, in 1879. When dry, the root is from ¼ to 1 inch in diameter, and appears in the market in pieces of from 6 inches to 2 feet in length. The bark is of a dark, rusty-brown color externally, and a pink or walnut color below the cork. It is about ⅛ of an inch in thickness, and throughout the inner bark of a prime article are little cavities containing a transparent balsam, somewhat resembling balsam of fir. The wood is white or yellowish. When fresh, the wounded bark exudes a turpentine-like balsam, or solution of a resin in some volatile oil, which dries to a glossy tear or layer. The bark is astringent, but, undoubtedly, the turpentine-like balsam likewise possesses considerable medicinal value. Alcohol extracts this substance, and the addition of water to the tincture produces a milkiness. In making the tincture of either the fresh or dry bark, alcohol alone should be used, and any addition of water is objectionable. Quantitative analysis of the drug by H. W. Harper (*Amer. Jour. Pharm.*) showed the presence of volatile and fixed oils, several resins and wax, butyric acid, tannin, glucose, gum, starch, oxalates, etc., and 13.8 per cent of ash. The berries were examined for acids by Edo Claassen (*Pharm. Rundschau*, 1890, p. 262), and yielded 10.65 per cent of citric and a small quantity of malic acids.

Action, Medical Uses, and Dosage.—This exceedingly valuable medicine was introduced by J. T. McClanahan, M. D., Booneville, Mo. (*Ec. Med. Jour.*, 1879, p. 317). At first, the use of this remedy was confined to the treatment of *diabetes*, and other excessive discharges from the kidneys and the bladder, as well as to cases of *incipient albuminuria.* More recently, in addition to the above-named diseases, it has been largely employed with advantage in *urethral irritations*, *uterine leucorrhœa*, *cholera infantum*, *diarrhœa*, *dysentery*, *chronic laryngitis*, *chronic bronchitis*, and especially in the *enuresis of children and of aged persons*.

While it is of undoubted value in many *hemorrhagic states*, particularly in *chronic hematuria*, a malarial form of which is quite common in the southern states, its chief value is in *enuresis*, with marked atony and chronic irritability of the urinary passages, whether in young or old subjects. The favorite remedies for "bed-wetting" are Rhus aromatica, belladonna, and thuja. Sometimes this affection yields to Rhus aromatica alone; sometimes a combination, as indicated, must be used. Fragrant sumach is indicated in all cases of over-activity of the kidneys, but is always contraindicated when there is active inflammation. A patient suffering, for several years, from *catarrh of the bladder* and *hypertrophy of the prostate*, with excruciating pain during micturition, necessitating the continued use of a soft catheter, the introduction of which invariably proved painful, was relieved by fragrant sumach. After exhausting the employment of all recognized remedies for the patient's condition, together with the use of the water at the Hot Springs of Arkansas, etc., without the least benefit, as a *dernier ressort*, the patient was placed upon teaspoonful doses, 3 or 4 times daily, of the fluid extract of Rhus aromatica. In 3 weeks' time the symptoms were all removed, and the prostate so far reduced that the use of the soft catheter became unnecessary. The patient was 65 years old and subsequently voided urine as freely and as painlessly as a boy of 18 years (J. King).

Inflammatory symptoms being absent, it may be employed in *passive uterine hemorrhage*, *hemorrhage of the bowels*, as in *chronic bloody-flux* (not in acute dysentery), *chronic painful vesical catarrh*, and in *phthisis*, to control hemorrhage when small in amount, and to restrain the accompanying *diarrhœa* and *night-sweats*. In *bronchitis*, with profuse, blood-streaked expectoration, it may be given with confidence. A good form of administration is as follows: ℞ Specific fragrant sumach, ʒss; glycerin, ʒiijss. Mix. Sig. Dose, from ½ to 1 teaspoonful every 3 or 4 hours. This remedy is reputed useful in *purpura hemorrhagica*. The forms of administration now preferred are specific fragrant sumach and the fluid extract, of which the dose of either varies from 5 to 60 minims, repeated every 3 or 4 hours. It may be taken in water, in glycerin and water, and in solution of pure gelatin, or in syrup, when these vehicles are not contraindicated.

Specific Indications and Uses.—Not the remedy for active conditions. As given by its introducer, Dr. McClanahan, the specific indications are: "Stools profuse, skin cool and sallow, pulse small and feeble, loss of flesh, abdomen flabby, tongue pale, trembling and moist, trembling in lower limbs; general sense of lassitude and languor. Dose for infants, 10 to 20 drops in a half-glass of water, teaspoonful as often as necessary; for children, perhaps 5 drops of the first dilution" (*Ec. Med. Jour.*, 1879, p. 317). To these may be added large, painless diarrhœal discharges; nocturnal enuresis, from weakness of spincter vesicæ; prostatic enlargement; and malarial hæmaturia.

RHUS GLABRA (U. S. P.)—RHUS GLABRA.

The fruit of *Rhus glabra*, Linné.

Nat. Ord.—Anacardieæ.

Common Names: *Smooth sumach, Upland sumach, Pennsylvania sumach.*

Illustration: Willdenow, *Sp. Plant*, I, 1478.

Botanical Source.—Great care is necessary in the selection of the several species of Rhus, as many of them are extremely poisonous. Rhus glabra, or Smooth sumach, is a shrub 6 to 15 feet high, consisting of many straggling, glabrous branches, with a pale-gray bark, having occasionally a reddish tint. The leaves are alternate, odd-pinnate, of from 6 to 15 leaflets, about 3 inches long and one-fourth as wide, lanceolate, acuminate, acutely serrate, smooth, shining, and green above, whitish beneath, and sessile, except sometimes the terminal odd one; during the fall they become red. Flowers greenish-red, in terminal, thyrsoid, dense panicles. Calyx of 3 sepals, united at base; petals 5; stamens 5, inserted into the edge or between the lobes of a flattened disk in the bottom of the calyx; styles 3; stigmas capitate. The fruit is a small red drupe, hanging in clusters, and, when ripe, is covered with a crimson down, which is extremely sour to the taste, owing to the presence of malic acid in combination with calcium (W.—G.).

Fig. 208.

Rhus glabra.

History and Description.—Rhus glabra, sometimes called *Upland* or *Pennsylvania sumach*, is common to the United States and Canada, growing in thickets and waste grounds, and on rocky or barren soil, flowering in June and July, and maturing its fruit in September and October. The drupes or berries only are official. They should be gathered before the rains have removed their external downy efflorescence, for when this is washed off the berries are no longer acid. The bark is likewise used to some extent in medicine. The berries are officially described as "subglobular, about 3 Mm. (⅛ inch) in diameter, drupaceous, crimson, densely hairy, containing a roundish-oblong, smooth putamen; inodorous; taste acidulous"—(*U. S. P.*).

Sumach leaves have been used in tanning, and a concentrated decoction of the bark is used as a mordant for dyeing red colors. Sumach root bark is of a light-gray color, with a tinge of red externally, yellowish-white internally, and of a very astringent and slightly sweet taste. When broken on the plant, a milky fluid exudes from the bark as well as from the leaves, which subsequently forms a solid, gum-like body. Both the bark of the branches and root are used. Both the bark and berries of sumach yield their active properties to water. The excrescences (*galls*) which form upon the leaves are reddish-brown externally, grayish-white internally, varying in size and appearance, being usually very irregular in their outline, hollow, and sometimes consist of a mere shell, of a line or less in thickness. Their taste is slightly bitter, and very astringent.

Chemical Composition.—Sumach berries have an agreeably acid, slightly styptic taste, which is due, according to W. J. Watson, to malic acid and tannic acids, beside which they contain malate of calcium, gallic acid, fixed and volatile oils, red coloring matter, etc. The bark of the root contains albumen, gum, starch, tannic and gallic acids, caoutchouc, soft resin, coloring matter, and probably a volatile odorous principle (*Amer. Jour. Pharm.*, 1853, p. 193). The leaves of Rhus glabra, collected in Iowa, contained, according to Jos. A. Palen (*ibid.*, 1888, p. 389), about 16 per cent of tannin. Virginia-grown leaves usually yield 20 to 25 per cent. The excrescences upon the leaves contain tannic and gallic acids, albuminous and coloring matter, and are fully equal to nutgalls in medicinal power. Prof. Trimble (*The Tannins*) found one specimen to contain 61.7 per cent of tannin.

Action, Medical Uses, and Dosage.—Sumach bark is tonic, astringent, antiseptic, and decidedly alterative; the berries are refrigerant and diuretic. In decoction or syrup, the bark of the root has been found valuable in *gonorrhœa*, *leucorrhœa*, *diarrhœa*, *dysentery*, *hectic fever*, *scrofula*, and in *profuse perspiration from debility*. Combined with the barks of slippery elm and white pine, in decoction, and taken freely, it is said to have proved highly beneficial in *syphilitic ulcerations*. Externally, the bark of the root in powder, applied as a poultice to *old ulcers*, forms an excellent antiseptic. A decoction may also be used in injection for *prolapsus uteri* and *ani*, and *leucorrhœa*, and as a wash in many *cutaneous diseases;* simmered in lard it is valuable in *scald head*. A decoction of the inner bark of the root is serviceable in the *sore mouth* resulting from mercurial salivation, and was formerly much used internally in *mercurial diseases*. A saturated tincture is useful in *ulcerative stomatitis*, and for *spongy gums* attending *purpura hemorrhagica* and *scorbutus*. *Diarrhœa* and *dysentery*, with intestinal ulceration, seem to be well controlled by it. Dose of the tincture, from 5 to 20 drops. The berries may be used in infusion in *diabetes*, *strangury*, *bowel complaints*, *febrile diseases* (as a pleasant acidulous drink where acids are indicated), etc., as a gargle in *quinsy* and *ulcerations of the mouth and throat;* and as a wash for *ringworm*, *tetter*, *offensive ulcers*, etc. Excrescences are frequently formed on the leaves of this plant, and which are very astringent; when powdered and mixed with lard or linseed oil, they are said to prove useful in *hemorrhoids*. In hot weather, if the bark be punctured, a gummy substance flows out, which has been used with advantage in *gonorrhœa* and *gleet*, and several urinary affections. Dose of the decoction of sumach bark, or infusion of the berries, from 1 to 4 fluid ounces. A free use of the bark will produce catharsis.

Specific Indications and Uses.—Relaxation of mucous tissues, with unhealthy discharges; mercurial ulcerations; aphthous stomatitis; spongy gums; ulcerative sore throat, with fetid discharges; flabbiness and ulceration of tissues.

Related Species.—There are several species of Rhus, as the *Rhus typhina*, *Staghorn* or *Velvet sumach;* and the *Rhus copallina*, *Mountain* or *Dwarf sumach*, which possess similar virtues, and which must be carefully distinguished from those which possess poisonous properties. The non-poisonous species have their fruit clothed with acid crimson hairs, and their panicles are compound, dense, and terminal; the poisonous varieties have axillary panicles and smooth fruit (see also *Rhus Toxicodendron* and *Related Species;* and *Coriaria*, p. 607).

RHUS TOXICODENDRON (U. S. P.)—RHUS TOXICODENDRON.

The fresh leaves of *Rhus radicans*, Linné (*Rhus Toxicodendron*, Linné).
Nat. Ord.—Anacardieæ.
Common Names: *Poison ivy*, *Poison oak*, *Poison vine*.
Illustration: Johnson, *Medical Botany of North America*, Fig. 117.

Botanical Source.—*Rhus Toxicodendron*, or *Poison oak*, is a creeping shrub from 1 to 3 feet high, with long cord-like shoots, emitting strong lateral fibers; the stems are either erect or decumbent. The bark is brownish-gray. The leaves are ternate, on long, semi-cylindrical petioles; the leaflets are broadly oval or rhomboidal, 2 to 6 inches long, ⅔ as wide, petiolate, acuminate, smooth and shining above, slightly downy beneath, especially on the veins; the margin is sometimes entire, and sometimes variously toothed and lobed, in the same plant. The flowers are small, greenish-white, diœcious, and grow in axillary, subsessile, racemose panicles on the sides of the new shoots. Barren flowers have a calyx of 5 erect, acute segments, and a corolla of 5 oblong recurved petals; stamens erect with oblong anthers; in the center is a rudiment of a style. Fertile flowers about half the size of the preceding, with calyx and corolla similar, but more erect. They have 5 small abortive stamens, and a roundish ovary, crowned by a short, erect style bearing 3 small capitate stigmas. The fruit is a roundish, smooth, dry berry, of a pale-green color, approaching to white, and contains a solitary bony seed (L.—W.—G.).

Fig. 209.

Rhus Toxicodendron.

History.—*Rhus radicans*, or *Poison ivy*, and sometimes called *Poison vine*, is considered by botanists to be merely a variety of the above species; it has a climbing stem from 3 to 20 or more feet in length, and climbs trees, fences and neighboring objects, to which it becomes attached by its myriads of radiating tendrils. The leaflets are quite entire, smooth and shining on each side, with the exception of the veins beneath. These plants grow throughout the United States and Canada along fence-rows, in thickets, etc., flowering from May to August. They yield an abundance of yellowish narcotic acrid milky juice, which becomes black when exposed to the air, and forms an indelible ink when applied to linen; it is soluble in ether. The genus Rhus belongs to an interesting family of plants—the *Anacardieæ* (*Anacardiaceæ*) or *Cashew family*, a group of frequent occurrence in the tropical sections of both the eastern and western worlds, diminishing in distribution, however, as we approach the northern and southern sections of the temperate zones. Species of this family produce some of the most valued of tropical fruits, yet the group is chiefly distinguished for its gum-resinous juices, that from the majority of the species being caustic, becoming black on exposure to the air, and charged with an acrid, poisonous principle. This family includes not only the species of Rhus but also the plants yielding the *Pistachia nut* (*Pistachia vera*) *Cashew-nut* (*Anacardium occidentale*), *Marking fruit* or *Oriental cashew-nut* (*Semecarpus Anacardium*), *Mango* (*Mangifera indica*), the *Mastich tree* (*Pistachia Lentiscus*) and other products interesting from a medicinal or economic standpoint. As before intimated, several species of Rhus have been used in medicine and in the arts. Many of these are now obsolete as medicines. However, a brief enumeration of them and their chief characteristics and uses may not be out of place. The bark of the *Wild olive* or *Venetian sumach* (*Rhus Cotinus*) is both astringent and aromatic. It was at one time employed as a substitute for cinchona. Under the name of *Smoke tree* it is frequently observed in cultivation for ornament in American yards and gardens. The wood of this species is known as *young fustic* and is much used in Greece to impart a beautiful yellow hue to woolen fabrics. In Italy, where it is known as *scotino*, the whole plant is used for tanning leather. *Doctor's gum* or *Gum hog* of Jamaica, is one of the substances once considerably used as a plaster-base, and substituted, in some instances, for copaiba balsam. It has been referred to *Rhus Metopium*, though as is often the case, the same common names have been applied to the products of widely different species, therefore there seems to be no certain evidence that the species of Rhus referred to produces it. Doctor's gum, when dissolved in water, is powerfully cathartic and emetic, and was formerly in great repute as a diuretic. The most poisonous species of Rhus is the recently rediscovered *Rhus Michauxii*, Sargent

(*Rhus pumila*, Michaux). Occupying a second place in toxic power is the *Rhus venenata*, well known as *Poison dogwood*, *Poison sumach*, or *Poison elder*. The *Rhus vernix* of Japan yields a whitish resinous varnish in small amount, which turns black on exposure to air. An oil, known as *Japanese wax*, is expressed from the seeds of *Rhus succedaneum*, which is employed by the Japanese in the making of candles to be used in times of special pagan festivities and in preparing certain kinds of food (Thunberg). A like oil is obtained from the fruit of the *Lacquer tree*. The *Japan varnish* or *Lacquer tree* is the *Rhus vernicifera* of De Candolle. From this plant exudes the gum-resinous substance used in making the celebrated *Japanese lacquer-work.* At first this juice is of a light color, and about as thick as cream. It is, however, so transparent that when laid unmixed with any other material upon wood even the faintest natural marking of the wood is plainly discernible through it. Generally a dark or reddish surface is first prepared and upon it the varnish is spread. This gives a mirror-like effect. The gum, when hardened, is difficultly soluble, even withstanding treatment with boiling water, but on the other hand is so brittle as to be very easily destroyed by striking it against any hard body. The *Rhus Coriaria* is powerfully astringent, and is much employed in tanneries. According to Lindley, its acid fruit is eaten by the Turks, who also employ it to add sharpness to vinegar. In Tripoli the seeds are sold as appetizers. The leaves are reputed astringent, tonic, cooling, and styptic, and boiled with broom (*Genista tinctoria*) were formerly employed by the Russians in hydrophobia. *Smooth sumach* (*Rhus glabra*) leaves are sufficiently astringent to be of importance in an economic sense, as in tanning. The fruit is employed as a mordant in dyeing red. The under surfaces of smooth sumach leaves produce excrescences which contain an abundance of tannic and gallic acids, and are considered equal in value to common galls. *Staghorn* or *Virginian sumach* (*Rhus typhina*) is sometimes called *Vinegar plant* from the fact that vinegar may be produced from it, and that when added to vinegar it increases its strength. Boiled with alum, the ripe fruit formerly furnished a hat dye. Yellow, green and black are the colors that may be produced from it. With green vitriol it forms a black ink. All parts of the plant are valued for tanning white glove-leather. The milky juice is said to furnish a varnish comparing favorably in value with that from Japan. It has been stated that honey-bees gather more honey from its flowers, when accessible, than from those of any other species of plants. The leaves were used like tobacco by the American Indians.

Indigenous Species.—The medicinal species of Rhus indigenous to North America are distributed as follows:

I. NON-POISONOUS SPECIES.

Rhus glabra, Linné.—A smooth shrub, known as *Smooth* or *Upland sumach*, found throughout the United States and Canada, flourishing in dry, barren or rocky situations, fence corners, etc. (see *Rhus glabra*).

Rhus typhina, Linné, *Staghorn* or *Virginian sumach*.—A shrub or small tree of Canada and the United States, growing in the rich soil of uplands.

Rhus copallina, Linné, *Dwarf* or *Mountain sumach*.—A small shrub found throughout Canada and the United States, growing in rocky and barren places.

Rhus aromatica, Aiton, *Sweet* or *Fragrant sumach*.—Eastern United States. A variety (*R. aromatica* var. *trilobiata*, Gray) is found in Texas and in the western states and territories (see *Rhus aromatica*).

II. POISONOUS SPECIES.

Rhus Michauxii, Sargent (*Rhus pumila*, Michaux).—A rare shrub, recently rediscovered in North Carolina, regarded by Prof. C. S. Sargent as our most poisonous species of Rhus. Grows from North Carolina to Georgia (Wood).

Rhus venenata, De Candolle, *Poison sumach*, *Poison dogwood*, or *Poison elder*.—Grows in swamps and other wet situations from Canada southward to Florida and thence westward.

Rhus diversiloba, Torrey and Gray.—Closely allied to *Rhus Toxicodendron*, and growing on the Pacific coast.

Rhus Toxicodendron, *Poison ivy*, or *Poison oak*.—Either a small shrub or a tall climbing vine growing from 10 to 100 feet high, found plentifully from Canada to the Mexican Gulf and from thence westward. Dr. Asa Gray, in his essay on

"*Sequoia and Its History*," says: "Our *Rhus Toxicodendron*, or *Poison vine*, is very exactly repeated in Japan, but is found in no other part of the world, although a species much like it abounds in California. Our other poisonous Rhus (*R. venenata*) commonly called Poison dogwood is in no way represented in western America, but has so close an analogue in Japan that the two were taken for the same by Thunberg and Linnæus, who called them both *Rhus vernix*." This explains why our older writers on the American *Rhus venenata* called it *R. vernix*. The species often spoken of as *Rhus radicans*, from the fact that it is a tall climber clinging by means of its numerous radicles to any object of support, is probably identical with *Rhus Toxicodendron*, or *Poison vine*, and is so considered in this article.

Description.—FOLIA TOXICODENDRI. The *U. S. P.* thus describes the drug: "Long-petiolate, trifoliolate; the lateral leaflets sessile or nearly so, about 10 Cm. (4 inches) long, obliquely ovate, pointed; the terminal leaflets stalked, ovate or oval, pointed, with a wedge-shaped or rounded base; the leaflets entire and glabrous, or variously notched, coarsely toothed or lobed, more or less downy; when dry, papery and brittle; inodorous; taste somewhat astringent and acrid. The fresh leaves abound with an acrid juice, which darkens when exposed to the air, and, when applied to the skin, produces inflammation and swelling. The leaves should, therefore, not be touched with bare hands. Rhus Toxicodendron should not be confounded with the leaves of *Ptelea trifoliata*, Linné (*Nat. Ord.*—Rutaceæ), which are similar in appearance, but have all the leaflets sessile"—(*U. S. P.*). The leaves of the R. Toxicodendron are the only parts of the plant used, although the whole plant is highly active. When dried they have no odor, and an insipid taste with acridity. Water or alcohol extracts their properties.

Chemical Composition.—Dr. Joseph Khittal (Wittstein's *Vierteljahrsschrift*, 1858, p. 348) found the leaves to contain chlorophyll, wax, resin, starch, tannin (*rhus-tannic acid*), etc., and a volatile alkaloid which exists in the plant combined with acids, and to which, he asserts, the toxic properties of the leaves are due. This opinion is contradicted, however, by Prof. Maisch. According to this authority, the exhalations of vigorous leaves redden blue litmus paper previously moistened, and contain volatile *toxicodendric acid*, the active principle. Its reactions do no coincide with those of formic acid (*Amer. Jour. Pharm.*, 1866, p. 6). Dr. Pfaff and S. S. Orr, however, state this acid in pure condition to be non-toxic, and that the real active principle is a non-volatile oil, *toxicodendrol*, allied to cardol, from cashew-nut. The oil is soluble in alcohol and forms an insoluble lead compound. Thus the authors recommend the use of an alcoholic solution of lead acetate as a wash in cases of poisoning (*Pharm. Jour. Trans.*, 1894-95, Vol. XXV, p. 818; also see V. K. Chesnut, in *Yearbook U. S. Dept. Agr.*, 1896, p. 139). The efficiency of this antidote has long been known (see Maisch, *loc. cit.*); among other remedies suggested are ammonium chloride, washing soda, sodium hyposulphite, potassium permanganate, aqua ammoniæ, or the bruised plant of *Pilea pumila* (*Amer. Jour. Pharm.*, 1888, p. 390), fluid extract of serpentaria (*ibid.*, 1884, p. 355), etc. Also compare interesting article, by G. M. Beringer, on Rhus poisoning (*ibid.*, 1896, p. 18).

Early Medical History of the Species of Rhus.—Medical interest, in the species of Rhus, during the early history of this genus, seems to have centered chiefly in two species—*R. Toxicodendron* and *R. glabra*. *Rhus venenata* (as *R. vernix*), was quite fully considered, more however, with a view to studying its juice from an economic view, and its poisonous qualities and the remedies therefor. We are not aware that it has been medicinally employed, to any extent at least. Rhus glabra received a good share of attention from the profession and probably had its medicinal starting point from its aboriginal and domestic uses. One of the most interesting accounts of some species of Rhus is "*An Experimental Dissertation on the Rhus vernix* (*venenata*), *Rhus radicans*, and *Rhus glabrum;* commonly known in Pennsylvania by the names of *Poison ash*, *Poison vine*, and *Common sumach*, by Thomas Horsfield, of Bethlehem, Pa.," published in 1798. This interesting 88-page book gives a most excellent résumé of the knowledge of those species acquired up to that date, and we might add that the description of the effects of the poisonous species has not, in our opinion, been excelled to this day.

Rhus Toxicodendron is almost universally admitted to have been introduced to the profession, in 1793, by Dr. I. Alderson, of Hull, England, that gentleman first using it as a remedy in paralytic states. Dr. Du Fresnoy, of France, however, previous to this had employed *Rhus radicans* in paralytic and herpetic disorders. This was in 1788, and if we consider *Rhus radicans* and *Rhus Toxicodendron* as identical, this gives Du Fresnoy priority. It further seems that Gleditsch, in 1782, wrote an article (in French) on "*Novel Effects Concerning a Dangerous American Plant*," referring to Rhus. Du Fresnoy first experimented on himself before administering the leaves to his patient. His experience with an infusion of 12 leaves he thus records: "At this dose I observed a slight pain in my stomach, and my perspiration and urine were increased in quantity." Alderson observed that when the drug acted beneficially in paralysis, "the first signs of improvement were an unpleasant feeling of pricking and twitching in the paralytic limbs" (Thacher's *Dispensatory*, 1821). Du Fresnoy's dissertation was the first publication in regard to the medical uses of Rhus. Horsfield (1798) experimented on consumptives with the infusion. In some cases benefit seemed to be derived from its use, while other cases were aggravated by it. He states of the wife of a consumptive patient that, "invited by the agreeable odor of the infusion, she drank a teacupful. It produced an unusual degree of cheerfulness, and a copious discharge of urine" (*Diss.*, p. 87). In a case of anasarca, it relieved the patient by "producing copious perspiration" (*ibid*). He concluded from his results that it "acts slightly as an incitant and diuretic." A tincture was used by Baudelocque in scrofulous chronic ophthalmia of infants (Porcher).

Rhus glabra was used early by American practitioners as an astringent in diarrhœa, dysentery, and in ulceration of the throat, etc. The fruit (*sumach bobs*) infused in water, was employed as a cooling drink in febrile affections. The whitish substance covering the berries, known as *Indian salt*, has acid properties, rendering the infusion pleasantly sour. *Rhus copallina* and *Rhus typhina* were used for like purposes, while the first was valued by the Chippewa Indians in gonorrhœa, and the gall-like excrescences on the leaves, powdered and made into an ointment, afforded the white settlers a remedy for piles (see *Rhus Glabra*).

Rhus diversiloba appears to have been effectual in dysmenorrhœa. A case (in California) is reported (*Ec. Med. Jour.*, 1865, p. 314) of an anemic girl, who usually suffered greatly during menstruation, the flow being scanty, cured by having been poisoned at the menstrual epoch by contact with this plant. An easy menstruation followed. When the next monthly period was due a return of the eruption came also, and with it again an easy catamenial flow. This, so far as we are aware, is the extent to which this plant has been known to act medicinally, though nearly all old works state that its properties are similar to those of *Rhus Toxicodendron* and *Rhus venenata*. The latter, we believe, has not been employed in medicine (see *Related Species*).

Rhus aromatica was introduced to the profession by an Eclectic physician, Dr. J. T. McClanahan, of Booneville, Mo., in 1879, who stated that the remedy had been employed by members of his family, several of whom were doctors, for a quarter of a century, for the relief of urinary, bowel, and hemorrhagic disorders, with uniform success (see *Rhus Aromatica*).

Action, Medical Uses, and Dosage.—Locally, rhus is a powerful irritant poison. The toxic manifestations produced from the different species is of precisely the same nature, differing only in degree of intensity. *Rhus Toxicodendron* ranks next to poison dogwood in point of virulence. Whilst locally poisonous to some persons, some individuals are totally unaffected by it. Many are but mildly poisoned by it; many more, however, show serious evidence of its great activity. Contact is not always necessary to obtain its effects. Indeed many individuals are poisoned merely by exposure to an atmosphere contaminated with the toxic exhalations of the plant. This is especially true when the air is heavy and humid, or when the susceptible individual is freely perspiring. Alcoholic solution of the toxic principle retains its virulence for many years (Johnson). The dried leaves are, as a rule, inert. A young lady in the employ of Prof. J. U. Lloyd, is always notified to remain at home—not even being allowed in the building—on the days when specific rhus is being bottled, so intense are poisonous effects in this case that mere exposure to the emanations is sufficient to cause the individual to be confined to her bed. Peter Kalm, the Swedish traveler, who visited this country during its colonial days—a man who investigated our plant resources and made large collections of the same—writes: "I was acquainted with a person, who, merely by the noxious exhalation of the *Rhus vernix* (*venenata*), was swelled to such a degree, that he was as stiff as a log of wood, and could only be turned about in sheets."

A singular feature connected with rhus poisoning is its recurrence from month to month, and from year to year, even when the affected individual is far remote from all exhalations of the plant. This was early noted by Barton, who personally experienced such recurrence for 5 successive years—a portion of which time was passed in Europe far from proximity to the plant in question. We have also observed this phenomenon. The smoke from burning rhus wood, was noticed as early as 1720, by Sherard, Wangenheim, and Kalm, to produce poisonous effects. It appears (Barton) that horses eat the plant with impunity. According to William Bartram, they are very fond of the leaves. Cows are wholly unaffected by the ingestion of the plant. Thunberg observed that sheep ate of the leaves of *Rhus lucidum*, a similar species, without harm. To dogs and guinea pigs, on the other hand, poison vine is fatal. The statement that the infusion of the leaves was administered to consumptives with non-poisonous results, may seem contradictory, but we can not but believe that a portion of the poisonous principle is volatile, in spite of the assertion that non-volatile *toxicodendrol* is the toxic agent, and consequently driven off in heating. The poisonous properties are likewise, in a measure, dissipated in drying the plant, hence the necessity of preparing the fluid preparations from fresh material. It is not surprising, therefore, that certain individuals—"eminent therapeutists"—have decried the use of rhus as of no value, when fluid extracts and tinctures from dried materials had failed to give good results.

The nature of poisoning by rhus has always partaken somewhat of the mysterious, and it has been the subject of much speculation. Various reasons have been assigned as to why it poisons at all, and as to why it affects only certain individuals. It has been customary to attribute the deleterious effects to emanations from the living plant. Later, Prof. Maisch announced a volatile substance of acid character as the offender, and named it *toxicodendric acid*. Still later, a bacterium was charged with creating the mischief. The latter cause, however, has now been satisfactorily disproved. An oil has now been isolated, and this, even when purified, excites exactly the same form of dermatitis as the growing plant. This discovery was made, in 1895, by Dr. Franz Pfaff, of Harvard University. It is present in every part of the ivy plant, and even the dried wood is said to retain it. It has been named *toxicodendrol*, and is asserted to be in reality the only tangible substance found thus far to which may be attributed the toxic effects of the vine. Still, this does not explain why individuals are poisoned when not in contact with the plants. Alcohol freely dissolves this oil, but water, as with oily bodies, does not, nor does it wholly remove it from the skin; hence the reason why washing after contact with ivy does not prevent the appearance of the characteristic eruption. Experimentation (see V. K. Chesnut, *United States Yearbook of Department of Agriculture*, 1896, p. 141) has shown that if the oil be placed upon the skin, and immediately removed with alcohol, but slight effects are observed. The longer the interval, however, the more pronounced the effects become. In all, the effects were less marked than when no such treatment was given. From the fact that several portions of the skin could be impressed without coalescence of the areas, it has been concluded that the action of the oil is wholly local, and that the poison does not enter the blood. We are not, however, satisfied with this view of the matter, for if so, how are we to explain the recurrence of the trouble after weeks and months, and even years, in persons who have not for some time been near the plants or in the neighborhood of their growth? There are many agents that might be used for the relief of this species of dermatitis, as lobelia, grindelia, sulphate of iron or copper, both of which have served us well, and the more recently recommended echafolta.

The *local* effects of rhus are well known. Briefly stated, it occasions an eczematous, sometimes erysipelatoid, inflammatory eruption, characterized by intense itching, redness, and tumefaction, followed by burning pain, sympathetic febrile excitement, and vesication. The vesicles are at first small and filled with a watery fluid; sometimes they become yellow, as if pus were present. Finally, as they mature, they rupture, when a yellow scab forms. The tongue is coated white, and headache and delirium are often symptoms. The effects are observable a short time after exposure to the poison, the affection usually spending its force in the course of 4 or 5 days, and is followed by desquamation of the cuticle. The face and genitalia seem to be favorite localities for the most pronounced swelling to appear. One case of poisoning by *Rhus venenata* came under our observation, in which the swelling of the face was so great as to wholly obliterate the features, giving to the individual a swine-like, rather than human, appearance. Domestic medication, in the shape of bruised *Impatiens pallida* and *fulva* (Jewel weeds) gave great relief in this instance. Lack of space forbids more than the partial enumeration of the many remedies that have been extolled for the cure of this malady. The chief, however, are lobelia (infusion), veratrum, gelsemium, hamamelis, grindelia, stramonium, eupatorium, serpentaria, lindera, sassafras bark, dulcamara, oak bark, tannic acid, alnus (boiled in buttermilk), carbolized olive oil, sodium bicarbonate, borax, alum curd (especially to be used near the eyes), and, perhaps the best of all, solution of ferrous sulphate (green vitriol). Sugar of lead (lead acetate) has long been a favorite agent for the relief of this trouble, but as it has most frequently been applied with water, it has very often failed to give relief. It has now been shown that a solution in weak alcohol (50 to 75 per cent) gives immediate and permanent relief. Occasionally, zinc and copper sulphates, oxalic acid, potassium chlorate, and other salts are effectual. Echafolta has recently been extolled in this affection.

All treatment should be accompanied with a light, cooling regimen, and cooling purgatives or diuretics. The bruised leaves of the *Collinsonia canadensis*, externally, and an infusion of the *Verbena urticifolia*, internally, have been successfully used in internal or external poisoning by these plants. A solution of caustic potash, sufficiently strong to render the skin soapy, has been advised as a local application. Sodium carbonate, sodium sulphite, chlorinated lime, weak ammonia solution, and lime-water have been similarly employed.

Internally, administered in small doses, Rhus Toxicodendron is slightly stimulant, increasing the renal and cutaneous secretions, and proving feebly laxative. Employed in *paralytic states* it is reputed to have effected a return of sensation and power of movement, the good effects being ushered in with a sensation of pricking and burning, with twitchings of the affected parts. Large doses occasion stupefaction, or a sort of intoxication, exhibited by vertigo, impairment of the special senses, pupillary dilatation, chilliness, sickness at the stomach with thirst and burning pain, and a feeling of constriction in the temporal regions. The pulse becomes slow, irregular and small, the activity of the skin and kidneys increases, weakness, trembling, and fainting occur, and sometimes convulsions ensue. A pint of rhus berries induced drowsiness, stupor, delirium, and convulsions in two children who partook of them. The infusion of the root taken internally is asserted to have produced the characteristic local eruptions besides producing a harsh cough, scanty urine, and severe gastro-intestinal symptoms. Rhus Toxicodendron is one of our best medicinal agents. Its range of application, specifically considered, is only excelled by few drugs. It is an ideal sedative, controlling the circulation, and acting primarily and most pronouncedly upon the nervous system. Fortunately specific medication does not require the enumeration of special diseases to show when and where a remedy should be employed. Indeed, the action of rhus is best understood by its fitness for conditions rather than for certain *disease-condition groups* which we know as particular diseases. The general specific indications and uses for rhus are: The small, moderately quick and vibratile pulse, especially exhibiting sharpness in stroke and associated with burning sensations. There is a peculiar nervous erethism which always indicates it. The sick infant requiring rhus, sleeps disturbedly, frequently starting suddenly from out its slumbers, and uttering a shrill cry (*cry encephalique*) as if from fright. Many of these conditions are met with in the cerebral irritation of children suffering from *cholera infantum* and other summer bowel troubles and in *cerebro-spinal meningitis*. The circulatory disturbance requiring rhus upon which the nervous phenomena chiefly depend is usually localized and not general; small areas of the brain or nerve centers only may have a disturbance of the blood supply. As a rule the marked restlessness is all out of proportion to the apparent circulatory derangement. Frontal pain, and more especially if confined to the left orbit, and sharp in character, is a prominent indication for this drug. The rhus tongue is reddened on the tip and edges, and even may take on the strawberry character, typical of gastric irritability, typhoid, and scarlatinal states. Associate with the kind of pulse mentioned, and with tympanites, brown sordes and reddened mucous surfaces, and the indication is still more direct. Discharges of an acrid character, and ichorous flow from tissues which seem to disappear by mere drainage, are further guides to its use. It is a certain remedy for *vomiting* when the tongue is of the kind above referred to. In fact, great unrest with vomiting is one of the most direct indications for its selection. *Pain* of a burning character, whether deep or superficial, is relieved by rhus quicker than by any other agent. It may be of the head, abdominal or thoracic viscera, of the urinary organs, of the eyes, or of the skin, no matter where the pain or what the name may be, *neuralgia*, *rheumatism*, *erysipelas*, *pleurisy*, or *cystitis*, etc. If there be burning, and if of the surface an erysipelatoid redness, rhus will cure. Rheumatic pain, aggravated by the warmth of the bed, is usually relieved by it. It is more valuable in acute than chronic rheumatism and is serviceable in *rheumatic paralysis* and *articular stiffness* after rheumatic attacks. It is particularly useful to control the feeling of restlessness of rheumatic subjects. *Rheumatic toothache*, aggravated by warmth or warm liquids, is relieved by it. It is a valuable drug in the bowel disorders of infants, as *diarrhœa* and *typhoid dysentery*, with head symptoms, and in *typhoid and other fevers*, such as *remittent* and *intermittent gastric fever*, and especially when typhoid symptoms are present. It is a fine remedy in *cholera morbus*.

Rhus is a valuable agent in *pneumonia*, *bronchitis*, *la grippe*, and *phthisis*, when the patient is extremely irritable and suffers from gastric irritation. With the small wiry pulse as a guide it controls that restlessness and delirium in *adynamic fevers*, which is probably caused by irritation and local hyper-vascularization of limited areas in the cerebral and other nerve centers. It is indicated in *typhoid pneumonia*, with red, glazed tongue, and offensive muco-purulent expectoration. Uncontrollable, dry, spasmodic, and tickling *cough* is frequently relieved by it. Rhus is an extremely useful remedy in the various *disorders of the skin* presenting the characteristic rhus indications. Redness, intumescence, and burning are the indications in cutaneous diseases.

For vivid, bright-red, glistening *erysipelas*, especially when confined to the upper part of the face, with marked puffiness, it is one of the most successful of remedies. In fact in *acute inflammations of the skin* it is often more serviceable than aconite and veratrum. It is of great service in *herpes* where there are burning, itching, and exudation of serum. *Eczema*, *pemphigus*, and many irritable and inflammatory skin affections are relieved by it when redness, intumescence, and burning are prominent symptoms. Associated with iron it has proved useful in *purpura hemorrhagica*. *Erythematous and erysipelatous inflammation of the vulva*, with burning pain, and the itching and vulval irritation following micturition, are permanently relieved by rhus. In the *exanthemata*, as in all zymotic diseases, rhus appears to exert a special antizymotic influence, for which it may be given in *scarlatina* and *measles* where the vital powers are greatly depressed, and in *variola*, with livid color of the surface and foul discharges. Tumid, reddened, and glistening enlargements, and *ulcerations* with red glistening margins, syphilitic or non-syphilitic, likewise call for rhus. In the ulcerative forms the parts seem to melt away without sloughing. It is of much value in *parotitis*, and in *swelling of the submaxillary gland* with great induration few remedies are better (Locke). Its constitutional effects are often manifested in *carbuncle* and *carbunculous furuncles*. In ocular therapeutics rhus is an important drug. It is sometimes administered to prevent inflammatory action after *cataract operations*. *Palpebral œdema*, with marked redness is relieved by it, while *neuralgic and other pains in the globe of the eye*, and aggravated by motion and warmth are often banished under its use. Acute and subacute forms of *conjunctivitis* are relieved by it on account of its special affinity for the blood vessels of the orbit. In the *catarrhal ophthalmia* of scrofulous children with strongly inflamed palpebral edges and conjunctivæ and marked photophobia and burning lachrymation, the action of the remedy is decided and prompt. There is usually a sensation as of foreign particles, such as sand, etc., in the eye. Rhus has been employed successfully in *paraplegia* without any actual organic lesion, and in *paralysis of the bladder and of the rectum.* In paralytic states, however, it is of little value except in those conditions which follow attacks of rheumatism. Its efficiency in *sciatica*, however, is admitted by some who think the drug practically valueless as a medicine.

The proper dose for specific effects, and it is scarcely employed in any other manner, is the fraction of a drop of specific rhus, thus: ℞ Specific rhus, gtt. v to xv; aqua, fl℥iv. Mix. Dose, 1 teaspoonful every hour in acute disorders; 4 times a day in chronic affections.

Specific Indications and Uses.—Small, moderately quick, *sharp* pulse, sometimes vibratile or wiry; great restlessness; child starts from sleep with a sharp, shrill cry as if from fright; great restlessness with vomiting; tongue red and irritable, showing red spots; strawberry tongue; burning pain; pain in or above left orbit; rheumatic pain aggravated by warmth; bright, superficial redness of the skin with burning, itching, or tingling; bright-red, glistening erysipelas with burning pain; pinched countenance; burning urethral pain with dribbling of urine; redness of mucous tissues; brown sordes; tympanites; acrid discharges from bladder or bowels; inflammation with bright-red tumid surfaces and deep-seated burning pain; inflammation with ichorous discharges, the tissues seemingly melting away; tumid red swellings; old ulcers with shining red edges; induration of submaxillary gland; conjunctival inflammation with burning lachrymation, pain, and photophobia.

Related Species.—*Rhus venenata*, De Candolle (*R. vernix*, Linné), or *Poison sumach*, also known as *Poison wood*, *Swamp sumach*, *Poison ash*, and inappropriately as *Poison elder* and *Poison dogwood*, has been confounded with the *Rhus vernix* of Linné, a species which grows in Japan. It is a shrub or small tree, 10 to 20, and even 30 feet in height, with the trunk 1 to 5 inches in diameter, branching at the top, and covered with a pale grayish bark, which is reddish on the leaf-stalks and young shoots. Leaves pinnate, with 3 to 6 pairs of opposite leaflets, and an odd terminal one, which are oblong or oval, entire or slightly sinuated, acuminate smooth, paler underneath, and nearly sessile, except the odd terminal one; they are about 3 inches long, and nearly half as wide. Flowers diœcious and polygamous, very small, green, and in loose, axillary, pedunculate panicles. Panicles of the barren flowers are downy, the largest most branched. Sepals 5, ovate; petals 5, oblong; stamens longer than the petals, and projecting through their interstices; the rudiment of a 3-cleft style in the center. In the fertile flowers the panicles are much smaller, sepals and petals resemble the last, while the center is occupied by an oval ovary, terminated by 3 circular stigmas. Fruit a bunch of dry berries or drupes, about the size of peas, smooth, greenish-yellow or greenish-white, sometimes marked with slight purple veins, and becoming wrinkled when old; roundish, a little broadest at the upper end, and compressed, containing 1 white, hard, furrowed seed (L.—G.—W.).

Rhus venenata grows in low meadows and swamps from Canada to the Gulf of Mexico, flowering from May to August. The milky juice which flows when the plant is wounded, is similar in its action to that of *Rhus Toxicodendron*, and may, according to Bigelow, be made into a beautiful, shining and permanent varnish, by boiling, very analogous to that obtained in Japan from the *Rhus vernix*. It is much more poisonous than *Rhus Toxicodendron*, and its volatile principle taints the air for some distance around with its pernicious influence, producing in many persons severe swellings of an erysipelatous nature; sometimes the body becomes greatly swollen, and the person unable to move. Some persons are hardly, or not at all, affected even by handling it. The affection caused by it generally abates after several days, and may be treated in the same manner as named for the poisonous effects of the *Rhus Toxicodendron*.

Rhus Michauxii, Sargent (*Rhus pumila*, Michaux).—This is the most poisonous Rhus in this country. It is an extensively procumbent, villous-pubescent shrub, about 1 foot high, with pinnate leaves; leaflets about 11, oval or oblong, slightly acuminate, coarsely toothed, with a velvety pubescence, the 3 upper leaflets often confluent, the terminal one when distinct attenuate at base. Panicles terminal, thyrsoid, nearly sessile; drupes covered with a red silky pubescence (T.—G.). It is a rare shrub, confined to the south, and is found in North Carolina and Georgia, and was recently rediscovered.

Rhus diversiloba, Torrey and Gray.—Dr. C. A. Canfield describes a very poisonous shrub, growing in California, which is very similar in appearance and poisonous qualities to our *Rhus Toxicodendron.* It is the *Rhus diversiloba* of Torrey and Gray, or *Rhus lobata* of Hooker. The remedy that he has found invariably successful as an antidote to its local poisonous effects is another plant of California, of the composite family, and somewhat resembling a small sunflower, the *Grindelia hirsutula*. A strong decoction of the herb may be used as a wash to the poisoned surfaces, or the bruised fresh herb may be rubbed over the affected parts. One application often cures, but in obstinate cases several days may be required (*Amer. Jour. Pharm.*, 1860, p. 412).

Rhus Metopium, Linné, is found in the south of Florida, and more abundantly in the West Indies. It is known variously as *Coral sumach*, *Mountain manchineel*, or *Bum wood*. It is a tree about 30 feet high, and its wood contains an abundance of tannin. Its leaves are composed of 5 leaflets, which are entire and smooth, and borne on long petioles. An acrid, red fruit is produced upon the tree. A gum-resin, known as *Hog gum*, or *Doctor's gum*, of Jamaica, is said to be yielded by this tree. In aqueous solution, it is reputed purgative and diuretic, and is an ingredient of strengthening plasters (Hogg, *Nat. Hist. of Veg. King.*, p. 241).

For further interesting matter regarding the Rhus family, consult Thomas Horsfield's *Experimental Dissertation on R. vernix, R. radicans, and R. glabrum*, published in 1798; see also paper on *Rhus Family in Medicine*, by H. W. Felter, M. D., in *Annual of Ec. Med. and Surgery*, Vol. V, a portion of which is included in this article.

Comocladia dentata, Jacquin (*Nat. Ord.*—Anacardiaceæ), *Guao, Bastard Brazil wood, Tooth-leaved maiden plum.* A small tree, 6 to 8 feet high, common in Cuba, thriving in stony and barren soils. The leaves are a beautiful deep-green, with a brownish margin. The bluish-brown flowers are small and borne in clusters. The branches and trunk contain a milky juice, which, upon exposure to sunlight, becomes black, and leaves a stain upon clothing and the skin. It is a native superstition that if one sleeps in the shade of this tree, death will be the penalty. The bark is the part employed, preferably when fresh. The action of this agent upon the skin is said to resemble Rhus, and it has some reputation as a remedy for *leprosy*.

Fustic.—Under this name several woods, from diverse sources, have entered commerce. Thus *Young fustic*, or *Hungarian fustic*, is derived from *Rhus Cotinus*, while *Old fustic* is the wood of *Morus tinctoria* (*Broussonetia tinctoria*). The latter contains the dye-stuff, *morin* ($C_{15}H_{10}O_7$), or *moric acid*, and *moritannic acid* ($C_{13}H_8O_6$); the former contains *fisetin* ($C_{23}H_{10}O_3[OH]_6$), which, in combination with sugar (the glucosid, *fustin*) and tannic acid, forms the yellow coloring matter of the wood. Some of the West Indian Xanthoxylums and allied species enter commerce under the name *fustic*. Fustic is not used in medicine and pharmacy, but as a dyeing material in the arts.

RIBES.—CURRANT.

The fruit of *Ribes nigrum*, Linné, and *Ribes rubrum*, Linné.

Nat. Ord.—Saxifragaceæ.

Common Names: (1) *Black currant*, (2) *Red currant*.

Botanical Source.—*Ribes Nigrum.* The Black currant is a woody bush or shrub, from 3 to 5 feet in height, with stems unarmed, and leaves 3 to 5-lobed, punctate beneath, dentate-serrate, and longer than their petioles. The racemes are lax, hairy, and somewhat nodding. Calyx campanulate, with reflexed segments; petals oblong, yellowish; bracts minute, subulate, or blunt, nearly as long as the pedicels. The fruit is large, roundish-ovoid, and nearly black (W.—L.).

Ribes Rubrum, or common *Red currant*, has unarmed, straggling, or reclined stems, with leaves obtusely 3 to 5-lobed, smooth above, pubescent beneath, subcordate at base, with margin mucronately serrate. The racemes are from lateral buds, distinct from the leaves, pendulous, and nearly glabrous. Bracts blunt, shorter than the pedicels. Calyx flattened out, short, spreading, with obtuse lobes; petals obcordate and green. Fruit globose, smooth, and red (W.—L.).

History and Chemical Composition.—The *Black currant* is a native of Europe and Siberia, growing in woods, cultivated in Europe and this country, and flowering in May. The *Red currant* grows in cold, damp woods and bogs in this country and Europe, and is extensively cultivated in gardens. It also flowers in May. The fruit of these two plants is the part used, and imparts its virtues to water. The juice of *Red currants* contains free acids (malic, citric, and tartaric acids, 1.5 to 3 per cent), sugar (4 to 7 per cent), vegetable jelly (pectin matter), gum, etc. That of *Black currants* contains the same, with the addition of a peculiar volatile principle, and a violet coloring matter.

Action, Medical Uses, and Dosage.—The juice of these berries, especially of the black currant, is said to be diuretic and diaphoretic. They may be made into a jelly, a jam, paste, etc., and are very useful in *febrile* and *inflammatory diseases*, and in *hoarseness* and *affections of the throat*. The raw juice is an excellent refrigerant beverage in *febrile diseases*. A decoction of the bark of the black currant has proved useful in *calculous affections*, *dropsy*, and *hemorrhoidal tumors*. It may be freely used. The French prepare from the berries an aromatized, fermented liquor called *cassis* (*Amer. Jour. Pharm.*, 1888, p. 337).

Related Species.—*Ribes floridum*, L'Heritier, the *Wild black currant* of this country, possesses similar properties. It is a handsome shrub, growing from 3 to 5 feet high, with leaves 1 or 2 inches long, and somewhat wider, subcordate, from 3 to 5-lobed; lobes acute, spreading, sprinkled on both sides with yellowish, resinous dots, just visible to the naked eye. Flowers greenish-yellow, subcampanulate, in pendulous, pubescent, many-flowered racemes. Calyx cylindrical; bracts linear, longer than the pedicels; petioles 1 or 2 inches long. Fruit obovoid, smooth, black, insipid. It flowers in May and June (W.—G.).

Shepherdia argentea, Buffalo berry, Bull berry.—This shrub produces an acidulous fruit, resembling currants, being a little more acid (Trimble). The fruit is largely used as a food along the Upper Missouri, where it occurs in abundance.

ROBINIA.—LOCUST TREE.

The bark and leaves of *Robinia Pseudacacia*, Linné.

Nat. Ord.—Leguminosæ.

COMMON NAMES: *Locust tree, Black locust, Yellow locust, False acacia.*

Botanical Source.—This is a tree from 50 to 80 feet in height, and from 1 to 4 feet thick; the bark is rough and dark. The branches are numerous, smooth, and armed with stipular prickles. The leaves are unequally pinnate; the leaflets in from 8 to 12 pairs, ovate and oblong-ovate, thin, nearly sessile, and very smooth; the stipules minute, bristle-form, and partial. The flowers are white, fragrant, showy, and borne in numerous, axillary, pendulous racemes. Calyx 5-cleft, short, campanulate, slightly 2-lipped. Standard large and rounded, turned back, scarcely longer than the wings and keel. Stamens diadelphous; style bearded inside. The fruit is a legume, or linear, compressed pod, 2 to 4 inches in length, and about 6 lines wide, margined on the seed-bearing edge. Seed several, small, brown, and reniform (G.—W.). When young, the tree is armed with thorns, which disappear in its maturity.

History.—This tree, known by the names of *Black locust* and *Yellow locust*, is found in several parts of the United States, principally west of the Allegheny Mountains, being seldom found north of Pennsylvania, or in the Atlantic southern states; it blossoms in May. It is valued for the durability, hardness, and lightness of its wood. The bark and leaves are used, and yield their properties to water or alcohol. The bark of the root is the most active. The seeds are slightly acrid, and contain much oil, which may be obtained by expression. By steeping in water, their acridity is removed, and a very mild, useful meal may be then prepared from them. The inner bark is tough and fibrous

Chemical Composition.—From the root of this plant Hlasiwetz (1852) isolated *asparagin*. The flowers, according to Zwenger and Dronke (1861; see Husemann and Hilger, *Pflanzenstoffe*, p. 1046), contain a yellow, crystallizable glucosid, *robinin* ($C_{25}H_{30}O_{16}$), which, upon hydrolysis, is split into *quercetin* and a non-fermentable sugar. The bark of the locust tree, when chewed, produced violent emeto-catharsis (*Amer. Jour. Pharm.*, 1887, p. 153; F. B. Power and Jacob Cambier, *Pharm. Rundschau*, 1890, pp. 29–38). The latter authors, searching for the poisonous principle, found it in an albuminous body (*phytalbumose*, 1.66 per cent), which is tasteless, soluble in water, insoluble in alcohol, and coagulated by heat, with complete loss of its toxic properties; for this reason some declare a decoction of the bark is inert. It is precipitated by tannic acid and by solution of potassium bismuth iodide. It is allied to *ricin*, the poisonous, albuminous constituent of the castor-oil seed. (For further reactions, see the original paper.) The authors, in addition, found an inert albumin (*globulin*, characterized by being insoluble in concentrated salt solution); small quantities of the poisonous alkaloid, *choline* (of the class known as *ptomaïnes*), fatty matter, inert resin, cane sugar (4.57 per cent, referred to air-dry bark), starch, gum, some tannin, coloring matter, and probably *asparagin*. The poisonous principle, in the form of an albuminous body, was likewise obtained by R. Kobert (*Jahresb. der Pharm.*, 1891, p. 146).

Action, Medical Uses, and Dosage.—A decoction of the bark of the root is tonic in small doses, but emetic and purgative in large ones. An ounce of the bark boiled in 3 gills of water, operates as a cathartic in doses of $\frac{1}{2}$ ounce, given morning and evening. The bark is supposed to possess some acro-narcotic properties, as the juice of it has been known to produce coma and slight convulsions. An overdose has produced symptoms very similar to those resulting from an improper dose of belladonna, and at the same time cured a case of *fever and ague*. The flowers possess antispasmodic properties, and form an excellent and agreeable syrup. The leaves, in doses of 30 grains, every 20 minutes, operate mildly and efficiently as an emetic. The drug should be tested for its effects upon *gastro-intestinal* and *nervous affections*.

ROSA CANINA.—DOG ROSE.

The recent ripe fruit of *Rosa Canina*, Linné, and other related indigenous species.

Nat. Ord. Rosaceæ.

COMMON NAMES AND SYNONYMS: *Dog rose, Hip-tree, Wild brier; Cynosbata, Fructus cynosbati.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 103.

Botanical Source.—Dog rose is a soft, branched, smooth bush, with long green curved root-shoots, covered with equal, remote, strong, compressed, falcate prickles. The leaflets, 5 to 9 in number, are ovate, firm, without glandular pubescence, and have acute, incurved and often double serratures. Flowers with leafy bracts. Sepals partly pinnated, and usually naked as well as the tube of the calyx. Petals white or pink, obcordate, and fragrant; throat of the calyx thick and quite closed up. Fruit red, succulent, ovoid, truncated, in consequence of the fall of the sepals (L.—W.).

History, Description, and Chemical Composition.—This plant is indigenous to Europe, and introduced into this country; it usually attains the height of 6 or 10 feet, and flowers in June and July. The flowers are succeeded by a scarlet fruit called *hip*. The fruit (*Rosæ Caninæ Fructus*) was official in *Br. Pharm.*, 1885. It is inodorous, but possesses a rather pleasant, sweetish, acidulous taste, which is increased by the action of frost. The hip or fruit (not a true fruit) consists of the developed tube of the calyx, inclosing within its cavity numerous carpels or true fruits; these must be carefully removed before it is used for pharmaceutical purposes. After having been dried it contains gum, citric acid, malic acid, a large proportion of uncrystallizable sugar, various salts, and traces of wax, resin, and volatile oil. Its properties are preserved by beating the pulp with sugar (C.). The vanilla-like fragrance of the fruits is due to the presence of *vanillin* (Schneegans, *Jahresb. der Pharm.*, 1890, p. 148).

Pharmaceutical Uses.—The conserve made by beating the pulp with sugar, is called conserve of dog rose, or conserve of hips (*Confectio Rosæ Caninæ, Br.*), and is tenacious, retaining its softness for a long time, even under exposure to the air. It is a useful material for forming pill masses, and, as it contains less tannic acid, may be used as a substitute for the conserve of red roses, when preparations of iron are to enter into the pill mass.

ROSA CENTIFOLIA (U. S. P.)—PALE ROSE.

"The petals of *Rosa centifolia*, Linné"—(*U. S. P.*).

Nat. Ord.—Rosaceæ.

COMMON NAMES AND SYNONYM: *Hundred-leaved rose, Cabbage rose-petals; Flores rosarum incarnatarum.*

ILLUSTRATION. Bentley and Trimen, *Med. Plants*, 105.

Botanical Source.—This is an erect shrub, 3 to 6 feet in height, having the branches closely covered with nearly straight prickles, scarcely dilated at base, and glandular bristles of various forms and sizes; the large ones are falcate. Shoots erect. Leaves unequally pinnated; leaflets 5 to 7, oblong or ovate, glandular-ciliate on the margin, and subpilose beneath. The flowers are large, usually of a pink color, but varying in hue, form, size, etc., through 100 known varieties, several together, and drooping, with leafy bracts; flower-bud short and ovoid. Sepals leafy, compound, viscid, and spreading in flower. Petals 5, and usually pale-red. Fruit ovoid; calyx and peduncles glandular-hispid, viscid, and fragrant (L.—W.).

History, Description, and Chemical Composition.—The native country of this rose-bush is unknown; but it is extensively cultivated in nearly all parts of the world, forming a valuable ornament to gardens. There are many varieties, the most fragrant of which are the best adapted for use. (For some accounts of the cultivation of roses, see *Amer. Jour. Pharm.*, 1887, p. 33, and 1893, p. 603.) The parts employed are the petals, which are "roundish-obovate and retuse, or obcordate, pink, fragrant, sweetish, slightly bitter and faintly astringent"—(*U. S. P.*).

They should be gathered before they are fully blown, freed from the calyx cups and stamens, and dried in the air. To preserve them they are frequently salted. The petals contain volatile oil (*otto of roses*, see *Oleum Rosæ*), tannic acid, coloring matter, saccharine matter, mineral salts, salts of malic and tartaric acids, etc. (J. B. Enz, Wittstein's *Vierteljahrsschrift*, 1867, p. 53).

Pharmaceutical and Medical Uses.—This rose, on account of its delightful fragrancy, is principally employed in France for the distillation of rose-water, so much used in collyria and other lotions; taken internally, it is said to be gently aperient, but is seldom, if ever, administered for this purpose.

ROSA GALLICA (U. S. P.)—RED ROSE.

"The petals of *Rosa gallica*, Linne, collected before expanding"—(*U. S. P.*).

Nat. Ord.—Rosaceæ.

Common Names and Synonyms: *Red rose petals*, *French rose*, *Provence rose; Flores rosarum rubrarum*, *Rosæ gallicæ petala* (*Br.*).

Illustration: Bentley and Trimen, *Med. Plants*, 104.

Botanical Source.—The *Red*, *French* or *Provence rose* is a dwarfish, short-branched bush, 2 to 3 feet high, with the stem and petioles armed with numerous fine, nearly equal, uniform prickles and glandular bristles intermixed; the leaflets, mostly 5, are stiff, elliptical, and rugose. The flowers are large, erect, and several together, with leafy bracts; sepals ovate, leafy, and compound. Petals 5 or more, obcordate, large, spreading, and of a rich crimson color. The fruit is oblong or ovoid, glossy, and very coriaceous (L.—W.).

History and Description.—This plant is indigenous to Austria and other parts of the middle and south of Europe, and is common in the gardens of that country and the United States. There are a great many varieties known in cultivation. With this plant as with other species, cultivation multiplies the petals very much, by the conversion of stamina. The official parts are the petals. They should be collected previous to the expansion of the flowers, freed from their calyces and claws or heels, and speedily dried in the sun or by artificial heat. When dried they are sifted to remove the stamens and insects, and should be kept in a dry place, as for instance, in well-covered tin canisters or bottles. "When dried they have a velvety appearance; their color is purplish-red; their odor is much improved by desiccation" (Pareira). As officially described they are "usually in small cones, consisting of numerous imbricated, roundish, retuse, deep purple-colored, yellow-clawed petals, having a roseate odor and a bitterish, slightly acidulous and distinctly astringent taste"—(*U. S. P.*).

Chemical Composition.—Infusion of red rose yields a black precipitate with ferric salts, and is changed to a scarlet color by sulphuric acid. Water takes up their properties. Cartier found in the petals volatile oil, coloring matter, tannic and gallic acids, fatty matter, albumen, soluble potassium salts (the ash containing 42 to 44 per cent of potassa, Niederstadt), calcareous insoluble salts, silica, and oxide of iron. Filhol found a notable quantity of *quercitrin* in them, to which he attributes their astringency, also a large amount (20 per cent) of non-crystallizable sugar. Bowman (*Amer. Jour. Pharm.*, 1869, p. 194) finds 5.4 per cent of tannin present. The coloring matter, according to H. Senier (1877), is insoluble in ether which dissolves quercitrin and fat, soluble in much alcohol, precipitated by lead acetate. Acids color it a more vivid red, while alkalies turn it dark-red with green reflection, then yellow. Adulteration sometimes consists in artificially dyeing rose leaves with aniline colors (*Amer. Jour. Pharm.*, 1881, p. 314).

Action and Medical Uses.—Red roses are tonic and mildly astringent. They have been used in *passive hemorrhages*, and *excessive mucous discharges*. They have also been found beneficial in *bowel complaints*, and are more commonly used in *ophthalmic diseases* as a poultice, or, the pith of sassafras and infusion of roses as a collyrium in *acute ophthalmia*. The infusion is also used as a vehicle for various other remedies. The confection is mostly employed as a basis for making pills. If iron be added to the confection, or any of its preparations, it forms a hard black pill, which passes through the alimentary canal unchanged.

ROSMARINUS.—ROSEMARY.

The tops and leaves of *Rosmarinus officinalis*, Linné.

Nat. Ord.—Labiatæ.

Common Name and Synonyms: *Rosemary; Folia rosmarini, Folia roris marini, Folia anthos.*

Illustration: Bentley and Trimen, *Med. Plants*, 207.

Botanical Source.—Rosemary is an erect, perennial, evergreen shrub, 2 to 4 feet high, with numerous branches of an ash color, and densely leafy. The leaves are sessile, opposite, linear, over an inch in length, and about 2 lines broad, entire, obtuse at the summit, revolute at the margins, of a firm consistence, dark-green and shining above, and downy and sometimes whitish beneath. The flowers are few, bright-blue or white, subsessile, and borne in short, opposite, axillary, and terminal racemes; the bracts are shorter than the calyx; the calyx purplish, campanulate, and villose; the corolla not ringed in the inside, somewhat inflated in the throat, with 2 equal lips, the upper of which is erect and emarginate, the lower trifid, with the middle lobe very large, concave, and hanging down. Stamens 2; filaments minutely toothed near the base; anthers linear, with 2 divaricating, confluent cells. Upper lobe of style very short. Seeds 4, oblong, naked at the base of the calyx (L.—W.).

Fig. 210.

Rosmarinus officinalis.

History.—Rosemary is a native of the countries surrounding the Mediterranean, and is cultivated in nearly every garden for its beauty and fragrance, flowering in April and May. The parts used in medicine are the flowering tops, which have a powerful, diffusive, camphoraceous odor, and an aromatic, bitter taste; they yield their properties to water or spirits, but more effectually to alcohol. The leaves are likewise used. Age and drying impair their odor and virtues, which are due to a volatile oil (*Oleum Rosmarini*), and which may be procured by distillation. On standing for some time, the oil deposits crystals of stearopten (*rosemary camphor*). Tannin, a bitter body, and resin are also constituents.

Action, Medical Uses, and Dosage.—Rosemary is stimulant, antispasmodic, and emmenagogue; seldom used in this country, except as a perfume for ointments, liniments, embrocations, etc. The oil is principally employed. Dose, internally, from 3 to 6 drops.

RUBIA.—MADDER.

The root of *Rubia tinctorum*, Linné.

Nat. Ord.—Rubiaceæ.

Common Names: *Madder, Dyer's madder.*

Botanical Source.—Dyer's madder has a perennial, long, cylindrical root, about the thickness of a quill, branched, externally deep, reddish-brown. The stems are several in number, herbaceous, diffuse, brittle, branched, tetragonal, and very rough, with sharp hooks. The leaves are 4 to 6 in a whorl, lanceolate or oblong-lanceolate, mucronate, somewhat membraneous, with pinnated veins, 2 or 3 inches long, and nearly one-third as wide. Flowers small and yellow. Corolla rotate and 5-parted; lobes ovate-lanceolate, apiculate. Stamens 5, short; styles 2 short; anthers ovate-oblong; stigmas conical. Fruit didymous, globose, baccate, shining, and juicy (L.—Wi.).

History and Description.—Madder is a native of the Mediterranean and southern European countries, and was extensively cultivated for the use of the dyer in various parts of that continent. The drug was chiefly imported from Holland and France, but its use is now largely supplanted by that of the artificial alizarin dye-stuffs. The root is collected in the third year of the plant, is freed from its epidermis and then dried. It consists of a dark, easily separable cortex, whose epidermis is thin, and of a ligneous meditullium, which, in the fresh state, is yellow, but becomes reddish by drying. It has a feeble odor, and a bitter and astringent taste, which properties, together with its color, are communicated to alcohol or water. The microscope discovers numerous needle-shaped crystals, or raphides, in the cells of the root-bark (P.).

Chemical Composition.—The color-producing principles of madder root are chiefly *alizarin* ($C_{14}H_8O_4$) and *purpurin* ($C_{14}H_8O_5$), which exist in the root partly free, but mostly combined with sugar, in the form of more or less easily decomposable glucosids. Decomposition is effected through the agency of the water-soluble, nitrogenous ferment, *erythrozym*, when solutions of madder extract are exposed to the air (Schunck, 1851). The alizarin-glucosid is the *ruberythric acid* of Rochleder (1851) (*rubianic acid* of Schunck), and is itself probably a decomposition product of *rubian* (Schunck). In the formation of purpurin from the glucosid, an intermediary product is *pseudo-purpurin* (*purpurin-carbonic acid*), which also exists in the root in free condition. Upon exposure to the air, it loses carbonic acid, and becomes purpurin. Additional constituents of madder root are sugar (10 to 15 per cent), pectin, albuminous bodies, yellow *xanthine* of Kuhlmann (1824), and *rubichloric acid* of Rochleder (*chlorogenine* of Schunck), which is a glucosid yielding an undesirable brownish-green coloring matter. Xanthine and chlorogenine can be removed with cold water, which dissolves from dried madder a total of 55 per cent, while boiling water abstracts about 3 per cent, consisting of nearly all the valuable color-giving constituents of madder.

ALIZARIN ($C_{14}H_8O_4$) was discovered in madder, in 1826, by Colin and Robiquet, and was obtained synthetically from the hydrocarbon, *anthracene* ($C_{14}H_{10}$), by Graebe and Liebermann, in 1869. According to these chemists, it is *dioxyanthraquinone*. Alizarin crystallizes in dark-yellow or red prisms, or in scales, is freely soluble in alcohol, ether, wood alcohol, benzol, carbon disulphide, oil of turpentine and glycerin, very little soluble in boiling water (1 in 2940). It is insoluble in cold, very little soluble in hot solution of alum, differing in this respect from purpurin. At a temperature of 237.7° C. (460° F.), it sublimes in the form of orange-colored prisms. It dissolves in caustic alkali with purple-blue color; with calcium, barium, aluminum salts, also with the salts of heavy metals, it forms insoluble colored compounds. With alumina, fixed in fabrics, it yields red and pink; with ferric salts, purple and black colors; calico impregnated with oil and alum produces, with alizarin, *Turkey-red*.

PURPURIN ($C_{14}H_8O_5$) is *oxyalizarin* or *trioxy-anthraquinone*. It was formerly designated as *madder-purple*. It crystallizes from alcohol in red needles, is more soluble in boiling water than alizarin, and dissolves readily in hot solution of alum with cherry-red color. By heating purpurin in sealed glass tubes to about 215° C. (400° F.), it is converted into alizarin (Bolley).

As to other coloring principles of madder, *e. g.*, *munjistin* ($C_{15}H_8O_6$) and *purpuro-xanthine* ($C_{14}H_8O_4$), see A. Wurtz, *Amer. Jour. Pharm.*, 1883, p. 365; and Husemann and Hilger, *Pflanzenstoffe*. Also see admirable paper on madder by Dr. Crace-Calvert, *Pharm. Jour. Trans.*, Vol. II, 1871–72, pp. 394 and 414; and by W. J. Russell, *ibid.*, Vol. IV, 1873–74, pp. 346 and 382.

Action, Medical Uses, and Dosage.—Madder is supposed to promote the menstrual and urinary discharges, and has been recommended for such purposes by various practitioners. However, it is not in general use, as the profession lack confidence in its action. The dose is 30 grains, 3 or 4 times a day. Animals fed upon madder have their bones colored red by it.

ALIZARIN INK.—Leonhardi obtained a patent for "*Alizarin Ink*" which does not contain gum, is prevented from becoming moldy by its indigo and acetate of iron, and in which the sulphate of indigo prevents the tannate of iron from separating. It is prepared by digesting 24 parts of aleppo galls and 3 parts of Dutch madder with 120 parts of water. The liquid is filtered and mixed with 1.2 parts solution of indigo, 6.2 sulphate of iron, and 2 parts crude acetate of iron solution. It is said to be a superior ink.

RUBUS (U. S. P.)—RUBUS.

The bark of the root of *Rubus villosus*, Aiton; *Rubus canadensis*, Linné; and *Rubus trivialis*, Michaux.

Nat. Ord.—Rosaceæ.

COMMON NAMES: *Blackberry*, etc. (see next page).

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 100.

Botanical Source.—*Rubus villosus* is a perennial, half shrubby plant, pubescent and prickly. Its root is woody, knotty, and horizontal, and sends up a tall, branching, slender, prickly, more or less furrowed and angular stem, recurved at top, and from 3 to 6 feet high. The leaves are mostly in threes, sometimes fives, often solitary, on a channeled, hairy petiole; leaflets ovate, acuminate, sharply and unequally serrate, covered with scattered hairs above, and with a thick, soft pubescence underneath; terminal stalked; 2 side ones sessile; petiole and back of the midrib commonly armed with short, recurved prickles. Branchlets, stalks, and lower surface of the leaves hairy and glandular; leaflets from 2½ to 4 inches long, by 1½ to 2½ inches wide. Flowers large, in erect racemes, with a hairy, prickly stalk; pedicels slender, 1 or 2 inches long, with glandular hairs and lanceolate bracts. Petals 5, white, ovate or oblong, concave, contracted into a short claw at base. Calyx short, with ovate, hairy segments, ending in an acuminate point, or a lanceolate leaflet. Stamens numerous, inserted on the calyx along with the petals; filaments slender; anthers small. The fruit is large, at first green, then red, and, when matured, black; it consists of about 20 roundish, shining, black, fleshy carpels, closely collected into an ovate or oblong head, subacid, well flavored, and ripening in August and September (L.—W.—G.).

Rubus canadensis, sometimes called *Low* or *Creeping blackberry*, has a slender, prickly stem, procumbent, or trailing several yards upon the ground. The leaves are petiolate, of three (or pedately 5 or 7) leaflets, which are elliptical, or rhomboidal-oval, acute, thin, membranaceous, sharply and unequally cut-serrate, often somewhat incised, somewhat pubescent, 1 to 1½ inches long, and about one-half as wide. The flowers are large, white, nearly solitary, on slender, elongated, prickly, somewhat corymbed pedicels, with leafy bracts; lower peduncles distant; upper crowded. Petals obovate and twice as long as the calyx. The fruit is large, black, very sweet, and juicy (W.—T.—G.).

Rubus trivialis, or *Low-bush blackberry*, of the southern states (*Southern dewberry*). has a procumbent, shrubby stem, armed with both prickles and bristles. The leaves are trifoliate, or pedately 5-parted, evergreen, leathery, and almost smooth. The leaflets are sharply serrate, and of the ovate-oblong or lanceolate form. Flowers large, and from 1 to 3 to the peduncles. They blossom in March.

History, Description, and Chemical Composition.—The *Dewberry* grows wild in dry, stony fields, gravelly soil, and neglected grounds, and is common from Canada to Virginia, flowering in May, and ripening its fruit in July and August. The root is the official part; it is generally smaller than the blackberry root, with its external covering transversely cracked, of a dark, brownish-gray color, odorless, and woody internally. The *Southern dewberry* blooms in March, and matures its fruit in May. It is found in sandy soils from Virginia to Florida, and from thence westward. *Blackberry* grows abundantly in most parts of the United States, in old fields, by the roadside, and on the borders of thickets, flowering from May to July, and maturing its fruit in August. The bark of the root is the part used. As demanded by the *U. S. P.*, it is "in thin, tough, flexible bands, outer surface blackish, or blackish-gray, inner surface pale-brownish, sometimes with strips of whitish, tasteless wood adhering; inodorous; taste strongly astringent, somewhat bitter"—(*U. S. P.*).

These plants possess astringent medicinal properties, and may be substituted the one for the other. The bark of the old roots, or the smaller roots, of dewberry and blackberry, should always be preferred, as the woody portion is inert. Their properties are similar, and they impart their virtues to water, alcohol, or port wine. The fruits of these plants (and *Rubus strigosus*) are much esteemed as an article of diet, and have been manufactured into cordials, jams, jellies, and syrups. They contain volatile oil, coloring matters, citric and malic acids, sugar, mucilage, etc. The root-bark of Rubus villosus, according to analysis by G. A. Krauss (*Amer. Jour. Pharm.*, 1889, p. 605, and 1890, p. 161), contains a crystallizable, bitter glucosid, *villosin*, sparingly soluble in water and petroleum benzin; freely soluble in alcohol, insoluble in chloroform, nearly so in ether. It is rather unstable, being readily hydrolyzed into sugar and resinous *villosic acid*, soluble in alcohol, ether, and chloroform. Herman Harms (*ibid.*, 1894, p. 580) believes villosin to be allied to *saponin*. This author found the dry bark to contain from 12 to 19 per cent of tannin.

Action, Medical Uses, and Dosage.—These plants are useful as astringents. An infusion or decoction of the leaves of raspberry (see *Rubus Idæus*), or the bark of the roots of the other two, has been found an excellent remedy in *diarrhœa*, *dysentery* (chronic), *cholera infantum*, *relaxed conditions of the intestines* of children, *passive hemorrhage from the stomach*, *bowels*, or *uterus*, and in *colliquative diarrhœa*. The decoction, used as an injection, is useful in *gonorrhœa*, *gleet*, *leucorrhœa*, and *prolapsus uteri* and *ani*. In *prolapsus uteri*, it may be used either alone or combined with the internal use of a decoction of equal parts of black cohosh and blackberry roots, taken freely. Rubus villosus is especially adapted to *children's diarrhœas*, the stools being copious, watery, and clay-colored. Such children are pale, fretful, without appetite, there is deficient glandular activity, and the gastro-intestinal tract shows evidence of enfeeblement and relaxation. The leaves of raspberry, in decoction with cream, will allay nausea and vomiting, and, combined with aromatics, have been found useful in *diarrhœa*, *cholera morbus*, and *cholera infantum*. It is said that raspberry will, during *labor*, increase the activity of the uterine contractions when these are feeble, even in instances where ergot has failed, and that it has been found serviceable in *after-pains*. The fruit, especially that of the blackberry, makes an excellent syrup, which is of much service in *dysentery*, being pleasant to the taste, mitigating the accompanying tenesmus and sufferings of the patient, and ultimately effecting a cure. The fruit of the raspberry contains very little nourishment, but is an agreeable acidulous article, rarely disturbing the stomach, and, when eaten freely, promotes the action of the bowels. Raspberry syrup, added to water, forms a refreshing and beneficial beverage for *fever patients*, and during convalescence. The jelly or jam may likewise be used in similar cases; that of the blackberry being more astringent, is better adapted to cases of *diarrhœa*, *dysentery*, and *cholera infantum*. Dose of the decoction of these plants, from 1 to 4 fluid ounces, several times a day; of the pulverized root-bark, 20 to 30 grains.

Specific Indications and Uses.—(*Rubus villosus.*) Gastro-intestinal atony, with copious, watery, and pale alvine discharges.

RUBUS IDÆUS (U. S. P.)—RASPBERRY.

"The fruit of *Rubus Idæus*, Linné"—(*U. S. P.*), and fruit and leaves of *Rubus strigosus*, Michaux.

Nat. Ord.—Rosaceæ.

Common Names: (1) *Raspberry*, (2) *Red raspberry*.

Botanical Source.—*Rubus Idæus*. This plant grows to a height of 6 feet. The young branches are glaucous, somewhat bristly and spinous, with odd-pinnate leaves, bearing 1, 2, or 3 pairs of serrate, ovate, sessile, whitish, pubescent leaflets. The flower-petals are white, about the length of the calyx-lobes, and 5 in number. The plant is believed to be derived from the following plant.

Rubus strigosus, Michaux, is a shrubby, strongly hispid plant, about 4 feet in height. The leaves are pinnately 3 or 5-foliate; the leaflets oblong-ovate or oval, obtuse at base, pointed, coarsely and unequally serrate, green above, canescent tomentose beneath, lateral ones sessile, odd one often subcordate at base, and distinctly petiolate, 1½ to 2½ inches long, and about one-third to two-thirds as wide. The flowers are white, and borne in panicled corymbs. Corolla cup-shaped, about the length of the calyx. Fruit a red berry, hemispherical, composed of many juicy, 1-seeded acini, on a dry receptacle, of a rich, delicious flavor (W.).

History and Description.—*Rubus Idæus*, or cultivated raspberry, is indigenous to Europe and to Asia, eastward to Japan, where the red raspberry is likewise found. The *Red raspberry* grows wild, and is common to Canada and the northern United States, growing in hedges, neglected fields, thickets, and hills, flowering in May, and ripening its fruit from June to August. The leaves and fruit are the medicinal parts. The leaves impart their properties to water, giving to the infusion an odor and flavor somewhat similar to that of some kinds of black tea. The *U. S. P.* describes Rubus Idæus fruit as follows: "Deprived of the conical receptacle, and, therefore, hollow at the base; hemispherical, red, finely hairy, composed of from 20 to 30 coalesced, small drupes, each one crowned with the withered style; juice red; of an agreeable odor, and a pleasant, acidulous taste.

The closely allied, light-red fruit of *Rubus strigosus*, Michaux, and the purplish-black fruit of *Rubus occidentalis*, Linné, may be employed in place of the above"—(*U. S. P.*). The *Rubus occidentalis* is the *Black raspberry*, or *Thimbleberry*, common in waste places and fence corners from Canada to Georgia, and west. Its fruit is inferior to that of the preceding varieties.

Chemical Composition.—According to analysis by Seyffert (*Archiv der Pharm.*, 1879, p. 324), garden raspberries yielded 9 per cent more juice than a wild-growing variety. Acidity was about equal in both specimens (1.4 per cent). The cultivated variety contained 4.5 per cent of sugar, while the other had only 2.8 per cent (referred to fresh berries). According to Papst (see Dragendorff's *Heilpflanzen*, p. 278), the acids of raspberry juice are chiefly malic and citric acids; the sugar consists of *lævulose* (4.6 per cent) and *dextrose* (2.5 per cent). *Raspberry camphor* is a volatile solid, which forms in an aqueous distillate from pressed raspberries (Bley; see Husemann and Hilger, *Pflanzenstoffe*, p. 1005).

Action, Medical Uses, and Dosage.—Same as for *Rubus*. A syrup is prepared from *R. Idæus.*

Related Species.—*Rubus odoratus*, Linné, *Rose-flowering raspberry*, or *Mulberry*, has an erect or reclining, unarmed, glandular-pilose, shrubby stem, from 3 to 5 feet in height. Leaves 4 to 8 inches long, nearly as wide, cordate at base, palmately 3 to 5-lobed, unequally serrate; lobes acuminate, the middle one prolonged; petioles 2 or 3 inches long, and with the peduncles, calyx, and branches clothed with viscid hairs. Flowers many, large, nearly 2 inches in diameter, in terminal corymbs. Petals orbicular, purple-rose color; stamens numerous, whitish. Fruit broad and thin, bright-red, sweet. This plant grows on rocky banks and in upland woods in the United States and Canada, flowering in June and July, and ripening its fruit in August. A decoction of it is said to be powerfully diuretic, and may be used freely in *affections of the urinary organs*, and *dropsy* (W.—G.).

Rubus Chamæmorus, Linné, or *Cloudberry*, is a small, herbaceous plant, found in our White Mountains. Mr. C. O. Cech found the berries to contain much sugar, citric acid, and an orange-yellow coloring matter. In Russia, where it is indigenous, the infusion of the leaves is successfully employed in *cystic debility* and *dropsy.*

RUMEX (U. S. P.)—RUMEX.

"The root of *Rumex crispus*, Linné, and of some other species of Rumex"—(*U. S. P.*).

Nat. Ord.—Polygonaceæ.

Botanical Source and History.—*Rumex crispus*, Linné, or *Yellow dock*, is the species of dock most commonly used by physicians. It has a deep spindle-shaped, yellow root, with a stem 2 or 3 feet high, angular, furrowed, somewhat zigzag, smooth to the touch, panicled, and leafy. The leaves are lanceolate, acute, strongly undulated, and crisped at the edges, of a light-green color; radical ones on long petioles, truncate, or subcordate at base; uppermost narrower, and nearly sessile. Flowers numerous, pale-green, drooping, in a large panicle consisting of many wand-like racemes of half-whorls, interspersed with leaves below. Inner sepals, or valves, much larger than the outer, veiny, waved, entire, ovate, each bearing a large ovate-brown grain or tubercle on the back. Nut contracted at each end, with three blunt or tumid angles. This plant is introduced into this country from Europe, growing in cultivated grounds, waste grounds, about rubbish, etc., flowering in June and July (L.—G.—W.).

Rumex aquaticus, Pursh (*R. orbiculatus*, Gray), or *Great water dock*, has a stout black root, whitish internally, with a thick, erect stem, 3 to 5 feet high. Leaves 1 foot or more in length, 3 to 5 inches wide, smooth, lanceolate, and pointed; lower ones cordate, on long petioles. Flowers verticillate, in a terminal, leafy panicle. Pedicels capillary, drooping. The 3 petals, or as termed by some botanists, the 3 inner divisions of the calyx, which form a kind of triangle, and are termed valves, are large, broadly-ovate, obtuse, entire, and minutely granular along the center. This is an European plant, but introduced into this country, growing in wet places, ditches, etc., and flowering in July (W.—G.).

Rumex britannica, Linné, or *Yellow-rooted water dock*, has a large root, externally dark, internally yellowish, with an angular, furrowed, branching stem, 2 or 3 feet high. Leaves broad-lanceolate, acute at both ends, 3 to 5 inches long, petiolate, flat, smooth, with the sheathing stipules slightly rent. Flowers perfect, in verticillate fascicles collected into a large, terminal panicle, the spikes of which are nearly leafless; pedicels capillary and nodding in fruit. Calyx valves large, cordate, entire, graniferous, 2 of the grains small or abortive. This is an indigenous plant, growing in muddy places, along banks of streams, etc., in various parts of the United States, and bearing flowers from May to August (W.—G.—Wi.).

Rumex obtusifolius, Linné, or *Blunt-leaved dock*, has its root brown outside and yellow within; the stem is 2 or 3 feet high, furrowed, somewhat roughish, branching, and leafy. Radical leaves about 1 foot long, and 5 or 6 inches in width, ovate-cordate, obtuse, rather downy on veins underneath, somewhat wavy margined, often with stock and veins red; upper ones oblong-lanceolate, and acute. Flowers in long, nearly naked racemes; whorls loose and distant; valves ovate-halbert-shaped, sharply denticulate at the base, strongly reticulated, one of them principally bearing a granule on the back. This is a common weed, introduced from Europe, growing about houses and fields, and flowering from May to August (G.—W.).

History and Description.—These four species of dock possess similar medicinal properties. The roots of several other species have been medicinally employed, and may be used indiscriminately with the above, as the *R. patientia* and *R. alpinus* of Europe, and the *R. acutus* and *R. sanguineus* of this country. These various dock-roots have hardly any odor, an astringent, bitterish taste, and yield their virtues to alcohol, or boiling water. The young leaves of some of the species are sometimes used as greens. Yellow dock root varies in length from 4 to 6 inches, or more, and has an epidermis easily removed, beneath which are the bark layers, the woody part, and the medulla. The bark of Yellow dock root is the most active part, though the whole root is generally employed. Occasionally the root is divided longitudinally into halves or quarters; it is sometimes called *Sour dock*, *Narrow dock*, or *Curled dock*. The term *Sour dock* has been given to it probably on account of the sourness of the petioles, and which is due to the oxalic acid they contain. As officially described rumex is "from 20 to 30 Cm. (8 to 12 inches) long, about 10 to 15 Mm. ($\frac{2}{5}$ to $\frac{3}{5}$ inch) thick, somewhat fusiform, fleshy, nearly simple, annulate above, deeply wrinkled below; externally rusty brown, internally whitish, with fine, straight, interrupted, reddish, medullary rays, and a rather thick bark; fracture short; odor slight, peculiar; taste bitter and astringent"—(*U. S. P.*).

Chemical Composition.—*Yellow dock root* has been found to contain a small amount of sugar, gum, albuminous substance, starch, tannin forming green precipitates with iron salts, etc. Riegel (1841) found in the root of *R. obtusifolius* (*Radix lapathi acuti*) resin and the aforenamed substances, and a principle which he named *rumicin*, and which Karl von Thann (*Amer. Jour. Pharm.*, 1859, p. 152) believed to be identical with *chrysophanic acid* of rhubarb (see *Related Species*, next page). Rumicin was first obtained in an impure condition by Buchner and Herberger in 1831. Oxalic acid is present in the petioles of Yellow dock. Prolonged boiling injures the properties of the roots.

Action, Medical Uses, and Dosage.—The dock roots are decidedly alterative, tonic, mildly astringent, and detergent, and are eminently useful in *scorbutic*, *cutaneous*, *scrofulous*, *scirrhous* and *syphilitic affections*, *leprosy*, *elephantiasis*, etc.; for which purpose we prefer the *Rumex crispus*, which is principally employed for its alterative and tonic influences in all cases where these are desired. Preparations from old material are worthless, but very efficient medicines are produced from the green root. The drug induces retrograde metamorphosis, increases innervation, and improves nutrition. In *bad blood* with *skin disorders* it is exceedingly efficient, acting decidedly upon the glandular system, removing *chronic lymphatic enlargements*, and especially influencing those conditions in which there is a tendency to *indolent ulcerations* and *low inflammatory deposits*. The most direct indication for its use is a scrofulous condition with low deposits in the cellular tissues and glands with a tendency to break down and but little tendency to repair. It should be used both locally and internally. Small doses of specific rumex are useful in *nervous dyspepsia*, with epigastric fullness and pain, and aching or darting pain in the left chest, with flatulent distension of the stomach and eructations of gas. It is said to check *painless watery diarrhœal discharges*. Rumex is employed for "*cough* with a sensation of fullness in the chest, with sighing, yawning, and efforts to take a full inspiration." It is most valuable in respiratory affections showing impoverished and vitiated blood. It may be employed in *laryngeal*, *tracheal*, and *bronchial catarrh*, and in *chronic sore throat* with hypersecretion, and is not without good effects in *incipient phthisis*. *Summer coughs*, of a dry and stubborn character have yielded to it (Webster). The fraction of the drop acts best here. Internally in doses of from $\frac{1}{10}$ to $\frac{1}{5}$ drop specific rumex may be employed for the relief of *army itch* (*contagious prurigo*).

The fresh root bruised in cream, lard, or fresh butter, forms an excellent ointment for *scrofulous ulcers*, *scrofulous ophthalmia*, *itch*, and a discutient for *indolent glandular tumors*. An ointment of the root of R. crispus, and the root-bark of Celastrus scandens, with gunpowder, is said to prove a certain cure for the *itch*, as well as being of value in other *cutaneous diseases* and *ulcers*. Its efficacy (of the ointment) in *itch* is probably chiefly due to the sulphur in the gunpowder. The powdered root is recommended as a dentifrice, especially when the gums are spongy. Dose of the decoction or syrup, from 1 to 4 fluid ounces, 3 times a day; specific rumex, fraction of a drop to 30 drops.

Specific Indications and Uses.—Bad blood with chronic skin diseases; bubonic swellings; low deposits in glands and cellular tissues, and tendency to indolent ulcers; feeble recuperative power; irritative, dry laryngo-tracheal cough; stubborn, dry, summer cough; chronic sore throat, with glandular enlargements and hypersecretion; nervous dyspepsia, with epigastric fullness and pain extending through left half of chest; cough, with dyspnœa and sense of præcordial fullness.

Related Species.—*Rumex nepalensis*, Wallich. This plant grows abundantly in Madras and other parts of India, and is used by the natives for its astringent qualities, and for dyeing purposes. According to O. Hesse (*Amer. Jour. Pharm.*, 1896, p. 443), this root contains a series of homologous substances (differing by multiples of the group, CH_2). The author found *rumicin* ($C_{15}H_{10}O_4$) differing from chrysophanic acid (see *Rheum*) chiefly in melting point; *nepalin* ($C_{17}H_{14}O_4$) in largest quantity, and *nepodin* ($C_{18}H_{16}O_4$). (Compare the series *chrysophanic acid*, *emodin*, and *rhein*, under *Rheum*.)

Rumex hymenosepalus, Torrey.—This species of dock is plentiful in sandy soils along the Rio Grande in Mexico, western Texas, New Mexico and California. The root, called *Canaigre*, has come into prominence in recent years, on account of the large amount of tannin it contains. It was used by the Indians as a tanning material and a dye-stuff; its Mexican name is *Raiz del Indio*. The root contains 23.16 per cent of tannin (Voelcker, *Amer. Jour. Pharm.*, 1876, p. 49) and 18 per cent of starch (Clifford Richardson, *ibid.*, 1886, p. 265). The coloring matters isolated by both chemists are analogous to those of rhubarb (see *Rheum*). Prof. Trimble (*The Tannins*) found the tannin to agree with that from mangrove, rhatany and perhaps mimosa.

RUMEX ACETOSA.—SORREL.

The leaves of *Rumex Acetosa*, Linné.
Nat. Ord.—Polygonaceæ.
COMMON NAME: *Sorrel*.

Botanical Source.—Rumex Acetosa has a long and tapering, somewhat woody root, with an erect, simple, leafy, striated stem, 1 or 2 feet high. The lower leaves are petiolate, somewhat ovate, and narrow-shaped, with 2 lateral teeth; the upper ones sessile, more oblong, and narrower. The stipule is tubular, membranous, and fringed. Clusters erect, compound, whorled, and leafless. Flowers diœcious; males green, with a reddish tinge; inner sepals ovate, rather larger than the outer; females rather redder; inner sepals ovate, obtuse, red, entire, each bearing an oblong, pale tubercle. The whole herb is smooth and powerfully and agreeably acid. The root is astringent. The plant is common to England, and is sometimes cultivated in this country (L.).

History and Chemical Composition.—The leaves of this and the following plant (see *Rumex Acetosella*, next page) are the parts used in medicine. They are inodorous, and have an agreeable, acid, slightly astringent taste. The leaves chiefly contain acid oxalate (binoxalate) of potassium, tannic acid, and nitrogenous matter. By drying, their acidity is lost. They are used alone, or in the form of an infusion of the fresh leaves. The root contains a substance allied to

Fig. 211.

Rumex Acetosa.

crysophanic acid, and an iron-greening tannin. In the early stage of its growth, it abounds in oxalic acid (5 per cent soluble, and about 9 per cent insoluble). (As to the distribution of oxalic acid at different seasons of the growth of the plant, see Berthelot and André, *Amer. Jour. Pharm.*, 1886, p. 500.)

Fig. 212.

Rumex Acetosella.

Action, Medical Uses, and Dosage.—Fresh sorrel leaves are refrigerant and diuretic. An infusion is useful in *febrile* and *inflammatory diseases*, and in *scorbutic diseases*. They may likewise be used as a salad, or boiled like spinach. The leaves, eaten freely, have produced poisonous effects, owing to the potassium binoxalate they contain (see *Amer. Jour. Pharm.*, 1887, p. 7). In poisoning by this agent the same treatment should be pursued as for poisoning by oxalic acid, viz.: the free administration of chalk suspended in an abundance of water; this should be followed by an emetic or stomach-pump, and subsequently by lenitives. Wrapped up and roasted, the leaves form an excellent application to *indolent tumors, wens, boils*, etc., hastening suppuration. The inspissated juice, applied on leather, is said to form an effectual but painful cure for *tumors*, and the improbable claim has been made that it will cure *incipient cancers*. Acting upon this hint, the following preparation has been used as a remedy in *cutaneous cancers*, viz.: Take of burnt alum, 1 drachm; citric or tartaric acid, 2 drachms; oxalic acid, 2 drachms; rain-water, ½ pint. Mix. To be applied by means of a camel's-hair pencil.

Related Species.—*Rumex Acetosella*, Linné, *Field* or *Sheep sorrel*, has a leafy stem, from 6 to 12 inches in height, with lanceolate-hastate, pleasantly-acid leaves. The flowers are small, reddish, in panicled racemes. Valves ovate, scarcely enlarging in fruit, destitute of granules. Stamens and styles on separate plants; styles adherent to the angles of the ovary. This weed is found in abundance throughout the United States, growing in pastures, waste grounds, and worn fields, flowering all summer (G.—W.). A strong tincture of the fresh plant (℥viii to alcohol, 76 per cent, Oj , in doses ranging from 1 to 30 drops, has been suggested by Dr. Scudder (*Spec. Med.*) as a remedy where there is a "tendency to degeneration of tissue," and he states that whether "in *syphilis, scrofula*, or *cancer*, the indication for its use is the replacement of tissue with lower organizations." The urinary apparatus and renal secretions are influenced by it.

RUTA.—RUE.

The leaves and unripe fruit of *Ruta graveolens*, Linné.

Nat. Ord.—Rutaceæ.

Common Name: *Garden rue.*

Illustration: Bentley and Trimen, *Med. Plants*, 44.

Botanical Source.—Rue is a glaucous, hairless, erect, suffruticose, perennial plant, with branching stems, 2 or 3 feet in height, woody below, with a grayish, rough bark; herbaceous and smooth above. The leaves are alternate, 2 and 3-pinnately divided; leaflets sessile, oblong, obtuse, dotted, glaucous, or bluish-green, 6 to 10 lines long, by 2 to 4 wide; terminal ones obovate-cuneate. The flowers are yellow, or pale greenish-yellow, in terminal, corymbose racemes; peduncles subdividing. Petals 4, yellow, unguiculate, concave, wavy, and a little irregularly toothed. Stamens 8, longer than the petals; filaments subulate; anthers ovate, obtuse, and yellow. Styles 4, distinct at the base, where they spring from the inner angle of the carpels above the common axis; united upward into a single pistil, which is attenuated toward the apex; stigma 4-furrowed. Carpels terminal, leafless, trichotomous, and cymose. The fruit is a roundish capsule, warted, and 4-lobed, each lobe opening into 2 valves (L.—W.). It is remarkable that the anthers move in turns to the pistillum, and after having shed their pollen retire.

Fig. 213.

Ruta graveolens.

History, Description, and Chemical Composition.—Rue is a well-known evergreen, half-shrubby plant, common to southern Europe, and introduced into this country as a garden plant. It flowers in July and August. The whole plant has a strong, heavy, unpleasant smell, and a bitter, acrid, pungent taste, which is due to its volatile oil. The leaves are the parts used, and, when fresh, are said to irritate and even vesicate the surface to which they are applied. They should be gathered when the seed-vessels are well developed, yet still green; the seed-vessels of the unripe fruit are covered with large oil vesicles, and may likewise be used for medicinal purposes. Rue yields its properties to boiling water in infusion, but alcohol is its best solvent. The plant loses much of its activity by drying. Its chief constituents are volatile oil (see *Oleum Rutæ*), *coumarin*, the crystallizable, yellow glucosid, *rutin* (*rutic acid*), and a volatile alkaloid (Dragendorff's *Heilpflanzen*, 1898, p. 351).

Rutin ($C_{42}H_{50}O_{25}$) was discovered, in 1842, by Weiss, in the leaves of the garden rue, and also occurs in the flower-buds (*capers*) of *Capparis spinosa*, Linné, *Sophora japonica*, Linné, and other plants. Boiling with diluted acids converts it into *quercetin* (1 molecule) and *isodulcite* (3 molecules). (For further details, see Husemann and Hilger, *Pflanzenstoffe*, p. 830; and Watt's *Dictionary of Chemistry*, Vol. IV, 1894, p. 419.)

Action, Medical Uses, and Dosage.—Rue is emmenagogue, ecbolic, anthelmintic, and antispasmodic. In large doses it seems to be a narcotico-acrid poison. It is asserted to cause abortion, and such effect is accompanied with inflammation of the stomach and bowels, with cerebral disturbance. Among the symptoms are retching and vomiting, violent pain in the stomach, headache, cerebral oppression and fullness, heat flushes, uncertain locomotion, somnolence, prostration, pulse feeble, at first rapid, then slow, coldness and twitching of the extremities, and frequent desire to pass urine, which is strongly impregnated with the peculiar odor of rue. Its action is chiefly directed upon the uterus, and is capable of exciting *menorrhagia*, *inflammation*, and *miscarriage*. It has been successfully used in *flatulent colic*, *hysteria*, some *nervous complaints*, *epilepsy*, and as an excellent vermifuge. Rue is a stimulant to the genito-urinary tract, and, in small doses, might prove a remedy in atonic conditions of these parts. Owing to its affinity for the nervous system, it relieves irritation and pain when administered in small amounts. It deserves study; and from 1 to 10 drops of the strong tincture (fresh herb, ℥viii to alcohol, 98 per cent, Oj) may be given, well diluted with water, at a single dose. Dose of the leaves, from 10 to 20 grains; of the decoction, from 1 to 4 fluid ounces; of the oil, from 2 to 6 drops.

SABADILLA.—CEVADILLA.

The seeds of *Schœnocaulon officinale*, Asa Gray (*Veratrum officinale*, Schlechtendal; *Sabadilla officinarum*, Brandt; *Helonias officinalis*, Don; *Asagræa officinalis*, Lindley), deprived of and unmixed with their pericarps.

Nat. Ord.—Melanthaceæ.

COMMON NAMES: *Cevadilla*, *Sabadill*.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 287.

Botanical Source and History.—The precise origin of this remedy is yet somewhat obscure; by some cevadilla is referred entirely to *Veratrum officinale*, with the synonyms as given above, while others consider it the product of *V. Sabadilla*, Retzius, with other plants of allied species. It is not probable, however, that *Veratrum Sabadilla* furnishes much of the commercial seed. The *British Pharmacopœia* (1885) gave *Schœnocaulon officinale* (*Asagræa officinalis*) as the only plant from which the seeds are procured. It is not official in the edition of 1898. The following is a description of two plants from which the seeds are reputed to be obtained:

Veratrum Sabadilla of Retzius, is a plant 3 or 4 feet high, with a simple, erect, round scape. The leaves are numerous, spreading on the ground, all radical, ovate-oblong, and obtuse, with from 8 to 14 ribs, glaucous underneath. The flowers are blackish-purple, rather nodding, on spreading, simple, or a little branched panicles; pedicels very short, approximated in twos and threes; those of the fertile flowers eventually becoming turned to one side; those of the sterile flowers deciduous, and leaving a scar. Segments of the perianth ovate-lanceolate, and veinless. Ovaries 3, oblong, connate, and obtuse; styles acute, and dilated downward; stigmas simple. Capsules 3, in form resembling those of Larkspur, occupying only one side of the stem, opening at the apex inside. Seeds 3 in each cell, imbricated, curved, blunt on one side, sooty, and acrid. This plant inhabits Mexico and the West Indian Islands (L.).

Schœnocaulon officinale, Gray (*Asagræa officinalis*, Lindley, *Veratrum officinale*, Schlechtendal, and *Helonias officinalis* of Don), is a cæspitose plant, bulbous, with the leaves linear, tapering to a point, even, smooth, entire, channeled above, carinate at the back, and about 4 feet long, by 3 lines broad. The scape is naked, the height of a man, quite simple, and terminated by a raceme 18 inches long. Perianth deeply 6-parted, spreading, yellowish-white, permanent, with linear, thick, veinless, obtuse segments, 3 of which are rather broader than the others. Filaments 6, somewhat clavate, those opposite the broad segments of the perianth longer than the others, and all longer than the perianth. Anthers large, yellow, cordate, and obtuse. Ovary formed of 3 cells, united by their sutures, with an obscure stigma. Fruit tricapsular; the carpels united by their suture separable. Seeds winged, and wrinkled. The lower flowers are hermaphrodite and fertile; the upper male and sterile. This plant is a native of the eastern side of the Mexican Andes, near Barranca de Tioselo, by the Hacienda de la Laguna, in grassy places (L.).

Description.—Cevadilla seeds are said to be brought from the Antilles, from Mexico (ripe capsules), and from Venezuela (seeds only), and are generally associated with the tri-follicled fruit, each division of which is composed of a slender elastic, membranous follicle, and from 1 to 3 black, shining, flat, shriveled, winged, elastic seeds. The seeds are odorless, but have a bitter, acrid, tingling taste, which is intense, persistent, and disagreeable; and their powder excites violent sneezing and discharge from the nostrils. They yield their properties with difficulty to water, but readily to alcohol. They are used as a source of the alkaloid *veratrine*, of which the yield is one-third of 1 per cent.

Chemical Composition.—Sabadilla seeds contain fixed oil (24.6 per cent), resin (10 per cent, of which 8.5 per cent is insoluble in ether), the alkaloid *veratrine* (Meissner, 1818) (see *Veratrina*), a peculiar volatile and crystallizable fatty acid called *sabadillic* or *cevadic acid* (Pelletier and Caventou, 1819), etc.

The alkaloidal constituents have been frequently investigated. C. R. A. Wright and A. P. Luff (*Amer. Jour. Pharm.*, 1878, p. 489, from *Lond. Jour. Chem. Soc.*, Aug., 1878, p. 358) come to the following conclusions: The seeds of Veratrum Sabadilla contain: (1) amorphous *veratrine* ($C_{37}H_{53}NO_{11}$), first isolated by Couerbe (1834); upon saponification it splits into *veratric acid* (*dimethylprotocatechuic acid*) and a new base, *verine* ($C_{28}H_{45}NO_8$); (2) crystallizable *cevadine* ($C_{32}H_{49}NO_9$), the principal alkaloid, first isolated by Merck (1855) and named by him *veratrine*. It melts at about 205.5° C. (402° F.), and upon saponification splits into the base *cevine* ($C_{27}H_{43}NO_8$) and *methylcrotonic acid* ($C_5H_8O_2$) with which the above cevadic acid is identical. The authors could not obtain the crystallizable, non-sternutatory (3) *sabadilline* of Couerbe (1834), Hübschmann (1852), and Weigelin (*Jahresb. der Pharm.*, 1871, p. 34), the existence of which, however, is upheld by Masing (*ibid.*). Wright and Luff found instead a similar body, likewise insoluble, or nearly so, in ether, but amorphous and insoluble in water, and named it *cevadilline*. The amorphous alkaloid *sabatrine* of Weigelin (*loc. cit.*) is believed by the authors to be a mixture. They likewise disbelieve the statements of former authors (Weigelin, E. Schmidt and R. Köppen, *Archiv der Pharm.*, 1877, p. 1) that cevadine (veratrine) occurs in two isomeric modifications, one crystalline, the other amorphous. Bosetti, however (*Archiv der Pharm.*, 1883, pp. 81–106), differentiated commercial veratrine into a crystallizable base, nearly insoluble in water, soluble in alcohol and ether, and identical with *cevadine* ($C_{32}H_{49}NO_9$), which he names veratrine, and an isomer of the latter, soluble in water, which he calls *veratridine* (also see *Veratrina*). E. Merck (*Amer. Jour. Pharm.*, 1891, p. 338) isolated from cevadilla seeds two new alkaloids *sabadine* ($C_{29}H_{51}NO_8$) and *sabadinine* ($C_{27}H_{43}NO_8$, or $C_{27}H_{45}NO_8$). Both are crystallizable and non-sternutatory. Wright and Luff believe the sabadilla alkaloids to be closely related to the alkaloids of aconite. Sabadilla seeds, when assayed by Keller's method (*Jahresb. der Pharm.*, 1892, p. 14), yield from 4.25 to 4.35 per cent of total alkaloid, while the yield is usually stated to be only from 1 to 2 per cent.

Action, Medical Uses, and Dosage.—Cevadilla seeds have been used as a vermifuge, and to destroy *vermin* in the hair, but their dangerous drastic and irritating properties have caused them to be dismissed from practice. They are principally used in the manufacture of veratrine; and rarely, but with great caution, in some *nervous diseases*, *tapeworm*, etc. The dose is from 5 to 15 grains, for the expulsion of *tænia*, and other *worms*. An extract has proved beneficial in painful *rheumatic* and *neuralgic affections*. Cevadilla is now used only as a source of veratrine, to which all of its activity and toxic properties are due.

SABBATIA.—AMERICAN CENTAURY.

The herb of *Sabbatia angularis*, Pursh (*Chironia angularis*, Linné).

Nat. Ord.—Gentianeæ.

COMMON NAMES: *American centaury*, *Rose-pink*.

Botanical Source.—This plant, also called *Rose-pink*, has a yellow, fibrous, biennial root, with an erect, smooth, quadrangular stem, the angles of which are winged, having many opposite branches, and 1 to 2 feet in height. The leaves are opposite, sessile, ovate, cordate at base, clasping the stem, 5-veined, smooth, entire, 1 or 2 inches in length, by ½ to 1½ inches in width. The flowers are numerous, 1¼ to 1½ inches in diameter, of a rich-rose color, terminal, on elongated peduncles, greenish or whitish in the center, forming a large corymbose panicle. Calyx with 5 lanceolate segments; tube of calyx angular. Corolla rotate, 5-parted, with oval segments twice as long as the calyx. Stamens 5; filaments slender; anthers yellow, oblong, slightly recurved when the flower first opens, after shedding their pollen, they become revolute and curl up. Ovary ovate; style longer than the stamens, and declined. Stigma 2 parted, the segments separate at first, but gradually become twisted spirally together. The capsule is 1-celled and 2-valved, with numerous seeds (L.—W.).

History and Chemical Composition.—This plant is common in most parts of the United States, growing in moist meadows, among high grass, on the prairies, and in damp, rich soils, flowering from June to September. The whole plant is used. It has a very bitter taste, and yields its virtues to water or alcohol. The best time for gathering it is during its flowering season. It is preferable to the European centaury (*Erythræa Centaurium*, Persoon). M. Mehu obtained, in 1866, crystallizable *erythrocentaurin* from European centaury. It is neutral, colorless, odorless, tasteless, and dissolves in 1630 parts of cold, 35 parts of boiling water, in 48 parts of alcohol, of 86 per cent strength, at 15° C. (59° F.), in 245 parts of ether, and 13 parts of chloroform; it is easily soluble in fixed and volatile oils. Direct sunlight causes it to turn red (*Jahresb. der Pharm.*, 1866, p. 70). Mr. J. F. Huneker (*Amer. Jour. Pharm.*, 1871, p. 207) detected a probably analogous substance in the American plant. As obtained in an impure form, it was soluble in water, alcohol, and ether, but insoluble in fixed and volatile oils, of a sharp, acrid taste, and an odor resembling that of nicotine. The crystals turn red when exposed to sunlight. Mr. William T. Hankey (*ibid.*, 1891, p. 335) made a complete analysis of the herb, and obtained the same substance, and, in addition 3.75 per cent of a bitter principle.

Action, Medical Uses, and Dosage.—Tonic. Used in autumn *periodic febrile diseases*, both as a preventive and as a remedy. It is also serviceable as a bitter tonic in *dyspepsia*, and *convalescence from fevers*. When administered in warm infusion, it is a domestic remedy for *worms*, and to restore the menstrual secretion. Dose of the powder, from ½ to 1 drachm; of the cold infusion, 4 fluid ounces, every 2 or 3 hours; of the tincture, 1 to 2 fluid drachms; and of the extract, from 2 to 6 grains.

Related Species.—*Sabbatia Elliottii*, Steudel (*Sabbatia paniculata*, Elliott), *Quinine flower*. This is an erect herb, about 12 inches in height, and is common to the pine barrens of the southern United States. It does not, probably, occur farther north than the Carolinas. The stem is smooth, slender, round, with but few leaves, and alternately branched. The leaves are small, opposite, entire, without leaf-stalks, and from ½ to 1 inch in length; the upper leaves are very narrow and linear, the lower are broader; they are attached at nearly a right angle to the stem. The flowers are white, nearly an inch broad, and quite showy; they are borne on slender peduncles, and appear late in the summer. The calyx has a short tube, and 5 linear lobes, about one-third the length of the corolla segments. The corolla is flat, rotate, and has 5 obtuse lobes. The stamens are 5, and attached to the corolla tube. The fruit is a dry, 1-celled capsule, opening by 2 valves, and containing many small seeds. This plant was noticed in the *Amer. Jour. Pharm.*, 1876, p. 455, by Dr. Palmer, of Monticello, Florida. It had been previously used in domestic practice, and during the civil war. Some little demand was created after the publication of Dr. Palmer's article, but the remedy has since almost fallen into disuse. This plant, as the name "quinine flower" would show, was supposed to possess tonic and antiperiodic properties, somewhat analogous to those of quinine. It was lauded as a remedy for all *malarial fevers*, as a tonic during convalescence from exhausting diseases, and in various forms of *debility*. It is seldom, if ever, employed at the present day. The dose of the fluid extract is from 5 to 60 minims, repeated every 1, 2, 3, or 4 hours, according to circumstances.

Erythræa Centaurium, Persoon (*Gentiana Centaurium*, Linné), *European centaury*.—A bitter tonic (see *Sabbatia*, preceding page). Several South American and Mexican species are employed as bitter tonics under the name of *Canchalagua*. Among them are *Erythræa chilensis*, Persoon; *E. jorullensis*, Kunth; *E. stricta*, Schiede, etc.

Pleurogyne rotata, Grisebach.—Japan and the Pacific states. A bitter tonic.

SABINA (U. S. P.)—SAVINE.

The tops of *Juniperus Sabina*, Linné"—(*U. S. P.*) (*Sabina officinalis*, Garcke).
Nat. Ord.—Coniferæ.

COMMON NAME: *Savin-tops.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 254.

Botanical Source.—Juniperus Sabina is an evergreen, very compact shrub, growing from 4 to 16 feet in height, with a disposition to spread horizontally rather than to form a stem. Its branches are slender, round and tough, with the bark of the young branches pale-green, of the trunk rough. The leaves are very small, ovate, convex, dark-green, densely imbricated, erect, decurrent, and opposite; the oppositions pyxidate. Flowers diœcious. The fruit is a deep-purple, almost black, ovoid berry, about the size of a whortleberry, and smaller than that of *J. communis* (L.—W.).

History, Description, and Chemical Composition.—This plant is indigenous to middle and southern Europe, Siberia, and in the northern United States, in rocky situations. The parts used are the tops and leaves. They have a powerful, peculiar, rather disagreeable odor, a bitter, acrid, biting taste, and yield their properties to alcohol, or hot water in infusion. Desiccation renders them of a lighter color. The drug is officially described as "short, thin, subquadrangular, branchlets; leaves rather dark-green, in 4 rows, opposite, scale-like, ovate-lanceolate, more or less acute, appressed, imbricated, on the back with a shallow groove containing an oblong or roundish gland; odor peculiar, terebinthinate; taste nauseous, resinous, and bitter"—(*U. S. P.*). Gardes found them to contain volatile oil (see *Oleum Sabinæ*), resin, gallic acid, chlorophyll, extractive, lignin, and calcareous salts. In addition to these, Mr. C. H. Needles found fixed oil, gum, and salts of potassium (*Amer. Jour. Pharm.*, Vol. XIII, 1841, p. 15).

Action, Medical Uses, and Dosage.—Savin is emmenagogue, diuretic, diaphoretic, and anthelmintic. In large doses it will produce gastro-enteritis. Care must be taken in its administration, as it has, in several instances, produced fatal results. It should never be given when there is any general or local inflammation present, and it should never be used during pregnancy, on account of its tendency to cause abortion, and yet, notwithstanding this effect, it is reputed efficient in checking the tendency to abort, and to be beneficial in *menorrhagia*, when carefully exhibited in small doses. It is also serviceable in *atonic leucorrhœa*, *amenorrhœa*, with torpor, *irritative urethral diseases*, and *vesical catarrh*, in all cases being contraindicated by an excited circulation. The oil (*Oleum Sabinæ*), given 2 or 3 times a day, in doses of from 10 or 15 drops on sugar, will, in most cases, cause abortion, but it is apt to violently affect the stomach and bowels at the same time, bringing life into extreme danger. It is sometimes combined with oils of tansy, pennyroyal, or hemlock, as an emmenagogue and abortivant, and given in doses of 2 to 5 drops. Sometimes the leaves of savin are combined with pink and senna and given to remove *worms*. Savin oil will also frequently remove them, but we have more efficient and much safer remedies for this purpose. Externally, the leaves, made into a cerate, have been used as a stimulant to *indolent ulcers*, and to promote a discharge from blistered parts. Mixed with an equal weight of verdigris, the powdered leaves have been used for destroying *venereal warts*. Dose of the powdered leaves, from 5 to 15 grains in syrup, 3 times a day; of the fluid extract, from 5 to 10 drops; of the strong tincture (℥viii to alcohol, 76 per cent, Oj), from 1 to 5 drops; of the infusion, from ½ to 2 fluid ounces.

Specific Indications and Uses.—"Suppressed menses, with colicky pains, general fullness of veins, headache" (Watkins, *Ec. Comp. of Prac. of Med.*).

Related Species.—*Juniperus virginiana*, Linné, is a tree which attains the height of 35 feet, or even more. Its trunk varies from 10 to 14 inches in diameter, is straight, and decreases rapidly from the ground, giving off many horizontal branches; its surfaces are generally unequal, and disfigured by knots, and by the crevices and protuberances they occasion. Small twigs, covered with minute, densely imbricated leaves, which are fleshy, ovate, concave, rigidly acute, with a small depressed gland on the middle of their outer side, growing in pairs which are united at the base to each other, and to the pairs above and below them. (A singular variety sometimes appears in the young shoots, especially those which issue from the base of the trees; this consists in an elongation of the leaves to 5 or 6 times their usual length, while they become spreading, acerose, remote from each other, and irregular in their insertion, being either opposite or ternate; such shoots are so dissimilar to the parent tree, that they have been repeatedly mistaken for individuals of a different species.) Barren flowers, in small oblong aments, formed by peltate scales with the anthers concealed within them. Fertile flowers form a small roundish galbus, with 2 or 3 seeds, covered on its outer surface with a bright-blue powder (L.—B.). The red cedar is a tree which inhabits almost all parts of the United States, especially the southern, preferring dry, rocky situations, and barren soils. It is evergreen, growing very slowly, and flowering in April and May. The internal wood is of a dull-reddish hue, fine-grained, and compact, very light and durable, and is much used for tubs, pails, lead-pencils, fences, etc. The parts used are the leaves and twigs. They have a characteristic, rather agreeable odor, and a peculiar, somewhat acrid and amarous taste. Their virtues are taken up by alcohol or ether, and partly by hot water, and are due to essential oil (see *Oleum Juniperi Virginianæ*). The leaves are often confounded with those of *Juniperus Sabina*, which have an entirely different smell. According to Jenks, the leaves yield gum, albumen, volatile oil, tannic acid, resin, bitter extractive, chlorophyll, fatty matter, woody fiber, etc. (*Amer. Jour. Pharm.*, Vol. XIV, p. 235). Excrescences known as *cedar apples*, are frequently formed on the branches, and occasioned, like galls, by the pricking of an insect; they have a somewhat agreeable odor, and an austere taste. These are sometimes powdered and administered successfully as a vermifuge, the dose being from 10 grains to ½ drachm, in some convenient vehicle, and repeated every 4 hours through the day. The medical properties and uses are the same as for the *Juniperus Sabina;* less energetic, but used in the same diseases; also with spearmint and marshmallows, in *scalding of urine*, and derangements of the kidneys and bladder. The oil makes a valuable external stimulating application for *rheumatic pains, bruises*, etc. Dose of the leaves, from 1 to 2 drachms; of the oil, from 10 to 15 drops. The excrescences, or *cedar apples*, are decided anthelmintics. The following makes a pleasant and excellent vermifuge and tonic for pale, sickly children; I have used it with much success: Take of cedar apples, 1 pound; of black alderberries (*Prinos verticillatus*), 1 pint, by measure. Digest these, for 14 days, in 1 quart of alcohol and 1 pint of molasses. The more recent the articles, the better. Dose, 1 fluid drachm, 3 times a day, for a child 1 or 2 years old; it is a laxative, tonic, and vermifuge (J. King).

SACCHARINUM.—SACCHARIN.

FORMULA: $C_6H_4COSO_2NH$. MOLECULAR WEIGHT: 168.65.

SYNONYMS: *Glusidum, Gluside, Glucusimide, Benzoyl-sulphonimide* (all in *Br. Pharm.*, 1898); *Benzoic sulphimide, Benzoic sulphinide, Orthosulphamine-benzoic anhydride.*

Source and History.—The sweet taste of saccharin (gluside) was discovered by Constantin Fahlberg in his researches on this substance (see Fahlberg and Remsen, *Amer. Chem. Jour.*, 1879 and 1880). It is the anhydride of *orthosulphamido-benzoic acid* (C_6H_4 COOH.SO$_2$NH$_2$) and has the formula C_6H_4:(CO)(SO$_2$):NH. It is prepared from the benzene hydrocarbon *toluene* (C_6H_5 CH$_3$) by a series of reactions, for which see explanatory details in *Pharm. Jour. Trans.*, Vol. VII, 1898, p. 593. Commercial saccharins, when first introduced, were frequently a mixture of saccharin (the *ortho* compound) with *para-sulphamido-benzoic-acid* (see *Tests*, next page; and dissertation by Dr. A. R. L. Dohme, on *Ortho-Sulpho-Benzoic Acid*, etc., Baltimore, Md.). In recent years, purified saccharins are being obtained, which consist of the ortho compound only (see *Chem. Centralblatt*, Vol. II, 1896, p. 690).

Description and Tests.—The most characteristic feature of this substance is its intense sweetness, hence the names gluside, saccharin, although the latter name properly belongs to another substance previously so named, a bitter, crystallizable derivative of the sugar group, of the formula $C_6H_{10}O_5$.

Saccharin (gluside) is a light, white, minutely crystalline powder having an intensely sweet taste in dilute solutions. A solution of 1 in 10,000 is said to be still decidedly sweet. The sweetening power of the absolutely pure ortho compound is stated to be from 500 to 550 times that of sugar. According to the *British Pharmacopœia*, gluside is "soluble in 400 parts of cold water, in 24 parts of boiling water, in 25 parts of alcohol (90 per cent), and but slightly in ether or chloroform." It is sufficiently soluble in ether, however, to enable its abstraction, for analytical purposes, from its acidulated aqueous solution. "It is very soluble in diluted solution of ammonia; also in solution of sodium bicarbonate, with evolution of carbonic anhydride. A warm solution of sodium bicarbonate, when neutralized with gluside and evaporated to dryness, yields 'soluble gluside' or 'soluble saccharin,' which is very soluble in water, 100 parts of gluside yielding nearly 113 parts of neutral 'soluble gluside'"—(*Br. Pharm.*, 1898). When saccharin is heated, it melts and then sublimes with partial decomposition, the vapors possessing an intensely sweet taste. When saccharin is heated with caustic soda to about 250° C. (482° F.) salicylic acid is formed which may be detected by dissolving the mass in acidulated water, shaking out with ether, evaporating to dryness and producing the characteristic violet-blue coloration by adding ferric chloride. If saccharin and salicylic acid are simultaneously present in a liquid (*e. g.*. beer), the amount of saccharin may be determined, according to A. H. Allen (*Amer. Jour. Pharm.*, 1888, p. 360), by igniting the isolated mixture of the two, with addition of caustic alkali and a little nitre, and determining the sulphate formed by means of barium chloride. By another method, salicylic acid may be separated from saccharin in acidulated solution by means of bromine water which precipitates all the salicylic acid as a bromine compound; from the supernatant liquid, saccharin may be conveniently extracted with ether, after the excess of bromine is removed by a current of air (Hairs, *Amer. Jour. Pharm.*, 1893, p. 554). Saccharin is distinguished from sugar by not being charred by sulphuric acid even when warmed with it for a short time. To test for para-sulphamido-benzoic acid which melts at about 288° C. (536° F.), the *British Pharmacopœia* (1898) directs that a solution of 0.5 gramme of gluside in 80 cubic centimeters of warm water, set aside for 12 hours, should deposit tabular crystals which melt between 218.8° and 220° C. (426° and 428° F.), and it should not, even when briskly shaken, deposit crystals melting at a higher temperature (absence of sulphamido-benzoic acid).

Action, Medical Uses, and Dosage.—Saccharin has come into use somewhat as a sweetening agent to replace sugar where the latter is for any reason contraindicated. It has been demonstrated that even in large doses it does not affect the system in the least. It does not augment or diminish the secretions, disturb the respiratory or circulatory functions, nor interfere with nutrition. Elimination takes place almost wholly by the kidneys, and the urine. while not increased in quantity is rendered decidedly sweet and its putrefactive tendency is markedly delayed. Saccharin passes from the system unchanged. Owing to its power over putrefaction it has been employed in *fermentative disorders of the stomach and bowels*, with distension, in *suppurative otitis*, and in *disorders of the urinary tract* with purulent urine. On account of retarding the digestive action of the pancreatic and salivary fluids in experiments conducted without the body it has been concluded by some physicians that it may retard or disorder stomachic and intestinal digestion, but clinical experience does not appear to support such a view. It is employed principally in lieu of sugar and milk sugar in *saccharine diabetes*, *fermentative dyspepsia*, *obesity*, and other disorders in which the sugars are contraindicated. Its sweetening power is exceedingly great. from 1 to 1½ grains of saccharin in combination with sodium bicarbonate being sufficient to sweeten an ordinary cup of coffee. For sweetening purposes it should be mixed with sodium bicarbonate in the proportion of 2 parts of the saccharin to 3 parts of the sodium salt. A glycerin solution prepared by heating together saccharin. 30 grains, and glycerin, ℥viij (by weight), is an efficient sweetening preparation for lemonade and acid fruits. The dose of saccharin is from 1 to 4 grains, in capsules. 4 or 5 times a day. The taste of many disagreeable medicines may be disguised by saccharin; among them are quinine, cod-liver oil, guaiacum, etc.

Related Preparation.—DULCIN, *Sucrol*, or *Paraphenetol-carbamide* ($C_6H_4.OC_2H_5.NH.CONH_2$). Colorless needles of a sweet compound prepared synthetically by acting with ammonia upon the product of the reaction between the gaseous carbonyl chloride ($COCl_2$) (1 molecule), and paraphenetidin ($C_6H_4[OC_2H_5]NH_2$) (2 molecules), both in toluene solution. The crystals fuse at 160° C. (320° F.) (see *Jahresb. der Pharm.*, 1892, p. 407; and *Amer. Jour. Pharm.*, 1893, p. 288).

SACCHARUM (U. S. P.)—SUGAR.

FORMULA: $C_{12}H_{22}O_{11}$. MOLECULAR WEIGHT: 341.2.

"The refined sugar obtained from *Saccharum officinarum*, Linné, and from various species or varieties of *Sorghum* (*Nat. Ord.*—Gramineæ); also from one or more varieties of *Beta vulgaris*, Linné (*Nat. Ord.*—Chenopodiaceæ)"—(*U. S. P.*).

COMMON NAMES AND SYNONYMS: *Cane-sugar*, *Sucrose*, *Refined sugar*, *Saccharum purificatum*, *White sugar*.

History, Source, and Preparation.—Sugar, which at present constitutes so important an article in the food of all civilized nations, seems to have been known at a very early period to the inhabitants of India and China. It was used only as a medicine for ages after its introduction into the West. But it was not until after the discovery of America, and the introduction of the sugar-cane into the West Indies by the Spaniards, that its use as an article of food became common. About one-half of the total sugar production of the world is from sugar-cane; another equally important source is the sugar-beet (*Beta vulgaris*, Linné) cultivated chiefly in Germany and Austria, and now to some extent also in this country. The occurrence of sugar in the beet was demonstrated by Marggraf, as early as 1747, but only since about 1840, the manufacture from this source began to flourish. Minor quantities of cane-sugar (sucrose) are produced from several species of Sorghum (*e.g.*, *Sorghum saccharatum*, Persoon, and *Holcus saccharatus*, Linne), a Chinese plant, and from the sap of the sugar-maple (*Acer saccharinum*, Linné, and other species), as well as the sap of the date palm (*Phœnix dactylifera*), and other palm trees. The crude sugar obtained in India, from the latter source, is called *jaggery*. Cane-sugar also occurs in corn-stalks, and in the roots of many plants, *e.g.*, parsnips, carrots, and such drugs as ipecacuanha, scopolia, etc.; in the nectar of flowers, and, together with other sugar, in ripe fruits, such as pineapples, pears, apples, bananas, dates, strawberries, etc., while it is entirely replaced by other sugars in figs, grapes, gooseberries, and sweet cherries.

Saccharum officinarum, Linné, *Sugar-cane*, is a plant having an articulated, juicy root, from which proceed several erect, solid stems, 10 or 12, sometimes 15 or 20 feet high, 1 or 2 inches in diameter, of a hard, shining rind, which is green, while the cane is immature, but turning yellow, purple, red, or striped when the cane ripens. Internally it is whitish, juicy, saccharine, and pithy. The leaves are situated at the joints, at intervals of about 2 or 3 inches, flat, sheathing at the base, 2 to 4 feet in length, about one-fourth as wide, the margins being armed with numerous small, sharp teeth. The panicle is terminal, spreading, erect, oblong, 1 to 3 feet in length, and grayish from the quantity of long, loose hairs surrounding the florets; the branches are alternate and very spreading. Rachis striated. Florets diœcious in pairs. Glumes smooth. Paleæ smooth, membranous, and of a pink color. This plant, a native of tropical and subtropical climates, is cultivated in the East and West Indies, Mauritius, Tahiti, the Sandwich Islands, and in some of the southern United States.

In cultivation, the canes are not allowed to flower, because the yield of sugar is greatest from non-flowering canes. (For interesting details regarding the cultivation of sugar-cane, and connected matters, see Henry Pocklington, *Pharm. Jour. Trans.*, Vol. V, 1875, p. 746.) When the canes turn yellow, they are cut and transported to the sugar-mills, where the juice is obtained by crushing the canes between revolving cylinders of stone or, preferably, iron. The resultant cane-straw is called *bagasse*, and is used as fuel. Sugar-cane, when matured, contains about 90 per cent of juice, which holds, on an average, 18 per cent of cane-sugar, with small quantities of uncrystallizable (invert) sugar. The latter kind occurs mostly in the upper part of the stem; it is more abundant in rapidly-growing cane than in cane of slower growth. Cane-juice also contains about 9 per cent of a peculiar albuminous matter, which readily undergoes putrefaction; likewise, small quantities of organic acids, *e. g.*, oxalic and malic acids, and *aconitic acid* (A. Behr, 1877), a derivative of citric acid, are present. These constituents cause cane-juice to be rapidly decomposed in warm climates; the acids tend to convert sucrose into uncrystallizable invert sugar. Hence, the juice must be immediately worked for sugar, by neutralizing the free acid with a calculated quantity of milk of lime; after boiling and removing the scum *(defecating)*, the juice is gradually evaporated in a series of open pans (old method), or by means of *vacuum pans*, *i. e.*, under diminished pressure at a lower temperature (modern method). By the old method, the *raw*, *brown*, or *muscovado sugar* is separated from the mother liquor, or *molasses*, by simple draining in perforated vessels; by the modern method, the molasses is separated from the sugar in centrifugal machines, and the raw sugar thus obtained is frequently pure enough for many purposes. From molasses additional quantities of sugar are frequently obtained; the residual, impure molasses is fermented and used in the distillation of *rum*. To produce *refined*, *white* or *loaf-sugar*, the raw sugar is sent to refineries, where it is dissolved in water, purified by means of bullock's blood and bone-black, and decolorized by passing the syrup through filters of animal charcoal. It is then evaporated in vacuum pans to crystallization, and the mass is run into conical molds, wherein the molasses *(treacle)* is either allowed to drain or is separated by centrifugal force. According to Dr. S. P. Sadtler (*Indust. Org. Chem.*, 2d ed., 1895, p. 152), the hard commercial sugars (dried by artificial heat) contain over 99 per cent of pure sucrose, while the softer sugars (merely centrifugated) hold about 4 per cent of water, due to traces of mother liquor adhering to the crystals.

The SUGAR-BEET contains from 12 to 15 per cent of sucrose. Unlike sugar-cane, it is free from uncrystallizable invert sugar, but contains the sugar *raffinose*. The presence of about 1.25 per cent of nitrogenous matter (*betaïne*, *asparagin*, etc.) and a comparatively large amount of salts, make the purification of the raw beet-sugar a more complicated operation than that of the sugar from sugar-cane. The molasses from beet-sugar, unlike that from cane-sugar, can not be used for table syrups, on account of its bad taste and smell. It contains about 50 per cent of sucrose, which can be recovered for the most part by precipitating the sugar in the form of calcium sucrate, or strontium sucrate (*strontium process*). (For further details, we must refer the reader to special works on technology—*e. g.*, see S. P. Sadtler, *loc. cit.*, pp. 119–166.)

Description and Tests.—Cane-sugar (sucrose), as demanded by the *U. S. P.*, occurs in "white, dry, hard, distinctly crystalline granules, odorless, and having a purely sweet taste. Permanent in the air. Soluble, at 15° C. (59° F.), in 0.5 part of water, and in 175 parts of alcohol; in 0.2 part of boiling water, and in 28 parts of boiling alcohol; also soluble in 80 parts of boiling, absolute alcohol, but insoluble in ether, chloroform, or carbon disulphide. The aqueous solution, saturated at 15° C. (59° F.), has the specific gravity 1.345, and is miscible with water in all proportions. The aqueous or alcoholic solution of sugar is neutral to litmus paper"—(*U. S. P.*).

An aqueous solution of 850 parts of sugar in water, sufficient to make 1000 Cc., has a specific gravity of 1.317; this solution is the official *syrup* (formerly called *Syrupus Simplex*). Cane-sugar melts at about 160° C. (360° F.), and solidifies on cooling, forming a glossy, amorphous mass, called *barley sugar;* its specific gravity is only 1.509, while that of cane-sugar is 1.606. When heating cane-sugar to about 200° C. (392° F.), a brown-coloring matter, called *caramel*, is formed. Cane-sugar, upon dry distillation, yields acetone, aldehyde, acetic acid, formic acid, carbonic dioxide, some monoxide, methane, tarry products, etc. Concentrated sulphuric acid converts sugar into a charred mass, sulphurous acid being evolved. Boiling with nitric acid produces *saccharic acid* ($C_4H_4[OH]_4.[COOH]_2$), tartaric and oxalic acids. By the action of concentrated nitric and sulphuric acid upon sugar, explosive *nitro-sugars* are formed, analogous to nitro-cellulose (see *Pyroxylin*). With bases, as calcium and strontium oxide, sugar forms characteristic compounds, called *saccharates*, or *sucrates*, *e. g.*, tri-calcium sucrate ($C_{12}H_{22}O_{11}.3CaO$), which are technically important (see *Preparation*, preceding page).

Cane-sugar is optically dextro-rotatory, but upon warming with diluted acids, it is converted into *invert sugar*, which is a mixture of equal molecules of dextrose and lævulose, the combination of which is slightly lævo-rotatory. Measurement of the optical rotation by means of especially devised instruments, is of great importance in the analysis of the various sugars. (For details on this subject, with index of literature, see H. W. Wiley, *Principles and Practice of Agricultural Analysis*, Vol. III, Easton, Pa., 1897.) Cane sugar (sucrose) does not reduce Fehling's solution, nor ammoniated silver nitrate, except in traces; reduction takes place freely after inversion by means of acids. Cane-sugar as such ferments, only after it is transformed by the action of yeast into invert sugar; the latter is capable of being fermented.

The *U. S. P.* gives the following tests for the purity of cane-sugar: "Both the aqueous and the alcoholic solution of sugar should be clear and transparent. When kept in large, well-closed and completely filled bottles, the solutions should not deposit a sediment on prolonged standing (absence of *insoluble salts*, *ultramarine*, *Prussian blue*, etc.). If 1 Gm. of sugar be dissolved in 10 Cc. of boiling water, the solution mixed with 4 or 5 drops of silver nitrate T.S., then about 2 Cc. of ammonia water added, and the liquid quickly brought to the boiling point, not more than a slight coloration, but no black precipitate, should appear in the liquid after standing at rest for 5 minutes (absence of *grape-sugar*, or of more than a slight amount of *inverted sugar*)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Sugar is nutritive, alterative, demulcent, diuretic, and topically antiseptic. It belongs to the class of "elements of respiration," contributes to the formation of fat and lactic acid, and, by its oxidation, furnishes heat. It has been detected in the tissue of the liver. As it is void of nitrogen, it can not sustain life alone, and only becomes eminently nutritive when combined with other alimentary proximate principles. Used in large quantities, it is injurious to digestion. In relation to both vegetable and animal matters, it acts powerfully in preventing putrefaction; the former of which may be preserved indefinitely in syrup, so long as the syrup is secured against fermentation; while the latter, after long immersion in syrup, or in moistened sugar, may be perfectly mummefied. On this account it is now used considerably in the preservation of fish, and various meats, instead of salt, to which it is superior, requiring a smaller amount, and not materially affecting the flavor nor the nutritive properties of these meats. Sugar or molasses, when freely eaten by children, prove excellent anthelmintics, and have also proved efficient in *scorbutic affections.* Powdered white sugar is sometimes sprinkled over *ulcers* to remove fungus or proud flesh, and has been blown upon the ball of the eye to remove *specks on the cornea.* As a local application in *aphthæ*, it is quite efficient, and cures have been wrought with it in *trachoma.* It favors the detachment of *diphtheritic membranes*, and may be employed as an antiseptic dressing for various kinds of *wounds.* On account of its property of correcting fetor, a snuff of finely-powdered sugar has been used in *ozæna.* As a demulcent, sugar may be employed in various forms, in *cough*, *hoarseness*, *soreness of the throat*, etc. When taken to the extent of 12 or 16 ounces per day, dissolved in water, sugar is said to powerfully increase the sexual passion. It has long been supposed that the teeth are injured or acted upon by sugar, in a manner calculated to cause their decay, but this opinion is erroneous; if particles of sugar become lodged between the teeth, and are allowed to decompose, decay will inevitably ensue, but if the particles be removed at an early period, sugar will be found to exert a beneficial influence upon the teeth and gums. The use of it, however, is mainly confined to the preparation of syrups, to conceal the unpleasant taste of several drugs, to render water and oils miscible, to suspend certain medicines in the form of mixture or emulsion, to prevent the oxidation of some chalybeate compounds, and also for converting some agents into the state of conserve, confection, electuary, pill, or lozenge. For pills, molasses is most generally preferable to syrup, as it does not so readily harden, and preserves them in a soft, moist state, for a long time, while its antiseptic properties prevent them from becoming moldy.

Sugar, in solution, absorbs a very large quantity of lime. A *saccharate of lime* has been found very beneficial in the *chronic diarrhœas* of children, as well as to prevent acidity of the stomach, and the disposition to diarrhœa so common in children of a certain age at particular seasons. It is made by saturating simple syrup with lime, and then filtering it. It forms a transparent mixture of an extremely alkaline taste, and may be added to water or milk. It is altogether superior to the bicarbonate of sodium. Dose for an infant, from ¼ to ½ drachm, given in some of the mother's milk; for an adult, from 1 to 2½ drachms.

Related Sugars.—GLUCOSE, or GRAPE-SUGAR ($C_6H_{12}O_6$=179.58), known also as DEXTROSE, or STARCH-SUGAR, is found in grapes, cherries, plums, figs, honey, always associated with lævulose and sometimes cane-sugar (which see). Dextrose is the sugar of diabetic urine, and frequently occurs combined in the form of *glucosids*, such as *amygdalin*, *salicin*, *phloridzin*, *quercitrin*, etc. (which see). Chemically pure dextrose may be obtained by adding finely powdered cane-sugar, in small portions, to a mixture of 15 parts of alcohol (80 per cent) and 1 part of fuming hydrochloric acid, until the cane sugar is no longer dissolved. *Invert-sugar* is formed, and from the solution obtained, dextrose ($C_6H_{12}O_6+H_2O$) crystallizes, while lævulose remains in solution. On a commercial scale, grape-sugar is obtained from starch by boiling it under pressure with diluted sulphuric acid until the conversion of the starch into dextrin and finally into sugar (dextrose and some maltose) is complete. The acid solution is neutralized with calcium carbonate, the solution decolorized with animal charcoal and concentrated in vacuo, either to form commercial "grape-sugar," or the syrup known as "glucose." Commercial grape-sugar contains from 72 to about 73.5 per cent dextrose, from 0 to 3.5 per cent maltose, and from about 4 to 9 per cent dextrin; "glucose syrup" contains from 34 to 42 per cent dextrose, from 0 to 19 per cent maltose, and from 30 to 45 per cent dextrin. *Maltose* ($C_{12}H_{22}O_{11}$) is the sugar formed when *diastase*, the ferment of malt extract, is allowed to act upon solution of starch. Grape-sugar (dextrose) is soluble in water and diluted alcohol, insoluble in ether and chloroform, and crystallizes without combined water, in the form of warty masses, from hot absolute, and from methyl alcohol, also from aqueous solution at 30° to 35° C. (86° to 95° F.; otherwise it crystallizes with 1 molecule of water. In solution, it is optically dextro-rotatory (see *Cane-sugar*). Pure dextrose is less sweet than sucrose (cane-sugar), 1½ parts of the former being equivalent to 1 part of the latter. Unlike cane-sugar, dextrose is not charred by concentrated sulphuric acid, and is permanent toward acids, while sensitive toward warm alkalies; the latter darken and decompose it, with formation of lactic, formic, acetic, glucic, and saccharic acids (*Moore's Test*). Solutions of grape-sugar (dextrose) easily ferment when yeast is added, chiefly alcohol and carbonic acid being formed, according to the equation: $C_6H_{12}O_6 = 2CO_2+2C_2H_5OH$. Upon this reaction Dr. Wm. C. Alpers (Merck's *Report*, 1898, p. 468) bases a gravimetric method for determining the quantity of grape-sugar present in diabetic urine, by allowing it to ferment by means of yeast, and collecting the carbonic acid formed, in a weighed quantity of caustic potash. One Gm. of carbonic acid is equivalent to 2.0458 Gm. of dextrose.

Grape-sugar forms a crystallizable compound with sodium chloride ($2C_6H_{12}O_6.2NaCl+H_2O$) which has been incidentally obtained in the isolation of dextrose from diabetic urine. Grape-sugar (dextrose) in alkaline solution is a strongly reducing agent. It reduces Fehling's solution, ammoniated silver solution and alkaline mercuric cyanide (Knapp's) solution, etc. In these and other reactions it behaves as an aldehyde, and is believed to have the graphic formula $CH_2OH.(CHOH)_4.CHO$, while lævulose is considered to be a ketone, $CH_2OH.(CHOH)_3.CO.CH_2OH$. Both sugars are reduced to the alcohol *mannit* with nascent hydrogen in alkaline solution. An important test for dextrose is that with *phenylhydrazine* ($C_6H_5NH.NH_2$). With 2 molecules of the latter it forms *dextrosazone* which crystallizes in yellow needles, is almost insoluble in water, crystallizable from warm alcohol, and can be identified by its melting point which lies at 204° C. (399.2° F.). It is prepared by prolonged heating of 1 part of dextrose, 2 parts of the hydrochlorate of phenylhydrazine, and 3 parts of sodium acetate on the water-bath, and recrystallizing the precipitate formed. (For an exceedingly interesting summary of the more recent chemistry of the sugar group, see *Amer. Jour. Pharm.*, 1893, p. 32, from *Pharm. Jour. Trans.*, 1892.)

DETECTION OF SUGAR IN URINE.—A rapid, qualitative test for sugar, if much is present, consists in adding to the warmed suspected liquid a warmed saturated solution of potassium bichromate mixed with sulphuric acid in slight excess. A brisk effervescence ensues if sugar is present, the chromate being reduced to green chromium salt. The presence of albumen, urea, or uric acid does not interfere with this test. The most certain test for sugar is undoubtedly that by means of the optical method, but can be practically employed only in rare cases, since a polarizing apparatus is not always available (see remarks under *Saccharum*).

Fermentation of the slightly acid specimen with pure yeast at a temperature of about 30° C. (86° F.), and collecting the gas over mercury (or water), in qualitative analysis is a good test for sugar in urine. A parallel experiment with yeast and a sugar-free urine should always be made. Also compare the gravimetric method, mentioned above. A good qualitative test consists in the formation of the crystals of *dextrosazone* which must show the melting point 204° C. (399.2° F.) (see above). The best-known test which still gives much satisfaction, is that with Fehling's solution. For the preparation of the latter, see *U. S. P. Volumetric Solutions*. When testing for sugar, mix in a test-tube equal volumes of the copper and the tartrated alkali solution, and heat to boiling; no reduction must take place. Then add to the deep-blue liquid a few drops or more, of the suspected urine. Mix, and boil again. If a small quantity of sugar is present, the liquid becomes fluorescent, and upon standing deposits a *copper-red* precipitate; if much sugar is present, the liquid upon warming rapidly turns bright yellow, then cinnabar red, and precipitates at once a *copper-red* precipitate of cuprous oxide (Cu_2O). If uric acid or urates occur in the urine, these must be removed by the addition of a few drops of hydrochloric acid, setting aside for 12 hours and filtering. For the quantitative determination of sugar by means of this and other tests, see for example, Hammarsten and Maudel, *A Text-book of Physiological Chemistry*, 2d ed., New York, 1898.)

LÆVULOSE, UNCRYSTALLIZABLE OR FRUIT-SUGAR ($C_6H_{12}O_6$ = 179.58), called by Soubeiran *Chylariose*, is found in sweet fruits and honey, along with grape-sugar; it is likewise obtained with dextrose grape-sugar by subjecting cane-sugar to the action of acids. From invert-sugar it may be isolated by means of its calcium saccharate which is less soluble in cold water than that of dextrose. It is not usually crystallized, but it has been obtained in long silky needles, has a very sweet taste, is dissolved in water or alcohol, and wholly parts with its water when heated upon the water-bath. Its solution in water rotates the plane of polarized light to the left. Like grape-sugar, it is capable of direct vinous fermentation (see *Honey*).

INOSIT, OR PHASEO-MANNIT, is a peculiar sugar found in muscle and other organs of the body. The fruits of several leguminous, and other plants, when green, also yield this sugar. It is not fermentable, is very sweet, soluble in water (1 in 6), not soluble in absolute alcohol or ether, crystallizing easily from the first two. With diluted nitric acid, oxalic acid is formed; with concentrated nitric acid explosive nitrates result.

SACCHARUM LACTIS (U. S. P.)—SUGAR OF MILK.

FORMULA: $C_{12}H_{22}O_{11}+H_2O$. MOLECULAR WEIGHT: 359.16.

SYNONYMS: *Milk-sugar, Lactin, Lactose.*

"A peculiar, crystalline sugar, obtained from the whey of cow's milk by evaporation, and purified by recrystallization"—(*U. S. P.*).

Preparation and Description.—Remove from milk its fat and casein by precipitation with rennet. The residual thin fluid is called "whey;" this, evaporated to the consistence of molasses, clarified by white of eggs, strained and evaporated, forms sugar of milk crystals on cooling. To purify them, redissolve in boiling water, decolorize by animal charcoal, and recrystallize, repeating the process as often as may be necessary. Or, the whey is decolorized by running it through animal charcoal and concentrated in vacuum pans. Neutralization of the free acid is stated to increase the yield of milk-sugar. It is met with in commerce in powder form, or in crystallized cylindrical pieces of various lengths, and from 2 to 4 inches in diameter. Until about 1890, most of the milk-sugar in the American market came from Switzerland; since then, sugar of milk is being manufactured in America on a large scale and is competing even in the European markets (see *Amer. Jour. Pharm.*, 1897, p. 161, 1892, p. 386, and 1893, p. 158). As described by the *U. S. P.*, it is "in white, hard, crystalline masses, yielding a white powder feeling gritty on the tongue, odorless, and having a faintly sweet taste. Permanent in the air. Soluble in about 6 parts of water at 15° C. (59° F.), and in 1 part of boiling water; insoluble in alcohol, ether, or chloroform. The aqueous solution of sugar of milk is neutral to litmus paper"—(*U. S. P.*). Milk-sugar loses its water of crystallization, without melting, when heated to 130° C. (266° F.), leaving a white hygroscopic mass. A higher heat causes it to become yellow. At 170° C. (338° F.) or above it is converted into *lacto-caramel* ($C_6H_{10}O_5$).

Milk-sugar, by boiling with diluted acids, is converted into *galactose* ($C_6H_{12}O_6$) and *dextrose* ($C_6H_{12}O_6$), hence, like cane-sugar, belongs to the compound group called *saccharobioses*. Milk-sugar as such is probably not capable of undergoing vinous fermentation; it ferments, however, after conversion by acids, *e. g.*, lactic acid which is formed in the presence of lactic ferments. Alcohol and mannit are additional products of milk-sugar fermentation. Sugar of milk reduces Fehling's solution more slowly than grape-sugar. "On adding to a few Cc. of a hot, saturated aqueous solution of sugar of milk an equal volume of sodium hydrate T.S., and gently warming, the liquid will turn yellow and brownish-red. On the further addition of a few drops of copper sulphate T.S., a brick-red precipitate will appear"—(*U. S. P.*).

To test milk-sugar for cane-sugar, the *U. S. P.* directs the following test: "If about 1 Gm. of powdered sugar of milk be sprinkled upon about 5 Cc. of cold sulphuric acid contained in a flat-bottomed capsule, the acid may acquire a greenish or reddish but no brown or brownish-black color within half an hour (absence of *cane-sugar*)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—The principal medicinal use of sugar of milk is in the trituration of drugs; to aid in rendering them finer and more energetic, as well as to assist in more easily dividing active agents which are to be given in minute doses; thus, if we wish to divide 1 grain of strychnine into 20 doses, it may be thoroughly triturated with 19 grains of sugar of milk, and 1 grain of the mixture gives the required dose. Or, 1 grain of resin of podophyllum, which, in general, is a cathartic dose, by long trituration with 10 grains of sugar of milk, will form several purgative doses. In these cases, the trituration should always continue for from 1 hour to 1½ hours. As a medicinal agent, sugar of milk is thought to be practically inert, yet Germain Sée and others declare it a powerful hydragogue diuretic, and have employed it in doses of 1 to 6 ounces well diluted with water, or milk, and in a concentrated syrup in *dropsies of cardiac origin.* Though being a non-nitrogenous substance, it has been employed as an article of diet in *pulmonary and other affections* where such diet is desirable; also, as a nutrient in *excessive gastric irritability.* On account of its lesser liability to fermentation in the stomach it is preferable to cane-sugar for sweetening infant foods.

SAGO.—SAGO.

The prepared farina from the pith of the *Metroxylon Rumphii*, Martius (*Sagus Rumphii*, Willdenow; *Sagus genuina*, Blume), and other species of palm.

Nat. Ord.—Palmæ.

Botanical Source.—*Metroxylon Rumphii*, or *Sago palm*, has an erect stem, of middling height, with large, pinnately-divided leaves, and prickly petioles, rachides, and spathes; the prickles scattered or confluent. The flowers are polygamomonœcious, on the same spadix. The spadix is much branched, and sheathed by many incomplete spathes. The amenta are terete; the calyx 3-cleft; the corolla tri-partite. Stamens 6, with anthers affixed by the back. The fruit is a 1-seeded, globose berry, coated by reversed scales, and depressed on both sides.

History and Preparation.—This tree is common to New Guinea and the Molucca Islands, growing spontaneously in low, swampy lands, and the sago is obtained from its pith, or spongy medullary substance, of which it contains a large quantity when the tree is sufficiently developed. Several species of palm are known to produce fine sago, among which may be named *Metroxylon Sagu*, Rottboell (*Sagus lævus*, Blume; *Metrorylon Sago*, Koenig; *Metroxylon læve*, Martius; *Sagus inermis*), which is the *Spineless* or *Unarmed sago palm*, a native of Borneo and Sumatra; the *Arenga saccharifera*, Labillardière (*Saguerus Rumphii*, Roxburgh), the sugar palm, abounding in all the isles of the Indian Ocean; and the *Sagus farinifera*, Lamarck, and other palms.

As soon as the palm has arrived at a sufficient degree of maturity, which is from 5 to 7 years, it is cut into pieces of 5 or 6 feet in length; the woody part is cut off on one side, exposing the pith lying, as it were, in the hollow of a canoe. Cold water is poured in, and the pith well stirred, by which means the starch is separated from the fibrous part and passes through with the water, when the whole is thrown on a sieve. The sago, thus separated, is allowed to settle; the water is poured off, and, when it is half dry, it is granulated by being forced through a kind of funnel. It is then either air-dried (*sago flour*), or it is granulated by mechanical means, and dried by artificial heat, which causes part of the starch to become gelatinous (*pearl sago*). A single tree of some species, will yield no less than from 200 to 500 pounds. (For an interesting description of the cultivation of sago in north Borneo, see *Amer. Jour. Pharm.*, 1895, p. 331.)

Description and Chemical Composition.—Sago occurs in commerce either in the form of a fine amylaceous powder, called *sago meal* or *sago flour*, or as *pearl sago.* Sago meal is whitish, with a reddish tint, of a feeble, somewhat unpleasant, moldy odor, and has the general characters of starch. The microscope shows it to consist of irregularly elliptical or oval, more or less ovate, usually isolated particles, often narrowed or tapered at one extremity, and appearing as if truncated, or more or less mullar-shaped; most of them have an irregular surface as if eroded (see illustration of sago-starch grains, in *Amer. Jour. Pharm.*, 1876, p. 297). *Pearl sago* occurs in white or brownish, pearl-like grains, which vary in size from that of a poppy seed to that of a white mustard seed, or even larger. It is the kind usually met with in commerce, and contains about 86 per cent of starch, 13 per cent of water, and small amounts of mineral and nitrogenous matters. A factitious sago is frequently prepared from potato starch.

Action, Medical Uses, and Dosage.—Sago is nutritive and demulcent, and is a convenient and agreeable article for making puddings, gruel, and diet drinks for the sick-room. It should always be long boiled before it is used. It is not so much used as formerly, being superseded by the purer arrow-root and tapioca. For common uses, half an ounce of sago may be boiled in a pint of water (in some cases milk is preferred), the solution strained, and flavored with sugar and spices, lemon, or even with a little white wine, when there are no contraindications to their use.

Castillon's Powders, a popular article of diet for invalids, in cases of *indigestion, chronic dysentery*, etc., is composed of sago, salep, tragacanth, each, in powder, 4 drachms; powdered prepared oyster shells, 1 drachm. These are to be well mixed, and divided into 12 powders; sometimes it is colored with a small quantity of cochineal. For use, each powder is to be boiled with a pint of milk, which may be sweetened and flavored to suit the patient's taste.

SALEP.—SALEP.

The dried tubers of several species of *Orchis* and related genera.

Nat. Ord.—Orchidaceæ.

Botanical Source and History.—Formerly, the tubers derived from *Eulophia campestris* and *E. herbacea*, Lindley, and related species, growing in Persia and the Levant, constituted the drug salep. South and central Europe now furnish salep, and the only kinds admitted in the *German Pharmacopœia* are those unbranched tubers derived from *Orchis mascula*, Linné; *Orchis ustulata*, Linné; *Orchis Morio*, Linné; *Platanthera bifolia*, Reichenbach; *Anacamptis pyramidalis*, Richard; and other related species. The tubers are gathered, scalded, and dried quickly, which process removes their bitterness and disagreeable odor, as well as renders them somewhat translucent. The Oriental salep is less translucent than that from Europe. Oriental salep is dark in color. Among other species, the *Orchis maculata*, Linné; *Orchis latifolia*, Linné; *Orchis sambucina*, Linné; and *Gymnadenia conopsea*, Robert Brown, furnish the flattish, palmately-divided tubers, having 3 to 5 divisions. They resemble the commercial grades, excepting that they contain less mucilage. They were once called *Radix Palmæ Christi*.

Description and Chemical Composition.—European salep is never so large as Oriental salep, which ranges from 1 to 1⅝ inches in length, ovoid, oval, oblong, or pyriform, more or less flattened and corrugated, and marked at the apex with a terminal bud-scar. It is yellowish and translucent, hard, and horn-like, and without odor, but has a mucilaginous and somewhat insipid taste. In commerce it occurs mostly as a yellowish powder. The chief constituents of salep, according to Dragendorff (1865), are *mucilage* (48 per cent), starch (27 per cent), albuminous bodies (5 per cent), etc. The mucilage of salep is soluble in cold water, this solution being precipitated by alcohol, and by basic lead acetate.

Action, Medical Uses, and Dosage.—Salep is nutrient and demulcent. Administered in milk, water, broth, or jelly, it is useful in the *summer diarrhœas* of infants and children, and in the *chronic diarrhœa* of adults, particularly that form associated with *tuberculosis*. A good mucilage may be prepared by macerating 40 grains of salep in some cold water, and subsequently adding boiling water until 8 fluid ounces of water have been used. The jelly may be prepared by rubbing 30 grains of salep with water until the powder has swollen fourfold, and gradually adding, with continual stirring, 8 fluid ounces of boiling water; boil until but 4 ounces remain. Like tapioca and similar products, it may be freely administered.

Related Species.—*Asphodelus bulbosus*. The corm of this plant, under the term "*Tsiniss*," is used in eastern countries as a mucilage, and to adulterate powdered salep.

SALICINUM (U. S. P.)—SALICIN.

Formula: $C_{13}H_{18}O_7$. Molecular Weight: 285.33.

"A neutral principle obtained from several species of *Salix* and *Populus* (*Nat. Ord.*—Salicaceæ)"—(*U. S. P.*).

Source, History, and Preparation.—Salicin was discovered, in 1830, by Leroux, and its glucosidal nature recognized by Piria. It occurs in the bark of most of the willows and poplars (see *Salix* and *Populus*), and in smaller quantity in the leaves, young twigs, and pistillate flowers of the willows, and in the leaves of the poplar. The barks of *Salix Helix*, Linné; *S. pentandra*, Linné; and *S. præcox*, Hoppe, are richest in salicin, containing from 3 to 4 per cent of this glucosid (Herberger).

Salicin may be prepared by concentrating an aqueous decoction of willow bark, adding litharge to the hot liquid until it is nearly colorless; this precipitates tannin, gum, and extractive. From the filtrate remove the lead by sulphuric acid and barium sulphide (BaS), filter again, and evaporate to crystallization. By this process, Merck obtained from Salix Helix a yield of 3.2 per cent. (For additional methods, see this *Dispensatory*, preceding edition.)

Description.—Salicin is described by the *U. S. P.* as occurring in "colorless, or white, silky, shining, crystalline needles, or a crystalline powder, odorless, and having a very bitter taste. Permanent in the air. Soluble, at 15° C. (59° F.), in 28 parts of water, and in 30 parts of alcohol; in 0.7 part of boiling water, and in 2 parts of boiling alcohol; almost insoluble in ether or chloroform. When heated to 198° C. (388.4° F.), salicin melts, yielding a colorless liquid, which, on cooling, congeals to a crystalline mass. Upon ignition, it is consumed, leaving no residue. Salicin is neutral to litmus paper"—(*U. S. P.*). Salicin is optically lævo-rotatory.

When salicin ($C_{13}H_{18}O_7$) is carefully warmed with diluted sulphuric or hydrochloric acid, or treated with the ferment emulsin (see *Amygdala*), it splits into *dextrose* ($C_6H_{12}O_6$) and crystallizable *saligenin* ($C_7H_8O_2$ or $C_6H_4OH.CH_2OH$), the alcohol of salicylic acid ($C_6H_4OH.COOH$). With ferric chloride, the aqueous solution of saligenin produces an indigo-blue color. Upon warming saligenin with diluted acids, it loses water, and is converted into resinous *saliretin* ($C_{14}H_{14}O_3$). When *salicin* is carefully oxidized with concentrated nitric acid (in the cold), a new glucosid, *helicin* ($C_7H_8O_2$), is formed, which, upon hydrolysis, yields dextrose and *salicylic aldehyde* ($C_6H_4OH.CHO$) (compare *U. S. P. Tests*, below). The glucosid *populin* (see *Populus*) is benzoyl-salicin.

Tests.—"On heating a small portion of salicin, in a test-tube, until it turns brown, then adding a few Cc. of water, and afterward a drop of ferric chloride T.S., a violet color will be produced. Cold, concentrated sulphuric acid dissolves salicin with a red color; the solution, after the addition of water, becomes colorless, and deposits a dark-red powder, insoluble in water or alcohol"—(*U. S. P.*). This substance has received the name *rutilin*, by Braconnot. "On heating a small portion of salicin with 1 Cc. of potassium dichromate T.S., and 2 Cc. of sulphuric acid, the odor of salicylic aldehyde (or of oil of meadow sweet, *Spiræa Ulmaria*, Linné (*Nat. Ord.*—Rosaceæ), will become noticeable. The aqueous solution of salicin is not precipitated by tannic or picric acid, nor by mercuric potassium iodide T.S. (absence of, and difference from, *alkaloids*)"—(*U. S. P.*). (For further details regarding salicin, see Husemann and Hilger, *Pflanzenstoffe*, p. 475.)

Action, Medical Uses, and Dosage.—Salicin is not regarded as poisonous to man. However, large doses have produced unpleasant symptoms, among which may be mentioned a dusky countenance, severe headache, nervous irritability, extreme weakness, tinnitus aurium, hurried breathing, tingling of the extremities, and huskiness of the voice. As a rule, the temperature in a healthy individual is uninfluenced by it. In its passage through the system, salicin undergoes oxidation, and is converted into salicylous, salicylic, and salicyluric acids, which are found in the urine. Their presence is detected by a ferric salt, which strikes an intense violet color with urine containing it. Salicin is tonic, antiperiodic, and febrifuge, and may be used as a substitute for quinine, to which, however, it is slightly inferior. It is, however, less likely to irritate the stomach and excite the nervous system, for which properties it may be administered in cases where cinchonism would be produced by the exhibition of quinine. The *intermittents* cured by salicin are those showing distinct periodicity, together with rheumatic pain. Give from 10 to 30 grains in divided doses. It has been successfully employed in *periodical neuralgia*, *lumbago*, *diarrhœa of phthisis*, and som forms of *rheumatic fever*. It is often employed to adulterate quinine, and may detected by sulphuric acid, which will turn the salicin red, even in minute quantity. Salicin is frequently effectual in controlling various forms of pelvic pain. The dose of salicin is from 2 to 10 grains, to be repeated 3 or 4 times a day; 3 doses of 6 grains each, have been known to cut short intermittent fevers in 1 day. Salicylous acid (salicylic aldehyde) and salicylite of potassium, in 4-grain doses, have been found useful sedatives in acute maladies, acting without causing any primary excitement.

Specific Indications and Uses.—Periodicity, with severe pain, rheumatic in character, or simulating rheumatism; anti-rheumatic, associated with the special sedatives to control the fever.

SALIX.—WILLOW.

The bark of *Salix alba*, Linné.

Nat. Ord.—Salicaceæ.

COMMON NAMES: *Willow, White willow, European willow.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 234.

Botanical Source.—The white willow is a tree 30 to 80 feet in height, with many round, widely spreading branches, silky when young, and a thick, brown bark, full of cracks; that of the smaller branches smooth and greenish. The leaves are alternate, on short petioles, lanceolate, or elliptic-lanceolate, broadest a little above the middle, pointed, tapering toward each end, acutely serrate, with the lower serratures glandular; both sides of a grayish, somewhat glaucous, green, beautifully silky, with close-pressed, silvery hairs, especially on the under surface, and which is very dense and brilliant on the uppermost, or youngest leaves; the lowermost on each branch, like the bracteas, are smaller, more obtuse, and greener. Stipules variable, either roundish or oblong, small, and often wanting. The flowers and leaves appear coincidently. The aments are borne on short stalks, with 3 or 4 spreading, leafy bracteas, and are terminal, cylindrical, and elongated. Scales brown, elliptical, lanceolate, pubescent at the margin; those of the barren aments narrower toward the base; of the fertile, dilated and convolute in that part. Stamens 2, yellow, rather longer than the scales, with 1 obtuse gland before and 1 behind; filaments hairy in their lower part. Anthers roundish and yellow. The ovary is very nearly sessile, green, smooth, ovate-lanceolate, bluntish, and longer than the scale. Style short; stigmas short, thick, 2-parted, recurved, and nearly sessile. Capsule ovate, brown, smooth, and rather small (L.—W.—G.).

History and Description.—The white or European willow is a large tree of rapid growth, native of Europe, and introduced into this country. Its flowers appear from March to June. The bark, which is the medicinal part, is readily removed from the stem during the months of July, August, and September. The dried bark is met with more or less quilled, pliable and tough, with a faint odor, and a bitter taste, combined with some astringency. Water takes up its medicinal properties, the decoction having a dark-reddish color, and which is precipitated abundantly by gelatin, carbonates of potassium, and ammonium. Limewater gives at first a blue, and then a buff-colored precipitate. Ferric chloride throws down a dark-green tannate of iron. If the decoction contains much salicin, concentrated sulphuric acid reddens it. This species belongs to the group of willows known as the *crack willows*. A species much resembling it is the *Salix fragilis*, Linné. There are numerous species of Salix, many of which, undoubtedly, possess analogous medicinal virtues. The best rule to follow is to select those whose barks possess great bitterness, combined with astringency. Among those which have been used are the *S. alba*, *S. caprea*, *S. russelliana*, *S. purpurea*, *S. nigra*, and *S. pentandra*. The Weeping willow, or Babylonian willow (*Salix babylonica*) is cultivated as an ornamental tree.

Chemical Composition.—White-willow bark, according to Pelletier and Caventou, consists of bitter, yellow coloring matter, green fatty matter, tannic acid, resin, etc. The chief constituent, however, as with all the willows, is the glucosid *salicin* (see *Salicinum*). Tannin is also prominent, and is more abundant in the crack willows, while salicin seems to predominate in the purple willows. Johanson (1875) showed the presence of *benzohelicin* ($C_{20}H_{20}O_8$), a glucosid previously obtained (Piria, 1851) by acting upon populin with nitric acid (compare *Salicinum*).

Robert W. Beck (*Amer. Jour. Pharm.*, 1891, p. 581) obtained from the bark of *Salix lucida*, 1.09 per cent of salicin; from the leaves, 0.3 per cent. The bark of *S. alba* yielded 0.56 per cent, that of *S. nigra*, 0.73 per cent of salicin. The leaves of *S. alba* contained 6.48 per cent of tannin, while the quantity of tannin in the barks of *S. alba* and *S. nigra* varied from 3.3 to 4.3 per cent.

Action, Medical Uses, and Dosage.—Willow bark is tonic, antiperiodic, and an astringent bitter. It has been given in *intermittents*, *dyspepsia*, connected with debility of the digestive organs, *passive hemorrhages*, *chronic mucous discharges*, in *convalescence from acute diseases*, and in *worms*. Although occasionally substituted for the cinchona bark, it is inferior in activity. In *chronic diarrhœa* and *dysentery*, the tonic and astringent combination of the willow renders it very eligible. It may be given in substance, in doses of 1 drachm of the powder, repeated as indicated; or of the decoction, 1 or 2 fluid ounces, 4 or 5 times a day. The decoction has also proved efficient as a local application to *foul* and *indolent ulcers*.

SALIX NIGRA.—BLACK WILLOW.

The bark and aments of *Salix nigra*, Linné.

Nat. Ord.—Salicaceæ.

Common Names: *Black willow*, *Pussy willow*.

Botanical Source.—*Salix nigra*, Black or Pussy willow, is a tree growing from 15 to 25 feet high, covered with a rough, blackish bark, and found on the banks of rivers, especially in New York and Pennsylvania. The leaves are narrowly lanceolate, pointed and tapering at each end, serrulate, smooth and green on both sides; the petioles and midveins, tomentose. The stipules are small, deciduous, and dentate; the aments erect, cylindric, and villous; the scales oblong, and very villous. Sterile aments 3 inches long; glands of the sterile flowers 2, large, and deeply 2 or 3-cleft. Stamens 4 to 6, often but 3 in the upper scales; filaments bearded at base. The ovary is pedicellate, smooth, and ovoid; the style very short; the stigmas bifid. The branches are pale-yellow, and brittle at base, and are much used for the manufacture of baskets and other kinds of wickerwork (G.—W.).

History.—The medicinal part of the black willow, according to the older authors, and particularly Michaux, is the bark of the root. The bark of the tree has also been employed (compare *Salix Alba*). But the value of salix nigra bark as a remedy has been shown by Eclectic physicians to be of little value as compared with preparations of the *fresh aments*. It is these preparations that have given salix nigra its place as a remedy for sexual disorders. The greatest of care is necessary in the production of the fluid preparations of the aments, absolutely fresh aments, gathered about the first of May, being requisite to produce a preparation of any medicinal value. Dried aments produce inferior, if not worthless, products, and especial care should be exercised by the physician that he procure the preparations of the *fresh aments* and not of the *bark* when a sexual sedative and tonic is demanded.

Action, Medical Uses, and Dosage.—The bark of black willow is recommended as a poultice in *gangrene*, and as an external application to *foul* and *indolent ulcers* and *rhus poisoning*, in which it stands unrivaled. It is made by simmering the powdered bark in cream. It has also been successfully used in *various swellings of the neck*. Internally, the root is a bitter tonic, effectual in *intermittents*. Some have highly recommended it in *asthma* and *gout*. At the present day the bark is seldom employed and the aments now furnish the preferred drug. A decoction of the black willow buds or aments, taken internally and applied locally, is useful in *gangrene;* and drank freely it proves a powerful anaphrodisiac, suppressing venereal desires for a long time, and is highly recommended in the treatment of *spermatorrhœa*. The last statement, written years ago by Prof. King, has been abundantly verified in the last few years by practitioners of all schools of medicine. The drug is not only anaphrodisiac, but by controlling genital irritability it becomes a marked sexual sedative and tonic. As Prof. Bloyer has aptly remarked, it is not a remedy for physiological losses nor is a beneficial action to be expected in cases requiring operative measures at the hands of the orificial surgeon. Its field of action is in those functional wrongs of the reproductive organs due most largely to undue irritability of the parts, and thought to be less due to mental or emotional causes. However, sexual passion from any functional cause is moderated by it, and it is especially adapted to the disorders of the sexually intemperate male or female, and of the youth, subject day or night to libidinous suggestions and lascivious dreams terminating in pollutions, while for those extreme forms of sexual perversion, *satyriasis*, *erotomania*, and *nymphomania*, it is more nearly specific than any other agent. Not only does salix nigra act as a check to sexual passion and misuse, but it proves a useful tonic and sedative to many conditions following in the wake of sexual intemperance, among which may be mentioned *spermatorrhœa* in its varied forms, *prostatitis*, *cystitis*, and *ovaritis*. Specific Salix nigra is the preparation most largely used by Eclectic practitioners, and is to be preferred, for the fresh aments can not be procured at all times for the preparation of the decoction. The dose is from 10 to 60 drops, 3 or 4 times a day.

Specific Indications and Uses.—To moderate sexual erethism, irritability, and passion; lascivious dreams; libidinous thoughts; nocturnal emissions; nymphomania and satyriasis; cystitis, urethral irritation, prostatitis, cystitis, ovaritis, and other sexual disorders arising from sexual abuse or excesses.

SALOL (U. S. P.)—SALOL.

FORMULA: $C_6H_5C_7H_5O_3$. MOLECULAR WEIGHT: 213.49.

"The salicylic ether of phenol"—(*U. S. P.*).

SYNONYM: *Phenyl salicylate.*

History and Preparation.—Phenyl salicylate, or salol, was brought into use as a medicine by Dr. Sahli (1886), of Basel, though previously prepared by Prof. Nencki (1883), of Berne. Salicylic acid and phenol are heated together in the presence of phosphorus oxychloride ($POCl_3$); the elements of water are abstracted, and phenyl salicylate is produced as follows: $C_6H_4OH.COOH+C_6H_5OH=H_2O+C_6H_4OH.COOC_6H_5$. A more recent, patented process consists in heating salicylic acid in an atmosphere of carbonic acid gas; carbonic acid and water are given off, and phenyl salicylate (salol) is formed. Salol contains about 60 per cent of salicylic acid and 40 per cent of phenol.

Description and Tests.—Salol is "a white, crystalline powder, odorless, or having a faintly aromatic odor, and almost tasteless. Permanent in the air. Almost insoluble in water; soluble in 10 parts of alcohol at 15° C. (59° F.), very soluble in boiling alcohol; also soluble in 0.3 part of ether, and readily in chloroform, and in fixed or volatile oils. When heated to 42° to 43° C. (107.6° to 109.4° F.), salol melts. When heated on platinum, it takes fire, and is consumed, leaving no residue. Salol is neutral to litmus paper moistened with alcohol. On warming a small portion of salol with enough sodium hydrate T.S. to dissolve it, and then supersaturating the liquid with hydrochloric acid, salicylic acid will separate, and the odor of phenol will become perceptible. In an alcoholic solution of salol, bromine water, added in excess, produces a white precipitate. On adding a few drops of diluted ferric chloride T.S., made by diluting the test-solution with 20 volumes of water to 10 Cc. of an alcoholic solution (1 in 50) of salol, the liquid will acquire a violet tint. If, however, a few drops of the alcoholic solution of salol be added to 10 Cc. of the diluted ferric chloride T.S., a whitish cloudiness, but no color, will be produced on shaking. On shaking 1 Gm. of salol with 50 Cc. of water, the filtrate should not be affected by ferric chloride T.S. previously diluted with 2 volumes of water (absence of uncombined carbolic or salicylic acid); nor by barium chloride T.S. (absence of sulphate or phosphate); nor by silver nitrate T.S. (absence of chloride)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Salol, in proper doses, is an important medicine, but if the dose be large, toxic symptoms may be expected from it. Through the agency of the pancreatic juice, it is split up in the small intestines into carbolic and salicylic acids, and its toxic action may partake of the symptoms common to both of these agents. Undoubtedly, the chief agent in poisoning by it is the phenol. Circumstances seem to control the action of the drug;

if the pancreatic fluid be abundant, or the dose be large, the toxic symptoms are quicker to manifest themselves. Carboluria (black or smoky urine) is a prominent symptom of poisoning by salol. As a rule, the drug is rather slowly absorbed and slowly eliminated (kidneys), on which account doses of it should not be too rapidly repeated, lest a cumulative effect be produced. Other symptoms which have been observed from its administration are urticaria, herpes, vomiting, persistent anorexia, sweating, and the intoxicating effects of salicylic acid. The kidneys are extremely susceptible to the drug, which should never be administered where there are known acute or chronic structural diseases of those organs. Death, with the symptoms of phenol poisoning, is reported, by Hesselbach, to have been caused by 120 grains of salol. Albuminuria has resulted from large doses of the drug. In view of its evident power over the kidneys, the drug should be very cautiously employed. The toxic renal symptoms are less likely to be produced if diarrhœa be present.

Externally, salol has been applied as an antiseptic in substance (triturated with starch), and in an aqueous dilution of its alcoholic solution. For this purpose it has been used in *wounds*, *erysipelas*, *burns*, *diphtheria*, *otorrhœa*, *ozœna*, *venereal diseases*, *gangrenous* and other *ulcers*, and in *sycosis*, *impetigo contagiosa*, and other skin affections. It is chiefly used internally, as an antirheumatic and intestinal antiseptic. As an antipyretic, it has not met with favor in our school. It may serve a useful purpose in all forms of *rheumatism*, but particularly in chronic cases and the articular varieties, when the kidneys are functionally inactive and no organic renal trouble exists. The same is true in *lumbago* and *sciatic neuralgia*. Salol is useful in *fermentative and putrefactive disorders of the gastro-intestinal tract*, particularly in *fetid diarrhœa*, *fermentative*, *gastric* and *intestinal dyspepsia*, and *dilatation of the stomach*. It may be useful in *typhoid fever* for its effects as an intestinal antiseptic, but is of no value here for its antipyretic action. Signal success has attended the use of salol in urinary disorders requiring an agent to prevent decomposition of the urine. For this purpose it has given excellent results in *cystitis*, with turbid, ammoniacal urine. As the urine becomes clear and acid in reaction, the dysuria is relieved and the catarrhal symptoms vanish. It is of some value in *pyelitis*, but care should be taken that the kidneys are in a condition to act, though there is manifest renal torpor. Salol, in divided doses, may be given to the extent of 20 or 30 grains a day. From 5 to 15 grains may be given at a single dose, though it is far preferable to give from 2 to 5 grains, every 3 hours. It may be administered in milk, emulsion, trituration with milk-sugar, or in capsules. When given in trituration, it imparts to the teeth a sensation as if biting upon rubber. As a dressing for irritated and inflamed parts, it is best triturated with an equal bulk of starch.

Specific Indications and Uses.—Turbid, ammoniacal urine, with renal torpor, when the kidneys are not structurally diseased; gastro-intestinal fermentative disorders; some cases of rheumatism, associated with renal inactivity.

Related Compounds.—SALOL CAMPHOR, *Camphol.* Gradually and completely melt a mixture of camphor (2 parts) and salol (3 parts). A colorless or light-colored fluid is obtained, which readily decomposes when exposed to air or light, therefore it is directed to preserve it, hermetically sealed, in yellow-glass tubes or vials. This fluid mixes with alcohol, ether, and oils, but is not soluble in water. It is a local anæsthetic.

DIIODOSALOL, *Phenyl diiodosalicylate* ($C_6H_2I_2[OH]CO_2C_6H_5$). This compound is produced by acting upon diiodosalicylic acid with phenol. It is a crystalline powder, devoid of odor or taste, and melts at 133° C. (271.4° F.).

CRESALOL, *Cresol salicylate* ($C_6H_4[OH]CO_2C_6H_4CH_3$).—This compound is prepared like salol, except that *meta-* or *para-cresol* ($C_6H_4[CH_3].OH$) is substituted for the phenol employed in the case of salol. Accordingly, either the meta- or para-compound is obtained. Alcohol and ether dissolve these bodies, which are crystalline, but they are not soluble in water. They are local and internal antiseptics, and are reputed useful in correcting and checking fetid discharges. They are less toxic than salol, and are sometimes substituted for it.

SALICYLAMIDE ($C_6H_4[OH]CONH_2$). This compound is formed by the action of dry ammonia gas upon oil of wintergreen (methyl salicylate). It is a colorless, or faintly yellowish powder, is soluble in alcohol, chloroform, ether, and less readily in water (250 parts). It is nearly tasteless, and produces a sensation of grittiness between the teeth. In from 2 to 5-grain doses this compound has been proposed as a substitute for salicylic acid, being favored on account of its tastelessness, greater solubility, and more powerful analgesic powers. Its superiority, however, has not yet been satisfactorily established. Large doses are poisonous.

Salophen, *Acetylpara-amidophenol-salicylate* ($C_6H_4[OH]CO_2.C_6H_4NH.COCH_3$).—A substance, introduced in 1891, and intended to replace salol, because the intestinal fluid does not convert it into a poisonous phenol as it does salol, but resolves it into salicylic acid and acetyl-para-amidophenol, which is comparatively harmless. It is a neutral compound, containing about 51 per cent of salicylic acid. It is odorless and tasteless, insoluble in cold, but partially soluble in boiling water, and is readily dissolved by alkaline solutions, ether, and warm alcohol. *Salophen* should not be confused with *saliphen* (*salicyl-phenetidin*, $C_6H_4[OC_2H_5]NHC_6H_4[OH]CO$), a compound of phenetidin ($C_6H_4[OC_2H_5]NH_2$) and salicylic acid. *Acute articular rheumatism, neuralgia, hemicrania*, and other *headaches* are reputed to yield promptly to this drug, and no ill effects are said to follow its use. It is also an intestinal antiseptic. Dose, 5 to 10 grains, every 2 hours.

Salacetol, *Acetonyl-salicylate* ($C_6H_4[OH]COOCH_2.CO.CH_3$), is intended to replace salol, for the same reason as that given under *Salophen*, above. It is prepared by heating monochloracetone with salicylate of sodium. Salacetol crystallizes from alcohol in needles, slightly soluble in cold water and cold alcohol, easily soluble in ether, chloroform, benzol, benzin, is somewhat bitter, and melts at 71° C. (159.8° F.).

SALVIA (U. S. P.)—SALVIA.

The leaves of *Salvia officinalis*, Linne.

Nat. Ord.—Labiateæ.

Common Names: *Sage, Garden sage.*

Illustration: Bentley and Trimen, *Med. Plants*, 206.

Botanical Source.—Salvia officinalis, or Garden sage, is a plant with a pubescent, 4-sided stem, with erect branches, hoary with down, leafy at the base, those bearing flowers 1 foot or 1½ feet long, and tomentose. The leaves are opposite, entire, petioled, ovate-lanceolate, crenulate, rugose, the lowermost being white with wool beneath. The flowers are blue, in whorls, and in long, terminal, nearly simple racemes; whorls few-flowered, and distinct; floral leaves or bracts sessile, ovate, acuminate, membranous, and striated at the base. The calyx is campanulate, membranous, colored, striated, downy, and bilabiate; the upper lip 3-toothed; the lower bifid; and all the teeth subulate and acuminate. The corolla is 2 or 3 times as long as the calyx, with a large projecting tube, ringed in the inside, and bilabiate; the upper lip is arched, the lower one tri-lobed, the lateral lobes being reflexed. The stamens are affixed to short pedicels transversely about their middle (L.—W.).

Fig. 214.

Salvia officinalis.

History, Description, and Chemical Composition.—Sage is a native of southern Europe, and has been naturalized in this country as a garden plant; the leaves and tops should be gathered and carefully dried during its flowering season, which is in June and July. As described by the *U. S. P.*, the leaves are "about 5 Cm. (2 inches) long, petiolate, ovate-oblong, obtuse or subacute at the apex, rounded or somewhat heart-shaped at the base, finely crenulate, thickish, wrinkled, grayish-green, soft-hairy, and glandular beneath; odor aromatic; taste aromatic, bitterish, and somewhat astringent"—(*U. S. P.*). The odor and aromatic taste of sage are due to its volatile oil. Sage imparts its virtues to boiling water in infusion, but more readily to alcohol. The infusion becomes black on the addition of sulphate of iron, which is due to the presence of tannin. Oil of sage is obtained by distilling the leaves with water; the yield from Dalmatian leaves ranges from 1.3 to 2.5 per cent. Oil of sage is "a yellowish or greenish-yellow liquid, having the penetrating, characteristic odor of sage. Specific gravity, 0.915 to 0.925; optically dextrogyrate. The oil contains small amounts of pinene and cineol, but its chief constituent (50 per cent) is *thujone* ($C_{10}H_{16}O$) (formerly termed *salviol*), which also occurs in the oils of thuja, tansy, and wormwood" (Prof. Power, *Descrip. Cat. of Essential Oils and Org. Chem. Preparations*, 1894; also see Gildemeister and Hoffmann, *Die Ætherischen Oele*, 1899).

Action, Medical Uses, and Dosage.—Sage is feebly tonic, astringent, expectorant, and diaphoretic, and has properties common to aromatics. An infusion is beneficial in *flatulence* connected with *gastric debility*, and will, when the skin is soft and relaxed, the extremities cold, and the circulation enfeebled, prove efficient in restraining *exhausting sweats*. Should the sweating be preceded by hectic fever, and dry harsh skin, it is less likely to prove beneficial. The infusion may be taken cold throughout the day; it may likewise be used warm, as an anthelmintic, and for the purpose of causing diaphoresis in some *febrile diseases.* The warm infusion will cause active diuresis by checking its diaphoretic tendency. Dr. James Anton, of Lebanon, Ohio, considered it an excellent remedy for *spermatorrhœa;* also a valuable anaphrodisiac to check excessive venereal desires. It may be used in connection with moral, hygienic, and other aids, if necessary. Van Swieten stated that a vinous infusion forms an excellent fomentation to the breasts, when it is desirable to check the flow of milk. The infusion, either alone or combined with vinegar, honey, alum, or sumach berries, is much used as a gargle for *inflammation and ulceration of the throat,* and *relaxed uvula.* The oil may be used in small doses as a carminative and stimulant; and externally, applied with friction in *rheumatism.* Dose of the infusion, from 2 to 4 fluid ounces, 3 or 4 times a day; of the powdered leaves, 20 to 30 grains. A strong tincture (℥viij to alcohol, 76 per cent, Oj) may be given in from 1 to 60 drop doses.

Specific Indications and Uses.—Skin soft and relaxed; extremities cold, and circulation enfeebled; colliquative sweating; urine of low specific gravity.

Related Species.—Numerous other species of Salvia have similar properties, as the *S. sclarea,* or *Clarry,* a native of southern Europe, which is said to be antispasmodic and balsamic. The foregoing and *S. pratensis,* Linné, have been official in Europe. *S. Horminum, S. bengalensis* of India, *S. pomifera* of Greece, etc., have also been used. The seeds of *S. verticillata* and *S. verbenacea* are mucilaginous.

Salvia lyrata, Linné, variously named *Wild* or *Meadow sage, Lyre-leaved sage,* or *Cancer-weed,* is a perennial plant, growing from Canada to Florida in shady woods and meadows, and flowering in May and June. It has an erect, quadrangular, nearly leafless stem, 1 or 2 feet high, branching and covered with hairs pointing downward. Radical leaves obovate, lyre-shaped or sinuate-pinnatifid, sometimes almost entire, and petiolate; cauline leaves mostly, but 1 or 2 pairs, just below the raceme, smaller and narrower than the radical. Flowers blue, in loose and distant whorls of about 6, forming a long, interrupted raceme; bracts oblong-linear, not longer than the calyx. Upper lip of the blue-purple pubescent corolla, short, straight, not vaulted; tube much exserted (W.—G.). The fresh radical leaves will, it is positively asserted, when bruised and applied to *warts,* generally destroy them; the application to be continued for a day or two, and renewed every 12 hours. It is also reputed to have cured *cancers,* hence one of its names.

Salvia lanceolata, Willdenow, or *Rocky Mountain sage,* is reputed diaphoretic and diuretic, and is employed domestically in the *eruptive, malarial,* and *rheumatic fevers.*

Chia Seeds.—The seeds of some Mexican species are known as *Chia seed.* The true chia seed is yielded by *Salvia polystachya,* Ortega (*Salvia Chian,* La Slave). These seeds are used in sweetened decoction by the Mexicans for *sore throat, fevers,* etc., and the cold decoction is applied to *inflamed eyes.* The fruit of *Salvia Columbariæ,* Bentham, is also known as *Chia seed* (Gray and Rothrock).

SAMBUCUS (U. S. P.)—SAMBUCUS.

"The flowers of *Sambucus canadensis,* Linne"—(*U. S. P.*). In Eclectic medicine, the fresh inner bark is preferred.

Nat. Ord.—Caprifoliaceæ.

Common Names: *Elder, American elder.*

Illustration: Bentley and Trimen, *Med. Plants,* 138.

Botanical Source.—Sambucus canadensis is a common, well-known native plant, from 5 to 12 feet high, with a shrubby stem, filled with a light and porous pith, especially when young. The bark is rather scabrous and cinerous. The leaves are nearly bipinnate, and antiposed; leaflets in 3 or 4 pairs with an odd one, oblong, oval, acuminate, smooth, serrate, with the lower ones often 2 or 3-parted. Petioles smooth. Flowers numerous, white, in very large, level-topped, 5-parted cymes, and have a heavy odor. Calyx small and 5-parted; corolla 5-cleft, with segments obtuse; stamens 5; stigma obtuse, small, and sessile. The fruit consists of numerous purplish-black berries (W.).

History.—Sambucus canadensis is an indigenous shrub, growing in all parts of the United States, in low, damp grounds, thickets, and waste places, flowering in June and July, and maturing its berries in September and October. *S. nigra* (see *Related Species*) is indigenous to Europe, growing in situations similar to those of the American variety. The two plants possess similar medicinal properties. The medicinal parts are the flowers, the berries, and the inner bark

Description and Chemical Composition.—The *U. S. P.* recognizes the flowers only, giving the following description: "The flowers, when fresh, about 5 Mm. (⅕ inch) broad, and, after drying, shrivelled; calyx superior, minutely 5-toothed; corolla originally cream-colored, after drying pale brownish-yellow, wheel-shaped and 5-lobed, with 5 stamens on the short tube; odor peculiar; taste sweetish, somewhat aromatic and bitterish. The peduncles and pedicels of the inflorescence should be rejected"—(*U. S. P.*). The odor of the *flowers* is characteristic and heavy, quite powerful when fresh, but faint when dried; they are slightly aromatic and bitterish, and impart their virtues to hot water. Boiling dissipates a volatile oil, which may be obtained by distillation with water; when cold it has the consistence of butter. Mr. F. F. Lyons (*Amer. Jour. Pharm.*, 1892, p. 1) found the bitterness of the flowers to be due to an amorphous, yellow, glucosidal substance, soluble in chloroform. The *berries* have little or no odor, an acid-saccharine taste, and yield by expression a purple juice, called *elder-rob*, which turns a dark-lilac color with alkalies, and a scarlet with acids; acetate of lead added to the juice causes a blue deposit of its coloring substance. It contains malic acid, some citric acid, and, according to J. B. Metzger (*Amer. Jour. Pharm.*, 1881, p. 553), a dark-brown resin, fat, sugar, gum, tannin, etc. The *inner bark* is whitish, with a green tint, odorless, of a saccharine taste, but subsequently bitterish, with some acrimony, and imparts its properties to water or alcohol. Mr. Charles G. Traub (*Amer. Jour. Pharm.*, 1881, p. 392) found the bark to contain valerianic acid, volatile oil, fat, resin, tannin, sugar, coloring matter, etc. Also see quantitative analysis, by C. Otto Moosbrugger (*ibid.*, 1895, p. 520), who found tannin, starch, alkaloids, and glucosids to be absent.

Fig. 215.

Sambucus canadensis.

Action, Medical Uses, and Dosage.—Sambucus is stimulant to all of the emunctories, increasing secretion. In warm infusion, elder flowers are diaphoretic and gently stimulant; in cold infusion, they are diuretic, alterative, and cooling, and may be used in all diseases requiring such action, as in *hepatic derangements of children*, *erysipelas*, *erysipelatous diseases*, etc. In infusion, with maidenhair and beech-drops, they will be found very valuable in all erysipelatous diseases. The expressed juice of the berries, evaporated to the consistence of a syrup, is a valuable aperient and alterative; 1 ounce of it will purge. An infusion of the young leaf-buds is likewise purgative, and sometimes acts with violence. The flowers and expressed juice of the berries have been beneficially employed in *scrofula*, *cutaneous diseases*, *syphilis*, *rheumatism*, etc. The inner green bark is cathartic; an infusion of it in wine or cider, or the expressed juice, will purge moderately, in doses of from ½ to 1 fluid ounce; large doses produce emesis; in small ones, it proves an efficient deobstruent, promoting all the fluid secretions, and is much used in *dropsy*, especially that following *scarlatina*, and other *febrile* and *exanthematous diseases*, as well as in many chronic diseases. Specific sambucus is largely used as an alterative where there is a tendency to unhealthy deposits in, or depravation of the tissues. The chief indication for sambucus is a fullness or œdematous condition of the parts, giving them a watery and flabby appearance. In these conditions it is a valuable agent in dropsy. Webster asserts that small doses of specific sambucus are valuable in the *catarrhal nasal obstructions of infants*. The juice of the root in ½ ounce doses, daily, acts as a hydragogue cathartic and diuretic, and will be found valuable in dropsical affections requiring purgation.

Externally, sambucus is a valuable agent, especially for eruptions which appear upon the full, flabby, œdematous tissues as described above, and particularly when attended with abundant discharge of serum. Beaten up with lard or cream, it forms an excellent discutient ointment, which is of much value in *burns*, *scalds*, and some *cutaneous diseases*, such as *eczema*, *milk-scall*, *old ulcers*, with soft, œdematous edges and free secretion of serum, and in *mucous patches*, with free discharges. The dose of specific sambucus ranges from 1 to 60 drops; decoction (inner bark, 2 ounces, to water, 1 quart, boiled down to 1 pint), from 2 to 4 fluid ounces.

Specific Indications and Uses.—In skin affections, when the tissues are full, flabby, and œdematous; epidermis separates and discharge of serum is abundant, forming crusts; indolent ulcers, with soft, œdematous borders: mucous patches, with free secretions; post-scarlatinal dropsy; low deposits in, or depravation of tissues.

Related Species.—*Sambucus nigra*, Linné, is the species official in the *British Pharmacopœia*. It grows in northern Africa and southern Siberia, and throughout the larger part of Europe. *Sambucus nigra*, or *European elder*, is much larger than the *S. canadensis*. The stem is much and irregularly, though always oppositely branched, and of quick growth; after a year's growth, the branches become filled with a light, spongy pith, and covered with a smooth, gray bark. The bark of the stem is rough and whitish. The leaves are usually two pairs of smooth, deep-green leaflets, with an odd one, all smooth, ovate-lanceolate, and serrate. The flowers are numerous, cream-colored, in large, smooth, 5-parted cymes, with a sweet but faint smell; some in each cyme are sessile. Calyx 5-cleft; corolla rotate and 5-cleft; lobes obtuse. The fruit is a globular, purplish-black berry, having reddish stalks (L.—De Cand.). H. Kramer (1846) found the bark to contain *viburnic acid*, proved, by Monro, to be *valerianic acid;* a trace of volatile oil, albumen, tannic acid, fatty matter, resin, gum, wax, sugar, starch, etc. *Chemical Gazette*, May, 1846). The inner bark of Sambucus nigra is hydragogue and emeto-cathartic. It has been successfully employed in *epilepsy*, by taking it from branches 1 or 2 years old, scraping off the gray outer bark, and steeping 2 ounces of it in 5 ounces of cold or hot water for 48 hours. Strain, and give a wineglassful every 15 minutes when the fit is threatening; the patient fasting. Resume it every 6 or 8 days. Simon (*Amer. Jour. Pharm.*, 1840, p. 250) states that the active principle of the bark of the root is a soft resin, which may be obtained by treating an evaporated, syrup-like, alcoholic tincture with ether, which separates an inert, hard, and takes up the soft resin; filter, and make into an extract by evaporation. Twenty grains produced vomiting 4 or 5 times, and as many stools.

Sambucus Ebulus, Linné, *Dwarf elder*.—The fruit of this plant is 4-seeded, and bears some resemblance to elderberries. Its taste, however, is considered more agreeable, and the fruit is sometimes employed medicinally.

Lonicera caprifolium, *Italian honeysuckle*, *Honeysuckle*.—Europe. A syrup of the flowers of this well-known garden vine has been successfully employed in *asthma* and other *respiratory disorders*, and the juice of the plant is said to give relief to *bee-stings*. The fruit, like all species of this genus, is emeto-cathartic.

SANGUINARIA (U. S. P.)—SANGUINARIA.

The rhizome of *Sanguinaria canadensis*, Linné, gathered in autumn after the leaves and scape have died to the ground.

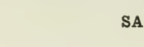
Nat. Ord.—Papaveraceæ.

Common Names: *Bloodroot*, *Puccoon*, *Red puccoon*, *Indian paint*, *Tetterwort*.

Illustrations: Bentley and Trimen, *Med. Plants*, 20; Johnson's *Med. Bot. of N. A.*, Pl. III.

Botanical Source.—Bloodroot is a smooth herbaceous, perennial, indigenous plant, with a horizontal, truncate or premorse, creeping rhizome covered with scattered fibers, and emitting an acrid bright orange-colored juice when cut or bruised. It is frequently crooked, 2 or 3 inches long, 3 to 6 lines in diameter, brownish-red externally, and red internally. From each bud of the root-stalk there springs a single leaf, and a round, erect scape about 6 inches high, with a single flower; and as they arise, the folded leaf incloses the flower-bud, and rolls back as the latter amplifies. The leaf is smooth, on long, channeled petioles, reniform or cordate, with large roundish lobes separated by rounded sinuses; the underside strongly reticulated by orange-colored veins, paler than the upper, and at length glaucous. The flowers are white, scentless, of a quadrangular outline, and of short duration. The calyx is formed of 2 concave, ovate, obtuse sepals, falling off when the corolla expands; the corolla has 8 (or more by cultivation) petals, which are spreading, concave, obtuse, the external ones the longer; sometimes they have a purple or rose tint. Stamens short, numerous,

Fig. 216.



Sanguinaria canadensis

with oblong, yellow anthers. Ovary oblong, and compressed, style none; stigma thick and somewhat 2-lobed. Capsule oblong, acute at both extremities, and 2-valved. The seeds are numerous, roundish, compressed, dark shining red, half-surrounded by a white vermiform raphe (L.—W.—B.).

Description.—The root of sanguinaria is the official part, although the whole plant is actively medicinal. The fresh root is from 1 to 4 inches in length, fleshy, round, about as thick as the finger and tolerably stout in the middle, abrupt at the end, often contorted and truncated, somewhat curved at each end, covered with orange-colored fibers 2 or more inches in length, of a reddish-brown color externally, brighter blood-red within, and containing an abundance of orange-colored juice, which flows out when the root is cut. The end of the root always appears as if broken or cut off by a dull instrument in removing it from the ground.

A horizontal section of the fresh root is a most beautiful object under the microscope; it is found to consist of numerous cells throughout its central part, somewhat oval or hexagonal, of nearly equal diameter, and containing: (1) a large proportion of the orange-colored resin peculiar to the plant, presenting the most beautiful shades of transparent amber; (2) a magnificent transparent, garnet hue, not seen, however, in every cell, resembling dots of garnet scattered over the field, with lateral facets, like a precious stone; and (3) a scarcity of white, transparent substance, consisting of a colorless, fixed oil. The juice when examined under the microscope, presents numerous transparent milk-like globules, and many colored granules, free and in clusters; with a power of 740 diameters, multitudes of transparent monads are seen in active motion. These globules and granules are rendered thinner and more transparent by liquor potassæ, and are mostly dissolved by ether; acetic acid dissolved most of the granules. The juice forms a fine dye of an orange color, the color being fixed by various mordants, as perchloride of tin, and sulphate of aluminum (G. D. Gibb).

As found in commerce, the dried root, considerably shrunken, is dark brown externally, bright yellow internally, but becoming dark-brown by the action of the air, more or less crooked, compressed, corrugated, having a short, uneven, pith-like fracture, a peculiar faintly virose odor, and a bitter, acrid, and pungent taste, leaving an impression in the fauces for some time after it has been chewed. "Of horizontal growth, about 5 Cm. (2 inches) long, and 1 Cm. (½ inch) thick, cylindrical, somewhat branched, faintly annulate, wrinkled, reddish-brown; fracture short, somewhat waxy, whitish, with numerous small, red resin-cells, or of a nearly uniform, brownish-red color; bark thin; odor slight; taste persistently bitter and acrid"—(*U. S. P.*). It is readily reduced to brownish-red powder, which causes sneezing when stirred. Boiling water or alcohol takes up its active properties, the latter, however, being the best menstruum; the root should be kept in a dry place; age or moisture impairs its activity. The seeds are about the size of barley grains, of a shining dark reddish-brown color, half surrounded with a peculiar white vermiform appendage, projecting at the lower end; they contain a bland, nutritious, and colorless fixed oil.

History.—Sanguinaria is one of the best known of our vernal-flowering-plants, making its appearance very early in the spring, usually in this climate in April, frequently covering the ground with large patches of beautiful white flowers. It usually grows in open woods, but may also be found along fences, around old stumps, and in recent clearings. Though extremely common throughout the eastern half of the union it is rapidly becoming scarce in the New England states, where it formerly grew in abundance. It thrives best in clayey soils, and rich loam, and is not usually found in wet places, as swamps and marshes, nor is it fond of sand, consequently it is not found near the ocean and lakes, nor in the swamps of the south. Otherwise it is encountered from Quebec and Ontario on the north to the Gulf of Mexico on the south, and from the Atlantic to the western boundary of the tier of states bordering on the west bank of the Mississippi River. It is commonly known as Bloodroot and Red puccoon, and less familiarly as Bloodwort, Red-root, Puccoon, Turmeric, and Indian paint. By the middle of summer the whole plant dies to the ground. The rhizome is fleshy, fibrous rooted, and breaks abruptly with a transverse fracture. The first botanical mention of bloodroot was made by Cornuti, in 1635, who placed it in the genus

Chelidonium. The name sanguinaria was first applied to it by a French botanist, Pierre Morin (Morinus), who published, in 1651, a catalogue of plants in his garden, and through John Jacob Dillenius, an eminent English botanist (of German birth and education, however), became established as the generic name, though it remained for Linnæus to define the genus. The name *sanguinaria* is from the Latin *sanguis*, blood; so named because the plant when wounded throws out the copious blood-like sap before referred to. The name sanguinaria, or "herba sanguinalis" had previously been used by both Greek and Latin writers, but was probably applied to other plants, as the name had reference to such plants as had the property of stopping the flow of blood—acted as hemostatics—and not on account of any red coloring possessed by them. This plant was well known to the American Indians, who used it as a dye. Through them the Virginians became acquainted with it. Strachey, who lived in Jamestown in 1610, states that it was called by the natives "*Musquaspenne*."

Perhaps no indigenous plant created greater interest among the early botanical physicians than the bloodroot. While nearly every writer on materia medica and botany gave full descriptions of the plant, and commended it for its beauty and usefulness, yet it never obtained the prominence that a drug of its class merits. In fact, while used to a considerable extent in domestic and botanical practice, it remained for the "Eclectic fathers" to take it up and develop its use as a remedy. Schoepf was among the earliest to notice it as a medicine. He speaks of 15 or 20 grains of the powdered root producing powerful emesis, and further notices its irritating action on the fauces, when given in powder. He advised a decoction or pill form of administration. Both Schoepf and Mérat used it for gonorrhœa, and Colden employed it in jaundice. Thacher mentions it, stating that it was the chief ingredient of a nostrum known as "Rawson's Bitters." The younger Barton employed a spirituous tincture in connection with the tinctures of bitter plants as a tonic, and used it locally as a wash for indolent ulcers, with hardened edges and ichorous discharges. He also applied the pulverized root to fungoid growths and nasal polypi. Bigelow and Smith used it for the same purpose. Thacher speaks of its use for coughs and pneumonic complaints, being used in place of digitalis. It was also used for "peripneumonia trachealis, cynanche maligna, and cynanche trachealis." Barton and Downey pointed out that the leaves and seeds were possessed of a narcotic power similar to that possessed by stramonium seeds, which fact was confirmed by the celebrated Dr. Bard (in an inaugural address), who used the root in croup, pneumonia, whooping-cough, phthisis, and jaundice. In 1831, Dr. Daniel B. Smith published in the *Journal of the Philadelphia College of Pharmacy* a dissertation on bloodroot, giving the natural and botanical history, and called attention to Dr. Dana's experiments, in 1824, when the latter possibly first obtained *sanguinarine*. Prof. Tully, who carefully experimented with bloodroot, classed it therapeutically with squills, seneca, digitalis, guaiacum, and ammoniacum. About the middle of the present century Dr. Fell, of England, was permitted to make a trial of a secret method of treating cancer, in the Middlesex Hospital of London, an act which was severely condemned by the *London Lancet*, consequently it led Dr. Fell to publish a work on "*Cancer and Its Treatment*," in which he said that he used the "bruised bloody pulp of the white flowering puccoon" (*Drugs and Medicines of North America*). *The Western Medical Reformer*, the pioneer Eclectic medical journal, in October, 1836, gave a description of bloodroot and its uses, and from that time on it has been a favorite remedy with our practitioners. The salts of sanguinarine were introduced into commerce by the late William S. Merrell, M. D.

Specific sanguinaria, the preparation principally employed by Eclectic physicians, has a deep ruby-red color and little odor. The taste is sharp and acrid, or as some might contend peppery, the after-taste being disagreeable, especially the sensation that remains in the throat and fauces. When ammonia is added to specific sanguinaria the red color disappears, a buff, purplish hue resulting. Acids restore the red color. When specific sanguinaria is dropped into water it imparts a yellow color if in small amount, which deepens to red as the proportion increases. A slight opalescence also results owing to precipitation of resin in a finely divided condition, and if the specific be in large amount the mixture becomes turbid and ultimately precipitates.

Chemical Composition.—G. König (*Amer. Jour. Pharm.*, 1891, p. 457) isolated from the root of sanguinaria the following alkaloids: *Chelerythrine* ($C_{21}H_{17}NO_4$), occurring in largest quantity, and forming lemon-yellow salts with acids; *sanguinarine* ($C_{20}H_{15}NO_4$), forming red-colored salts with acids; *gamma-homochelidonine* (probably $C_{22}H_{21}NO_4$); and *protopine* ($C_{20}H_{17}NO_5$), which is also a constituent of opium and chelidonium. *Sanguinarine* (formerly also called *chelerythrine*) was discovered in bloodroot by Dana, in 1829, and, afterward, in Chelidonium majus (see *Chelidonium*) by Probst (1838). It crystallizes in colorless needles, melting at 211° C. (411.8° F.) (G. König); insoluble in water, soluble in alcohol and ether, and in acids, forming red-colored salt-solutions of acrid taste (see *Sanguinarine*, page 1713). The bases above-named are combined in the root with *sanguinaric acid* (Newbold, 1866), which L. C. Hopp showed to be a mixture of citric and malic acids (*Amer. Jour. Pharm.*, 1875, p. 193). Mr. F. L. Slocum (*ibid.*, 1881, p. 275) found the root to contain about 3.5 per cent of resin, soluble in alcohol, insoluble in water. Sanguinaria seeds were analyzed by John Culley (*ibid.*, 1894, p. 189); petroleum ether extracted fixed oil and alkaloids (28.2 per cent), ether then took up resin and alkaloids (4.47 per cent), and absolute alcohol finally removed 2.9 per cent of resin. Mr. Charles H. LaWall (*Amer. Jour. Pharm.*, 1896, p. 305) recommends an assay of sanguinaria by abstracting the powdered root with petroleum benzin and aqua ammoniæ, an average of 1.5 per cent of total alkaloids being uniformly obtained. Other solvents extracted as much as 5 or 6 per cent.

Action, Medical Uses, and Dosage.—I. SANGUINARIA. The physiological action of sanguinaria is pronounced. The powder, when inhaled, is exceedingly irritating to the Schneiderian membrane, provoking violent sneezing, and free and somewhat prolonged secretion of mucus. To the taste, bloodroot is harsh, bitter, acrid, and persistent, and, when swallowed, leaves an acridity and sense of constriction in the fauces and pharynx and induces a feeling of warmth in the stomach. In small doses, it stimulates the digestive organs, and increases the action of the heart and arteries, acting as a stimulant and tonic; in larger doses it acts as a sedative to the heart, reducing the pulse, causing nausea, and, consequently, diaphoresis, increased expectoration, and gentle diuresis, at the same time stimulating the liver to increased action. If the dose be large, it provokes nausea, with violent emesis, vertigo, disordered vision, and great prostration. It also increases the broncho-pulmonary, cutaneous, and menstrual secretions. It is a systemic emetic, very depressing, causing increased salivary and hepatic secretions, and hypercatharsis may result. When an emetic dose has been taken, the heart's action is at first accelerated and then depressed. Poisonous doses produce violent gastralgia of a burning and racking character, which extends throughout the gastro-intestinal canal. The muscles relax, the skin becomes cold and clammy, the pupils dilate, there is great thirst and anxiety, and the heart's action becomes slower and irregular. Spinal reflexes are reduced and paralysis of the spinal nerve centers follow. Lethal doses produce death by paralysis of medullary, respiratory, and cardiac centers, death being sometimes preceded by convulsions.

Sanguinaria fulfils a variety of therapeutic uses according to the size of the dose employed. Though an emetic, it is seldom employed alone, but in combination with lobelia, as in the acetous emetic tincture, it forms one of our most efficient systemic agents of this class, and may be employed in *inflammatory* and *febrile states*, where it is thought necessary to thoroughly cleanse the stomach, and to excite the hepatic and general glandular system to activity. Upon the liver it acts as a gentle but reliable cholagogue, and may be employed in torpor of that viscus, or in congestive states and subacute as well as *chronic hepatitis*. Its action on the stomach is kindly. It promotes secretion and improves the appetite. It is a good remedy for *atonic dyspepsia*, administering drop doses of specific sanguinaria every 2 or 3 hours. By its stimulant action on the mucous surface, it proves valuable in the treatment of *gastric* and *duodenal catarrh*, and in *catarrhal jaundice*. It is applicable in all cases of *hepatic debility*, especially where the biliary product is suppressed, deficient or vitiated, and the general circulation is feeble, with cold extremities and *sick headaches*. Its value is often increased when combined with either podophyllin or specific iris. Bloodroot has proven serviceable in *rheumatism*, *dysentery*, and *scrofula*, with imperfect circulation.

Bloodroot is useful in many troubles of the genital system. *Amenorrhœa*, especially in anemic and chlorotic patients, with chilliness and headache, is benefited by it, as well as *dysmenorrhœa* in debilitated females. *Hysteria*, when due to moral causes, or pain, has likewise yielded to sanguinaria. *Hemorrhage of the lungs*, depending on vicarious menstruation, has been controlled by bloodroot. In the male, it is a remedy for *genital debility* and *seminal weakness*, *impotence*, with seminal incontinence and relaxed sexual organs.

Sanguinaria is "a neglected drug in respiratory disorders. Its action upon the pulmonary organs is somewhat similar to that of lobelia. It is important as a stimulating expectorant, to be used after active inflammation has been subdued. It may be employed in atonic conditions. It restores the bronchial secretions when scanty, and checks them when profuse. It is indicated in burning, smarting, itching conditions of the throat, larynx, and nares; tickling or burning in the nasal passage with abundant secretion, and an irritative, tickling cough; or when from atony the secretions are checked, it restores them, and removes the dry, harsh cough. It is useful in both *acute* and *chronic bronchitis*, *laryngitis*, *sore throat*, and *acute* or *chronic nasal catarrh*. It acts as a sedative to the irritable mucous surfaces, promotes expectoration, and stimulates their functions. It has proved very valuable as a cough remedy in *phthisis pulmonalis*. It is further a valuable alterative. It has been successfully employed in various forms of *croup*, particularly *mucous croup*. It is serviceable in *humid asthma* and *whooping-cough*. *Pharyngitis*, with red and irritable mucous membranes, and burning, smarting, or tickling, is cured by it. As an expectorant, it may be combined with other agents, as lobelia, etc. It enters into the composition of the 'acetous emetic tincture,' and, in powder form, is contained in the 'compound powder of lobelia and capsicum.' It is too harsh to use as an emetic, still good results have come from its use in *pseudo-membranous croup*, first giving small doses until profound nausea is produced, then carrying it to emesis. In *pneumonia*, after the inflammatory stage has passed, it may be given in 1 or 2-drop doses, frequently repeated, or it may be combined with wild cherry, lycopus, or eucalyptus. The vinegar of sanguinaria is a very efficient pectoral agent. The nitrate of sanguinarine is, with many, a favorite remedy to fulfil the indications for bloodroot. It may be administered in water, syrup, or in trituration with milk-sugar. The specific indications are a sense of burning in the fauces, pharynx, larynx, or nasal tissues, with redness of surface, and thin, acrid burning, smarting discharge; post-sternal constriction, or at the supra-sternal notch, with difficult breathing. A decoction of bloodroot is of service in *scarlatinal sore throat*" (Felter, *Ec. Med. Jour.*).

Sanguinaria is of value in *syphilitic skin eruptions*, and, as an ointment, has been employed, locally, in *tinea*. The powder, made into a cataplasm with slippery-elm, has been used in domestic practice as a local dressing for *frozen feet*. An infusion, made in vinegar, has been found valuable in several cutaneous diseases, as *eczema*, *ringworm*, and *warts*. At one time the root was extensively employed in the treatment of *carcinomata*, and was also applied to *exuberant excrescences* for its escharotic action, and to *ill-conditioned ulcers*, to create a healthy energy in the sores. Bloodroot, with bayberry, was formerly popular as an errhine in *catarrhal affections of the nose*, *cephalalgia*, *neuralgic affections of the head*, and to destroy *nasal polypi*. Prof. W. Byrd Scudder (*Ec. Med. Jour.*, 1892, p. 86) reports a case of *hypertrophic rhinitis*, caused by irritating dust in a seed-house, promptly relieved by $\frac{1}{10}$-grain doses of sanguinarine nitrate. The patient complained of a "dryness of the naso pharynx and throat, attended with sharp lancinating pain, and a sensation as if one side of the throat rubbed against the other." We have employed the nitrate of sanguinarine when the only symptom was an irritating cough, with tickling low in the larynx, with marked benefit. The preparations of sanguinaria in use are the powder, fluid extract, tincture, specific sanguinaria, vinegar of sanguinaria, syrup of sanguinaria, sanguinarine, and sanguinarine nitrate. The latter should be given in milk-sugar, or in syrup, on account of its acridity. Dose of the powder, as an emetic, from 10 to 20 grains; of the tincture, from 20 to 60 drops; as a stimulant or expectorant, from 3 to 5 grains; as an alterative, from $\frac{1}{2}$ to 2 grains. The dose of sanguinarine is $\frac{1}{24}$ to $\frac{1}{12}$ grain; of sanguinarine nitrate, $\frac{1}{30}$ to $\frac{1}{10}$ grain; specific sanguinaria, from 1 to 10 drops. For chronic respiratory troubles the syrup may be combined with wild cherry and liquorice.

II. SANGUINARINE NITRATE.—The action of this agent is practically that ascribed to sanguinaria (which see), though for respiratory affections it is to be preferred to that drug. The usual methods of administration are the syrup (½ to 2 grains to 4 fluid ounces of water and syrup), the dose of which is a teaspoonful every 1 to 3 hours; and the 2 x trituration, the dose of which ranges from 1 to 10 grains.

Specific Indications and Uses.—I. SANGUINARIA. For its specific indications, Prof. J. M. Scudder gives a "sensation of burning and itching of mucous membrane, especially of fauces, pharynx, Eustachian tubes and ears; less frequently of larynx, trachea, and bronchia, occasionally of stomach and rectum, and rarely of vagina and urethra. The mucous membrane looks red and irritable. Sometimes the redness will be of the end of the nose." Added to this he gives "nervousness, redness of nose, with acrid discharge, burning and constriction in fauces of pharynx, with irritative cough and difficult respiration." Prof. Locke gives also feeble circulation, with coldness of extremities.

II. SANGUINARINE NITRATE.—Tickling or irritation of the throat, with cough, burning or irritative sensation in the fauces, pharynx, larynx, or nasal tissues, with red surface and thin, acrid, burning, or smarting discharges; dryness of the nasopharynx and throat, with sharp, lancinating pain, and a feeling as if the walls of the throat were rubbing against each other; post-sternal constriction, or sense of uneasiness at the supra-sternal notch, with difficulty in breathing; sense of uneasiness and burning in the stomach, with nervousness.

Related Species.—*Stylophorum diphyllum*, Nuttall. United States. E. Schmidt (*Amer. Jour. Pharm.*, 1888) found the plant to contain *chelidonine* and another alkaloid, probably *chelerythrine*. This plant was first analyzed by J. U. Lloyd at the suggestion of C. G. Lloyd, who argued that its botanical relationship suggested an alkaloidal constituent. The product, a white alkaloid, was obtained in considerable amount, but no attempt at identification was made. Subsequently, the alkaloid was sent to Prof. Eykman, of Tokio, Japan, who reported in detail concerning it.

The following agent, though not related botanically, is also used for antispasmodic purpose. It may be well to state here that under the subheads *Related Species* and *Related Preparations*, we have frequently placed plants or drugs usually according to botanical or chemical relationship to the subject of the main article, but in several instances physiological or therapeutic relationship only has been taken into consideration.

Adhatoda Vasica, Nees (*Justicia Adhatoda*, Linné) (*Nat. Ord.*—Acanthaceæ).—India, "in the sub-Himalayan tract, from Nepal westward." The *Malabar nut-tree*, also known as *Arusa* (Hindu), *Adulsa* (Bombay), *Bàkas* (Bengalese), and *Adatodai* (Tam.). Of this plant, Ainslie long ago made the following statement: "The flowers, leaves, and roots are supposed to possess antispasmodic qualities; they are bitterish and subaromatic" (Lindley's *Medical Flora*). This shrub is largely employed in India as an antispasmodic and expectorant, particularly in *asthma* (leaves smoked also in this complaint), and in *phthisis* and *bronchitis*, and in other *catarrhal* and *pectoral complaints*, with cough and hectic. There is a saying in the East, according to Dutt, "that no man suffering from phthisis need despair as long as the *Vasaka* (Sanscrit) plant exists." The flowers are also used to purify the blood, and in *gonorrhœa*; the wood makes a fine charcoal for gunpowder (Dymock, *Mat. Med. of Western India*). Adhatoda contains *adhatodic acid* and the alkaloid, *vasicine*, in combination. Frogs and leeches, and fleas, mosquitoes, and many other insects are destroyed by a solution of vasicine. Adhatoda has been advised in this country in the treatment of *diphtheria* and *intermittent* and *typhoid fevers*. The leaves are the parts chiefly employed, of which a fluid extract may be given in doses of from 5 to 60 drops. Adhatoda leaves are said to be used in rice cultivation, being spread over the recently-flooded districts to kill the lower orders of aquatic plants (green scum), which interfere with the growth of the rice; they also serve as fertilizers to the soil.

Sanguinarine, Its Salts, and Sanguinarin.—The Eclectic name *Sanguinarine* was affixed to the mixed alkaloids thrown down by ammonia from an aqueous solution of the drug. When purified, this mixture, while free from extraneous matter, was still a mixture of alkaloidal educts and never free from decomposition or oxidation products. Change rapidly occurs, the ammoniacal precipitate if white, soon changes to buff and then to blue, drying dark. The salts are, when first thrown out of ethereal solution, of a yellow color; they darken soon, and on drying become of a deep-red color. These salts have long been used in Eclectic medicine.

SANGUINARINÆ.—*Sanguinarine* ($C_{19}H_{17}NO_4$, Limpricht; $C_{20}H_{15}NO_4$, G. König), the alkaloid of bloodroot. Dr. T. L. A. Greve, of Cincinnati, proposed the following formula for an impure alkaloid: "It may be obtained by adding aqua ammoniæ to the liquor from which the resin (*sanguinarin*) has been precipitated. It is then separated from the liquid by straining or filtering, washing the mass on the filter with water, then drying and powdering it. It may also be procured by treating ground bloodroot with water acidulated with sulphuric acid, and then precipitating with aqua ammoniæ, as above named." We have found that a purer form of sanguinarine may be obtained by triturating the sanguinarine nitrate with an ethereal solution of ammonia gas, which yields the alkaloid to ether which may then be evaporated to dryness. Sanguinarine ($C_{19}H_{17}NO_4$) is a white or pearl-gray body, having a bitter taste with some acrimony, is hardly dissolved by water, but readily by ether or alcohol, and possesses well-marked alkaline characters, rendering turmeric paper brown or red, and forming red-colored salts with the acids. So intensely irritating is it that even a very minute amount of the dust in the room will render the air irrespirable. It is a strong base and readily combines with even the weaker organic acids to form salts. All that is necessary to produce the salt is to simply neutralize the alkaloid with a weak solution of the desired acid, and evaporate to dryness. The uses of sanguinarine are similar to those of preparations of bloodroot. One grain of this alkaloid may be thoroughly triturated with 20 or 30 grains of sugar of milk, and divided into 10 or 30 doses, according to the effect desired. A very excellent cough preparation may be made, composed of chloride of ammonium, 2 drachms; extract of liquorice, 2 drachms; extract of hyoscyamus, ½ drachm; syrup of tolu, 1 fluid ounce; water, 6 fluid ounces; acetate or sulphate of sanguinarine, 1 or 2 grains. Mix. The dose is a tablespoonful, repeating it 3 or 4 times a day.

Sanguinarinæ Sulphas, *Sanguinarine Sulphate.*—Prof. E. S. Wayne recommends the following mode of obtaining sulphate of sanguinarine, which is Dr. Schiel's process: Exhaust bloodroot, in coarse powder, in a percolator, with diluted sulphuric acid, and then add ammonia; a deep purple precipitate occurs, which must be washed with water upon the filter, dried, and treated with ether, which dissolves out the sanguinarine. Treat this solution with animal charcoal, and the alkaloid is obtained as a sulphate of a bright vermilion color, on the addition of a solution of sulphuric acid in alcohol (*Amer. Jour. Pharm.*, Vol. CXXV, p. 521).

Sanguinarinæ Nitras, *Sanguinarine Nitrate.*—The nitrate of the alkaloids obtained from *Sanguinaria canadensis*, Linné. Prepare an alcoholic extract of sanguinaria, evaporate to a syrupy consistence, mix it with water, filter, and to the filtrate add ammonia water in slight excess. A bluish precipitate falls which must be filtered out and dried. Cautiously powder the dried mass, exhaust with ether, and filter. To prepare the nitrate, cautiously add nitric acid to the ether solution, being careful to avoid an excess, when sanguinarine nitrate will have formed, and not being soluble in ether precipitates as a yellow-red magma which, when dried, assumes a crimson hue. This substance is a salt of the mixed alkaloids of sanguinaria. It forms a powder of a crimson or brick color (according to process employed), almost entirely soluble in water, of an acrid taste, and a slight odor like that peculiar to the root, intensely irritating to the nasal mucous surfaces, and is employed as an expectorant, and likewise used where the root is indicated, in doses of from ⅛ to ¼ grain. (For *Action*, and *Specific Indications and Uses*, see *Sanguinaria.*)

Sanguinarin.—The alka-resinoid principle of bloodroot. Under the above name the early Eclectics used an impure resinous product of sanguinaria made after the manner of making resin of podophyllum. It possessed the qualities, largely, of the sanguinaria alkaloids which were mixed mechanically therewith. When used alone it should be triturated with sugar, sugar of milk, or some other article. As a tonic, the dose is from ¼ to 1 grain, 3 or 4 times a day; as a hepatic and alterative, from ½ to 2 grains. It may be proper for me to state here that I consider the *resin* of sanguinaria nearly, if not quite, devoid of medicinal principles, and that all the effects stated, as above, to have occurred from its administration, are entirely owing to its containing a greater or less amount of the alkaloid. Consequently, it would be better, both in a therapeutical and economical view, to dispense with this resin altogether, and employ sanguinarine only (J. King).

SANGUIS.—BLOOD.

Description.—Blood is an animal fluid somewhat of the character of an emulsion. It is the fluid which flows through the circulatory system of animals, that passing through the arteries in the vertebrate animals being bright red, and that returning to the heart by the veins, of a darker color and loaded with impurities. In the lower animals blood is white. This emulsion-like fluid, holding in suspension the blood corpuscles, is composed of a liquid and solid portion; the *corpuscles*, red and white, form the visible solid constituent, and the *liquor sanguinis*, or *plasma*, the fluid in which they float. These portions must not be confused with the fluid and solid portions of blood seen when drawn blood is allowed to stand. The solid portion is the "*clot*," or "*coagulum*," and contains a solid, colorless material—*fibrin*—enclosing the blood corpuscles, while the yellowish fluid in which the clot floats is the *serum*, which contains the salts and albumen. Blood has a faint but characteristic odor, a clammy somewhat viscid feel, is salty to the taste and of alkaline reaction. The coloring of blood corpuscles is due to a complex proteid compound known as *hæmoglobin*. This is crystallizable, and is capable of entering into a loose molecular combination with oxygen, called *oxyhæmoglobin*, and into a more stable compound with carbon-monoxide. Hæmoglobin is converted by acids or alkalies into a crystallizable red-coloring matter, *hæmatin*. The saline constituents of blood are iron, sodium and potassium chlorides, sulphates, and phosphates, and magnesium and calcium phosphates. The sodium chloride predominates. When ox-blood is evaporated to the consistence of an extract, it is known as *extractum sanguinis;* when pulverized, *pulvis sanguinis;* when defibrinated and dried as *sanguis bovinus exsiccatus.*

Action, Medical Uses, and Dosage.—Outside of its nutritive value blood has been employed as a medicine. Blood was introduced by Vacher (1873) as a remedy for *scrofulous conditions* of children and for the expulsion of *entozoa*, being found most efficient for *rectal ascarides.* Liquid blood has been administered in *chlorosis*, but the form generally employed is defibrinated blood, being administered chiefly by rectum and hypodermatically, the latter method being unattended with inflammatory or other ill-results. The conditions in which it has been found to exert a favorable and permanent influence are: *Debility* of infants and children, due to *dyspepsia*, *anemia*, debilitating discharges and various chronic affections; by the subcutaneous method in *anemia* from *hemorrhage*, *leukæmia*, *pernicious anemia*, and *anemia from exhausting discharges.* By rectum from 2 to 3 ounces may be injected several times a day.

SANICULA.—SANICLE.

The root of *Sanicula marilandica*, Linné.

Nat. Ord.—Umbelliferæ.

Common Names: *Sanicle, Blacksnake root, Pool-root.*

Botanical Source.—Sanicle is an indigenous, perennial herb, sometimes known by the name of *Blacksnake root*, with a stem from 1 to 3 feet high, smooth, furrowed, and dichotomously branched. The leaves are 3 to 5-parted, digitate, mostly radical, on petioles 6 to 12 inches long; the segments 2 to 4 inches long, half as wide, oblong, and irregularly and mucronately toothed. Cauline leaves few and nearly sessile. The flowers are mostly barren and white, sometimes yellowish; the sterile flowers are borne on slender pedicels; the fertile ones sessile. Segments of the calyx entire. Involucre 6-leaved and serrate. Umbels often proliferous; umbellets capitate. Fruit several in each umbellet, and densely clothed with hooked bristles (W.—G.). A variety (*S. canadensis*) has short-pedicelled, sterile flowers.

History and Chemical Composition.—Sanicle is common to the United States and Canada, and is found in low woods and thickets, flowering in June. The fibrous root is the medicinal part. Its taste and odor are somewhat aromatic. An alcoholic tincture contains its medicinal properties. Resin, essential oil, tannin, coloring matters, and ash (9 per cent) were obtained from the root by C. J. Houck (*Amer. Jour. Pharm.*, 1884, p. 463).

Action, Medical Uses, and Dosage.—Sanicle very much resembles valerian in its action on the system, possessing nervine and feebly anodyne properties, together with some astringency. It has been used with advantage as a domestic remedy in *intermittent fevers*, *sore throat*, *cynanche trachealis*, *erysipelas*, and some *cutaneous diseases.* It is very efficient in *chorea*, in doses of ½ drachm of the powdered root, 3 times a day, to children 8 or 10 years of age. It has also been beneficially employed in various other *nervous affections.* The decoction of it, administered in doses of from 2 to 4 fluid ounces, and repeated 3 or 4 times a day, is said to be valuable in *gonorrhœa*, *dysentery*, *passive hemorrhages*, and *leucorrhœa.* The decoction used freely, at the same time bathing the wound with it, is reputed a certain cure for the bites of *poisonous snakes* (J. King).

Related Species.—*Sanicula europæa*, Linné. The root of this plant is astringent, and possesses an acrid, bitter taste. In the Old World it is a domestic remedy for *hemorrhages* of a profuse character, such as from the lungs, uterus, etc.; *leucorrhœa*, *dysentery*, and *diarrhœa* are likewise treated with it. Externally, it is applied to *wounds.* An infusion in wine, or the fresh juice, is generally administered in ½-ounce doses.

Astrantia major, Linné. This plant has a root similar to the sanicles, and is employed sometimes as *Black imperatoria* (*Radix imperatoriæ nigræ*). This root is commonly known as *Black sanicle.*

SANTALUM RUBRUM (U. S. P.)—RED SAUNDERS.

The wood of *Pterocarpus santalinus*, Linné filius.

Nat. Ord.—Leguminosæ.

Common Names and Synonym: *Red saunders, Ruby wood, Red sandal-wood; Lignum santalinum rubrum.*

Illustration: Bentley and Trimen, *Med. Plants*, 82.

Botanical Source.—This is a lofty forest tree. The leaves are alternate, stalked, ternate, and rarely pinnate; the leaflets alternate, petiolate, the uppermost larger, ovate-roundish or oblong, entire, emarginate or retuse, smooth above, and hoary beneath; the stipules wanting. The flowers are yellow, with red veins, papilionaceous, and borne in axillary, simple or branched, erect racemes. Bracts none. Calyx brown and 5-cleft. Stamens 10, combined into a sheath, split down to the base on the upper side, and half-way down on the lower. The legume is roundish, long-stalked, falcate upward, compressed, smooth, and keeled on the lower edge; the keel is membranous and undulated. Seed solitary (L.).

History and Description.—This is a large forest tree inhabiting Ceylon and the mountains of the opposite Coromandel coast on the Indian continent. Only in the Madras Presidency does it grow wild. The wood is the official *Red saunders*, or *Red sandal-wood*. It is "a hard, heavy, dark reddish-brown, coarsely splintery wood, deprived of the light-colored sap-wood; usually met with in chips, or as a coarse, irregular, brownish-red powder, nearly inodorous and nearly tasteless. Red saunders does not impart any red color to water when macerated with it"—(*U. S. P.*). Other dye-woods generally communicate their color to water, which is not the case with red saunders; the latter, however, imparts to alkaline solutions, ether, and alcohol, a scarlet color. The alcoholic solution produces with solutions of lead a violet-colored, with corrosive sublimate a scarlet, and with sulphate of iron a deep-violet, precipitate.

Chemical Composition.—The coloring principle of red saunders is *santalic acid* (*santalin*), discovered by Pelletier. It is a red, tasteless, and odorless, crystalline powder, insoluble in water, soluble in ether, with yellow color, and in alcohol, with blood-red color (L. Meyer, 1848). It likewise dissolves in alkalies and acetic acid, but not in essential oils. H. Weidel (1869) obtained a similar substance, *santal* ($C_8H_6O_3$), by extracting the wood with boiling alkaline water, precipitating with hydrochloric acid, and recrystallizing from alcohol. The yield was 0.3 per cent. Cazeneuve and Hugounenq (*Jahresb. der Pharm.*, 1887, p. 159; and 1889, p. 127) digested the powdered wood with milk of lime, extracted the coloring substance with ether, and crystallized from alcohol. Carbon disulphide differentiated the product obtained into insoluble *pterocarpin* ($C_{20}H_{16}O_6$) and soluble *homo-pterocarpin* ($C_{24}H_{24}O_6$). Both substances are probably orcin-derivatives (see *Lacmus*). A small amount of tannin is contained in red saunders.

Action and Medical Uses.—Tonic and astringent. Formerly used for these indications, but at present employed only for coloring tinctures, etc.

Related Wood.—Cam Wood. Red dye-wood from *Baphia nitida*, De Candolle (*Nat. Ord.*—Leguminosæ). Western Africa. It scarcely colors water, but readily gives its red color to alkalies and alcohol. The coloring principle is thought to be identical with *santalin*.

SANTONICA (U. S. P.)—SANTONICA.

"The unexpanded flower-heads of *Artemisia pauciflora*, Weber"—(*U. S. P.*) (*Artemisia Lercheana*, Karel et Kirel; *Artemisia maritima*, var. *a pauciflora*, Ledebour; *Artemisia maritima*, var. *a Stechmanniana*, Besser).

Nat. Ord.—Compositæ.

Common Name and Synonyms: *Levant wormseed; Semen cinæ, Semen sanctum, Semen contra, Semen santonici.*

Illustration: Bentley and Trimen, *Med. Plants*, 157.

Botanical Source and History.—The plant furnishing santonica is one of the many forms of *Artemisia maritima*, a plant having a wide distribution, especially in salty soils of marshes in the northern hemisphere of the Old World. "It is found in the salt marshes of the British Islands, on the coasts of the Baltic, of France and the Mediterranean, and on saline soils in Hungary and Podolia; thence it extends eastward, covering immense tracts in southern Russia, the regions of the Caspian, and central Siberia, to Chinese Mongolia. The particular variety which furnishes at least the chief part of the drug, is a low, shrubby, aromatic plant, distinguished by its very small, erect, ovoid flower-heads, having oblong, obtuse, involucral scales, the interior scales being scarious. The stem in its upper half is a fastigiate, thyrsoid panicle, crowned with flower-heads. The localities for the plant are the neighborhood of the Don, the regions of the lower Volga, near Sarepta and Zaretzyn, and the Kirghiz deserts"—(*Pharmaeographia*). The great fair of Nishnei-Novgorod is the chief mart for Levant wormseed, the drug being conveyed there from Moscow, St. Petersburg, and the western ports of Europe. Two commercial varieties of the drug are known in Europe, the one under consideration being called *Aleppo*, *Levant* or *Alexandria wormseed*, the other is known as *Barbary wormseed*, and is the product of other Artemisiæ, growing in Arabia and Palestine, the exact species being yet undetermined.

Description.—"From 2 to 4 Mm. ($\frac{1}{12}$ to $\frac{1}{6}$ inch) long, oblong-ovoid, obtuse, smooth, somewhat glossy, grayish-green, after exposure to light, brownish-green, consisting of an involucre of about 12 to 18 closely imbricated, glandular scales, with a broad midrib, enclosing 4 or 5 rudimentary florets; odor strong, peculiar, somewhat camphoraceous; taste aromatic and bitter"—(*U. S. P.*).

Chemical Composition.—Levant wormseed contains resin, essential oil (about 2 per cent), and the crystalline, active principle, santonin ($1\frac{1}{2}$ to 2 per cent) (see *Santoninum*). *Oil of Levant wormseed* "has a yellowish color and a penetrating, disagreeable odor; specific gravity 0.930. It consists chiefly of *cineol* ($C_{10}H_{18}O$), with some dipentene" (see *Essential Oils*, by Prof. F. B. Power, 1894). *Cineol* is identical with *eucalyptol* and *cajuputol*.

Action, Medical Uses, and Dosage.—Levant wormseed is seldom used in substance in medicine, but is the official source of *santonin*. In small doses, it is a gastric stimulant, and, in larger amounts, a nervous and circulatory stimulant. Very large doses have produced a sense of depression at the stomach, nausea, emesis, purgation, and congestion of the brain. Wormseed is a vermicide, and is less apt than santonin to produce yellow vision. It is a remedy for the expulsion of *lumbricoides* and *rectal ascarides*, and less efficient for *tænia*. The dose of the powder is from 10 to 40 grains, 3 times a day, in syrup, honey, or similar fluid, in combination with a purgative, such as jalap, etc.

SANTONINUM (U. S. P.)—SANTONIN.

FORMULA: $C_{15}H_{18}O_3$. MOLECULAR WEIGHT: 245.43.

"A neutral principle obtained from Santonica. Santonin should be kept in dark, amber-colored vials, and should not be exposed to light"—(*U. S. P.*).

History and Preparation.—Santonin, the vermifuge principle of santonica, was discovered, in 1830, by Kahler and Alms, simultaneously. The *British Pharmacopœia* (1885) gives detailed directions for its preparation, which consists in boiling the bruised santonica seeds in water with addition of slaked lime, concentrating the solution of calcium santonate, adding hydrochloric acid, and allowing it to stand for 5 days. Wash the precipitated santonin (santonic anhydride) with water and ammonia water, which removes resin, and recrystallize from alcohol after treating the solution with animal charcoal. Another method consists in boiling out a mixture of santonica seeds and slaked lime with alcohol of 50 per cent (by volume), and decomposing the calcium santonate with carbonic acid (see Flückiger, *Pharmacognosie des Pflanzenreichs*, 3d ed., 1891, p. 822). (Also see detailed *Bibliography on Santonin*, by A. Van Zwaluwenburg, *Pharm. Arch.*, 1899, pp. 1–11.)

Description.—Santonin occurs "in colorless, shining, flattened, prismatic crystals, odorless and nearly tasteless when first put in the mouth, but afterward developing a bitter taste; not altered by exposure to air, but turning yellow on exposure to light. Nearly insoluble in cold water; soluble in 40 parts of alcohol at 15° C. (59° F.), in 250 parts of boiling water, and in 8 parts of boiling alcohol; also soluble in 140 parts of ether, in 4 parts of chloroform, and in solutions of caustic alkalies. When heated to 170° C. (338° F.), santonin melts, and forms, if rapidly cooled, an amorphous mass, which instantly crystallizes on coming in contact with a minute quantity of one of its solvents. At a higher temperature, it sublimes partly unchanged, and, when ignited, it is consumed, leaving no residue. Santonin is neutral to litmus paper moistened with alcohol. Santonin yields, with an alcoholic solution of potassium hydrate, a bright pinkish-red liquid, which gradually becomes colorless. From its solution in caustic alkalies, santonin is completely precipitated by supersaturation with an acid"—(*U. S. P.*).

Santonin ($C_{15}H_{18}O_3$) is the anhydride of *santonic acid* ($C_{15}H_{20}O_4$), which is a derivative of *dimethyl-naphtalene* ($C_{10}H_6[CH_3]_2$). Santonin dissolves in alkalies with formation of salts of this acid. Santonin, in acetic acid solution, when exposed to sunlight for about a month, is converted into (colorless) *photosantonic acid* ($C_{15}H_{22}O_5$). The ethyl-ester of the latter is obtained when an alcoholic solution of santonin is exposed to sunlight (Sestini). The yellow coloration developed upon exposure of santonin to light, is believed to be due to a red resin. Santonin is optically lævo-rotatory.

Adulterations and Tests.—Santonin has been adulterated by boric acid: this substance may be recognized by being insoluble in chloroform, or by not being volatilized when heated on platinum foil. If the residue is dissolved in water, and the solution acidulated with hydrochloric acid, a strip of yellow turmeric paper is colored brown by it. Santonin, turned yellow from exposure to light, has been mistaken for picric acid; the latter is easy of detection, being soluble in cold and hot water with yellow color (J. M. Maisch, *Amer. Jour. Pharm.*, 1874, p. 52); or the white crystals of santonin might be mistaken for strychnine, the latter, however, may readily be distinguished by the violet coloration it produces with sulphuric acid and potassium dichromate (see *Strychnina*). Other substitutions, *e. g.*, salicin, may be recognized by the following *U. S. P.* directions for santonin: "Its solution in cold, concentrated sulphuric acid is at first colorless (absence of easily carbonizable, organic substances), but, after some time, turns yellow, then red, and finally brown. If water be added, immediately after it is dissolved without color in sulphuric acid, it will be completely precipitated, and the supernatant liquid should not have a bitter taste, nor should it be altered upon the addition of potassium dichromate T.S. (absence of brucine or strychnine), or of mercuric potassium iodide T.S. (absence of alkaloids in general)"—(*U. S. P.*). D. Lindo's test for santonin is as follows: Dissolve, in a test-tube, a small quantity of santonin in strong sulphuric acid, add a few drops of a highly-diluted solution of ferric chloride; upon warming in the flame of a Bunsen burner, a beautiful violet coloration is developed.

Action, Medical Uses, and Dosage.—Santonin is an active agent, and, in improper doses, is capable of producing serious symptoms, and even death. As small a dose as 2 grains is said to have killed a weakly child of 5 years, and 5 grains produced death in about ½ hour in a child of the same age. Among the toxic effects may be mentioned gastric pain, pallor and coldness of the surface, followed by heat and injection of the head, tremors, dizziness, pupillary dilatation, twitching of the eyes, stertor, copious sweating, hematuria, convulsive movements, tetanic cramps, stupor, and insensibility. Occasionally symptoms resembling cholera morbus have been produced, and in all cases the urine presents a characteristic yellowish or greenish-yellow hue. We have observed convulsions caused by the administration of "worm lozenges." Death from santonin is due to respiratory paralysis, and post-mortem examination revealed in one instance a contracted and empty right ventricle, and about an ounce of liquid, black blood in the left heart, an inflamed duodenum, and inflamed patches in the stomach (Kilner). The chief form of treatment of poisoning by santonin is by artificial respiration. Internal and external stimulation should also be resorted to, inhalations of ether or chloroform, to control the convulsions, should be given, and a purgative administered to remove remaining traces of the poison from the bowels. Santonin often produces a singular effect upon the vision, causing surrounding objects to appear discolored, as if they were yellow or green, and occasionally blue or red; it also imparts a yellow or green color to the urine, and a reddish-purple color if that fluid be alkaline. Prof. Giovanni was led to believe that the apparent yellow color of objects observed by the eye, when under the influence of santonin, did not depend upon an elective action on the optic nerves, but rather to the yellow color which the drug itself takes when exposed to the air. Santonin colored by the air does not produce this effect, which only follows the white article. The air gives the yellow color to santonin, to passed urine containing it, and to the serum of the blood when drawn from a vein, and, according to Giovanni, it is owing to its direct action upon the aqueous humor, where it is carried by absorption, that objects present this color. The view now held, however, is that of Rose, that the alkaline serum dissolves the santonin, which then acts upon the perspective centers of the brain, producing the chromatopsia or xanthopsia. Santonin has been advantageously given in *amaurosis* following acute inflammation of some of the internal parts of the eye; also in *subacute* and *chronic retinitis* and *choroiditis*. It is said to have materially benefited cases of *non-congenital color-blindness*, being administered in $\frac{1}{20}$ or $\frac{1}{10}$ grain doses (Foltz).

Santonin is the chief remedy now used for the expulsion of the *roundworm* or *ascaris lumbricoides*. It acts less effectually upon *rectal ascarides*, and not at all upon the tapeworm. As a rule, when a single dose is to be given, it should be administered upon an empty stomach, and the patient should refrain from eating for a short time afterward. A purgative should precede and follow its use. Another method, which has found much favor in the Eclectic school, is that of giving santonin, in divided doses, as follows: ℞ Santonin, grs. v; podophyllin, grs. j; milk-sugar, ʒi. Mix. Divide into 10 powders, and administer 1 powder 3 times a day.

Santonin is an important nerve stimulant. It relieves many of those nervous phenomena which simulate the conditions produced by worms—picking at the nose, starting in sleep, intestinal irritation, etc. Its effects upon troubles of the urinary apparatus, due to disordered or deficient innervation, make it one of our best specific remedies. In *retention of urine*, due to atony of the bladder, no remedy surpasses it, and when this occurs as a symptom of the advanced stage of acute diseases of children, indicating an unfavorable prognosis, unless the urinary function can be restored, santonin may be given in $\frac{1}{4}$ to $\frac{1}{2}$-grain doses (triturated with sugar), every hour, until a free urinary flow is established. Retention of urine, caused by opium preparations, is corrected by it. Being strongly diuretic, it may be administered in *renal colic*. It relieves *urethral irritation*, *dysuria*, *strangury*, *nocturnal enuresis*, *chronic vesical catarrh*, and *vesical tenesmus*. It acts promptly in the urethral irritation, with pain and scalding, associated with *uterine disorders*, and in large, but unsafe, doses (10 grains), it has been recommended in *uterine colic* and *amenorrhœa* (Berthey). It relieves the difficult micturition and urinal retention following parturition, when not due to long-continued pressure of the child's head upon the parts. Many of the unpleasant urinary symptoms of *albuminuria* and *chronic nephritis* are relieved by santonin, and it is a remedy for impaired breathing and tympanitis due to deficient spinal innervation. The dose of santonin for an adult ranges from $\frac{1}{10}$ to 4 grains; for a child, $\frac{1}{20}$ to 2 grains, always avoiding the larger dose when possible; 2 x trituration, 2 or 3 grains, for its effects upon the urinary apparatus.

Specific Indications and Uses.—To remove all kinds of intestinal worms but the tapeworm; retention of urine from atony; nocturnal enuresis from atony; urethral irritation, with pain and scalding, accompanying uterine disorders; retention of urine in fevers; deficient spinal innervation, as evidenced by impaired respiration and tympanitis; vesical tenesmus and strangury; retention of urine from the use of opiates.

Related Products.—SANTONINOXIME ($C_{15}H_{19}NO_3$, or $C_{15}H_{18}O_2:N.OH$). Said to be a safe substitute for santonin, and the dose given may be 3 times as large. P. Guici (1889) prepared it by the interaction of santonin (5 parts), hydroxylamine hydrochloride (4 parts), strong alcohol (50 parts), and precipitated calcium carbonate (4 parts). These were digested for 3 or 4 days at about 80° C. (176° F.). It forms white silky, lævogyre needles, very sparingly soluble in hot water. It fuses at near 217° C. (442.6° F.).

Santolina chamæcyparissus (Compositæ).—Popular in Scotland as a remedy for *roundworm*. Half ounce of the plant may be boiled with 1 pint of water for 30 minutes, strained, and brought to the measure to 1 pint when finished. Of this decoction, 2½ ounces may be given to children, or 5 ounces to adults for 4 successive days, and may be followed with an active cathartic. Maben finds in the plant a bitter body, which he believes to be the active substance, resin, and an essential oil (*Pharm. Jour. Trans.*, Vol. XVI).

SAPO (U. S. P.)—SOAP.

"Soap prepared from soda and olive oil"—(*U. S. P.*).

COMMON NAMES AND SYNONYM: *Soap*, *White castile soap*, *Castile soap*, *Hard soap*; *Sapo durus*, *Br.*

Source and Preparation.—Soaps in general are the sodium or potassium salts of the higher fatty acids (lauric, stearic, palmitic, oleic acids, etc.) occurring in fats or fixed oils, these being glycerin esters of the acids named (see *Olea Fixa* and *Adeps*). Sodium and potassium soaps are readily soluble in water, while calcium soaps and the soaps formed with heavy metals are insoluble. The latter are called *plasters, e. g.*, lead plaster (see *Emplastrum Plumbi*).

Commercial soaps are broadly classed as *hard soaps* and *soft soaps*. As a rule, sodium soaps are hard soaps, while potassium soaps are soft. The nature of the higher fatty acid with which the alkali is combined, has a secondary influence on the consistency of the soap. Fats in which the solid stearic acid is preponderant, *e. g.*, mutton and beef suet, yield a harder soap than those in which the fluid oleic or related acids are predominant, *e. g.*, olive oil, linseed oil, fish oils. The fats from which soaps are prepared are chiefly tallow and lard, palm oil, olive oil, cocoanut oil, for hard, partly also for soft soaps, and hempseed oil, linseed oil, cotton-seed oil, and fish oils, for soft soaps; castor oil for transparent toilet soaps, and commercial oleic acid both for hard and soft soaps. In the case of oleic acid, soap-making consists simply in the neutralization of the free acid by caustic alkali or by the carbonate of an alkali. The carbonic acid evolved in the latter case is liable to be a disturbing element in the manufacture. With neutral fats, decomposition into the fatty acid and glycerin may be effected in several ways (see *Glycerinum*); of these, saponification by caustic alkalies is still the prevailing method of making soap. Taking *stearin* (glyceryl-tristearate) as a type of a solid fat, the reaction with caustic soda will be as follows: $C_3H_5(C_{18}H_{35}O_2)_3+3NaOH=$ $3C_{18}H_{35}O_2Na$ (sodium stearate) $+C_3H_5(OH)_3$ (glycerin). White castile soap is officially recognized and is made from olive oil.

HARD SOAPS.—In practical soap-making, saponification of the fat must be started with a weak lye, because soap being insoluble in strong alkali, the first soap formed would envelop the fatty particles and prevent them from being further attacked. The heating is done in copper boilers provided both with indirect and direct steam. After adding stronger lye, the mixture is boiled until a sample becomes firm on cooling; the soap is then "salted out," *i. e.*, common salt or concentrated brine is added, in which the soap is insoluble. The latter rises to the top, while the liquid below ("spent lye") contains all the glycerin, salt solution and various impurities, but should not contain either soap or free alkali. It is drawn off, and the supernatant soap boiled with another quantity of strong soda-lye, which completes the saponification. A small quantity of weak lye is now added and the mass boiled for several hours by direct steam. This produces *curd soap*, composed of hard, granular particles. The soap is taken out and allowed to harden in wooden or iron frames. *Mottled soap* is obtained when ferrous sulphate (about 0.25 per cent) is incorporated into the cooling mass which causes greenish streaks of ferrous hydrate to form, turning red on the surface of the soap. Other substances are also used for this purpose. *Yellow* or *resin soap*, is formed by adding a certain quantity of resin (see *Resina*) (as much as 50 per cent and more, of the fat employed) to the mass in the soap boiler toward the end of the process; a yellow soap of uniform texture, not curdy and granular, is produced. When unbleached palm oil is saponified, the soap that is formed is also yellow.

Filled Soaps.—These are the cheapest soaps made. As they are not salted out they represent the total contents of the soap boiler, including the glycerin. The fats usually receive an addition of a large percentage of cocoanut oil, which has the remarkable property of being readily saponifiable with a strong soda-lye at a lower temperature producing a hard soap which can not be separated from the liberated glycerin, and in addition is capable of taking up large amounts of extraneous matters, soluble silicate of sodium being especially used for this purpose Thus, 100 kilogrammes of cocoanut oil, 75 to 80 kilogrammes of rosin, 300 kilogrammes of waterglass, and 100 to 150 kilogrammes of tallow, yield, with 240 kilogrammes of soda-lye of 33° Beaumé, a total of 800 kilogrammes of finished soap (S. P. Sadtler, *Indust. Org. Chem.*, 2d ed., 1895, p. 62).

Saponification of cocoanut oil, even when mixed with twice its quantity of tallow, takes place with soda-lye of the above strength at a temperature as low as 50° C. (about 120° F.) (*cold process*). The soap known as *marine soap* is made from cocoanut oil by boiling with the calculated quantity of caustic soda. It retains all the glycerin of the fat, and has the property of forming a lather with sea-water which ordinary soap does not do. *Toilet soaps* are prepared from *grained* (*curd*) *soap*, and according to the process of treatment are distinguished as transparent soaps, remelted soaps, and milled soaps. The latter are produced by slicing and drying the stock soap, grinding the material, mixing in the ingredients, *e. g.*, perfumery, etc., and pressing into cakes. Transparent soaps may be obtained by making an alcoholic solution of soap and distilling off the alcohol.

SOFT SOAPS.—These are made by saponifying hempseed, linseed (*U. S. P.*) or cotton-seed oil (*Nat. Form.*, 1st ed.), fish oils, etc., with caustic potash. They can not be salted out with potassium chloride, hence contain glycerin and any excess of alkali that may have been employed. The *U. S. P.* gives the following directions for making *soft soap* (SAPO MOLLIS): Take of "linseed oil, four hundred grammes (400 Gm.) [14 ozs. av., 48 grs.]; potassa, ninety grammes (90 Gm.) [3 ozs. av., 76 grs.]; alcohol, forty cubic centimeters (40 Cc.) [1 fl℥, 169 ♏]; water, a sufficient quantity. Heat the linseed oil in a deep, capacious vessel, on a water-bath or steam-bath, to a temperature of about 60° C. (140° F.). Dissolve the potassa in four hundred and fifty cubic centimeters (450 Cc.) [15 fl℥, 104 ♏] of water, add the alcohol, and then gradually add the mixture, constantly stirring, to the oil, continuing the heat until a small portion of the mixture is found to be soluble in boiling water without the separation of oily drops. Then allow the mixture to cool, and transfer it to suitable vessels. The potassa used in this process should be of the full strength directed by the *Pharmacopœia* (90 per cent). Potassa of any other strength, however, may be used, if a proportionately larger or smaller quantity be taken, the proper amount for the above formula being ascertained by dividing 8100 by the percentage of absolute potassa (potassium hydrate) contained therein"—(*U. S. P.*). (Also see formula for *Sapo mollis* from olive oil, *Amer. Jour. Pharm.*, 1895, p. 485; and comment on this and the official formula, by S. A. Sicker, *Pharm. Review*, 1898, p. 15.)

Description, Chemical Composition, and Tests.—Dr. S. P. Sadtler (*loc. cit.*) broadly classifies the many commercial varieties of soaps as follows: (1) *Compact soaps*, including curd soaps (tallow soap or *Sapo animalis*, *S. domesticus*, and toilet soaps), mottled and yellow (palm oil and rosin) soaps; they contain from 10 to 25 per cent of water; (2) *smooth* or *cut soaps*, which are curd soaps, allowed to take up more water; they contain from 25 to 45 per cent; (3) *filled* or *padded soaps* (see previous page), from 45 to 75 per cent of water, and glycerin, spent lye, etc.; (4) *soft* or *potash soaps*.

Two classes of medicinal soaps are recognized by the *U.S.P.*: I. SAPO (*U.S.P.*), *Soap; White castile soap*.—This soap, prepared from olive oil, is also known as *Hard soap* (*Sapo durus*), *Sapo oleaceus*, *Sapo venetus*, *Sapo Hispanicus*, or *Spanish soap*. As described by the *U. S. P.*, it is "a white or whitish solid, hard, yet easily cut when fresh, having a faint, peculiar odor free from rancidity, a disagreeable, alkaline taste, and an alkaline reaction. Soluble in water and in alcohol, more readily with the aid of heat"—(*U. S. P.*).

Soap is insoluble in petroleum ether; this permits the quantitative extraction of any unaltered fat that may be present in soap. Soap is incompatible with all acid liquids, with the salts of heavy metals, with alum, and the solutions of the alkaline earths and their salts, *e. g.*, with lime-water, chloride of calcium, sulphate of magnesium, etc. Hard waters do not form a lather with soap, because soap forms granular compounds with the calcium salts of the water. Previously boiling the water with sodium carbonate will precipitate the calcium salts, and the water thus purified will foam with the soap. Or, sodium or potassium carbonate incorporated with the soap, is said to produce the same effect.

The *U. S. P.* directs the following tests for hard soap: "On placing a small, weighed portion of soap, together with about 10 Cc. of alcohol, in a tared beaker containing sand, evaporating the resulting solution of the soap to dryness, and drying the residue at 110° C. (230° F.), the loss of weight should not exceed 36 per cent (absence of an undue amount of water). A 4 per cent alcoholic solution of soap should not gelatinize on cooling (absence of animal fats). An aqueous solution of soap should remain unaffected on the addition of hydrogen sulphide or ammonium sulphide T.S. (absence of metallic impurities). On dissolving 20 Gm. of soap in alcohol, with the aid of heat, transferring the undissolved residue, if any, to a filter, and washing it thoroughly with boiling alcohol, it should, after drying, weigh not more than 0.6 Gm. (limit of sodium carbonate, etc.); and at least 0.4 Gm. of this residue should be soluble in water (limit of silica and other accidental impurities). If a solution of 5 Gm. of soap in 50 Cc. of water be mixed with 3 Cc. of decinormal oxalic acid V.S., the subsequent addition of a few drops of phenolphtalein T.S. should produce no pink or red tint (limit of alkalinity)"—(*U. S. P.*). The presence of free alkali in soap may be qualitatively ascertained by adding to a concentrated solution of the soap either calomel or solution of mercurous nitrate. A black precipitate is formed if free alkali is present.

The adulterants that have been found in hard soap are China clay, fuller's earth, chalk, pumice stone, gypsum, sand, bran, etc. They all remain undissolved when the soap is treated with alcohol or water.

II. SAPO MOLLIS (*U. S. P.*), *Soft soap*, *Sapo viridis* (*Pharm.*, 1880), *Green soap.*—"A soft, unctuous mass, of a yellowish-brown or brownish-yellow color. Soluble in about 5 parts of hot water to a nearly clear liquid; also in 2 parts of hot alcohol, without leaving more than 3 per cent of insoluble residue"—(*U. S. P.*). This soap has been found adulterated with starch to the extent of 25 per cent. The adulteration may be recognized by iodine in slightly acidulated solution. (For a tabulated scheme of systematic soap analysis, we refer the reader to S. P. Sadtler, *Handbook Indust. Org. Chem.*, 2d ed., 1895, p. 82; or to A. H. Allen, *Commercial Organic Analysis*, 3d ed., Vol. II, Part I, 1899, p. 277. An interesting account of the analysis of five samples of castile soap and four samples of soft soap, with comment on the above *U. S. P.* requirements, is given by F. A. Sieker, *Pharm. Review*, 1898, pp. 15, 94, and 267; also see S. R. Knox, *Proc. Amer. Pharm. Assoc.*, 1894, p. 174; and article by Alfred Smethan, on "Soap Manufacture and Soaps of Commerce," in *Pharm. Jour. Trans.*, Vol. XIV, 1883–84, p. 534.)

The following table, from Dr. S. P. Sadtler's *Handbook*, p. 73, gives the results of some analyses performed by M. Dechan (*Pharm. Jour. Trans.*, Vol. XV. 1884–85, p. 870), of the soaps chiefly employed in pharmacy:

NAME OF SOAP.	Fatty Acids.	Combined Alkali.	Free Alkali.	Silica.	Sulphates and Chlorides.	Insoluble Matter.	Water.	Insoluble in Alcohol.
Hard soap (*Sapo durus*)................	81.5	9.92	.08	.00	.28	0.20	10.65	0.50
White castile soap................	76.7	9.14	.09	.00	.36	0.90	13.25	0.60
Mottled castile soap................	68.1	8.9	.19	.15	.63	0.80	21.70	1.30
Tallow soap (*Sapo animalis*)	78.3	9.57	.28	.00	.47	0.40	12.50	1.10
Soft soap (*Sapo mollis*)................	48.5	12.6	.38	.17	.93	1.00	39.50	1.60

Action, Medical Uses, and Dosage.—Soap taken internally is slightly laxative, and, externally, it is detersive. Its action is very much like that of the alkalies, but less energetic; hence it may be administered in considerable doses without producing inflammation, though it readily disturbs digestion. As an antacid, it is useful in strong solution, in cases of *poisoning by mineral acids*, and also in *acid conditions of the stomach*. It has likewise been found serviceable in those cases of *gravel* in which uric acid prevails, but it does not dissolve the uric acid formations. In cases of poisoning by acids, it may be used until more effective agents can be procured, as chalk, lime, magnesia, or the alkaline bicarbonates. It is seldom used alone as a purgative, but is usually combined with aloes, gamboge, resin of podophyllum, or other resinous cathartics, whose irritating properties are thereby modified. United with rhubarb, it forms a pill of much service in *obstinate costiveness* and *biliary derangements*. It lessens the astringent action of rhubarb. Externally, it has been found serviceable in *tinea capitis*, *itch*, *boils*, and other *cutaneous diseases*, and as a discutient in *glandular enlargements*, *abscesses*, *contusions*, etc., in which it is used either in form of liniment or plaster. Soft soap, especially, has been found efficient in these cutaneous affections, used either alone, or in combination with other suitable agents. An excellent injection is formed by making a strong soap-water from soft soap, which will be found useful in obstinate costiveness, or where it is desirable to produce a prompt discharge from the bowels. In the preparation of pills, liniments, or plasters, we must be particular not to add agents which are chemically changed by the soap. Soap may be administered in a dose of 5 to 30 grains, and is commonly used in the pilular form; in poisoning by mineral acids, ½ pint of a strong solution should be promptly administered and be repeated every few minutes, if necessary.

Special Soaps.—As such we consider soaps containing certain ingredients intended to impart to the soap special medicinal or economic characters. This includes the multitude of *medicated soaps*. The following special soaps may be mentioned:

Transparent Glycerin Soap may be made by melting together 10 kilogrammes of tallow, 10 kilogrammes of cocoanut oil, 6 kilogrammes of castor oil, 10 kilogrammes of glycerin, heating to about 50° C. (122° F.), adding 13 kilogrammes of soda-lye of 40 per cent, and 12 kilogrammes of 96 per cent alcohol, stirring the mixture until the soap becomes transparent, then add sugar solution (2 kilogrammes of sugar boiled with ½ kilogramme of water), 100 grammes of cassia oil, 50 grammes of bergamot oil, and pour the finished soap into tin molds (*Amer. Jour. Pharm.*, 1879, p. 566). It is stated by Dr. Sadtler, however, that the addition of sugar is harmful to sensitive hands.

Opodeldoc is the camphorated soap liniment (*Linimentum Saponato Camphoratum*) of the *German Pharmacopœia* (also see p. 1143).

Sapo Medicatus of the *German Pharmacopœia* (which enters into the composition of the preceding) is a neutral soda soap, prepared on the steam-bath, with the aid of alcohol, from a mixture of equal amounts of lard and olive oil.

Sapo Jalapinus (*Ger. Pharm.*).—Dissolve jalap resin (4 parts) and medicinal soap (4 parts) in diluted alcohol (8 parts), evaporate on the steam-bath to 9 parts, with constant stirring.

Tannin Soap.—Saponify cocoanut oil (9 kilogrammes) with soda-lye (4.5 kilogrammes); add solution of tannin (250 grammes) in alcohol; finally add balsam of Peru (30 grammes), oil of cassia, oil of cloves (each, 10 grammes).

Iodine Soap.—Cocoanut oil (10 kilogrammes), lye of 38° Beaumé (5 kilogrammes), potassium iodide (500 grammes), dissolved in water (250 grammes).

Gall Soap.—Cocoanut oil (25 kilogrammes) is mixed with galls (1.5 kilogrammes) and saponified in the cold with 12.5 kilogrammes of soda-lye of 38° Beaumé. The soap is colored with 350 grammes of ultramarine green, and perfumed with 75 grammes each of oil of lavender and caraway.

Camphorated Sulphur Soap.—Cocoanut oil (12 kilogrammes), soda-lye of 38° Beaumé (6 kilogrammes), potassium sulphide (1 kilogramme), dissolved in water (0.5 kilogramme); camphor (160 grammes) is to be dissolved in melted cocoanut oil (*Amer. Jour. Pharm.*, 1882, p. 64).

Petroleum Soap.—Heat white beeswax (40 parts), petroleum (50 parts), alcohol of 90 per cent (50 parts) on a water-bath; when melted, add hard Marseille soap (100 parts), agitate and pour into molds. The soap is said to be firm, emulsifies easily and does not leave the washed parts impregnated with petroleum (*Amer. Jour. Pharm.*, 1889, p. 287).

Sand Soap may be prepared from curd soap and cocoanut oil soap, each, 7 pounds; sifted sea-sand, 28 pounds; oils of thyme, cassia, caraway, and French lavender, each 2 ounces.

Asepsin Soap is a milled tallow soap medicated with asepsin and borax (also see *Asepsin*).

Antiseptic Soap (*ethereal*, Johnston) is a medicinal soap in liquid form introduced and manufactured by Parke, Davis & Co., Detroit.

Shaving Cream.—The *Pharm. Jour. Trans.*, Sept. 19, 1896, p. 248, recommends the following formula: Curd soap, 2 ounces; fresh butter, 4 drachms; tincture of quillaja, 2 ounces; carbonate of potassium, 2 drachms; otto of rose, 10 minims; oil of lavender, 10 minims, oil of myrcia acris, 5 minims. Dissolve the soap, shredded fine, in 10 ounces of water by the aid of heat; melt the butter, and mix in a warm mortar with the carbonate of potassium dissolved in 1 ounce of water; gradually add the soap solution, and stir until a paste is formed, then add the quillaja tincture in which the oils have been dissolved.

Mollin.—An ointment base in use in German dermatological practice, and is classed as a soft soap containing 17 per cent of free fat. It is a smooth, soft, yellowish-white, non-rancid body not easily altered in the air, and readily washed from the skin with water, hot or cold. To prepare it, fresh fat, or cocoanut oil, 100 parts is first saponified with caustic potash solution (specific gravity 1.145), 40 parts. Glycerin, 30 parts, is then intimately mixed with it and carefully heated.

Pulverulent Medicinal Soaps.—This form of soap is recommended by Dr. P. J. Eichhoff. A *neutral* soap-powder base (anhydrous, hygroscopic) is obtained from beef tallow; *superfatted* soap powder is obtained from the preceding by adding oleic acid (2 per cent) and lanolin (3 per cent). An *alkaline* soap-powder base is obtained by adding to the neutral base potassium and sodium carbonates (2.5 per cent of each). A number of medicinal soaps have been prepared from the three bases named, by incorporating with them certain medicinal constituents, *e. g.*, sulphur (10 per cent), balsam of Peru, chrysarobin, chlorinated lime; or carbolic acid, salicylic acid, pyrogallol, iodoform, aristol, quinine sulphate, etc, etc. (see *Amer. Jour. Pharm.*, 1893, p. 68, from *Pharm. Zeitung*, 1892; also see *Amer. Jour. Pharm.*, 1891, p. 360).

SAPONARIA.—SOAPWORT.

The root and leaves of *Saponaria officinalis*, Linné.
Nat. Ord.—Caryophyllaceæ.
Common Names: *Soapwort*, *Soaproot*, *Bouncing Bet*, *Fuller's-herb.*

Botanical Source.—This is a stout, perennial herbaceous plant, sometimes known by the name of *Bouncing Bet*, with a stem 1 to 2 feet in height. The leaves are lanceolate, inclining to elliptical, very acute, smooth, 2 or 3 inches long, and about one-third as wide. The flowers are many, large, flesh-colored or pale pink, often double, and borne in paniculate fascicles. Calyx cylindrical and slightly downy. Petals 5, and unguiculate; crowns of the petals linear. Stamens 10; styles 2; capsule oblong and 1-celled (G.—W.).

Fig. 217.

Saponaria officinalis.

Description and Chemical Composition.—Soapwort is found growing in Europe and the United States, by roadsides and in waste places, flowering in July and August. The parts used medicinally are the root and leaves; they are without odor, and of a bitterish, slightly saccharine taste, with a subsequent persistent pungency and a benumbing sensation. With water they become frothy, like soap-suds; water or alcohol extracts their active properties. The active principle of this root was discovered in 1808 by J. C. C. Schrader, who named it *saponin*, and obtained it by extracting the powdered root with boiling alcohol and allowing to crystallize. Closely allied substances have since been found in the roots of *Polygala Senega*, *Gypsophila Arrostii* (not *Struthium;* see Flückiger, *Archiv der Pharm.*, 1890, p. 192), in the barks of *Quillaja Saponaria* and *Chrysophyllum glycyphlœum*, in the seeds of *Agrostemma Githago*, *Sapindus Saponaria*, and in many other plants, *e. g.*, the fruit of horse-chestnut, the root of the common pink, etc. (see complete enumeration by N. Kruskal, *Dissert.* Dorpat, 1891). Christophson (1874) found *Gypsophila* to yield the largest quantity of saponin (13 to 15 per cent). According to C. Schiaparelli (*Amer. Jour. Pharm.*, 1884, p. 273), *saponin* ($C_{32}H_{54}O_{18}$) from *Saponaria officinalis* is a white, amorphous powder which excites sneezing when inhaled through the nostrils; it has a pungent taste and is poisonous. It dissolves freely in water, but is insoluble in ether, benzene, and chloroform, only slightly soluble in alcohol. A diluted aqueous solution forms a persistent froth upon shaking. Saponin is a glucosid, and is hydrolyzed by boiling with diluted acids into sugar and *saponetin*, which is insoluble in water, alcohol and ether. W. Von Schulz (*Jahresb. der Pharm.*, 1896, p. 516) states that the active principle of white soaproot is *sapotoxin* (see *Quillaja*); that of red soaproot is *sapo-rubrin* (3.45 per cent), a glucosid which he finds to be *methyl-sapotoxin*.

Action, Medical Uses, and Dosage.—Soapwort is tonic, diaphoretic, and alterative; and forms a remedy in the treatment of *syphilitic*, *scrofulous* and *cutaneous diseases*, also in *jaundice*, *liver affections*, *rheumatism*, and *gonorrhœa*. It is generally used in decoction; although an extract or the inspissated juice will be found equally efficient. Saponin has been advised as a substitute for the root, but this is not satisfactorily established; it will likewise be found a powerful sternutatory. Dose, from 2 to 6 grains. E. Pelikan believes that saponin is destined to play a different part from that which is now given to it, and that it should be submitted to further investigations. According to his experiments he finds that saponin and identical substances produce a local paralysis followed by rigidity of the muscles and paralysis of the nerves of sensation; and also that between saponin and agents that act upon the pupil, as atropine and physostigmine, there exists considerable analogy (*Gaz. Méd. de Paris*, 1867). Decided emmenagogue properties are attributed to saponaria. Dose of the decoction ℥i to Oj), from 2 to 4 fluid ounces, 3 or 4 times a day; of the extract or inspissated juice, from 10 to 20 grains.

Related Drugs. SOAPBERRIES. A tree of the American tropics, the *Sapindus Saponaria*, Linné, of the natural order *Sapindaceæ*, yields an orange-colored, spherical or ovoid fruit about the size of our common cherry, containing a tough endocarp yielding tartaric and formic acids, and *saponin* (*sapindus-sapotoxin*). The fruit is known as the *soapberry*. The seeds yield a large quantity of fat of the consistence of butter. Other species of Sapindus have similar fruits containing like constituents. Among those employed are the fruits of *S. laurifolius*, Vahl, the pods of *S. emarginatus*, and the fruit-pulp of *S. detergens*, all of India.

LEVANT SOAPROOT. Formerly believed to be the root of *Gypsophila Struthium*, Linné, but now known to be derived from *G. Arrostii*, Gussone, *G. paniculata*, Linné (Flückiger, *Archiv der Pharm.*, 1890, p. 192). Asia Minor, north Africa, and south Europe (Sicily). Pale brown externally, white internally, corrugated longitudinally and transversely, and about 1 foot long and 2 inches in thickness. Its composition is similar to that of saponaria.

Megarrhiza californica, Man-root.—Root yielded J. P. Heamey (*Amer. Jour. Pharm.*, 1876, p. 451) a resinous body *megarrhizitin* and a bitter glucosid *megarrhizin*. Young (*ibid.*, 1883, p. 195) obtained another glucosid resembling *saponin* and possessing mydriatic qualities, which he called *megarrhin*. An alcohol-soluble and an ether-soluble resin were also found by Young. The root is cathartic.

Mackay Bean; the seed of *Entada scandens.*—Queensland. A substance believed to be saponin has been found in these seeds by John Moss. In its habitat the plant is considered very poisonous.

Randia dumetorum.—East Indies. Shrub; a fish poison, and to human beings an emet Fruit contains valerianic acid and saponin. A tincture is employed as an antispasmodic (Sawyer, *London Lancet*, 1891).

SARRACENIA.—PITCHER PLANT.

The root of *Sarracenia purpurea*, Linné.

Nat. Ord.—Sarraceniaceæ.

Common Names: *Pitcher plant, Side-saddle plant* or *flower, Fly trap, Huntsman's cup, Water cup.*

Botanical Source, Description, and History.—This plant is an indigenous perennial, of a very curious character. The leaves, or acidia, are 6 to 9 inches long, radical, short-globose, inflated or cup-form, contracted at the mouth, having a broad, arched, lateral wing from ½ to 1 inch in width, and extended on the outside of the mouth into a broad-cordate, erect lamina, or hood, covered above with reversed hairs. The scape is from 1 to 2 feet in height, terete, smooth, and supporting a single, large, purple, and nodding flower (W.).

Fig. 218.

Sarracenia purpurea.

This plant owes its strange appearance to a curious pitcher-shaped metamorphosis of the leaf, which resembles very much an old-fashioned side-saddle; 6 of these generally belong to each plant. The leaf, which springs from the root, is formed by a large, hollow tube, swelling out in the middle, curved and diminishing downward till it ends in a stem, contracted at the mouth, and furnished with a large, spreading, heart-shaped appendage at the top, which is hairy within, the hairs pointing downward, so as to cause everything which falls upon the leaf to be carried toward the petiole; a broad, wavy wing extends the whole length on the inside; these lie upon the ground with the mouth turned upward, so as to catch the water when it falls. They hold nearly a wineglassful, and are generally filled with water and aquatic insects, which undergo decomposition or a sort of *digestion*, and serve as a nutriment to the plant. The root is in the form of stems or fibers, 5 to 7 or 8 inches in length, of various diameters, not exceeding that of a quill, dented at unequal intervals, having a smooth fracture, and without rootlets or medullary sheath; it is readily reduced to a slightly aromatic powder and a fibrous residue, and communicates its bitter taste to water, alcohol, or ether. Oil is colored light-amber by it. The stem rises direct from the root; it is round, quite smooth, and bears an elegant, deeply reddish-purple terminal flower, having 2 flower-cups; the external consisting of 3 small leaves; the internal of 5, egg-shaped, obtuse leaves, shiny, and of a brownish-purple. The blossoms are 5, guitar-shaped, obtuse, repeatedly curved inward and outward, and finally inflected over the stigma, which is broad and spreading, divided at its margin into 5 bifid lobes, alternating with the petals, and supported on a short cylindrical style; this is surmounted by the stamens, which are numerous, having short threads, and large, 2-celled, oblong, yellow anthers attached to them on the under surface. In the yellow-flowered species of the southern states, the bottle is very long, resembling a trumpet, by which name it is often called.

The whole species are water plants, and are found only in wet meadows, wet, boggy places, marshes, mud lakes, etc., and grow from Labrador to Florida, flowering in June. There are several varieties, as the *S. heterophylla*, found in the swamps at Northampton, Mass., and the *S. rubra*, *S. flava* (trumpet-leaf), *S. variolaris*, *S. drummondii*, and *S. psyttacina*, which are common to the south, and all of which, probably, possess similar medicinal virtues. The attention of the medical world was first called to *Sarracenia purpurea*, by Drs. Herbert Miles and F. W. Morris, both of Halifax, N. S., in 1861 and 1862, both recommending its use in the treatment of smallpox. In this connection, see an interesting monograph on this plant, by Prof. Bentley (*Pharm. Jour. Trans.*, Vol. IV, 1862, pp. 294–302).

Chemical Composition.—The root is the part used; it has a bitter and astringent taste, and yields its properties to water. Björklund and Dragendorff (*Jahresb. der Pharm.*, 1864, p. 89) found the root to contain a volatile base (*sarracine*), a volatile acid (*acrylic acid*), starch (25.5 per cent), sugar, white resin (8.8 per cent), tannic acid, etc. The peculiar leaves of this plant showed about the same constituents as the root, only in different proportions. Hêtet (1879) claims to have observed in the root an alkaloid resembling veratrine, and E. Schmidt found a peculiar acid coloring matter (*sarracenic acid*), soluble in alcohol, little soluble in ether and benzin, and forming a yellow lake with alum (*N. Jahrbuch f. Pharm.*, 1872, p. 98).

Action, Medical Uses, and Dosage.—The therapeutical actions of sarracenia are not fully ascertained. It is supposed to be a stimulating tonic, diuretic, and laxative; in connection with Osmunda regalis and blue cohosh, it will form a valuable syrup for *chlorosis*, *uterine derangements*, *dyspepsia*, and other gastric difficulties. An infusion of the leaf has been found equally available with that of the root. The best mode of employing it is not well determined; though the powder may be given in doses of from 20 to 30 grains, 3 or 4 times a day; and the infusion or syrup, from 1 to 3 fluid ounces. Dr. Porcher, of South Carolina, instituted some experiments upon himself, using the recent root. He found it to possess bitterness and astringency, and to produce diuresis, gastric excitation, moderate catharsis, and, at the same time, to cause an increase and irregularity in the heart's action, and a feeling of congestion about the head. This was the result of 180 grains taken in 2 hours' time.

The root is useful in all cases where there is a sluggish, or torpid condition of the stomach, the intestines, the liver, the kidneys, or the uterus, producing *costiveness*, *dyspepsia*, *sick headache*, *amenorrhœa*, *dysmenorrhœa*, and the various functional derangements which are so commonly to be met with. The plant has been extolled as a prophylactic in *smallpox*, and also to modify it and shorten its duration when present. Although many physicians have made statements to this effect, yet all are not agreed. We do not think the plant possesses any such curative property as has been attributed to it in this disease, and believe those who have written in its favor, have allowed themselves to be mistaken. The plant, however, undoubtedly possesses valuable properties, which render it well worthy attention in this as well as in other diseases (J. King). Dr. Scudder suggests a strong tincture of the fresh root (℥viij to alcohol, 76 per cent, Oj) in doses of 1 to 20 drops.

SARSAPARILLA (U. S. P.)—SARSAPARILLA.

"The root of *Smilax officinalis*, Kunth; *Smilax medica*, Chamisso et Schlechtendal; *Smilax papyracea*, Duhamel; and of other, undetermined, species of *Smilax*"—(*U. S. P.*).

Nat. Ord.—Liliaceæ.

Common Names: (See next page.)

Illustration: (1 and 2) Bentley and Trimen, *Med. Plants*, 289, 290.

Botanical Source and History.—The Sarsaparillas are all climbing plants, having aculeate (prickly) stems; there are many species, but they do not all possess medicinal activity. Most of the drug-yielding species grow in the marshy forests of Mexico and the territory extending to the northern portion of Brazil. The botanical source of the sarsaparillas of commerce is not always exactly known; this, for example, is the case with Honduras sarsaparilla, which seems to be derived from several and partly undetermined species of Smilax, mostly from *Smilax officinalis*. The following species, however, are generally conceded to yield the drug in its various commercial forms.

Smilax officinalis has a twining, angular, prickly, and shrubby stem; the young shoots being unarmed. The leaves are ovate-oblong, acute, cordate, netted, 5 or 7-nerved, coriaceous, smooth, 1 foot long and 4 or 5 inches broad; the young ones are lanceolate, oblong, acuminate, and trinerved. The petioles are 1 inch long, smooth, bearing tendrils above the base. Flowers unknown. This plant grows in New Granada, on the banks of the Magdalena, was collected, in 1805, by Humboldt, and is called *Sarzaparilla* by the natives. Great quantities of it are sent to Carthagena, whence it is shipped to Jamaica, and, together with that coming from Central America (derived from *Smilax ornata*, Lemaire; see *Pharm. Jour. Trans.*, 1889, p. 889), constitutes *Jamaica sarsaparilla*.

Fig. 219.

Honduras sarsaparilla.

Smilax medica has an angular, zigzag, or flexuous stem, armed with straight aculei at the joints, and a few hooked ones in the intervals. The leaves are of the texture of paper, smooth, bright-green on each side, cordate, auriculate, shortly acuminate, and 5-nerved, with the viens of the under side prominent; they are variable in form, being ovate, somewhat panduriform, auriculate, and somewhat hastate, with the lobes of the base obtuse, sometimes obsolete, sometimes divaricating; their edges not straight, but as if irregularly crenate; the petioles and midrib are armed, when old, with straight, subulate prickles. The peduncles vary in length from 3 lines to 1 inch or more. The umbel is about 12-flowered, with the pedicels about 3 lines long. Schiede (1829) found this plant on the east slope of the Mexican Andes, where the root is gathered and then carried to Vera Cruz; it is supposed to furnish the *Vera Cruz* or *Mexican sarsaparilla* of commerce (L.).

Fig. 220.

Mexican sarsaparilla.

Smilax papyracea has a 4-cornered, or plane-angular, polished, prickly stem; leaves somewhat membranous, oval-oblong, obtuse at both ends, or usually pointletted at the apex, quite entire, unarmed, and 5-ribbed, with 3 more prominent ribs. Cirrhi are inserted beneath the middle of the petiole. This plant grows in the province of Rio Negro and neighboring places, and yields the *Brazilian* or *Para sarsaparilla*.

Smilax syphilitica, Kunth, has a round, smooth stem, furnished only at the knots with 2 to 4 short, thick, straight prickles. The leaves are a foot long, oblong-lanceolate, acuminate, shining, coriaceous, 3-nerved, and terminated by a long point (L.). Humboldt and Bonpland discovered this plant on the rivers Cassiquiare and Rio Negro.

Description.—The Mexican and South American sarsaparillas have numerous long, delicate roots proceeding from one caudex or rhizome; they are usually taken from the ground with the caudex attached, and are frequently packed in a peculiar manner for exportation (see commercial grades, next page). Those roots which have a deep orange-red tint are preferred, but more especially those whose taste is acrid. The stronger this is, the better is the quality of the root. Water, either cold or hot, and also diluted alcohol, extracts its medicinal virtues, which, however, are materially injured by too great or long-continued heat. Sarsaparilla should never be purchased unless, after having chewed it for a few minutes, it leaves a distinct, persistent pungency or acrimony in the mouth and fauces; without this effect it can not be relied upon as an efficient article.

The official sarsaparilla is thus described: "About 4 or 5 Mm. $\frac{1}{6}$ to $\frac{1}{5}$ inch thick, very long, cylindrical, longitudinally wrinkled, externally grayish-brown, or orange-brown; internally showing a whitish and mealy, or somewhat horny, cortical layer, surrounding a circular wood-zone, the latter enclosing a broad pith; nearly inodorous; taste mucilaginous, bitterish, and acrid. The thick, woody, knotty rhizome, if present, should be removed"—(*U. S. P.*). Commercially, the sarsaparillas are best distinguished as *mealy* and *non-mealy;* the latter are preferred for medicinal purposes.

Mealy Sarsaparillas.—Honduras Sarsaparilla is a kind much esteemed, and more commonly employed in this country. It is imported from Belize, and other parts of the Bay of Honduras, in parcels 2 or more feet in length; the roots are folded into a kind of hank, and held neatly and closely together by tying some of the roots transversely around those forming the parcel. These parcels, weighing from 2 to 20 pounds, are formed into large packages, weighing from 80 to 120 pounds, which are partially enveloped in hide or skin. The roots have a few rootlets attached, are bearded, of a grayish or reddish-brown color, approaching orange, and have a very mealy cortex.

Guatemala Sarsaparilla closely resembles the Honduras drug, being packed in a similar manner. Its orange color is, however, more decided, and its bark has a tendency to split and crack off, exposing the central ligneous column. It appeared in commerce about 1852—(*Pharmacographia*).

Brazilian Sarsaparilla (*Para*, *Lisbon* or *Rio Negro sarsaparilla*).—This variety is now less esteemed than formerly. "It is packed in a very distinctive manner, the roots being tightly compressed into a cylindrical bundle, 3 feet or more in length, and about 6 inches in diameter, firmly held together by the pliable stem of a bignoniaceous plant, closely wound round them, the ends being neatly shaved off"—(*Pharmacographia*). Its place of export is Para.

Caracas Sarsaparilla is also a mealy variety, resembling the preceding kind.

Non-Mealy Sarsaparillas.—Jamaica Sarsaparilla (*Bearded sarsaparilla*, *Red sarsaparilla*). "This drug consists of roots, 6 feet or more in length, bent repeatedly so as to form bundles of 18 inches long and 4 in diameter, which are secured by being twined round (but less trimly and closely than the Honduras sort) with a long root of the same drug. The rhizome is entirely absent, but the fibre or beard is preserved, and is reckoned a valuable portion of the drug. The roots are deeply furrowed, shrunken, and generally more slender than in the Honduras kind; the bark, when shaved off with a penknife, is seen to be brown, hard, and non-mealy throughout. Yet it is by no means uncommon to find roots which have a smooth bark rich in starch. In color, Jamaica sarsaparilla varies from a pale earthy-brown to a deeper ferruginous hue, the latter tint being the most esteemed"—(*Pharmacographia*). This drug (*Sarsæ radix*) is the official one of the *British Pharmacopœia*, and grows in the Isthmus of Panama, upon the mountains known as the Cordillera of Chiriqui, bordering on Costa Rica. Being exported through Jamaica, it has received the name of that place. Botanically, it is derived from *Smilax ornata*, Hooker filius.

Mexican Sarsaparilla (*Vera Cruz* or *Tampico sarsaparilla*).—Roots thin and shriveled, very fragile, pale dull-brown in color. Contains very little starch, but possesses considerable acridity. The plant grows in Papantla, Tuxpan, Nantla, etc., and is usually shipped at Vera Cruz and Tampico, being put up in large bales weighing from 150 to 200 pounds. The roots are not tied around the rhizome transversely, but merely envelop it longitudinally. The inside often contains earth and stone.

Guayaquil Sarsaparilla, from Ecuador via Guayaquil, is crudely packed in large bales, and is not generally made into separate hanks. "The rhizome (chump) and a portion of the stem are often present, the latter being round and not prickly. The root is dark, large, and coarse-looking, with a good deal of fibre. The bark is furrowed, rather thick, and not mealy in the slender portions of the root, which is near the rootstock, but as the root becomes stout, so its bark becomes smoother, thicker, and amylaceous, exhibiting, when cut, a fawn-colored or pale-yellow interior"—(*Pharmacographia*).

Chemical Composition.—Besides volatile oil (Pareira, *Mat. Med.*), resin, starch, coloring matter, calcium oxalate, etc., sarsaparilla root contains several glucosids, to which its peculiar properties are due. According to Kobert (1892), these glucosids are: (1) *Parillin* of Palotta (1824), first obtained pure by Flückiger, previously also called *smilacin* (not Merck's), *salseparin*, and *parillic acid;* it is crystalline, nearly insoluble in cold water, soluble in 20 parts of boiling water, forming a bitter solution, which froths upon shaking; it is the least active of the glucosids. Flückiger (see Husemann and Hilger. *Pflanzenstoffe*, p. 408) obtained about 0.19 per cent. Boiling with diluted sulphuric acid produces sugar and *parigenin*, insoluble in water. (2) *Saponin* (*sarsaparill-saponin; smilacin* of Merck) is amorphous, more active than the preceding, soluble in water and alcohol. (3) *Sarsasaponin*, crystallizing in needles, readily soluble in water; the most poisonous of the three.

Action, Medical Uses, and Dosage.—Sarsaparilla is generally considered as an alterative, though stated by some to possess diuretic, diaphoretic, and emetic properties. Its mode of action, however, is not well understood, as it effects normal changes in the system without any appreciable change in the operation of the various organs. No medicine has, probably, ever passed through so many changes of popularity, having been at various times most highly lauded as an efficient alterative, and as often been pronounced inert. There is no doubt, however, that, when properly prepared, it exerts a favorable influence over the system. The diseases in which it has been more particularly recommended, are inveterate *syphilis, pseudo-syphilis, mercurio-syphilis*, and *struma* in all its forms. It has been used in several chronic diseases, as of the skin, as *herpes* (best associated with sodium sulphite), *rheumatic affections* (with potassium iodide), *passive general dropsy, gonorrhœal rheumatism*, and other depraved conditions of the system where an alterative is required. The decoction, made acid with nitric acid, is serviceable in *syphilitic sore throats*, and, acidulated with hydrochloric acid, is of some value in *chronic hepatic disorders*, with torpor. A drink is made in Angostura, which enjoys much reputation there as an alterative beverage. It is made of Rio Negro sarsaparilla, 1 pound; rasped guaiac wood, 6 ounces; aniseed and bruised liquorice root, of each, 2 ounces; mezereon root-bark, 1 ounce; molasses, 1 pound; and ½ dozen bruised cloves; pour upon these articles 2 gallons of boiling water, and shake the vessel 3 times a day. As soon as fermentation begins, it may be taken in doses of 4 fluid ounces, 2 or 3 times a day (C.—*Trans. Med. Bot. Soc.*, 1829). At the present day, sarsaparilla is but little used as above. Probably much of good that has been accomplished with sarsaparilla mixtures has been chiefly due to the active ingredients that have been so frequently associated with it. Dose of sarsaparilla, in powder, 30 grains, 3 or 4 times a day; of the infusion or syrup, 4 fluid ounces. Some believe sarsaparilla to contain an active cardiac-sedative principle.

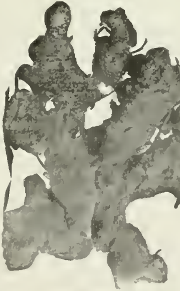
Related Species.—*Smilax sarsaparilla*, Linné, is "of doubtful origin, and so far as growing in the United States, it is not now recognized" (Walter H. Evans, *Lilly's Bulletin*, No. 16, Aug., 1891).

Smilax Tamnoides, Linné.—Indigenous. Tubers used like sarsaparilla.

BAMBOO BRIER, *Virginia sarsaparilla*.—Of this species Prof. King (*American Dispensatory*, 11th ed.) says: "There is a plant in the south extensively known as *Bamboo brier*, the root of which I have much used in practice, and with decidedly more successful results than from the use of any of the sarsaparillas of the shops, and I invite the attention of physicians to it, as a remedy in every respect superior to the usual commercial article, especially in primary and secondary *syphilitic diseases*."

This plant is derived from *Smilax lanceolata*, Linné, and, according to W. H. Evans (*loc. cit.*) has been confused with *Smilax Pseudo-China*, Linné. The stem is tall, often 30 to 40 feet, mostly unarmed; the branches are round, unarmed; leaves evergreen, paler beneath, rather thin, lanceolate to ovate-lanceolate, acute at each end, 3 to 5-ribbed, margin smooth, petiole short, most often without tendrils; the peduncles are short; flowers in May; the berries are 3-seeded, black when ripe; mature from August to September. This species grows in rich woods and swamps, where the entire rhizome frequently weighs 200 to 300 pounds when fresh. It grows from Virginia to Florida, and west to Arkansas and Texas (*Lilly's Bulletin*, No. 16, Aug., 1891). It was employed by the Indians as an antisyphilitic, and by the whites as a "blood purifier." *Rheumatism, scrofula*, and *cutaneous affections* are said to be cured by it. A decoction may be freely used. (See illustration, next page

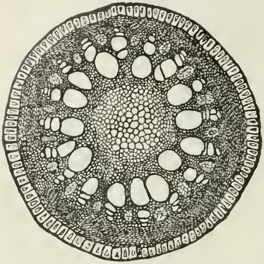
Fig. 221.



saparilla root

Smilax China, Linné, has a hard, large, knotty, uneven rhizome, brown or blackish externally, whitish within. Stem tapering, slightly prickly, growing 2 or 3 feet high without support, but acquiring a greater length if scrambling among bushes. Leaves thin, membranous, roundish, 5-nerved, acute or obtuse at each end, mucronate at the point; stipules distinct, obtuse. Umbels small, 10-flowered, greenish-yellow. Fruit red, about the size of a bird cherry (L.). This plant grows in eastern Asia (China and Japan), and furnishes the *China root* (*Rhizoma* [*radix*] *Chinæ*) of commerce. It has been used as a substitute for sarsaparilla, but is found not to be as active. It occurs in large, ligneous, knotty pieces, from 2 to 6 or more inches in length, and 1 to 2 inches in diameter; externally, it is grayish-brown; internally, a light-flesh, or yellowish-white color. It is inodorous, and has a slightly astringent taste (P.).

Fig. 222.



Bamboo brier root.

Smilax Aspera, Linné.—South Europe. Employed like sarsaparilla.

Smilax Pseudo-China, Linné, *False China root*, *China brier*, *American China root*, *China root of Mexico*.—Grows in New Jersey and west to southern Indiana and Missouri, south to Florida and the West Indies. The root is also used in Mexico, and regarded as diaphoretic and antisyphilitic. It is official in the *Mexican Pharmacopœia*, under the name Raiz de China de Mexico (*Smilax Pseudo-China*, Schlechtendal).

A False Jamaica Sarsaparilla, a species of *Philodendron*, is described by C. Hartwich (*Archiv der Pharm.*, 1894; also see *Pharm. Jour. Trans.*, Vol. VII, 1898, p. 583).

Carex Arenaria, Linné, *German sarsaparilla*, *Sand sedge*.—Europe. The long, creeping rhizome of this plant was at one time used like sarsaparilla for its effects in *syphilis*, *rheumatism*, *gout*, *lung* and *skin diseases*, its effects being exerted chiefly through the skin and kidneys. The decoction was employed.

Carex hirta and *Carex intermedia* were put to similar uses.

Arenaria rubra is a popular diuretic, in use among the Algerians, in *dropsy* and *affections of the urinary organs*.

Carnauba Root.—The long root of a wax-palm (*Corypha cerifera*) of Brazil. It resembles sarsaparilla in action, and contains an alkaloid, essential oil (both in small amounts), tannic acid, an acrid resin, and red coloring principle (Cleaver).

SASSAFRAS (U. S. P.)—SASSAFRAS.

The bark of the root and the pith of *Sassafras variifolium* (Salisbury), O. Kuntze (*Sassafras officinale*, Nees; *Laurus Sassafras*, Linné; *Laurus variifolium*, Salisbury).

Nat. Ord.—Laurineæ.

Illustration: Bentley and Trimen, *Med. Plants*, 220.

Botanical Source.—This is a small, indigenous tree, varying in height from 10 to 40 feet, with a trunk about 12 inches in diameter. The bark is rough and grayish; that of the twigs smooth and green. The leaves are alternate, petiolate, membranous, bright green, smooth above, finely downy beneath, very variable in form, some being obovate, others deeply 3-lobed, some lobed only on one side, all, however, tapering in a wedge-like manner into the petiole. The flowers which appear before the leaves, are small, greenish-yellow, in terminal and axillary, corymbose racemes, with linear bracts. Calyx 6-parted, membranous, and permanent at base. The male flowers have 9 stamens; the females 6; style simple. The fruit is an oval, succulent drupe, rather larger than a pea, bright-blue in color and borne upon red, clavate peduncles (L.).

Fig. 223.

Sassafras variifolium.

History and Description.—Sassafras is a well known tree common to the woods of North America, from Canada to Florida, and flowering in the latter part of April or early in May. The odor of the flowers is slightly fragrant, and they, together with the leaves and young branches, are used in decoction, in many parts of the country as a spring medicine to cleanse the blood. Sassafras was one of the chief remedies used by the American Indians, and the wood became known in Europe under the name *Lignum pavanum*, or *Lignum Floridum*, about the year 1582. (For a detailed account of the history of sassafras, see Dr. Frederick Hoffmann, in *Die Ætherischen Oele*, p. 514; J. U. Lloyd, *Amer. Druggist*, 1898, pp. 258 and 295; and Wm. Procter, Jr., *Amer. Jour. Pharm.*, 1866, pp. 481–492.) The root, bark, and the pith are the medicinal parts now in use, but the bark of the root is generally employed in this country; it is by far the most active part of the whole tree. Its virtues are due to a yellow essential oil, which may be obtained by distilling the wood with water (see *Oleum Sassafras*). Hot water, in infusion, or alcohol, takes up the active principles of the bark, but boiling dissipates them. The whole root of sassafras is official in the *British Pharmacopœia*, but only the root-bark and pith are official in this country.

I. SASSAFRAS (*U. S. P.*), *Sassafras*.—"The bark of the root of *Sassafras variifolium* (Salisbury), O. Kuntze (*Nat. Ord.*—Laurineæ)"—(*U. S. P.*). "In irregular fragments, deprived of the gray, corky layer; bright rust-brown, soft, fragile, with a short, corky fracture; the inner surface smooth; strongly fragrant; taste sweetish, aromatic, and somewhat astringent"—(*U. S. P.*). (See microscopical structure of the root-bark, described by Prof. E. S. Bastin, in *Amer. Jour. Pharm.*, 1895, p. 312; also see microscopical distinctions between root and stem bark in powdered form, by Katharine C. Burnett, *Pharm. Era*, Vol. XVII, 1897, p. 413.)

II. SASSAFRAS MEDULLA (*U. S. P.*), *Sassafras pith*.—"The pith of *Sassafras variifolium* (Salisbury), O. Kuntze (*Nat. Ord.*—Laurineæ)"—(*U. S. P.*). "In slender, cylindrical pieces, often curved or coiled, light, spongy, white, inodorous, and insipid. Macerated in water it forms a mucilaginous liquid, which is not precipitated on the addition of alcohol"—(*U. S. P.*). It is stated that pith collected before the 15th of October assumes a brown hue, probably on account of the presence of plant juices which would have disappeared after that date (*Amer. Jour. Pharm.*, 1856, p. 412).

Chemical Composition.—Dr. Reinsch (1845) obtained from the bark of the root essential oil, fatty matter, balsamic resin, wax, tannic acid, starch, and *sassafrid*, a principle, probably an oxidation product of tannic acid (*Amer. Jour. Pharm.*, Vol. XVIII, p. 159). (For the chemistry of the essential oil see *Oleum Sassafras;* also see Dr. Clemens Kleber, *Amer. Druggist*, Vol. XXXIII, 1898, p. 294.)

Action, Medical Uses, and Dosage.—Sassafras is a warm, aromatic stimulant, alterative, diaphoretic, and diuretic. It is generally used in combination with other alteratives, particularly podophyllum, whose flavor it improves, in *syphilitic affections*, *chronic rheumatism*, *scrofula*, and many *cutaneous eruptions*. Stubborn cases require also the aid of vapor, spirit or sulphur baths. The mucilage of the pith (2 drachms to 1 pint of water) is used as a local application in *acute ophthalmia*, and is a demulcent drink in *disorders of the chest*, *bowels*, *kidneys*, and *bladder*. The oil, in doses of from 5 to 10 drops on sugar, is used to afford relief in the distressing *pain attending menstrual obstructions*, and that following *parturition;* also used in *diseases of the kidneys and bladder*. I have also derived some benefit from its internal use in *gonorrhœa* and *obstinate gleet;* 5 to 10 drops on sugar, 3 times a day (J. King). Externally, as a rubefacient, in *painful swellings*, *sprains*, *bruises*, *rheumatism*, etc., and is said to check the progress of *gangrene*. An infusion of the bark (℥j to hot water Oj) administered internally and applied externally is reputed an excellent treatment for *rhus poisoning*.

Related Species.—*Umbellularia californica*, Nuttall. This is a large evergreen tree, which is found growing in the mountainous regions of California. It is known by various common names, of which the following have been recorded: *Mountain laurel*, *California laurel*, *California spice-tree*, *Sassafras laurel*, *Cajuput tree*, and *California olive*. There has been some considerable difficulty in determining its precise botanical position, and it has been variously described as *Umbellularia californica*, *Oreodaphne californica*, *Drimophyllum pauciflorum*, *Tetranthera californica*, and *Laurus regia*. The flowers appear in April, in lateral clusters, and are of a greenish-yellow color. The leaves are alternate, lanceolate, entire, and of a firm texture. They are borne on short leaf-stalks, and end in slender, acuminate points. The fresh or dry leaves are odorless, unless broken or bruised, when they exhale a pungent, aromatic odor, somewhat resembling cajuput oil. They are sharp and biting to the taste, and we find that both the odor and taste depend upon the presence of a volatile oil, which we obtained, in the proportion of 6 fluid drachms to 1 pound of green leaves, by distillation with water. This oil is the characteristic principle, and was previously examined by Mr. John P. Heaney, of California (*Amer. Jour. Pharm.*, 1875, p. 105; and *Med. and Surg. Jour.*, 1875), who obtained 4 per cent from the leaves. He states that the exhalation from the fresh leaves occasions headache; and this statement is supported by a communication received by us from Dr. L. Mann, although we perceived no ill effects when distilling the oil. The oil has a sharp, biting taste, an odor resembling cajuput and nutmegs, and is of a greenish-straw color. The oil is composed of a hydrocarbon, boiling at 175° C. (347° F.), and *oreodaphnol*, boiling at 210° C. (410° F.), and containing oxygen (Heamy, *loc. cit.*). The latter is probably allied to the *umbellol* of Stillman (*Amer. Jour. Pharm.*, 1880, p. 313). The seeds contain a crystalline fatty acid termed *umbellulic acid* ($C_{11}H_{22}O_2$) by Stillman and O'Neill, 1882.

Dr. L. Mann sent a specimen of this plant to Mr. Curtis G. Lloyd, who forwarded to him its botanical name, with description. Dr. Mann states that it is a valuable remedy in *nervous headache*, *cerebro-spinal meningitis*, *bilious colic*, and *atonic diarrhœa*. According to his experience, it certainly demands a careful investigation. Dose of the fluid extract of the leaf is from 5 minims to ½ fluid drachm, repeated 3 or 4 times a day, or as may be required.

SATUREJA.—SUMMER SAVORY.

The leaves of *Satureja hortensis*, Linné.

Nat. Ord.—Labiatæ.

Botanical Source.—Summer savory is an annual plant, with a branching and bushy stem, about 18 inches in height, woody at the base, and frequently changing to purple. The leaves are numerous, small, linear-oblong, entire, and acute at the end. The flowers are pink-colored, and borne on axillary, cymose peduncles. Calyx tubular, ribbed, and about as long as the corolla. Corolla bilabiate, with nearly equal divisions; the stamens are diverging and scarcely exserted (W.).

History and Chemical Composition.—This well-known plant is a native of the south of Europe, and is extensively cultivated in the gardens of this country and Europe for culinary purposes, flowering in July and August. The leaves are the parts employed. They have an aromatic odor and taste, analogous to those of thyme, and impart their properties to boiling water by infusion, but more freely to alcohol. Its virtues depend upon a volatile oil, which was found by Jahns (1882) to contain *carvacrol* (30 per cent) and the hydrocarbon, *cymol* (20 per cent), and an undetermined *terpene* (50 per cent).

Action, Medical Uses, and Dosage.—Summer savory is a stimulant, carminative, and emmenagogue. A warm infusion is beneficial in *colds*, *menstrual suppression*, and *flatulent colic;* the cold infusion is a gentle stimulating tonic during convalescence from *fevers*. The infusion may be used in doses of from 2 to 4 ounces, several times a day. The oil is sometimes used as a local application to carious teeth, for relieving *toothache;* and its tincture is a valuable carminative.

Related Species.—*Satureja montana*, Linné (*Micromeria montana*, Reichenbach). The *Winter savory*, with mucronate leaves, somewhat 1-sided peduncles, and acuminate and mucronate segments of the calyx, possesses similar properties. Haller examined this plant, in 1882, and obtained an orange-yellow essential oil, having an origanum-like odor. It contained *carvacrol* (about 35 to 40 per cent) traces of another phenol, and two hydrocarbons, probably terpenes.

Micromeria Douglassii, Bentham.—The *Yerba buena* of California, is a labiate plant of the tribe Satureineæ, closely allied to the common garden thyme (*Thymus vulgaris*). It is a native of California, and has a slender, creeping, perennial stem. The leaves are opposite, nearly round, and are borne on slender stalks. The flowers are small, purple, and in axillary clusters of from 1 to 3. This plant, it is stated, is not only a febrifuge, but possesses emmenagogue and anthelmintic properties. It is very probable that its virtues are simply those of a stimulating aromatic and tonic, and that its effects are due to these qualities. It may be employed in decoction, or in doses of from 15 to 90 minims of the fluid extract.

SCAMMONIUM (U. S. P.)—SCAMMONY.

"A resinous exudation from the living root of *Convolvulus Scammonia*, Linné"—(*U. S. P.*).

Nat. Ord.—Convolvulaceæ.

Illustration: Bentley and Trimen, *Med. Plants*, 187.

Botanical Source.—This plant has a perennial, fleshy, fusiform root, from 3 to 5 feet long, and from 3 to 5 inches in diameter, branched toward the lower end, with a grayish bark, and abounding in an acrid, milky juice. The stems are annual, numerous, slender, round, smooth, branching, twining, very slightly angular near the ends, and growing from 12 to 20 feet upon the soil, or on adjacent plants. The leaves are on long petioles, alternate, sagittate, oblong, acute, entire, quite smooth, truncate and angular at the base, with acute, spreading lobes, and of a bright-green color. The flowers are borne on axillary, solitary, 3-flowered peduncles, scarcely twice as long as the leaves. Sepals 5, rather lax, smooth, ovate, repand, obtuse, with a reflexed point, and covered at the edge. Corolla funnel-shaped, very much expanded, pale sulphur-yellow, thrice as long as the calyx, an inch or more in length; limb entire, and somewhat reflexed. Stamens 5, erect, converging, thrice as short as the corolla. Ovary 2-celled, 4-seeded, supporting a slender style as long as the stamens, with 2 linear-cylindrical, erect, oblong, parallel, distant, and white stigmas. Capsule 2-celled; seeds small and pyramid-shaped (L.).

History.—Scammony plant is a native of Turkey, Syria, Greece, Persia, etc., and somewhat resembles the Convolvulus panduratus. The official portion is the concrete juice of the root, the other parts of the plant yielding no milky juice whatever. It is collected in the month of June, the root being cut across, obliquely, near its crown, and shells fixed beneath, into which the milky juice gradually flows. This soon concretes under exposure to the air and evaporation, forming the gum-resin of commerce (scammony), of which but a few drachms are obtained from a single root. Evaporation being necessarily slow, partial fermentation sets in, producing porosity and a somewhat cheesy odor. It is seldom obtained in a pure state, being more or less adulterated with flour, ashes, meal, chalk, sand, tragacanth, colophony (resin), etc. It is imported directly from Smyrna, or from some of the Mediterranean ports. There were several varieties of scammony formerly known as the *Aleppo*, *Smyrna*, and *Montpellier*, of which the first-named was the best (*Virgin scammony*), but, owing to extensive adulteration of the drug, it is now more feasible to distinguish between *genuine* and *factitious scammony*, based on its resin contents. (For an interesting account of the production of scammony, near Smyrna, by Sidney H. Maltass, see *Amer. Jour. Pharm.*, 1854, pp. 139–146; also see D. Hanbury, on several commercial specimens of scammony, *ibid.*, 1854, p. 146; and Jos. Carson, *ibid.*, 1848, pp. 1–15.)

Description and Tests.—As required by the *U. S. P.*, scammonium is "in irregular, angular pieces or circular cakes, greenish-gray or blackish, internally porous, and breaking with an angular fracture, of a resinous lustre; odor peculiar, somewhat cheese-like; taste slightly acrid; powder gray or greenish-gray. When triturated with water, scammony yields a greenish emulsion; it does not effervesce on the addition of diluted hydrochloric acid, and the decoction, when cold, does not assume a blue color on the addition of iodine T.S. (absence of starch). Ether dissolves at least 75 per cent of it; and, when the ether has been evaporated, the residue, dissolved in hot solution of potassium hydrate, is not reprecipitated by diluted sulphuric acid"—(*U. S. P.*). The latter test excludes rosin, which, when mixed with scammony, is precipitated upon the addition of acid. This precipitate also turns dark-red immediately with concentrated sulphuric acid. Scammony resin is but slowly changed by this reagent to a light wine-colored red. Colophony, if present, may also be separated by means of oil of turpentine, in which scammony resin is nearly insoluble. Scammony, treated with ether, may yield to this solvent as much as 90 and 95 per cent of resin; gum and mineral and the other afore-mentioned insoluble adulterants remain undissolved. The resinous part of scammony is also soluble in alcohol (see *Resina Scammonii*).

The *British Pharmacopœia* (1898) directs for scammony that which is known in commerce as Virgin scammony. It is very brittle, easily reduced to powder, should afford only the slightest reactions with the tests for starch (allowing for scammony starch; see T. Greenish, *Amer. Jour. Pharm.*, 1875, p. 29), and should not yield more than 3 per cent of ash on incineration. "An alcoholic solution should not afford a blue color with test-solution of ferric chloride (absence of guaiacum resin)"—(*Br. Pharm.*). The whitish powder occasionally found on scammony is calcium carbonate, and effervesces with diluted hydrochloric acid. At Montpellier, in southern France, a factitious scammony (*Montpellier scammony*) has been manufactured, being prepared by evaporating the expressed juice of *Cynanchum monspeliacum*, Linné, a plant belonging to the natural order Asclepiadaceæ. According to Jessler (1865), the air-dried root of this plant contains 3.24 per cent of resin.

Chemical Composition.—Mr. Charles A. T. Doench (*Amer. Jour. Pharm*, 1882. p. 545) obtained from the root a yield of 5.4 per cent of scammony resin (also see his analysis of commercial specimens). Commercial scammony resin, as stated before, contains from 75 to 90 per cent and more of resin, soluble in ether and alcohol, very little soluble in water, and small quantities of gum, albuminous bodies, wax, extractive matters, traces of starch, etc. The active principle of scammony resin is the glucosid *scammonin* (Spirgatis), which is identical with *jalapin* of W. Mayer (*orizabin* of Maisch, 1887; and Th. Poleck, *Zeitschr. d. allgem. Oesterr. Apotheker Vereins*, 1892, p. 451). *Scammonin* is the anhydride of water-soluble *scammonic acid* (*jalapic acid*), and, by treatment with diluted acids, is decomposed into sugar and *scammonolic acid* (*jalapinolic acid* of Poleck). (For further details regarding these bodies, see *Orizaba root.*)

Action, Medical Uses, and Dosage.—Scammony is a powerful drastic cathartic, operating with harshness and griping. It was a favorite internal and external remedy with the Arabians. It does not appear to be poisonous even in large doses, but is seldom used alone, except in cases where a powerful impression on the bowels is desired; most commonly it is combined with other cathartics, whose action it augments, while its own virulence is diminished. Scammony is usually given in the form of an emulsion with sugar or sweet almonds. But when triturated with milk it is considered a superior preparation, as follows: Seven grains of pure scammony to be gradually triturated with 3 ounces of unskimmed milk, to which a few grains of ginger may be added, forms a safe purgative. Another form of using this gum-resin is that of biscuit. A paste is made of scammony, 1 drachm; Venice soap, 5 grains; sugar, 9 grains; biscuit, in powder, 1 ounce; and a few drops of water. Mix together, divide into 2 biscuits, and let them dry; 1 biscuit acts energetically. The dose of powdered scammony is from 3 to 12 grains; of the pure resin, half this quantity. Its use is always contraindicated by intestinal inflammation.

SCILLA (U. S. P.)—SQUILL.

"The bulb of *Urginea maritima* (Linné), Baker" (*Scilla maritima*, Linné, *Urginea Scilla*, Steinheil), "deprived of its dry, membranaceous outer scales, and cut into thin slices, the central portions being rejected"—(*U. S. P.*).

Nat. Ord.—Liliaceæ.

COMMON NAME: *Squills.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 281.

Botanical Source.—Squill is a perennial plant with a roundish-ovate bulb, very large, half above ground, with the integuments either pale-green or red, and giving off fibrous roots. The leaves proceed from the bulb, are broad-lanceolate, channeled, spreading, recurved, shining, deep-green, and make their appearance long after the flowers. The scape is 2 or 3 feet high, and terminated by a rather dense, long, ovate raceme. The flowers are about $\frac{3}{4}$ inch in diameter, spreading, pale, yellowish-green, with a green stain on the middle of each segment. Peduncles purplish; bracts linear, twisted, and deciduous. Filaments shorter than the segments of the perianth (L.—Wi.).

History and Description.—Squill is a native of almost every part of the Mediterranean coast, and is also met with in Portugal and France. It flowers in August and September. The only part used is the bulb. When recent it is pyriform, from 3 to 6 inches in its largest diameter, and consists of concentric scales, the outer ones of which are thin and membranous, while the inner ones are whitish, thick, fleshy, and full of juice; they weigh on an average from 1 to 4 pounds, though they have attained a weight of 10½ pounds. Two kinds of squill, both abounding in an acrid juice, and having a bitter taste, are met with in commerce, the *white* and the *red*, so called from the color of their scales. The white is preferred. The juice of the fresh bulb is very acrid and vesicating, but is rendered much milder by desiccation. According to Prof. Schroff (1865), scilla irritates the skin when rubbed into it, and this is due mainly to a mechanical effect, viz.: to the presence of hard crystals of oxalate of calcium, sharp pointed at each end. The crystals sometimes attain a length of 1 millimeter. When intended for medicinal use, squill bulbs ought not to be kept entire, but should be stripped of their outer scales, cut transversely into thin slices, and dried carefully at a temperature of about 37.7° C. (100° F.). When recent, these slices have a mucilaginous, disagreeably bitter, and somewhat acrid taste, with a feeble radish-like odor. As ordinarily met with, dried squill is in scales or slices of various sizes. They attract moisture from the air, and then become pliable and spoiled, on which account they, as well as their powder, should always be kept in well-closed vessels. The official drug is "in narrow segments, about 5 Cc. (2 inches) long, slightly translucent, yellowish-white or reddish, brittle and pulverizable when dry, tough and flexible after exposure to damp air; inodorous; taste mucilaginous, bitter, and acrid"—(*U. S. P.*). Squill yields its properties to water, spirit, or diluted acids; but the best solvents are proof-spirit or vinegar. Squill kills rats almost instantly; 2 drachms of powdered squill may be made into balls with ½ pound of strong-smelling cheese (or with fried lard), and spread where they visit.

Chemical Composition.—Squill contains mucilage, calcium oxalate (see above), dextrose, starch, albuminous bodies, volatile oil, mineral salts (leaving about 3 to 4 per cent of ash), a peculiar coloring matter in the red variety, producing dark-green with ferric chloride and an evanescent blue (Hartwich) with caustic alkali. The peculiar active principles of squill have been investigated by many chemists. E. Merck (1879), by an unpublished process, obtained amorphous, bitter *scillipicrin* soluble in water; amorphous, brown *scillitoxin* insoluble in water and ether, soluble in alcohol, a cardiac poison; and crystalline yellow *scillin*, not easily soluble in water, producing numbness, vomiting, etc. The bitter principle, *scillain*, was also isolated, in 1879, by E. Von Jarmerstedt, and more recently (1894) by Franz Kurtz. The latter obtained it by digesting the aqueous solution of an alcoholic extract of squill with lead oxide, removing lead from the solution by hydrogen sulphide, abstracting the bitter principle by animal charcoal and removing it from the charcoal with alcohol. *Scillain* so obtained is amorphous, readily soluble in water and alcohol, soluble with difficulty in ether; intensely bitter, neutral, and non-alkaloidal, containing no nitrogen. It is a glucosid, yielding upon hydrolysis *dextrose*, *butyric acid* and *iso-propyl-alcohol*. A glutinous carbohydrate ($C_6H_{10}O_5$) resembling dextrin, exists in squill in large quantity, and was called *sinistrin* by Schmiedeberg (1879), and *scillin* by Riche and Rémont (1880). It differs from dextrin in being lævo-rotatory, and upon hydrolysis yielding chiefly lævulose and other sugars. (For an excellent summary of the chemistry of squill, see F. X. Moerk, *Amer. Jour. Pharm.*, 1894, pp. 245–250.)

Action, Medical Uses, and Dosage.—Squill is irritant, emetic, cathartic, diuretic, and expectorant. In large doses it is a dangerous irritant poison, producing inflammation of the alimentary canal, and urinary organs, and proving fatal in the dose of only 24 grains of the powder. Some constitutions are so susceptible of its irritant action, that it can not be safely used in any dose, unless combined with opium. The usual effects of very large doses are violent vomiting and purging attended with severe abdominal pain. The urine may be bloody and is passed with difficulty; the skin becomes cold, and coma and convulsions supervene. The juice of fresh squill acts as a rubefacient, and if the skin be broken its diuretic effects may be exhibited. It is seldom used as an emetic or cathartic, on account of its uncertainty in producing these effects. In small doses it causes nausea and depression of the pulse, and never stimulates the circulation. It stimulates all of the secretory organs. Small doses of it relieve irritation of the mucous surfaces and check excessive secretions. Its expectorant action is greatly increased by the addition of opium, and its diuretic by the conjunction of digitalis, or some other vegetable or saline diuretic, as potassium acetate. It is used extensively in *dropsy* not due to organic changes. It acts better in general and passive than in local dropsies, and also in those of an asthenic character. *Dropsies of cardiac origin* are probably more often relieved by it. It may be used in all cases where no inflammation is present, and there is over-action of the kidneys. According to dose it may be made to restrain or to increase the amount of urine secreted. To check the renal flow, as in *diabetes*, the minute dose should be employed. While in the majority of cases the drug has been employed with digitalis in the cases showing enfeebled circulation, yet in small doses (1 to 10 drops of a strong tincture, bulb, ℥viii to alcohol, 76 per cent, Oj) it acts favorably where there is a "dry, harsh skin, parched tongue, fevered lips, and contraction of features" (Scudder). Squill long continued gives rise to gastric irritation and loss of appetite, and when these effects are the result of its internal use the tincture may be rubbed into the skin or applied to the abdomen by means of compresses saturated with it. In cardiac dropsy, when the heart's action is feeble and the pulse is weak and rapid, 2 grains of squill may be given in a fluid drachm of infusion of digitalis 3 times a day. As an expectorant it will be found useful in *chronic catarrh, humid asthma, pneumonia, phthisis, winter cough*, and other *chronic bronchial affections*. In chronic respiratory troubles, with but little febrile reaction and no inflammation, and scanty tenacious sputa, 1 part of syrup of squill may be added to 3 parts of syrup of wild cherry and a teaspoonful be administered 4 times a day. Troublesome vomiting or purging caused by squill is best corrected by opium. Where there is much inflammation or vascular excitement, it is contraindicated. Dose of the powder, as a diuretic and expectorant, from 1 to 3 grains; as an emetic, 6 to 12 grains; of the syrup, 1 or 2 fluid drachms; tincture, 1 to 20 drops. The pilular form is the best when squill is given in powder.

Specific Indications and Uses.—Chronic cough, with scanty, tenacious sputa; scanty, high-colored urine, with sense of pressure in the bladder; overactivity of the kidneys with inability to retain the urine; dropsy, with no fever or inflammation, and a general asthenic condition.

Related Species.—The following plants yield bulbs which may be used like squill, but on account of the cheapness of the latter, are not found in commerce (see *Pharmacographia* for fuller information).

Scilla indica, Baker (*Ledebouria hyacinthina*, Roth), India and Abyssinia; *Urginea indica*, Kunth (*Scilla Indica*, Roxburgh), India and east Africa; *Urginea altissima*, Baker (*Onithogalum altissimum*, Linné), south Africa, well represents squill; *Crinum Asiaticum*, var. *toxicarium*, Herbert (*Crinum toxicarium*, Roxburgh), India, Ceylon, and the Moluccas; *Drimia ciliaris*, Jacquin, *Itch bulb* of the Cape of Good Hope. The juice is a powerful local irritant.

Medeola virginica, Linné (*Gyromia virginica*, Nuttall) (*Nat. Ord.*—Liliaceæ).—This is the *Indian cucumber* found in shady situations and woods of the United States from the Mississippi River eastward. It bears greenish-yellow flowers in May and June. The rhizome is the part employed and resembles, both in taste and shape, our common cucumber. It is horizontal, from 1 to 1½ inches in length and ¼ inch in diameter, lower end pointed, has a white interior, and a brown-yellow exterior. It is beset with simple capillary rootlets. The rhizome contains starch. It is said to have been used as a food by the Indians (Pursh) and has been employed in *dropsical disorders*, it possessing both diuretic and hydragogue properties. It is now seldom used.

Gloriosa superba, Linné.—The tuberous root of this liliaceous climber contains, according to Warden, two resins and a bitter principle, *superbine*, which is very poisonous and closely allied, he believes, to the bitter principle of squill. Various statements are made regarding the toxic nature of the root and its reputed criminal uses. These reports, however, are not well established (Dymock).

SCOPARIUS (U. S. P.)—SCOPARIUS.

"The tops of *Cytisus Scoparius* (Linné), Link"—(*U. S. P.*) (*Genista scoparia*, Lamarck; *Spartium scoparium*, Linné; *Sarothamnus Scoparius*, Koch; *Sarothamnus vulgaris*, Wimmer).

Nat. Ord.—Leguminosea.

COMMON NAMES: *Broom, Irish broom, Broom tops.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 70.

Botanical Source.—This is a large, bushy shrub, growing from 4 to 9 feet in height, with numerous, long, straight, pentangular, dark-green, smooth, tough, very pliant branches. The leaves are deciduous, scattered, stalked, and ternate; the upper ones generally simple; leaflets uniform, obovate, obtuse, entire, and silky when young. The flowers are axillary, solitary, or in pairs, on simple stalks, longer than the leaves, papilionaceous, large and handsome, of a deep golden-yellow color. The fruit is a brown legume, flat, above an inch long, nearly smooth at the sides, fringed with hairs at each margin, and contains about 15 or 16 seeds. The swelling ovary soon splits the tube of the filaments (L.).

History and Description.—This plant is common to Europe and this country, and is frequently cultivated in gardens; it grows on dry and sandy soils, and flowers in May and June. The tops (*Scoparii Cacumina, Br. Pharm.; Herba Scoparii*) are the official parts. The seeds are also employed, and may be preserved for a longer time than the former. All parts of the plant have a peculiar, nauseously amarous taste, and, when rubbed, have a characteristic odor. They yield their virtues to water or alcohol. The young blossoms, when pickled, are said to be equal in quality to capers. The *U. S. P.* demands broom tops "in thin, flexible, branched twigs, pentangular, winged, dark-green, nearly smooth, tough, usually free from leaves; odor peculiar when bruised; taste disagreeably bitter" (*U.S.P.*). The seeds of *Spartium junceum*, Linné, of Europe, are possessed of emetic, purgative and diuretic properties.

Chemical Composition.—The flowers contain volatile oil, yellow fat, wax, sugar, gum, tannin, yellow coloring matter, mineral matter, etc. (Cadet de Gassicourt, 1824). Stenhouse, in 1851, isolated from broom tops the volatile, oily, narcotic, and bitter alkaloid, *sparteine* ($C_{15}H_{26}N_2$), and the yellow, crystallizable coloring matter, *scoparin*, which is diuretic and purgative. (For preparation and properties of sparteine, see *Sparteinæ Sulphas.*) *Scoparin* is obtained by evaporating an aqueous decoction of the plant to a smaller bulk, and allowing to stand for 24 hours. A jelly-like, crude scoparin is obtained, which is pressed out and purified by recrystallizing from hot water, then from hot alcohol. Hot alcohol converts it into a jelly-like insoluble, and a crystalline, soluble modification. It forms a pale-yellow, amorphous mass, or yellow crystals, quite soluble in hot water and hot alcohol, easily soluble in aqua ammoniæ, caustic alkalies, and alkali carbonates. When fused with caustic potash, *phloroglucin* and *protocatechuic acid* are formed (Hlasiwetz, 1866). Stenhouse gives the formula $C_{21}H_{22}O_{10}$, while Goldschmidt and von Hemmelmayr find $C_{20}H_{20}O_{10}$, or $C_{19}H_{16}O_8(OH)(OCH_3)$ (*Chem. Centralblatt*, Vol. II, 1893, p. 213; and *Amer. Jour. Pharm.*, 1894, p. 37).

Action, Medical Uses, and Dosage.—Broom is not without decided physiological effects—a staggering gait, impaired vision, and profuse vomiting and sweating have resulted from its use. The physiological effects of *scoparin* are not yet well studied, though it is regarded as diuretic and purgative. (For the action of *sparteine*, the cardiac principle, see *Sparteinæ Sulphas.*) In large doses, broom is emetic and cathartic; in small doses, diuretic. Used in all chronic forms of *dropsy;* said to never fail in increasing the flow of the urine; especially beneficial in *dropsy of the thorax*, combined with diseases of the lungs. *Scurvy* and *jaundice* have been successfully treated with it. Dose, of a strong decoction, prepared by boiling 1 ounce of the tops in a pint of water for 10 minutes, 4 fluid ounces every hour, until it produces some effect, using about 1 pint in 24 hours (dandelion and juniper berries may be made into a decoction with it); of the pulverized seed, from 10 to 15 grains, aided by the free use of diluents; of the tincture, 15 to 30 drops. The latter is inferior to the infusion.

Related Species.—*Ulex Europæus, Gorse, Whin, Furze.* A spiny plant, bearing bright-yellow flowers, and very common along the roadways and in waste places in Great Britain. A. W. Gerrard (1886) isolated from the seeds an alkaloid, *ulexine.* This alkaloid, according to the views of Kobert (1890), Moer (1891), and Partheil (1892), is identical with *cytisine* (see *Laburnum*, for description; also see *Amer. Jour. Pharm.*, 1893, p. 296). The action of ulexine is similar to that of cytisine and sparteine, giving to the heart vigorous and slower action. It induces greater arterial contraction, and proves diuretic. Its diuretic effects, however, are less pronounced than those of digitalis, which it most resembles. Cardiac paralysis is the result of toxic doses. A child was poisoned by milk from a cow which had eaten gorse. The remedy may be used in *dropsies of cardiac origin* (Kobert). Dose, of ulexine, $\frac{1}{20}$ to $\frac{1}{15}$ grain; of the nitrate, $\frac{1}{20}$ to $\frac{1}{12}$ grain, hypodermatically.

SCROPHULARIA.—CARPENTER'S SQUARE.

The leaves, tops, and roots of *Scrophularia nodosa*, Linné, var. *marilandica*, Gray (*Scrophularia nodosa*, var. *Americana*, Michaux).

Nat. Ord.—Scrophularineæ.

COMMON NAMES: *Figwort, Carpenter's square, Scrofula plant, Square stalk, Heal-all.*

ILLUSTRATION: Lloyd's *Drugs and Med. of N. A.*, Plate 37.

Botanical Source. *Scrophularia nodosa*, Linné, has a perennial, whitish, tuberous, and knotty root, with a leafy, erect, quadrangular, smooth stem, 2 to 4 feet in height, with paniculate, opposite branches above. The leaves are opposite, petiolate, ovate, ovate-oblong, or the upper lanceolate, acute, sharply and unequally serrated, rounded, acutish, or broadly cordate at base, veined, of a deep-green color, and 3 to 7 inches in length. The flowers are small, 3 or 4 lines long, ovoid, dark-purple, slightly drooping, on axillary and terminal, forked, angular, glandular peduncles in oblong, thyrsoid panicles. The calyx is in 5 segments, which are broadly ovate, obtuse, and slightly margined; the corolla of a dull-green color, with a livid-purple lip, and subglobose; the limb contracted, sublabiate, having a green scale or sterile filament, adnate to the upper side. Stamens didynamous; sterile anthers, broadly orbicular. Capsule ovate-oblong (L.—W.—G.). The variety *marilandica*, Gray, differs from the preceding chiefly in being taller (4 to 6 feet), and in having obtuse angles to the stems.

Fig. 224.

Scrophularia nodosa.

History and Description.—Figwort is a native of Europe, and found growing in different parts of the United States, in woods, hedges, damp copses, and banks, flowering from July to October. The American variety was formerly considered distinct from the European plant, and was named *Scrophularia marilandica*. Michaux, however, did not regard it as such, but placed it as a variety under the name *Scrophularia nodosa*, var. *Americana*, which name should have been retained. Gray, in his more recent works, gave it as the variety *marilandica*, under which it is now known. The plant is generally known to Eclectics as *Carpenter's square;* to other branches of the profession as *Figwort* and *Scrofula plant*. A variety lacking the cordate leaf-base, is more common in the southern localities of this country. It is the variety *lanceolata*, and the kind figured in *Drugs and Med. of N. A.* (see preceding page). Pursh named it *Scrophularia lanceolata*. The leaves and root are the medicinal parts, and yield their virtues to water or alcohol. The leaves have an offensive odor, and a bitter, unpleasant taste; the root is slightly acrid. Much of the odor and taste are lost by drying. The root is generally employed.

Chemical Composition.—J. U. Lloyd (*Drugs and Med. of N. A.*, Vol. II, p. 112) found the root to contain a small quantity of an alkaloid, fixed oil, and a brown, amorphous resin of a peppery taste, insoluble in water and benzol, soluble in alcohol and chloroform. The herb yielded abundant mucilage, but no alkaloid. F. Koch (*Archiv der Pharm.*, 1895) found the ether extract of the plant to contain *lecithin*, free cinnamic acid and butyric acid. The alcoholic extract contained *caffeotannic acid*, sugar (probably dextrose), and a resin, from which cinnamic acid may be isolated. According to van de Moer (1895), the aqueous and alcoholic extracts of the herb and the seeds are poisonous. From the alcoholic extract, an amorphous, yellow powder was obtained, resembling digitalis, medicinally.

Action, Medical Uses, and Dosage.—Figwort is alterative, diuretic, and anodyne; reputed highly beneficial in *hepatic diseases*, *scrofula*, *secondary syphilis*, *cutaneous diseases*, *dropsy*, and as a general deobstruent to the glandular system, when used in infusion or syrup. Prof. Goss valued it highly in conditions coming under the head of *struma*, when the fluids and solids are depraved, and ulceration readily follows contusions. Externally, in the form of fomentation, or ointment, it is valuable in *bruises*, *mammary inflammation*, *ringworm*, *piles*, *painful swelling*, *itch*, and *cutaneous eruptions of a vesicular character*. The root, in decoction, and drank freely, is said to restore the lochial discharge when suppressed, and to relieve the pains attending *difficult menstruation*. This plant possesses valuable and active medicinal properties. Its alterative properties are pronounced, though the remedy is very slow to produce its effects. Dose of the infusion or syrup, from 2 to 4 fluid ounces; fluid extract, 30 to 60 drops; strong tincture (℥viij to alcohol, 76 per cent, Oj), from 10 to 40 drops.

Specific Indications and Uses.—Struma; ulcerations about the eyes, ears, nose, or face; inclination to ulceration from abrasions or contusions; enlarged lymphatics, with perverted nutrition; full lips, pink and white countenance, with fullness or puffiness of the alæ nasi; epiphyseal thickenings and fullness of the joints (Goss, *Drugs and Med. of N. A.*, Vol. II, p. 115).

SCUTELLARIA (U. S. P.)—SCUTELLARIA.

"The herb of *Scutellaria lateriflora*, Linné"—(*U. S. P.*). The green herb is preferred in Eclectic pharmacy.

Nat. Ord.—Labiatæ.

Common Names: *Scullcap, Skullcap, Madweed.*

Illustration: Strong's *American Flora* (opposite page 100).

Botanical Source and History.—We introduce this plant, accompanied with illustrations, to overcome the confusion that has existed in commercial circles regarding the plant ordinarily sold as scullcap. The official species is the *Scutellaria lateriflora*, but the larger part of the drug sold upon the market under that name is derived from two other species of Scutellaria. The genus Scutellaria is well characterized by the calyx, which in all the species consists of 2 round lips closed in fruit, the upper lip of which has a helmet-shape appendage, giving to it the appearance of a mask or cap; hence the common name *scullcap*.

Fig. 225.

Scutellaria lateriflora.

Scutellaria lateriflora, Linné, the official scullcap, is the most widely-distributed of the species. It is common in every section of the United States, and is found growing in damp places on the banks of streams, and in similar situations. Inasmuch as this is the proper scullcap to use in medicine, and as it is often confounded with other species, we will give a close description of the plant (see Fig. 225). The stem is slender, herbaceous, 4-angled, much branched, and from 1 to 2 feet high; it is smooth, green when the plant grows in shady situations, but turns brown on exposure to the sun. The leaves are small, from 1 to 2 inches long, and about one-half as wide, ovate, rounded at the base, and acute at the apex. They are smooth, crenate, and are borne on opposite leafstalks, which are about 1 inch long. The flowers appear late in summer, and are borne in numerous, slender, simple, one-sided racemes, from the axils of the leaves; they are small, opposite, and have short pedicels, subtended at the base by small bracts. The calyx is about the length of the pedicel, and has the peculiar helmet-shape characteristic of the genus. When the fruit is mature, the calyx splits in the base, the upper lip falling away, the lower one remaining. The corolla is small, blue, about one-fourth of an inch long; it has a slender, exserted tube, and 2 subequal lips, the upper of which is arched, the lower, spreading. The stamens are 4, and included in the corolla. The fruit consists of 4 small nutlets.

Fig. 226.

Scutellaria versicolor.

Scutellaria versicolor, Nuttall, and *Scutellaria canescens*, Nuttall, are the species generally collected by herbalists, and substituted for Scutellaria lateriflora. We present an engraving of Scutellaria versicolor, and both this and S. canescens can readily be distinguished from official scullcap, by their being much more robust, having thicker stems, and growing from 2 to 4 feet high. The flowers are large in both, being 1 inch long; and instead of being borne in very slender, lateral racemes, as with S. lateriflora, they are borne in a single, large, terminal, branched raceme. The leaves are also much larger than those of S. lateriflora, being from 2 to 4 inches long, and nearly as broad. They are cordate at the base, and acute at the apex. The leaves of S. versicolor are thin, softly pubescent, and of a bright-green color; those of S. canescens are thick in texture, light-green, and often variegated with a purple line around the margin.

Scullcap is an indigenous herb, growing in damp places, meadows, ditches, and by the sides of ponds, flowering in July and August. Besides the names given above it is known by the names of *Blue scullcap*, *Side-flowering scullcap*, *Mad-dog weed*, and *Hoodwort*. The whole plant is official, though but the mature leaves and flowering tops should be employed. It should be gathered while in flower, dried in the shade, and kept in well-closed tin vessels. Alcohol or boiling water extracts its properties. It is officially described as "about 50 Cm. (20 inches) long, smooth; stem quadrangular, branched; leaves opposite, petiolate, about 5 Cm. (2 inches) long, ovate-lanceolate or ovate-oblong, serrate; flowers in axillary, one-sided racemes, with a pale-blue corolla and bilabiate calyx, closed in fruit, the upper lip helmet-shaped; odor slight; taste bitterish"—(*U. S. P.*). The drug loses its properties largely when dried, and by age becomes inert; hence the many failures in therapy from the use of scutellaria.

Chemical Composition.—*Scutellaria lateriflora* contains volatile and fixed oil, tannin, gum, sugar, and a bitter principle (Cadet de Gassicourt, 1824). C. O. Myers and H. R. Gillespie (*Amer. Jour. Pharm.*, 1889, p. 555) obtained this bitter principle in the form of acicular crystals by treating an alcoholic extract of the drug with water and abstracting the principle from the aqueous solution with ether. The authors found it to be a glucosid; the presence of tannin in the drug could not be verified.

From the root of *Scutellaria lanceolaria*, Miquel (*Scutellaria baicalensis*, Georgi), growing in Japan. Takahashi (1889) isolated *scutellarin* ($C_{10}H_8O_3$), crystallizing in yellow tasteless needles, sparingly soluble in hot water, soluble in other simple solvents and in alkalis. It is not a glucosid, and seems to be physiologically inert.

Action, Medical Uses, and Dosage.—Scullcap is tonic, nervine, and antispasmodic. This is one of those valuable agents which a certain class of physicians consider inert; yet it has proved especially useful in *chorea*, *convulsions*, *tremors*, *intermittent fever*, *neuralgia*, and many *nervous affections*. In *delirium tremens*, an infusion drank freely will soon produce a calm sleep. In *intermittents* it may be beneficially combined with lycopus. Where teething has impaired the health of children, an infusion may be given with advantage. In all cases of *nervous excitability*, *restlessness*, or *wakefulness*, attending or following acute or chronic diseases, from physical or mental overwork, or from other causes, it may be drank freely with every expectation of beneficial results. The warm infusion has a tendency to keep the skin moist; the cold has a tonic influence, and either may be drank freely. When its soothing effects have ceased, it does not leave an excitable, irritable condition of the system, as is the case with some other nervines. Scullcap has been extolled as a remedy in *hydrophobia*, but this is still a matter of uncertainty. That it influences the cerebro-spinal centers, controlling nervous irritation there can be no doubt, and this fact is well illustrated by its control over *functional cardiac disorders*, due to purely nervous causes, with or without hysterical manifestations, and exhibiting intermittency of pulse. Specific scutellaria well represents the plant. Half an ounce of the recently dried leaves or herb, to ½ pint of boiling water, will make a very strong infusion. Dose of specific scutellaria, 1 to 30 drops; of scutellarin, 1 to 5 grains; fluid extract, 1 to 60 drops.

Specific Indications and Uses.—Nervousness, attending or following acute or chronic diseases, or from mental or physical exhaustion, teething, etc.; nervousness manifesting itself in muscular action; tremors, subsultus, etc.; hysteria, with inability to control the voluntary muscles; functional cardiac disorders of a purely nervous type, with intermittent pulse.

Related Species.—*Scutellaria pilosa*, Linné; *Scutellaria integrifolia*, Linné, and *Scutellaria hyssopifolia*, Linné, now regarded as a variety of the last-named species, are sometimes employed. They are decidedly bitter. They possess properties similar to scullcap.

Scutellaria galericulata, Linné.—Europe, Asia, and North America; *European scullcap.* Odor, alliaceous; taste, bitter. Applied to *old ulcerations*, and given internally in *intermittents*.

Brunella (or *Prunella*) *vulgaris*, Linné. *Self-heal*, or *Heal-all*, is bitter and astringent. It is a common herb in the woods and grassy situations of Asia, Europe, and North America. The flowers are borne in dense bracted spikes and are of a purplish-blue color. It was once used locally in *sore throat*, and internally in *diarrhœal* and *hemorrhagic affections*.

Derivative of Scutellaria. SCUTELLARIN (*Scutellarine*). The preparation, erroneously called scutellarine, is one of the concentrations and is to be classed therewith. It is of a light greenish-brown color, with a faint, tea-like odor, and a peculiar, herbaceous, somewhat gritty, resinous, tea-like taste. It is reputed a nervine and tonic, especially useful in cases of depression of the nervous and vital powers after long sickness, over-exercise, excessive study, or from long-continued and exhausting labors. One grain will, it is stated, frequently produce its quiet and soothing effect, controlling nervous agitation, and inducing a sensation of calmness and strength. It has been advantageously combined with oleoresin of cypripedium, resin of cimicifuga, and resin of caulophyllum, in various *female disorders*, both in the gravid or non-gravid state, accompanied with an excitable or irritable condition of the nervous system. It may be used wherever scullcap is indicated. Its dose is from 1 to 5 grains, 3 or 4 times a day, though an increased quantity will not produce any unpleasant effects (J. King).

SEDUM.—MOSSY STONECROP.

The plant of *Sedum acre*, Linné.

Nat. Ord.—Crassulaceæ.

COMMON NAMES: *Mossy stonecrop*, *Biting stonecrop*, *Small houseleek*.

Botanical Source and Description.—This is a low, moss-like, fleshy plant, native of Europe, but very common in cultivation, and sometimes naturalized in this country. It has a spreading, thick, green stem, from 1 to 3 inches high. The leaves are fleshy, small, sessile, erect, and numerous, almost entirely covering the stems. The flowers are bright-yellow, sessile, and arranged in 3-parted, terminal cymes. The sepals, petals, and carpels are in fives, in the central flowers of the cyme, and in fours in the others. The stamens are in number double the other parts of the flower. There are about half a dozen native species of Sedum, mostly found in dense patches, in rocky woods, throughout the United States. They all have white or light-purple flowers, which appear in June or July. *Sedum ternatum*, Michaux, is the most common species in Ohio and the neighboring states.

Chemical Composition.—Sedum acre was analyzed by Mylius (*Archiv der Pharm.*, 1872, pp. 97–110), who found it to contain wax, chlorophyll, acid resin, mucilage, sugar, an alkaloid, and other substances common to plants, but no starch. He describes the alkaloid as uncrystallizable, acrid and nauseous to the taste, not volatile, oxidizable in the air, soluble in ether, alcohol, chloroform, but little soluble in water. It unites with acids to form soluble salts. The hydrochlorate, in solution, is precipitated by excess of ammonia, or the hydrate, or carbonate of potassium. *Rutin* or *rutic acid* (see *Ruta*) is present in the ether extract; it produces dark-green with ferric chloride.

Action, Medical Uses, and Dosage.—Sedum acre has little or no odor, and its taste, at first herbaceous, is followed by a persistent acrid pungency. The leaves, pounded and applied to the surface of the body, will occasion a troublesome vesication. Taken internally, the plant, or its expressed juice, has an emeto-cathartic action, and was recommended in *scrofulous affections*, *malarial fevers*, and even in *epilepsy;* however, it is rarely employed at the present day, except, occasionally, as a local application to *glandular enlargements*, to *scrofulous ulcers*, and to some *chronic cutaneous maladies*—the fresh leaves only (bruised) being used—thus applied to *warts*, *corns*, or similar growths, it is said to ultimately effect their removal. It is said to relieve "the extreme sensitiveness associated with disorders of the reproductive function" (Scudder, *Spec. Med.*, p. 238). Internally, the expressed juice has been used in doses of from 1 to 2 fluid drachms, taken in beer or wine.

Related Species.—*Sempervivum tectorum*, Linné, *Common houseleek*. Houseleek has a fibrous root crowned with several rosaceous tufts of numerous, oblong, acute, keeled, fringed, extremely succulent leaves. The stem from the center of one of these tufts, is about a foot high, erect, round, downy, clothed with several, more narrow, sessile alternate leaves, and terminating in a sort of many-flowered cyme, with spiked branches. Flowers large, pale rose-colored, without scent. Segments of the calyx 12 or more, with a similar number of petals, stamens, and pistils. Offsets spreading (L.). This is a well-known perennial plant, a native of Europe, and is so succulent and hardy that it will grow on dry walls, and on the roofs of houses. It sends out runners with offsets, rarely flowering (W.). Its period of flowering is in August. It is much cultivated in some places. The fresh leaves are the parts used. They are thick, fleshy, mucilaginous, somewhat plano-convex, smooth, odorless, and of a mixed flavor, combining slight acidity with astringency. Their most important constituent, according to Vauquelin, is calcium malate. The fresh leaves are useful as a refrigerant, when bruised, and applied as a poultice, in *erysipelatous affections*, *burns*, *stings of insects*, and other *inflammatory conditions of the skin*. The leaf, sliced in two, and the inner surface applied to *warts* or *corns*, and changed twice a day, will, it is said, positively cure them. The juice, applied locally, has cured *ringworm*, *shingles*, and many other *cutaneous affections*. *Erysipelas* has been benefited by the free internal use of the leaves bruised in milk and water, in quantity sufficient merely to stain the liquid. The bruised leaves, applied as a poultice, have cured severe cases of *herpes circinata*. The leaves also possess an astringent property, which is beneficial in many cases. Minute doses of the tincture of sempervivum are said to "be indicated by a flushed surface and stinging pains, as from the sting of a bee or mosquito" (Scudder).

Sedum Telephium, Linné, is the common *Live-for-ever*, or *Garden opine*.

Sedum latifolium leaves are chewed and applied to *wounds* by the Cree Indians, who also used the leaves for tea.

Sedum dendriodeum, Mocino.—Mexican species used like *Sedum acre*.

SELINUM.—MARSH PARSLEY.

The root of *Selinum palustre*, Linné.

Nat. Ord.—Umbelliferæ.

COMMON NAMES: *Marsh parsley*, *Marsh smallage*.

Botanical Source.—Marsh parsley has a simple, tapering, perennial root, with many long fibers. Its stem is erect, 4 or 5 feet high, hollow, deeply furrowed, not hairy, branched and corymbose in the upper part, and bright-purple at the base. The leaves, about 5 or 6 on the stem, are alternate, remote, and ternate, with bipinnate divisions; the leaflets opposite, deeply pinnatifid, dark-green, smooth, their segments linear-lanceolate, never quite linear, acute, entire, or trifid; the petioles smooth, striated, dilated, and sheathing at the base, with a reddish membranous margin. The umbels are large, horizontal, of numerous, angular, general and partial rays. General bracts several, lanceolate, pointed, dependent, not half the length of the rays, with their margins membranous and partly colored; partial ones similar, but rather longer in proportion, and often confluent. Flowers white, numerous, and uniform, with involute petals. The fruit is very light straw-color, 4 lines long, shining, and obovate; the dorsal ridges very near each other, distinctly elevated, sharp, the lateral depressed and far within the broad, thin margin; the vittæ of the commissure subulate, straight, and about half the length of the fruit (L.).

History, Description, and Chemical Composition.—This plant is the *Cnidum palustre* of Sprengel, the *Peucedanum montanum* of Koch, and the *Conioselinum* of Fischer, also known as *Peucedanum palustre* of Moench. This plant grows in marshes and boggy meadows in the north and middle of Europe. The root is branched, fleshy, deep-brown externally, white and milky within, having a strong aromatic odor, and an acrid and piquant taste; the dried root is of a less deep-brown color, yielding a bright-yellow, grayish powder. The root abounds in a white, fetid, bitter juice, which hardens into a brown, acrid resin; it is the part employed. It imparts its properties to water or alcohol. According to Peschier, the root contains a volatile oil, a fatty oil, soluble in ether and alcohol, gummy matter, a yellow coloring principle, a nitrogenous principle, etc.

Action, Medical Uses, and Dosage.—Marsh smallage is emmenagogue, diuretic, and antispasmodic, but abandoned as an internal remedy on account of its caustic and dangerously poisonous properties. Ten or 20 grains, according to the patient's age, repeated every 5 hours, and, after a time, gradually augmented, have cured several cases of *epilepsy* in the course of from 3 to 6 months, but it must not be used where abdominal obstruction exists, or where there is an exalted sensibility of the genital apparatus. If it produces diarrhœa or colic, the doses must be lessened to twice, or even once, a day; sometimes it purges, nauseates, or causes gastralgia. In nervous and sanguine persons, especially those of irritable habits, it increases the violence of the disease. Two-grain doses, repeated twice daily, have proved almost immediately beneficial in the *dentition convulsions* of children. This agent generally exerts a favorable influence upon menstruation and its disorders. It has also been used with success in *pertussis*, *nervous affections*, etc. (J. King).

Related Species.—(See Levisticum, Heracleum, and Imperatoria.) *Selinum canadense*, Bentham and Hooker; *Marsh* or *Hemlock parsley*, *Selinum canadense*, or *Cnidium canadense* of Sprengel, and *Conioselinum canadense* of Fischer, which grows in swamps, wet woods, and around the mouths of large rivers from Canada to Carolina, and westward, is a species of the above plant, and deserves a trial in the diseases just mentioned. It is a plant 2 to 4 feet in height, somewhat resembling the Conium maculatum, and having an angular, flexuous, hollow stem. Leaves on large, inflated petioles, ternately divided; the divisions bipinnate, with linear-oblong, acute lobes. Umbels compound. Petals white, spreading. Involucre wanting, or 2 or 3-leaved. Styles slender, diverging. Fruit about 2 lines long, oblong, oval. Vittæ solitary in the dorsal interval, 2 or 3 in the lateral. It flowers in August and September (W.—G.). (See also page 1454.)

Æthusa Cynapium, Linné (*Nat. Ord.*—Umbelliferæ), *Fool's parsley*, *Dog parsley*, *Dog poison*, *Garden hemlock*, *Lesser hemlock*.—A European plant, having a strong resemblance to parsley, from which, however, it may be readily distinguished by its loathsome taste, and its nauseous odor when rubbed. The root is spindle-shaped, the flowers white, and the seeds globular and striated. A toxic, crystallizable alkaloid, *cynapine*, soluble in alcohol and in water, but not in ether, has been found in the herb (Ficinus, *Archiv der Pharm.*, 1828, p. 251). The seeds yield a volatile, oily base, somewhat like coniine, volatile oil, fatty oil, and several resins (Walz, *Neues Jahrbuch f. Pharm.*, Vol. XI, 1859, p. 355; and W. Bernhardt, *Archiv der Pharm.*, 1880, p. 117). The question as to the toxicity of this plant is still unsettled, several cases of poisoning having been reported from it, but Harley believes that *Conium maculatum*, which closely resembles this plant, has been mistaken for it. Æthusa is recommended for the gastro-intestinal troubles of infants, especially when artificially fed. The symptoms pointing to its use are practically those indicating ipecac. *Cholera infantum*, *summer diarrhœa*, and *convulsions*, attending intestinal disorders of children, have been treated with it. *Active delirium*, easily excited, and with tendency to rage, mental confusion, dizziness, simulating intoxication, and violent *headache*, with dizziness, are also said to be indications for the drug. A strong tincture of the flowering plant may be used, adding from 1 to 2 drops to 4 fluid ounces of water, and giving 1 teaspoonful every 2 or 3 hours.

SENECIO.—LIFE ROOT.

The root and herb of *Senecio aureus*, Linné.

Nat. Ord.—Compositæ.

Common Names: *Life root*, *Ragwort*, *False valerian*, *Golden senecio*, *Squaw weed*, *Female regulator*.

Botanical Source.—This plant has an erect, smoothish, striate stem, 1 or 2 feet high, floccose-woolly when young, simple or branched above, terminating in a kind of umbellate, simple or compound corymb. The radical leaves are simple and rounded, the larger mostly cordate, crenate-serrate, and long-petioled; the lower cauline leaves lyre-shaped; the upper ones few, slender, cut pinnatifid, dentate, sessile, or partly clasping, the terminal segments lanceolate. The peduncles are subumbellate and thick upward. Corymb is umbel-like. Rays from 8 to 12, 4 or 5 lines long, and spreading. Flowers golden-yellow. Scales linear, acute, and purplish at the apex (W.—G.).

History.—This is an indigenous, perennial plant, growing on the banks of creeks and on low, marshy grounds, throughout the northern and western parts of the Union, flowering in May and June. The root and herb are the medicinal parts, and the medicine is peculiar to Eclectic practitioners. It yields its properties to water or alcohol. It has not been analyzed, but appears to contain both an acrid and bitter principle, and tannin.

Action, Medical Uses, and Dosage.—Senecio is diuretic, pectoral, diaphoretic, tonic, and exerts a peculiar influence upon the reproductive organs, and particularly of the female, which has given to it, especially the *S. gracilis*, the name of *Female regulator*. This is one of our valuable remedies in the treatment of female diseases. It relieves irritation and strengthens functional activity. Ovarian or uterine atony, with impairment of function, increased mucous or mucopurulent secretions, or displacements of the womb and vaginal prolapse, are the chief guides to its use. It is very efficient in promoting the menstrual flow, and may be given alone, in infusion, or combined with equal parts of asarum and savine, in *amenorrhœa*, not connected with some structural lesion. It will also be found valuable in *dysmenorrhœa*, *sterility*, and *chlorosis*. In *menorrhagia*, combined with cinnamon and raspberry leaves, it has been found very serviceable, when administered during the intermenstrual period, as well as at the time of ovulation. Tenesmic and painful micturition of both sexes is often relieved by it. Senecio often cures *leucorrhœa* when associated with weakness of vaginal walls, allowing uterine displacements, and accompanied with vascular engorgement and pelvic weight. Senecio is of value in many genital disorders of the male, the indications being pelvic weight and full, tardy, or difficult urination and sensation of dragging in the testicles. Senecio aids digestion when tardy from congested or relaxed conditions of the gastric membranes. It is also useful in *capillary hemorrhage*, especially in *hematuria*, and in *albuminuria*, with bloody urine. *Pulmonary hemorrhage* has also been checked by it. It has proved an excellent diuretic in *gravel* and other urinary affections, either alone, or given in combination with other diuretics, and is said to be a specific in *strangury*. In *pulmonary* and *hepatic affections* it has proved advantageous, and, taken freely, the decoction has effected cures of *dysentery*. This remedy produces its effects slowly in chronic disorders. Dose of the decoction, 4 fluid ounces, 3 or 4 times a day; specific senecio, 1 to 30 drops.

Specific Indications and Uses.—Atony of the reproductive organs, with impairment of function; uterine enlargement, with uterine or cervical leucorrhœa; difficult tenesmic micturition; dragging sensations in the testicles; perineal weight and fullness.

Varieties of Senecio and Related Species.—There are several varieties of the above species, which possess similar medicinal virtues, as the *Senecio balsamitæ*, or *Balsam groundsel*, with the stem and peduncles villous at base; leaves few, small, distant, pubescent; radical ones oblong, spatulate, or lanceolate, sometimes cut-toothed, tapering into the petiole; cauline ones lyrate or pinnatifid; flowers subumbellate. This variety grows in pastures and on rocky hills (W.—G.).

Another, the *Senecio gracilis*, *Unkum*, or *Female regulator*, a slender state of the species, is found on rocky shores. Radical leaves orbicular, on long petioles, subcordate, crenate; cauline ones very few, remote, linear-oblong, dilated at the base, incisely dentate; peduncles very short, pilose, subumbelled; involucre smooth; rays few, very short.

The *Senecio obovatus*, a variety of the *S. aureus*, with the radical leaves obovate, crenate-serrate, petioled; cauline ones pinnatifid, toothed; flowers subumbelled, long-peduncled, bracted, with a cavity under the receptacle like some other of the genus; stem somewhat glabrous. Found in the meadows, etc. (W.). This plant, in infusion, has cured several cases of *amenorrhœa*. Several cases of abortion are stated to have followed its use, and it has been recommended as a substitute for ergot. It certainly deserves further investigation.

Senecio lanceolatus.—Found in shady cedar swamps in Vermont. It has all the leaves lanceolate-oblong, thin, sharply and unequally toothed, either wedge-shaped or somewhat cordate at the base, the upper cauline ones being pinnatifid-cut toward the base.

Among these varieties, the *Senecio gracilis* is considered the most efficient in uterine difficulties, and it is from this that the oleoresin, improperly called *senecin*, was at first prepared. The whole herb is used. The root grows just below the surface of the ground, and runs along horizontally. It is from ½ to 6 or 8 inches in length, and about 2 lines in diameter, reddish or purplish externally, white-purplish internally, with an aromatic taste, and having scattered fibers. When dried and mixed with the herb, it is found of various lengths, from ¼ to 1 or 2 inches, greenish-brown or yellowish-brown externally, with very fine longitudinal lines, a few fibers attached, short fracture, presenting under the microscope a shining, waxy surface, with a central pale-purple substance, surrounded by a greenish-yellow one, with a light-yellowish ring between the two. It is inodorous, and has a faintly bitter, herbaceous, peculiar, resinous taste, with a very slight degree of pungency. It yields its properties best to alcohol.

Senecio Doronicum, *Senecio Saracenicus*, *Senecio vulgaris*, and *Senecio Jacobæa*, are among the European species which have been employed in medicine, while, in Mexico, the *maturin* (*S. cerviariæfolius*) and *matrique* (*S. grayanus*) are said to furnish a dog-poison. Exalted temperature, pupillary dilatation, and convulsions are the reputed effects of these species, which, according to Henckel (*Amer. Jour. Pharm.*, 1891, p. 6), contain a glucosidal body, resembling digitalin in its action; resin, volatile oil, tannin, etc., are likewise present. Another Mexican dog-poison is *Yerba de la Puebla*, or *Senecio canicida*, and contains a poisonous organic acid, *senecic acid* (Rio de la Loxa, *Amer. Jour. Pharm.*, 1886, p. 170).

SENEGA (U. S. P.)—SENEGA.

"The root of *Polygala Senega*, Linné"—(*U. S. P.*).

Nat. Ord.—Polygaleæ.

COMMON NAMES: *Seneka root*, *Senega snakeroot*, *Seneca snakeroot*.

Botanical Source.—Senega is an indigenous plant, with a perennial, firm, hard, branching root, consisting of a moderately solid wood, and a thick bark; it sends up several annual stems, which are erect, simple, smooth, 8 to 14 inches high, and occasionally tinged with red. The leaves are alternate, nearly or quite sessile, lanceolate, with a sharpish point, smooth, paler underneath, 1 to 3 inches long, and about one-third as wide. The flowers are white, on short pedicels, in a close terminal spike, from 1 to 3 inches in length. Calyx of 5 sepals, the two largest, or wings, concave, roundish-ovate, white, slightly veined, and larger than the petals. Corolla of 3 petals, two lateral and obtuse, and a short-crested extremity; they are small and closed. Capsules small, obcordate, invested by the persistent calyx, compressed, 2-celled, and 2-valved. The seeds are 2 in number, oblong-ovate, acute at one end, slightly hairy, curved, blackish, with a longitudinal, bifid, white strophiola on the concave side. The spike opens slowly, so that the lower flowers are in fruit while the upper ones are in blossom (L.—W.).

Fig. 227.

Root of Polygala Senega.

History and Description.—Seneka, or Seneca snakeroot, as it is usually called, is found in various parts of the United States, in rocky woods, and on hillsides, flowering in July. Distinction is sometimes made in commerce between *Southern* and *Northern senega*. The latter is probably a botanical variety of the former. Southern senega comes from Kentucky, Virginia, Tennessee, North Carolina, Arkansas, Missouri, Ohio, Indiana, and Illinois, while Northern senega, since about 1871, was brought from Minnesota and Wisconsin (J. U. and C. G. Lloyd, *Amer. Jour. Pharm.*, 1881, p. 481; also see *Related Species*, next page, for *False Senega*). The dried root, which is the official part, is described by the *U. S. P.* as "about 10 Cm. (4 inches) long, with a very knotty crown, and spreading, tortuous branches, keeled when dry, fleshy and round after having been soaked in water; externally yellowish-gray or brownish-yellow; bark thick, whitish within, enclosing an irregular, porous, yellowish wood; odor slight, but unpleasant; taste sweetish, afterward acrid"—(*U. S. P.*). The knotty crown seems to be formed by the junction of several stems; the keel line extends the whole length of the root. The meditullium, or central portion, possesses but little or no medicinal properties, which reside chiefly in the thick, resinous bark. The recent root has a disagreeable, sickening odor, which diminishes very much by drying. Its taste is somewhat sweetish, succeeded by heat and pungency, irritating the mouth and fauces. It imparts its virtues to water or alcohol; alcohol of specific gravity 0.935 is its best solvent. Too high a temperature renders the acrid principle insoluble in water.

Chemical Composition.—The acrid principle of seneca root was discovered, in 1804, by Gehlen, and named *senegin* by Gmelin. It is the *polygalic acid* of Quevenne (1836). Bolley (1854) showed senegin to be identical with the glucosid *saponin* ($C_{32}H_{54}O_{18}$). W. Procter, Jr. (*Proc. Amer. Pharm. Assoc.*, 1859, p. 297), prepared polygalic acid (senegin) by exhausting the root with diluted alcohol, distilling off the solvent, and precipitating by ether-alcohol. The yield was about 5 per cent. J. Atlass (*Ueber Senegin*, Dissert., 1887) differentiated *polygalic acid*, of acid reaction, from neutral *senegin*, the former being precipitated by both neutral and basic lead acetate, senegin by basic lead acetate only. *Senegin* (*saponin*) is a white powder, acrid, excites sneezing, and is readily soluble in water; the solution is neutral, and froths upon shaking. It is insoluble in absolute cold alcohol, in ether, carbon disulphide, benzin, cold amyl alcohol, etc., very little soluble in chloroform. By boiling with diluted acids, senegin is decomposed into reducing sugar and *sapogenin*. Atlass obtained from the root 1.64 per cent of senegin. *Polygalic acid* closely resembles senegin in all its properties, except those mentioned. Joseph Kain (*Amer. Jour. Pharm.*, 1899, p. 86) found in senega another glucosid, lævo-rotatory, and soluble in absolute alcohol and ether. J. H. Schroeder (*ibid.*, 1896, p. 178) made a proximate analysis of the root, and noted the absence of tannin and starch, and the presence of volatile oil, fixed oil, resins, dextrose, saccharose (5.32 per cent), asparagine (0.62 per cent), ash (6.65 per cent). The volatile oil (0.10 per cent on an average) consists chiefly of methyl salicylate and valerianic ester (L. Reuter, *Archiv der Pharm.*, 1889, p. 313; see *ibid.*, pp. 452, 549.

and 927). Roots seemingly exhausted of the oil by distillation with water, produced additional quantities when slightly acidulated; the salicylic ether is also yielded by false senegas of commerce (E. Kremers and Martha M. James, *Pharm. Review*, 1898, p. 45).

Action, Medical Uses, and Dosage.—In large doses, senega is emetic and cathartic; in ordinary doses, it stimulates most of the secretions, acting especially as a sialagogue, expectorant, diuretic, diaphoretic, and emmenagogue. Its expectorant properties render it very useful in *chronic catarrh*, and protracted and *typhoid pneumonia*, *bronchorrhœa*, *chronic bronchitis*, with profuse secretion, *humoral asthma*, and in the commencing stages of *croup*. In active inflammation its use is contraindicated. In *relaxed sore throat*, it is recommended as a local stimulant; also as a diaphoretico-diuretic in *rheumatism*, and as an emmenagogue in *amenorrhœa*. It is not without effect upon *squamous skin diseases*, and its action in this direction should be studied. Dose of the powdered root, from 5 to 20 grains; of the infusion or syrup, from ½ to 2 fluid ounces. The extract prepared from an infusion of the root, obtained by percolation, and evaporated to the proper consistence by means of a water-bath, may be given in doses of from 1 to 4 grains; specific senega, 1 to 20 drops. Polygalic acid may be given for the same purposes as the root, in doses of from ¼ to ½ grain. It is best taken in hot, sweetened water.

Specific Indications and Uses.—Relaxation of the respiratory mucous membranes and of the skin; cough deep and hoarse, with excessive secretion, mucous rales, nausea, and sometimes vomiting; last stage of typhoid pneumonia, bronchorrhœa.

Related Species and Substitutes.—*Polygala rubella*, Willdenow, *Bitter polygala*, *Bitter milkwort*. This is the *Polygala polygama* of Walter. It is an indigenous herb, with a perennial, branched, and somewhat fusiform root. Stems simple, crowded, many from the same root, angular, smooth, and erect, from 6 to 12 feet high. This plant inhabits fields and pastures from Canada to Florida, being common to dry, sandy, or gravelly soils, and bearing handsome rose-purple flowers in July. The whole plant is used. It is inodorous, with a persistent and powerfully bitter taste, which is imparted to water or alcohol. It has not been analyzed, though its active constituent is probably similar to senegin. The *Polygala amara*, Linné (*Herba polygalæ*), and the *Polygala paucifolia*, or Fringed polygala, possess similar properties, and may be employed as substitutes. The root of the latter has a pleasant, spicy flavor, very similar to that of gaultheria. In doses of from 3 to 10 grains, bitter polygala is an excellent bitter tonic; from 10 to 30 grains act upon the bowels, and cause slight diaphoresis. An infusion has been found beneficial as a tonic in *debility of the digestive organs*. It may be used in all cases where a bitter tonic is indicated (Bigelow).

Polygala Nuttallii, Torrey and Gray, *Ground centaury*.—This plant, called *Nuttall's polygala*, the *Polygala Nuttallii* of Torrey and Gray, and the *Polygala fastigiata*, or *P. sanguinea* of Nuttall, is an annual plant, with erect, often branched-fastigiate stems, from 6 to 12 inches in height; sometimes 15 or more stems will grow from one root, and on the root will be observed something resembling a nearly developed flower. This plant grows in pine barrens and dry, sandy soils, from Massachusetts to New Jersey, and southward near the coast, flowering from July to October (G.). The whole plant is used. It yields its virtues to water or alcohol. The *P. Nuttallii* and the *P. fastigiata* are described by botanists as different species, but they closely resemble each other, and possess the same properties. Tonic, alterative, diuretic, and antifuruncular. It has been used as a domestic medicine on Long Island, N. Y., where it has the reputation of being almost infallible as a remedy in *fever* and *ague*. Two or 3 drachms of the plant made into a strong decoction will act as a purgative. It is much used, also, as an alterative in *boils*, *cutaneous eruptions*, and *especially in erysipelas*. I have found this plant decidedly efficient in *erysipelas* and *boils*, and would recommend it to the profession as a valuable remedial agent, whose powers are not yet fully understood (J. King).

The following species of Polygala have been employed: *Polygala scoparia*, Kunth, Mexico; *P. vulgaris*, Linné, Europe; *P. major*, Jacquin, southeastern Europe (*Radix polygalæ hungaricæ*); *P. venenosa*, Jacquin, Java (reputed toxic); *P. Serpentaria*, Ecklon and Zeyher, south Africa; and *P. butyracea*, Africa. The seeds of the latter yield a fat eaten by the native Africans. The *P. amara*, Linné, of Europe, yields a volatile solid oil, wax, tannin, pectin, and *polygalamarin*, a very bitter, crystalline principle, which causes water to foam when shaken with it (Reinsch, 1839).

Related to these are *Monnina polystachya*, Ruiz et Pavon (Peru). Used in metal polishing as a soap, and as a remedy for *diarrhœa*. The bark of the root yields *saponin*. *Soulamea amara*, Lamarck (Molucca Isles), an antiperiodic bitter.

Polygala sanguinea, Linné, *Caducous polygala*.—New Jersey to Florida. Possesses similar properties to senega, and may be used as a substitute.

Polygala Boykinii, Nuttall.—Growing in Georgia and southern Tennessee. Its root is smaller than that of senega, is without keel, and has a uniform bark and cylindrical, woody column. (See its microscopical and chemical examination, by G. Goebel, *Amer. Jour. Pharm.*, 1881, who found it to yield 3 per cent of senegin. Prof. Maisch, who received a specimen from Dr. Gunn, of Alabama, thought it to be the plant which yielded *False* or *White senega*, that had been on the market since about 1875, but decided, in 1889 (*Amer. Jour. Pharm.*, p. 449; and 1892, pp. 181 and 553), that this was derived from *Polygala alba*, Nuttall, which grows in Louisiana, Texas, New Mexico, Arizona, Arkansas, Kansas, Nebraska, and Dakota.

NORTHERN SENEGA.—According to J. U. and C. G. Lloyd (*Amer. Jour. Pharm.*, 1881, p. 481), this comes from Minnesota and Wisconsin, and is believed to be derived from a species intermediate between *Polygala Senega* and *P. latifolia*. It furnishes a larger root than the official drug. The crown is sometimes 2 or 3 inches broad, and the upper portion of the root nearly an inch in thickness. It is more fleshy, but less contorted than senega, and the branches do not so distinctly exhibit a keel.

Concerning a *Northern Senega*, collected in Minnesota, see Prof. L. E. Sayre (*Amer. Jour. Pharm.*, 1892, p. 113), and Prof. J. M. Maisch (*ibid.*, p. 182). Prof. Sayre reports it to contain 3.5 per cent of senegin and much methyl salicylate.

Admixtures.—Certain roots have been accidentally mixed with senega. Among these are ginseng, valerian, cypripedium, and the roots of *Cynanchum Vincetoxicum*, Persoon; *Ionidium Ipecacuanha*, Ventenat; and *Gillenia trifoliata*, Moench.

SENNA (U. S. P.)—SENNA.

"The leaflets of *Cassia acutifolia*, Delile (Alexandria Senna), and of *Cassia angustifolia*, Vahl (India Senna)"—(*U. S. P.*).

Nat. Ord.—Leguminosæ.

ILLUSTRATION: Bentley and Trimen *Med. Plants*, 89, 90, and 91.

Botanical Source and History.—There are several species of the cassia plant, which are supposed to furnish *Senna*, as the *C. acutifolia*, *C. obovata*, *C. angustifolia*, *C. lanceolata* of Forskal, and *C. æthiopica* of Guibourt, etc.

Cassia acutifolia, Delile (*C. lanceolata*, De Candolle; *C. senna*, Linné; *C. lenitiva*, Bischoff; *C. orientalis*, Persoon; *Senna acutifolia*, Batka).

A perennial shrub, growing from 2 to 10 feet high; stem erect and smooth. The leaves are alternate, narrow, and equally pinnated; leaflets in pairs, from 4 to 8 on each leaf, ovate, nearly sessile, smooth above, rather downy beneath, with the veins turning inward, forming a flexuose intramarginal line; petioles without glands; stipules softly spinescent, semihastate, spreading, and minute. The flowers are bright yellow, in erect, stalked, axillary and terminal racemes, and rather longer than the leaves; the pedicels are without bracts. Sepals linear, and obtuse. Stamens 10, the 5 lowest small and sterile, the next 2 large, curved, and perfect, the 3 uppermost minute and gland-like. The ovaries are linear, downy, and falcate, with a smooth recurved style. The fruit consists of legumes or pods, which are pendulous, oblong, flat, membranous, about 1 inch long, ½ inch broad, quite straight, tapering abruptly to the base, and rounded at the apex; the seeds are many, ash-colored, and cordate (L). It grows in Nubia and upper Egypt, Kordofan, Sennaar, and yields most of the commercial *Alexandria senna* consumed in this country.

Cassia angustifolia, Vahl (*C. elongata*, Lemaire; *C. acutifolia*, Nees; *C. lanceolata*, Wight et Arnott; *C. medicinalis*, Bischoff; *C. medica*, Forskal; *Senna angustifolia*, Batka; *S. officinalis*, Roxburgh).

Cassia angustifolia, although an annual, may with attention be kept alive beyond the year, and made to assume a suffruticose character. It differs from *C. acutifolia* in having its leaflets lanceolate instead of ovate, and the legumes longer and not so round. Its seeds are deep-brown. It grows in northern and central India, Arabia, and in the Somali country, and is being cultivated from African seeds in Tinnevelly, near the southernmost point of India. It furnishes the *India senna*.

Cassia obovata, Calladon (*C. Senna*, Forskal; *C. obtusata*, Hayne; *C. obtusa*, Wallich; *Senna obovata*, Batka). A perennial herbaceous plant, smaller than the preceding, being about 18 inches high, with an erect or procumbent, smooth stem, downy at the base. Leaves alternate, equally pinnate, smooth, with no gland upon the petiole; leaflets in 4 to 6 pairs, opposite, obovate, rounded, mucronate at the apex, unequal at the base, the uppermost gradually the largest; stipules narrowly triangular, rigid, acute, spreading, and persistent. The flowers are pale-yellow, on erect, rather lax, axillary, stalked racemes. The legumes are oblong, falcate, membranous, smooth, rounded at each end, with an elevated ridge upon the valves over each side, so as to have an equally interrupted ridge along the middle, toward which the veins of each suture are directed nearly at right angles;

the seeds, 6 to 8 in number, are cordate (L.). This species grows in the high, dry, uncultivated lands of Mysore, Egypt, Nubia, desert of Suez, central Africa, as far west as Senegambia, and is cultivated in many parts of southern Europe. It furnishes an inferior senna, known as the *Italian* or *Aleppo*, rarely to be found in the market. It is called in Egypt *Senna baladi* or *Wild senna*.

Cassia Sophera, Linné (*C. lanceolata*, Forskal), resembles the above, having, however, never more than 4 or 5 pairs of leaflets, oblong, and either acute or obtuse, not at all ovate or lanceolate, and perfectly free from downiness even when young; the petioles have constantly a small, round, brown gland a little above the base. The pods are erect, oblong, tapering to the base, obtuse, turgid, mucronate, and rather falcate, especially when young, at which time they are sparingly covered with coarse, scattered hairs. It grows in Arabia, and was considered by Forskal as the true *Mecca senna* (L.).

Description.—The two principal commercial varieties of senna used in this country are *Alexandrian* or *Egyptian* and the *Indian* or *Tinnevelly senna*.

ALEXANDRIA SENNA is collected from Senaar, Nubia, and upper Egypt, partly also from tropical Africa, near Timbuctoo, and forwarded to Alexandria and Cairo for the European markets. The leaves are gathered by cutting the branches in autumn, commencing in September, exposing them to the sun and atmosphere until they are quite dry, when the branches are removed by threshing, the leaves placed in sacks, and sent to the places of export. A preliminary crop is harvested in April. As received in this country, Alexandria senna is generally in bales and barrels, and is considered the finest and most valuable variety; the best and most esteemed is that which contains the least quantity of cynanchum leaves, senna leaf-stalks and pods, where the entire-lanceolate leaves are numerous, and where the odor and taste is strong and pure. It has a peculiar but not disagreeable odor, with an unpleasant, nauseous, mucilaginous, and sweetish taste, with hardly any perceptible bitterness, unless it be admixed with the leaves of the *Argel* (*Solenostemma Argel*, Hayne, or *Cynanchum oleæfolium*), which impart bitterness to the powder or infusion, and which is the most important impurity to remove. They may be recognized by having no visible lateral nerves on their under-surface; by being longer, thicker, and firmer than senna leaves, and by the greater regularity of their base.

When conforming to the *U. S. P.* standard "*Alexandria senna* consists of leaflets about 25 Mm. (1 inch) long and 10 Mm. (⅜ inch) broad, lanceolate, or lance-oval, subcoriaceous, brittle, rather pointed, unequally oblique at the base, entire, grayish-green, somewhat pubescent, of a peculiar odor, and a nauseous, bitter taste. It should be free from stalks, and from argel leaves (the leaves of *Solenostemma Argel*, Hayne; *Nat. Ord.*—Asclepiadeæ), which are frequently present; these leaves are thicker, 1-veined, wrinkled, glaucous, and even at the base"—(*U. S. P.*). The *German Pharmacopœia* allows the presence of argel leaves. *Garbled Alexandria senna* is a selected kind, free from stalks, and sometimes free from argel leaves.

INDIA SENNA is of two kinds, the *Bombay*, or *East Indian*, and the *Tinnevelly*. The first is usually imported from Bombay, though it comes from Mocha and other parts of the Red sea (*Mecca* or *Arabian senna* is frequently alluded to as *Bombay senna*); the Tinnevelly is the cultivated kind and is esteemed the best. The *Pharmacopœia* thus describes India senna: "India senna consists of leaflets from 3 to 5 Cm. (1½ to 2 inches) long, and 10 to 15 Mm. (⅜ to ⅝ inch) broad; lanceolate, acute, unequally oblique at the base, entire, thin, yellowish-green or dull green, nearly smooth; odor peculiar, somewhat tea-like; taste mucilaginous, bitter, and nauseous. It should be free from stalks, discolored leaves, and other admixtures"—(*U. S. P.*). Tinnevelly senna is the purest of all sennas, being free from stalks and foreign leaves. (For microscopical examination of Alexandria and India senna, see L. E. Sayre, *Amer. Jour. Pharm.*, 1896, p. 585, and 1897, p. 298, also R. H. Denniston, *Pharm. Review*, 1898, p. 105; and E. Latour, Senna and Its Adulterants, *Pharm. Jour. Trans.*, 1896, p. 481.)

TRIPOLI SENNA somewhat resembles the Alexandrian, but is considered much inferior to it; the leaves are more fragmentary, and the leaf-stalks more numerous. It very seldom contains any adulteration with the argel leaves. It is believed to be derived from *Cassia acutifolia*, while others regard it as the product of *C. æthiopica*, Guibourt, growing in Nubia, Fezzan, and probably in Ethiopia. The active principles of senna are taken up by cold or warm water, glycerin, alcohol, and proof-spirits; boiling destroys its virtues unless it be in vacuo. It should be powdered only as wanted, because the powder absorbs moisture, from which follows moldiness and destruction of its therapeutical virtue.

Chemical Composition.—Senna leaves contain mucilage (about 10 per cent), calcium oxalate and acetate (12 per cent), and other salts yielding 9 to 12 per cent of ash; a non-purgative bitter resin, soluble in alcohol and ether (Rau, *Amer. Jour. Pharm.*, 1866, p. 193), yellow coloring matter identified by Keussler (*Jahresb. der Pharm.*, 1878, p. 199) as *chrysophanic acid* and *emodin:* the sugar *catharto-mannit* (Kubly and Dragendorff, 1865), which is dextro-rotatory, non-reducing and non-fermentable, having the formula, $C_6H_7(OH)_5$ (*sennit* of A. Seidel, *Amer. Jour. Pharm.*, 1885, p. 557). The cathartic principle of senna leaves is a glucosid and was first obtained in a comparatively pure state by Kubly and Dragendorff (Wittstein's *Vierteljahrsschrift*, 1867, p. 96) and named by them *cathartic acid.* It is an amorphous, black, solid mass, almost insoluble in water and strong alcohol, insoluble in ether and chloroform, soluble in warm alcohol of 40 to 60 per cent, and readily soluble with dark-brown color in alkalies and alkali carbonates; from this solution it is precipitated in brown flakes by acids. Boiling with diluted mineral acids decomposes it into sugar and *cathartogenic acid.* It loses its purgative action by heat and prolonged exposure to air. It exists in the leaves in the form of soluble calcium and magnesium salts. Kubly and Dragendorff prepare cathartic acid by evaporating *in vacuo* an aqueous infusion of senna leaves to a thick syrup, adding an equal bulk of strong alcohol which precipitates inorganic salts and gum, evaporating and precipitating the filtrate with excess of strong alcohol. The precipitate is dissolved in water, and the cathartic acid liberated by the addition of hydrochloric acid. The precipitate is purified by washing with absolute alcohol and ether. Mr. O. C. Dilly (*Amer. Druggist*, 1893, p. 13) obtained by this method 0.9 per cent of cathartic acid from Alexandria, and 0.6 per cent from Tinnevelly senna. (For other methods see R. Stockman, *Amer. Jour. Pharm.*, 1885, p. 256; and A. Gentz, *ibid.*, 1893, p. 334.) A. Gentz obtained a yield of about 0.75 per cent (also see *Rheum* and *Frangula*). Senna pods are now sold in the London market, and are stated to be richer in the cathartic principle than the leaves, and to contain none of the griping resin of the latter (E. F. Salmon, *Amer. Jour. Pharm.*, 1889, p. 581). C. Symes (*ibid.*, 1890, p. 46) found 0.8 per cent of pure cathartic acid.

Action, Medical Uses, and Dosage.—Senna is a certain, manageable, and convenient cathartic, very useful in all forms of *febrile diseases* in which a laxative action is desired, particularly in the forming stage of *bilious and other fevers*, especially in children, and in other diseases where a severe impression on the bowels is not desired. Constipation does not follow its employment. It is also efficient in *flatulent* and *bilious colics.* Its influence is chiefly exerted on the small intestines, augmenting their mucous secretions, exciting increased peristaltic motion, and producing loose, yellowish-brown evacuations. A nursing infant may be purged by the milk of the mother who has taken senna, and so susceptible are some persons to its action, that its odor is said to induce a cathartic action. It does not act as a sedative, as is the case with some other cathartics, nor as a refrigerant; but has a slight stimulating influence, insufficient, however, to contraindicate its use in case of general excitement or reaction. Besides the nauseating taste of senna, it is apt to cause sickness at stomach, and very few persons can use it alone, without experiencing more or less griping pains and flatulence. The addition of cloves, ginger, cinnamon, or other aromatics, are excellent correctives of these unpleasant effects. A teaspoonful of cream of tartar to a teacupful of the decoction or infusion of senna, is a mild and pleasant cathartic, particularly suited for females, where it may be required soon after delivery. The addition of neutral laxative salts, as phosphate of sodium, Epsom, or Rochelle salts, is another mode, adopted by a certain class of practitioners, of preventing the tormina, and, at the same time, increasing the activity of the infusion of senna. These are, however, rarely used by Eclectics. Saccharine and aromatic substances are also combined for this purpose, as sugar, manna, aromatic seeds, electuary of senna, etc. The purgative effect of senna is much increased by the addition of the pure bitters; the decoction of guaiacum is said to answer a similar purpose. Senna is contraindicated in an inflammatory condition of the alimentary canal, or even irritation of those parts, general debility, hemorrhoids, prolapsus ani, etc. The dose, in powder, is from 30 to 50 grains; in tincture, from ½ to 2 fluid ounces; specific senna, 1 to 60 drops; electuary, 2 drachms; and of the infusion, which is the most usual mode of administration, from 2 to 4 fluid ounces. But, according to Mr. T. B. Groves, the tincture of senna is without action; the decoction is of less value than the infusion, and the infusion less than maceration; the solution by maceration alone purges without gripings, as by this method the larger portion of the cathartic principle is extracted, leaving behind the acrid constituents. Cathartic acid has the same action of senna, purging with griping in doses of 1½ to 3 grains. The seed-pods and leaf-stalks of senna are slower to act than senna, but are freer from griping and nauseating effects than the leaves.

Specific Indications and Uses.—Wind or bilious colics; a laxative for non-inflammatory conditions of the intestinal tract.

Related Species and Adulterants.—(See *Pharm. Jour. Trans.*, Vol. II, 1896, p. 481, for description of microscopical characters of true *Senna leaves; Coriaria myrtifolia*, Linné; *Solenostemma Argel*, Heyne; *Vaccinium Vitis-Idæa*, Linné; *Globularia Alypum*, Linné; *Tephrosia appolinea*, De Candolle; and *Cassia marilandica*, Linné.)

Cassia brevipes, De Candolle.—Central America. Apex blunt, with 3 veins running parallel the whole length of the leaf; otherwise they resemble India senna. Destitute of cathartic properties (E. M. Holmes, 1875).

Cassia pubescens, R. Brown.—Oval or ovate leaflets, about an inch long, obtuse and mucronate, soft pubescent on both surfaces, and with ciliated margin. Occasionally mixed with Arabian senna.

Solenostemma Argel, Hayne (*Cynanchum Argel*, Delile; *Cynanchum oleæfolium*, Nectoux).—This Asclepiad inhabits upper Egypt, and constitutes the chief adulterant of Alexandria senna, which, in shape, size, and color, the leaves resemble. They are, however, pubescent, more leathery, wrinkled, bitter to the taste, and have an even base, and indistinct, lateral veins. The flower-buds, blossoms, and pyriform fruit, containing pubescent seeds, are often present also.

Tephrosia appolinea De Candolle (*Galega apollinea*, Delile) (*Nat. Ord.*—Leguminosæ).—Southern Europe. An occasional admixture in senna. Base uneven, apex emarginate, and general shape obovate.

Colutea arborescens, Linné (*Nat. Ord.*—Leguminosæ), *Bladder senna*.—Southern and eastern Europe. The leaflets of this shrub, which bears yellow flowers and greenish, vesicular pods, containing numerous blackish-brown, roundish seeds, have been substituted for and occasionally used to adulterate senna. They are, however, much feebler in cathartic power. The thin, smooth leaflets (borne in pairs of 4 or 5) are oval, elliptic, or obovate, slightly emarginate, deep-green above, pale or grayish-green beneath, the lower surface being covered with an appressed pubescence. The odor is not pronounced, but the taste is bitter and nauseous.

Coriaria myrtifolia, Linné, has poisonous leaves (containing *coriamyrtin*). They are sometimes used as an adulterant of senna. Can be recognized by the tests for tannin (gelatin, mercuric chloride, tartar emetic, ferric chloride) (Charles Heisch, *Amer. Jour. Pharm.*, 1888, p. 459).

Globularia Alypum, Linné (*Nat. Ord.*—Globulariaceæ).—Southern Europe, in the region of the Mediterranean. This plant, as well as *Globularia vulgaris*, contains an amorphous, bitter glucosid, *globularin* (Walz), and a peculiar tannin. *Globularin* ($C_{15}H_{20}O_8$) is soluble in water, alcohol, chloroform, and ether. Mineral acids split it into glucose and *globularetin* (C_9H_6O) (Heckel and Schlagdenhauffen, 1883). *Globularetin*, when heated with alkalies, yields cinnamic acid, which is also a constituent of the leaves. The leaves are used as a substitute for senna, and are mildly purgative. They are ovate-oblong, entire, or nearly so, almost sessile, exhibit fine granules, and are bluish-green beneath.

Caseria esculenta.—India. Plant said to yield an acid closely analogous to cathartic acid. Praised in *hepatic torpor*.

Allamanda cathartica.—A Porto Rico shrub, the extract of the bark of which, in doses of from 1 to 2 grains, is reputed a fine hydragogue cathartic.

Related Preparation.—SPECIES LAXANTES (N. F.), *Laxative species, St. Germain tea* (*Ger. Pharm.*). "Senna, cut, 16 parts; elder flowers, 10 parts; fennel, bruised, 5 parts; anise, bruised, 5 parts; potassium bitartrate, in fine powder, 4 parts. Moisten the senna with a small quantity of water, then sprinkle over it, as uniformly as possible, the potassium bitartrate. When it has become dry, mix it lightly and uniformly with the other ingredients"—(*Nat. Form.*, 1st ed.).

SERENOA.—SAW PALMETTO.

The fruit of *Serenoa serrulata*, Bentham and Hooker (*Sabal serrulata*, R. & S.; *Chamærops serrulata*, Pursh).

Nat. Ord.—Palmæ.

Botanical Source.—This southern palm has a creeping and branching stem, attaining a length of from 6 to 10 feet. The leaves, which are from 2 to 4 feet high, have a circular, fan-shaped outline, are bright-green, and shorter than the slender, somewhat spiny-edged, plano-convex petiole. They have from 15 to 30 divisions, which are erect and slightly cleft at the apices, and are without the thready filaments in the sinuses. The plant bears a densely woolly spadix, shorter than the leaves. The petals are almost united, the style slender, and the fruit is an ovoid-oblong, sweetish drupe.

History and Description.—This well-known palm is plentiful along the Atlantic shores, from Florida to South Carolina, where it forms the "palmetto scrub" of the coast. Parts of the plant have been employed in various economic ways, such as the thatching of huts, making of mattresses, straw hats, and paper. The fruit, though sweet and edible, is not regarded as particularly palatable. It is the medicinal part. Animals show a partiality for it, and are said to become fat and sleek when feeding upon the berries. (For an extended description, see monograph on *Saw Palmetto*, by the late Dr. Edwin M. Hale, of Chicago.) The dried fruit is a 1-seeded, blackish-brown drupe, of an ovoid-oblong form, from ½ to 1 inch long, and about ¼ to ½ inch broad. The exterior has a few wrinkles, with rather large, smooth, flat areas. A single panicle may yield from 6 to 8 pounds of the berries.

Chemical Composition.—According to the researches of P. L. Sherman and C. H. Briggs (*Pharm. Archives*, June, 1899), the pulp of the fruit yields, by pressure, 1.5 per cent of an aromatic oil (*Saw palmetto oil*), of a characteristic fruity odor. Fresh saw palmetto berries mixed with water and distilled by us, yielded a pungent, greenish oil. A greenish oil separates from the fluid extract of the fresh berries. Both oils have the characteristic cheesy odor of the fresh berries. This reminds us of œnanthic ether. The nuts of the fruit amount to 17.5 per cent, and contain about 12 per cent of a fatty oil (*oil of nuts*), which is chemically different from that derived from the pulp. *Saw palmetto oil* is brownish-yellow to dark-red, of acid reaction, and slightly volatile with steam. It can be distilled in a vacuum almost entirely without decomposition. It is soluble in alcohol, ether, chloroform, and benzene, insoluble in water and acids, partly soluble in diluted aqueous potash. The oil consisted of about 63 per cent of free acids (*caproic acid*, $C_6H_{12}O_2$; very little *caprylic*, $C_8H_{16}O_2$; some *capric*, $C_{10}H_{20}O_2$; much *lauric*, $C_{12}H_{24}O_2$; and *palmitic acids*, $C_{16}H_{32}O_2$; and some *oleic acid*, $C_{18}H_{34}O_2$), and 37 per cent of ethyl- but no glyceryl-esters of these acids. The oil of the nuts is a thick liquid of a greenish color, only slightly soluble in alcohol, insoluble in water, soluble in benzene, chloroform, and ether. The specimen examined contained only 2.3 per cent of free acids, the rest were glycerides of *caprylic*, *capric*, *lauric*, *palmitic*, *stearic*, and *oleic acids*. The fruit contains large amounts of sugar, but neither a glucosid nor an alkaloid.

Action, Medical Uses, and Dosage.—Saw palmetto appears, from clinical reports, to be a nutritive tonic. It is also an expectorant, and controls irritation of mucous tissues. It has proved useful in *irritative cough*, *chronic bronchial coughs*, *whooping-cough*, *laryngitis*, acute and chronic, *acute catarrh*, *asthma*, *tubercular laryngitis*, and in the *cough of phthisis pulmonalis*. Upon the digestive organs it acts kindly, improving the appetite, digestion, and assimilation. However, its most pronounced effects appear to be those exerted upon the urino-genital tracts of both male and female, and upon all the organs concerned in reproduction. It is said to enlarge *wasted organs*, as the breasts, ovaries, and testicles, while the paradoxical claim is also made that it reduces *hypertrophy of the prostate*. Possibly this may be explained by claiming that it tends toward the production of a normal condition, reducing parts when unhealthily enlarged, and increasing them when atrophied. At any rate, it has been lauded as the "old man's friend," giving relief from the many annoyances commonly attributed to enlarged prostate. May its results not be due to its control over urethral irritation, and thereby reducing swollen conditions not in reality amounting to hypertrophy? Besides this, it increases the tonus of the bladder, allowing a better contraction and more perfect expulsion of the contents of that viscus. Thus it overcomes the tenesmic pain so dreaded by the sufferer. We would rather regard it a remedy for *prostatic irritation* and *relaxation of tissue* than for a hypertrophied prostate. It is said to relieve aching, dull, throbbing pain in the prostatic portion of the urethra, with mucoid or prostatic discharge. It relieves the irritation following a badly-treated *gonorrhœa. Orchitis, ovaritis, orchialgia, ovaralgia*, and *epidymitis* have been asserted cured with it. It is reputed to restore sexual activity after exhaustive excesses, and, even in the feeble woman, strengthens the sexual appetite. Long-continued use of it is said to slowly and surely cause the *mammæ to enlarge.* Its reputed power to reduce *uterine hypertrophy* is probably due to its power over relaxed tissues, the organ being not in reality hypertrophied, but large, flabby, and actively leucorrhœal. The remedy needs a more careful and extended study. The dose of the fluid extract is from 1 to 60 drops; of specific saw palmetto, 1 to 60 drops.

Specific Indications and Uses.—Relaxation of parts, with copious catarrhal discharges; lack of development, or wasting away of testicles, ovaries, or mammæ; prostatic irritation, with painful micturition, and dribbling of urine, particularly in the aged; tenderness of the glands, and other parts concerned in reproduction.

SERPENTARIA (U. S. P.)—SERPENTARIA.

The rhizome and roots of *Aristolochia Serpentaria*, Linné, and of *Aristolochia reticulata*, Nuttall"—(*U. S. P.*).

Nat. Ord.—Aristolochiaceæ.

Common Names: (1) *Virginia snakeroot*, (2) *Red River* or *Texas snakeroot.*

Illustration: Bentley and Trimen, *Med. Plants*, 246.

Botanical Source.—*Aristolochia Serpentaria*, also called Snakeroot and Snakeweed, is a perennial, herbaceous plant, with an extremely fibrous, knotty, brown root, sending up numerous stems. The stems rise singly or severally from the same root, are erect, simple or branched, jointed, flexuous, cylindrical, often with a reddish tinge, and most commonly under a foot high. The leaves are alternate, on short petioles, oblong, entire, acuminate, heart-shaped, at base 3-nerved, and more or less downy on the surface, having a slightly yellowish tint. The flowers grow close to the ground, curve downward, have a stiff, leathery texture, and a dull brownish-purple color. The peduncle, which supports them, has one or more bracts, and gradually enlarges into a furrowed obovate ovary. The calyx, like others in this singular genus, consists of a long, contorted tube, bent in the form of the letter S, swelling at its two extremities, having its throat surrounded by an elevated edge or brim, and its border expanded into a broad, irregular margin, forming an under and upper lip, which are closed in a triangular manner in the bud, and is dull-purplish or red. Corolla none. Anthers 12 in number, growing in pairs to the sides of the fleshy style, which is situated in the bottom of the calyx, and covered by a firm, spreading, convoluted stigma, which extends over the anthers. Capsule obovate, 6-angled, and 6-celled, with numerous small, flat seeds (B.—L.).

Fig. 228.

Aristolochia Serpentaria.

Aristolochia reticulata, or Red River snakeroot, has a very flexuous stem, oval, cordate, clasping, subsessile leaves, thickish, strongly reticulated, with the lobes decussating. The plant is not smooth, but hirsute. The flowers are small, radical, densely pubescent, and of a purplish hue.

Description.—Several species of Aristolochia have been confounded with the above, but as they are nearly identical in medicinal properties, the confusion is probably of but little consequence. These species are the *A. hirsuta*, Muhlenberg, growing in the southern states, and strongly resembling the above; the *A. hastata* of Nuttall, or *A. sagittaria* of Muhlenberg, growing in the south; as well as the *A. tomentosa*, a tall climbing species of Louisiana. *A. reticulata*, of southwestern growth, is now official.

Aristolochia Serpentaria is found in rich woods, hedges, and thickets, from Connecticut to Illinois, and southward to Louisiana, being more common near the Alleghanies, and flowering from April to July. In commerce, the dried root consists of a short, knotty, premorse rootstock, or head, with very numerous radicles, 3 inches or more in length, filiform, flexuous, interlaced, and brittle. The *U. S. P.* gives the following description: "The rhizome is about 25 Mm. (1 inch) long, thin, bent; on the upper side with approximate, short stem-bases; on the lower side with numerous, thin, branching roots, about 10 Cm. (4 inches) long; dull yellowish-brown, internally whitish; the wood-rays of the rhizome longest on the lower side; odor aromatic, camphoraceous; taste warm, bitterish, and camphoraceous. The roots of *Aristolochia reticulata* are coarser, longer, and less interlaced than those of *Aristolochia Serpentaria*"—(*U. S. P.*). Pinkroot and seneca are sometimes found mixed with the A. Serpentaria, as well as some other roots, especially golden seal (as much as 10 per cent, see Prof. Patch, in Merck's *Report*, 1896, p. 403), cypripedium, and ginseng roots. These adulterations may be detected by the difference in the appearance of the roots, and of the leaves and stems when present, as well as by the absence of the peculiar serpentaria flavor. The root of *Polemonium reptans* has also been substituted for serpentaria (*Amer. Jour. Pharm.*, 1887, p. 374). The active principles of the root are extracted by water, alcohol, or proof-spirit. The tincture is bright-green, and is rendered turbid by water.

Chemical Composition.—Mr. J. A. Ferguson (*Amer. Jour. Pharm.*, 1887, p. 481) found the rhizome and roots of *Aristolochia reticulata* to contain volatile oil (1 per cent), resin, soluble in petroleum ether (3.2 per cent), resin, soluble in ether (1.9 per cent), furthermore tannin, gum, starch (6.48 per cent), dextrin, sugar, malic acid, calcium oxalate, etc., and a crystallizable alkaloid, which he named *aristolochine*, perhaps the *aristolochin* of Chevallier and Feneulle. It is very bitter, soluble in water, alcohol, ether, chloroform, and benzol. The volatile oil of this species was investigated by Joseph C. Peacock, *ibid.*, 1891, pp. 257–264), who found it to contain a *terpene* ($C_{10}H_{16}$), boiling at 175° C. (314.6° F.), and 40 per cent of solid, camphor-like *borneol* ($C_{10}H_{18}O$), which exists in the oil, partly free, partly in the form of an ester. Spica (*Jahresb. der Pharm.*, 1887, p. 45) previously established the presence of borneol in the oil from *Aristolochia Serpentaria*, the lower fractions of which have a valerian-like odor.

Action, Medical Uses, and Dosage.—Virginia snakeroot, in small doses, promotes the appetite and gives tone to the organs of digestion, and is very useful, especially in the form of vinous tincture, in cases of enfeebled stomach following exhausting diseases. In full doses, it stimulates the system, producing increased arterial action, free diaphoresis, and frequently diuresis. In large doses, it causes an uneasy sensation at the stomach, with sickness, vomiting, and purging, headache, drowsiness, and disturbed sleep, and, in warm infusion, it produces diaphoresis, and is beneficial in *adynamic eruptive fevers*, where the eruption is tardy, or has receded. In the *typhoid stage of febrile diseases*, where strong stimulants, as brandy, etc., can not be borne, it will be found very available. In *periodic fevers*, it may be advantageously used with or without its combination with quinine. It is a good remedy when the renal function is suppressed by colds, and in other troubles resulting from the same cause, with a tendency to locate in the viscera. An infusion of it forms an excellent gargle in *putrid sore throat*, and in *atonic throat disorders*, with a tendency to destruction of tissues. *Dyspepsia* has been benefited by it in tonic doses, and *amenorrhœa* has been cured, especially when caused by cold. When its use is too long continued, it occasions sickness at stomach, emesis, gripings, and tenesmus. Long boiling impairs its virtues. A cold infusion is useful in convalescence from acute diseases. Atonic and torpid conditions are those in which serpentaria is valuable, while severe inflammations and high fevers contraindicate its use. Some cases of *colliquative sweating* are controlled by it; such cases are those requiring a cutaneous stimulant. Dose of the powder, as a tonic, 3 to 6 grains; as a stimulant, 20 to 30 grains; of the infusion, 1 or 2 fluid ounces; of the tincture, 1 or 2 fluid drachms; specific serpentaria, 1 to 30 drops.

Specific Indications and Uses.—A cutaneous stimulant, increasing secretion; sensation of dragging and weight in the loins, with scanty renal secretion, or urine containing triple phosphates; renal and other visceral disorders, the direct result of taking cold; fullness in the chest, with difficult respiration; malignant sore throat, with tendency to destruction of tissues; torpid and atonic conditions only.

Related Species.—A number of species of Aristolochia have been used in medicine. They all have similar properties, being stimulant, tonic, and emmenagogue. Of the European species there are the *A. longa*, *A. clematitis*, *A. pistolochia*, and *A. rotunda*. *Aristolochin* (*aristolochic acid*, Hesse) is the active principle of the seeds of *A. clematitis* and the roots of *A. rotunda* and

A. longa (J. Pohl, *Amer. Jour. Pharm.*, 1892, p. 82). It is a yellow crystalline acid, soluble in alcohol, ether, and chloroform, insoluble in petroleum ether, little soluble in warm water. Another plant having the common properties of this genus, is the *jarra* (*jarrhina*) or *milhomen* of Brazil—the *A. cymbifera* of Martius (see *Jahresb. der Pharm.*, 1887, p. 44). The *Yerba del India*, of Texas and Mexico (*A. fœtida*), is applied to *ulcers*. *A. argentina*, of the Argentine Republic, a diaphoretic and diuretic, and *A. indica*, of the East Indies, both contain alkaloids. In the former species, O. Hesse found the alkaloid *aristolochine*, *aristinic*, *aristidinic* and *aristolic acids* (*Amer. Jour. Pharm.*, 1896, p. 141; also see *Pharm. Jour. Trans.*, Vol. XXII, 1891, pp. 245 and 551).

SESAMUM.—BENNE.

The leaves and seed of *Sesamum indicum*, Linné.

Nat. Ord.—Pedaliaceæ.

Common Names: *Benne*, *Sesame leaves*, *Sesame seeds*.

Illustration: Bentley and Trimen, *Med. Plants*, 198.

Botanical Source.—Sesamum indicum is an annual plant, with an erect, pubescent, branching stem, 2 to 4 feet in height. The leaves are ovate-lanceolate, or oblong; the lower ones trilobed and sometimes ternate; the upper undivided, irregularly serrate and pointed. The flowers are of a pale-purple color, axillary, and borne on short glandular pedicels. The fruit is an oblong, mucronate, pubescent capsule, containing numerous small, oval, yellowish seeds (W.—Wi.).

History and Description.—There were formerly thought to be two species of this genus, the *S. indicum*, and the *S. orientale*, both of which were originally from India, and are now much cultivated in several parts of Africa, West Indies, and in the southern United States. That growing in the south is the S. indicum, and flowers in August. The latter species is now regarded as identical with the former. The parts used are the leaves and seeds. The seeds are rather small, sulphur-colored, sometimes very dark, and contain a large quantity of a sweetish, odorless oil, of a light-yellow color, mild to the taste, of specific gravity 0.9191, and which may be obtained by expression (see *Oleum Sesami*). It does not readily acquire rancidity, and forms an excellent substitute for olive oil. The negroes of the south make considerable use of the seeds as an article of diet. The leaves are ovate-oblong, narrowed at base, with margin irregularly toothed, or entire, the lower ones often having tridentate lobes or leaflets. They are smoothish, or pubescent, and strongly veined underneath. The fresh leaves contain a large amount of mucilage, which may be procured by macerating them in water and precipitating with alcohol.

Action, Medical Uses, and Dosage.—A fresh leaf or two added to ½ pint of water forms a pleasant, demulcent drink, very useful in *catarrhal affections*, *acute diarrhœa* and *dysentery*, *summer complaint of children*, and *affections of the bladder*, *kidneys*, and *urethra*. It may be drank freely. When the leaves are dried, their mucilage will be best extracted by water at 100° C. (212° F.). The mucilage forms an excellent soothing application in *ophthalmia*, *irritations*, *cutaneous affections*, etc.; but is inferior to slippery elm. The oil may be used topically in *eruptions* of a scaly or bran-like character, or, it may be given internally in the same manner as olive oil to produce a laxative effect. It is stated that the natives of India employ it as an abortive, and to promote the menstrual discharge. It is much used as a perfumed oil for the hair.

SEVUM (U. S. P.)—SUET.

"The internal fat of the abdomen of *Oris Aries*, Linné (*Class*, Mammalia: *Order*, Ruminantia), purified by melting and straining. Suet should be kept in well-closed vessels impervious to fat. It should not be used after it has become rancid"—(*U. S. P.*).

Common Names: *Suet*, *Mutton suet*, *Sheep tallow*.

Preparation, Description, and Chemical Composition.—Prepared suet (*Sevum præparatum*, *Br. Pharm.*), mutton suet or sheep tallow, is the adipose matter of the domestic sheep, *Oris Aries*. For medicinal purposes the kidney fat is melted at a gentle temperature and then strained, in order to separate the membranous portions. It may be rendered still purer by heating it in water at 100° C.

(212° F.). By a special process, the fatty substance in the state in which it is removed from the animal is heated with a small quantity of sulphuric acid of specific gravity 1.3 to 1.45. The acid dissolves the membrane and other impurities present, acquiring a dark color and thick syrupy consistence, while the fat separates in a state of purity.

Prepared suet is somewhat similar in its properties to lard, but is harder and more compact. To meet the demands of the *Pharmacopœia* it should be "a white, solid fat, nearly inodorous, and having a bland taste when fresh, but becoming rancid on prolonged exposure to the air. Insoluble in water or cold alcohol; soluble in 44 parts of boiling alcohol, in about 60 parts of ether, and slowly in 2 parts of benzin. From its solution in the latter, kept in a stoppered flask, it slowly separates in a crystalline form on standing. An alcoholic solution of suet is neutral or has only a slightly acid reaction with litmus paper moistened with alcohol. Suet melts between 45° and 50° C. (113° and 122° F.), and congeals between 37° and 40° C. (98.6° and 104° F.)"—(*U. S. P.*). Suet consists chiefly of stearin and palmitin (70 per cent) and olein (30 per cent), with a trace of *hircin*, which is a liquid oil, probably a mixture of the glycerides of capric and caprylic acids (also see *Adeps*).

Action and Medical Uses.—Suet is nutritive and emollient, but not so easy of digestion as the fat of the pig or ox; yet it may be made into a broth, with or without aromatics, and used in *diarrhœa*, *dysentery*, and *general debility*. It is sometimes used as a dressing to *blisters*, and may be applied to most of the purposes for which lard is used, on account of its superior hardness, and higher melting point. For forming an ointment, it will be found preferable to lard, especially when it is to be applied to several forms of *cutaneous disease*. The addition of benzoic acid, sulphite of sodium, or sweet gum, will prevent its tendency to become rancid and disagreeably odorous.

SILPHIUM.—INDIAN CUP-PLANT.

The root of *Silphium perfoliatum*, Linné.

Nat. Ord.—Compositæ.

COMMON NAMES: *Cup-plant*, *Indian cup-plant*, *Ragged cup*.

Botanical Source.—This plant has a perennial, horizontal, pitted rhizome, beset with radicles, and a large, smooth, square, herbaceous stem, 4 to 7 feet high, and often branched above. The leaves are opposite, connate-perfoliate, ovate, coarsely toothed, abruptly narrowed into winged petioles at the base, the upper pairs forming a cup-shaped disk with their connate bases; they are from 8 to 14 inches long, by 4 to 7 wide. The flowers are terminal, with 15 or 25 oblong, lanceolate, yellow rays, and a large, dark-colored disk. Heads in a trichotomous cyme, the central one on a long peduncle; the scales ovate, obtuse, and squarrose; the achenia broadly ovate, winged, and emarginate (W.—G.).

History, Description, and Chemical Composition.—This plant is common to the western states, and is found growing in rich bottom or interval lands, bearing numerous yellow flowers in August. The root is the medicinal part. It is large, long, and crooked, and imparts its properties to water or alcohol. It has a persistent, acrid taste. There are several species of *Silphium*, which yield, by incision and exudation, a fine, fragrant, and bitterish gum-like frankincense, of white or amber color, and which is chewed by the Indians to sweeten the breath.

Action, Medical Uses, and Dosage.—Cup-plant is tonic, diaphoretic, and alterative. A strong infusion of the root, made by long steeping, or an extract, is said to be one of the best remedies for the removal of *ague-cake* or *enlarged spleen*. It is also useful in *intermittent* and *remittent fevers*, *internal bruises*, *debility*, *ulcers*, *liver affections*, and as a general alterative restorative. The gum is said to be stimulant and antispasmodic. The dose of the powdered root is 20 grains; tincture (fresh root, ℥viij to alcohol, 76 per cent, Oj), 1 to 20 drops, in water.

Related Species.—*Silphium laciniatum*, Linné (*Silphium gummiferum*), *Compass-plant*, *Polar-plant*, *Compass-weed*, *Rosin-weed*. Western and southwestern United States. This plant, which grows from 5 to 10 feet high, exudes from the stem and leaves transparent or translucent tears of an oleoresin resembling gum mastich, and possessing a pleasant, terebinthinate taste and odor. It consists of volatile oil (20 per cent), acid resin (37 per cent), sugar, wax, and inorganic salts (L. J. Morris, *Amer. Jour. Pharm.*, 1881, pp. 487–491). From the fact that the lower leaves of this plant point directly north and south, when growing in open prairie lands, it has received the name "compass-weed." Rosin-weed is said to be emetic in decoction. It has effected cures in *intermittent fever*, and is beneficial in dry, obstinate *coughs*, *asthmatic affections*, and *pulmonary catarrhal diseases*. Said to cure *heaves* in horses. The resin secreted by this plant is possessed of diuretic properties, increasing the flow of urine, to which it imparts a strong aromatic odor. The root has been used to some extent in *vesical catarrh*, *gonorrhœa*, and *gleet*. It is a remedy for *asthma*, with spasmodic, dry cough, with sense of constriction and dryness in the throat; not useful if there be congestion or profuse secretion. It has been employed as an expectorant in *cough* and other pulmonary difficulties. It has been prepared by cutting it in small pieces, covering each layer with loaf-sugar, and the whole with brandy. After standing for several days, express, strain, and bottle for use. A strong tincture of the fresh plant (℥viii to alcohol, 76 per cent, Oj) may be given in doses of from 1 to 10 drops.

Fig. 229.

Silphium laciniatum.

Silphium terebinthinaceum, Linné, *Prairie burdock*.—Also yields a resinous exudate.

SINAPIS ALBA (U. S. P.)—WHITE MUSTARD.

"The seed of *Brassica alba* (Linné), Hooker filius et Thompson"—(*U. S. P.*) (*Sinapis alba*, Linné; *Leucosinapis alba*, Spach).

Nat. Ord.—Cruciferæ.

Illustration: Bentley and Trimen, *Med. Plants*, 23.

SINAPIS NIGRA (U. S. P.)—BLACK MUSTARD.

"The seed of *Brassica nigra* (Linné), Koch"—(*U. S. P.*) (*Sinapis nigra*, Linné; *Brassica sinapoides*, Roth).

Nat. Ord.—Cruciferæ.

Illustration: Bentley and Trimen, *Med. Plants*, 22.

Botanical Source.—*Sinapis alba* is an annual plant, with a thinly hirsute stem, 2 to 5 feet high. The leaves are smoothish, lyrately pinnate, irregularly dentate, rugged, and pale-green; the lower lobes oblong and deeper; the terminal larger. Flowers large, pale-yellow; petals ovate, with straight claws; sepals linear, green, equal at base, and spreading. The siliques or pods are spreading, hispid, torose at the place of the seeds, nerved, shorter than the compressed, ensiform beak, about 4-seeded. The seeds are globose, large, and pale (W.—L.).

Sinapis nigra is also an annual plant, with a round, smooth, striate, branching stem, 3 to 6 feet high. The lower leaves are large, lyrate, rough, variously lobed, and dentate; the upper linear-lanceolate, smooth, entire, and pendulous; all petiolate. Flowers small, sulphur-yellow; calyx spreading; petals obovate. Pods very numerous, nearly an inch long, bluntly quadrangular, nearly even and smooth, appressed close to the rachis of the raceme, tipped by a small, short, 4-sided style, but wholly destitute of the ensiform beak of the above species. The seeds are numerous, small, globose, blackish-brown, and veined (L.—W.).

Fig. 230.

Brassica nigra.

Description.—These plants are indigenous to Europe, and have been introduced into this country, where they are cultivated for use, and are found growing in old fields and waste places, flowering in June and July. The *U. S. P.* describes *White mustard-seed* as "about 2 Mm. ($\frac{1}{12}$ inch) in diameter, almost globular, with a circular hilum; testa yellowish, finely pitted, hard; embryo oily, with a curved radical, and 2 cotyledons, one folded over the other; free from starch; inodorous; taste pungent and acrid"—(*U. S. P.*). *Black* *mustard-seed* is "about 1 Mm. ($\frac{1}{25}$ inch) in diameter, almost globular, with a circular hilum; testa blackish-brown or grayish brown, finely pitted, hard; embryo oily, with a curved radical, and 2 cotyledons, one folded over the other; free from starch; inodorous when dry, but when triturated with water, of a pungent, penetrating, irritating odor; taste pungent and acrid"—(*U. S. P.*). Both kinds of mustard-seeds are employed in medicine, in the form of flour, and the white seed is likewise used entire. Table mustard is prepared from the white seed, but the finest quality is prepared with the purest flour of both the white and black, in nearly equal quantities. Wheat flour is sometimes added to diminish the pungency, and turmeric has been added to improve the color. The medicinal flour of mustard should be made with the black and white seeds only, without any adulteration.

Chemical Composition.—Both white and black mustard-seeds contain *mucilage* (19 per cent in black mustard-seed), non-drying *fatty oil* (an average of 25 per cent; Hassall [*Pharm. Jour. Trans.*, Vol. IV, 1874, p. 670] found 35.7 per cent); it is light to brown-yellow, and consists of the glycerides of stearic and oleic acids, *erucic* (or *brassic*) *acid* ($C_{22}H_{42}O_2$), which is the principal acid, *behenic* ($C_{22}H_{44}O_2$) and *sinapolic* ($C_{20}H_{38}O_4$) *acids*. In both kinds of seeds much nitrogenous matter is present (26 to 31 per cent; see methods of analysis of black and white mustard by C. H. Piesse and L. Stansell, *Pharm. Jour. Trans.*, Vol. XI, 1880, p. 416). The nitrogenous ferment, *myrosin*, likewise occurs in both kinds of seeds. It is soluble in water, insoluble in alcohol. Starch is absent in ripe mustard-seed, and the ash varies from 4 to 5 per cent. The most important constituents of mustard are the glucosids *sinigrin*, in black, and *sinalbin*, in white mustard-seed, both of complicated, yet analogous, composition.

SINIGRIN (*potassium myronate*, $C_{10}H_{16}NS_2KO_9$, or $C_3H_5N{:}C{:}[S.C_6H_{11}O_5][O.SO_2OK]$, Gadamer) and *myrosin* were first isolated by Bussy (1839), and their behavior further studied by Will and Körner (1863). Dr. J. Gadamer (*Archiv der Pharm.*, 1897, pp. 44–114) obtained a yield of 1.3 per cent. It crystallizes in brilliant-white needles, is soluble in water, yielding a neutral solution of bitter taste. It is very little soluble in cold alcohol, insoluble in ether. In contact with myrosin in aqueous solution, at a temperature not above 70° C. (158° F.), it is readily decomposed into *allyl-mustard oil* (*allyl-isothiocyanide*, or volatile oil of mustard, which see), dextrose, and acid potassium sulphate, according to the equation: $C_{10}H_{16}NS_2KO_9+H_2O=C_3H_5NCS+C_6H_{12}O_6+KHSO_4$. At and above the temperature named, the activity of the myrosin is destroyed.

SINALBIN ($C_{30}H_{42}N_2S_2O_{15}$, Gadamer, 1897), so named and investigated by Will and Laubenheimer (1870), may be obtained from white mustard-seed in the quantity of 2.5 per cent (Gadamer). It crystallizes in nearly colorless prisms, is readily soluble in boiling water, little soluble in alcohol, insoluble in ether. In contact with myrosin and water, sinalbin undergoes decomposition analogous to that of sinigrin—namely, into non-volatile, pungent *sinalbin-mustard-oil* (*para-oxybenzyl-* [or *acrinyl-*] *isothiocyanide*, $C_6H_6[OH].CH_2.NCS$), *dextrose*, and *acid sinapine sulphate*, according to the equation: $C_{30}H_{42}N_2S_2O_{15}+H_2O=C_7H_7O.NCS+C_6H_{12}O_6+C_{16}H_{24}NO_5.HSO_4$.

The basis *sinapine* ($C_{16}H_{25}NO_5$, Gadamer) was ascertained by von Babo and Hirschbrunn (1852) to be the ester of *choline* ($C_5H_{15}NO_2$) and *sinapic acid* ($C_{11}H_{12}O_5$) (see researches regarding the latter, *Archiv der Pharm.*, 1897, pp. 102–114). According to Gadamer, the basis *sinapine* also occurs in black mustard-seed in the form of an acid sulphate, but no sinalbin occurs in the latter kind of seed. Neither does sinigrin occur in white mustard-seed. *Sinapine sulphocyanide* (*rhodanide*) ($C_{16}H_{24}NO_5.SCN$, characterized by the blood-red coloration of rhodanides with ferric chloride) does not occur as such in white mustard-seed, as was believed by von Babo and Hirschbrunn (also see *Oleum Sinapis Volatile*).

The efficiency of commercial mustard-seeds and "mustard farina" depends on the amount of volatile oil that is formed when in prolonged contact (5 to 6 hours, perhaps less) with myrosin and water. This amount is determined by distilling the mixture and determining the volatile oil, in the form of *thiosinamine* (see *Oleum Sinapis Volatile*). Piesse and Stansell thus obtained from commercial black mustard-seed 0.473 per cent, from black farina 1.38 to 1.5 per cent of oil, the higher value in the latter case being due to a concentration of the mustard substance by loss of water. (For further details regarding the analysis of white and black mustard-seeds, see Piesse and Stansell, *loc. cit.*, and A. R. Leeds and E. Everhart, *Amer. Jour. Pharm.*, 1882, p. 404; also see J. U. Lloyd's tests for starch in powdered mustard, *ibid.*, 1898, p. 433.)

Action, Medical Uses, and Dosage.—Mustard is an irritant, stimulant, rubefacient, vesicant, and diuretic. It is used in small quantities, internally, as a condiment and mild but efficient excitant of the organs of digestion. In drachm doses, it acts as an emetic, and will thus be found serviceable in cases of *gastric torpidity*, *poisoning by narcotics*, to stimulate the stomach, and to aid other emetics in fulfilling their indications. In large doses, the volatile oil is poisonous, causing inflammation of the stomach and bowels, and impairing the normal character of the fluids of the system by its absorption. Externally, it quickly excites redness of the skin, and, if too long applied, inflammation, ulceration, and even sloughing; but if removed in time, the redness is succeeded only by induration of the cuticle, and occasionally desquamation. The stinging pain which remains after the removal of the mustard, may be mitigated by sponging the part with cold water, or dropping ether on it. Sinapisms are beneficially applied over the abdomen and spine, in *gastric and enteric inflammations*, and over the epigastrium, in *vomiting* from irritability of the stomach; also to the spine, wrists, and ankles, to arouse the system in *apoplectic and comatose conditions*, and in *typhus fever;* to the feet and legs, for pains in the head during *fevers* and other diseases, and in determinations to the head; and to various parts for removing pain, mitigating *local inflammations*, or arousing from stupor. In the treatment of *cholera*, mustard is an excellent rubefacient application, likewise in *dyspepsia* and *obstinate constipation*. Applied to the breasts, it will often relieve *suppression of the menses*, as well as *menorrhagia;* to be applied intermittingly. Ellingwood advises a cold sitz-bath, strong with mustard, to restore *arrested menses*. A mustard-bath, at about 28.3° C. (85° F.), imparts a sense of coldness, and even distinct chills may be felt in the limbs, abdomen, and back. This continues until the person is removed from the bath, when stinging, glowing, and burning of the surface indicate that reaction is established. Mustard should be cautiously employed upon young children, as it has, in several recorded instances, induced suppression of the urine or strangury. The volatile oil of mustard is a powerful rubefacient and vesicatory; and, in the dose of 2 drops, several times a day, in some mucilaginous vehicle, it is a good diuretic, useful in *dropsy*, and has been serviceable in *colic*. The usual dose, however, of volatile oil of mustard is from $\frac{1}{12}$ to $\frac{1}{4}$ drop. A liniment, composed of 1 part of the oil, dissolved in 16 parts of alcohol, or in 10 parts of olive or almond oil, is a good substitute for a sinapism, though less manageable. White mustard-seed, taken entire, was formerly used as a favorite tonic in *dyspepsia*, and as a laxative, the seed passing unchanged, and probably acting by mechanical irritation. Dose of mustard, as an emetic, 1, 2, or 3 drachms, with 6 or 8 ounces of warm water (see *Charta Sinapis* and *Cataplasma Sinapis*). A prolonged application of a mustard cataplasm causes blistering, with even ulceration and gangrene. A mustard plaster is prepared from equal parts of wheaten or rye flour and lukewarm or cold water, spread upon fabric, and applied with a thin tissue, as of gauze, intervening between the plaster and skin. Its effects should be closely watched, especially in delicate individuals and the old and young. It often gives relief in *pleurisy* and the early stage of other *painful chest affections*. *Acute cardiac pain*, whether or not due to *angina pectoris*, is often promptly relieved by a mustard plaster. The same is very efficient when applied to the nape of the neck for the relief of *headache*, with fullness of the cerebral vessels, or when due to congestion. The application of mustard poultices to the spine—one to the cervical portion one day, one to the dorsal region the next day, and one to the lumbar the third day, repeating the procedure from day to day, has been advised in the treatment of *spinal irritation*. Care should be exercised that the skin be not blistered, rubefacient effect only being desired (Ellingwood). *Acute cerebro-spinal meningitis* has been aborted by wrapping the patient in a blanket wrung out of hot mustard-water (*ibid.*), while to reestablish the eruption after recession in the *exanthemata*, a hot mustard-bath is frequently all that will be required.

Specific Indications and Uses.—A counter-irritant and revulsive in local painful affections and internal congestions; a convenient emetic for narcotic poisoning.

Related Species.—*Brassica juncea*, Hooker filius (*Sinapis juncea*, Linné). Grown in place of the *Brassica nigra* in India, central Africa, and Russia. In the latter place it furnishes a fine, yellow flour, known as *sarepta* or *Russian mustard*. The fixed oil is there used like olive oil. The seeds closely resemble, and have the same constituents as those of black mustard *Pharmacographia*; also see *Amer. Jour. Pharm.*, 1875, p. 260).

Brassica campestris, Linné.—Several varieties of this species are cultivated, chief among which are *Brassica Napus* and *Brassica Rapa*. The roots furnish the vegetable *turnip*, and the seeds the oils known as *colza oil* and *rape-seed oil*. These oils are subacrid and brown, or greenyellow, before refining, but yellow and bland after purification. H. Ritthausen found a considerable quantity of potassium myronate (*sinigrin*) in yellow and brown turnip-seeds (*Brassica Rapa*) from India and east Prussia, yielding oil of mustard, while seeds from *B. Napus*, grown in Russia and in Prussia, were free from it.

Brassica sinapistrum, Boissier (*Sinapis arvensis*, Linné), *Charlock*.—Europe and the United States. A weed having deep-brown, smoothish seeds, not so pungent, and smaller than those of *Brassica nigra*.

Brassica sinensis.—The *petsai* of the Chinese. The oil is purgative, and has been employed in *cutaneous affections*. It is also used for illuminating purposes (see *Amer. Jour. Pharm.*, 1885, p. 306).

Brassica oleracea, Linné, var. *capitata*, *Cabbage*.—The leaves of cabbage are highly praised as a topical remedy for indolent and fetid *ulcers*.

Raphanus sativus, Linné, *Garden radish*, cultivated.—This yields a small quantity of a volatile oil, heavier than water, and containing sulphur. It has the taste but not the odor of the garden radish. Moreigne (1896) obtained from *Raphanus niger* only 0.0025 per cent of volatile oil, from which solid *raphanol* ($C_{29}H_{58}O_4$) separated (Gildemeister and Hoffmann, *Die Ætherischen Oele*, 1899, p. 544).

Raphanus raphanistrum, Linné, *Wild radish*, *Jointed charlock*.—Also yields oil of mustard.

Other Agents Acting Upon the Skin.—Under this head we include methods and agents used for their effects upon the skin and upon the blood supply of the visceral and other parts. These methods, very popular at one time, are not often resorted to at the present day. However, advantageous effects may occasionally be derived from them, and especially from the spirit vapor-bath.

Spirit Vapor-bath, *Hot-air bath*.—"A spirit vapor-bath exerts a most powerful, yet beneficial influence upon the whole system, aiding very materially our endeavors to remove disease. This highly valuable mode of producing activity of the cutaneous vessels has long been practiced in many sections of the country as a domestic remedial agent, and was first introduced to the notice of the medical profession by myself, about twenty-five years ago, since which it is in much use among physicians. The advantages to be derived from this method of producing perspiration are very great, and it is not followed with any of those injurious consequences which often attend the internal administration of a sudorific. It is to be given as follows: The patient is undressed, ready for getting into bed, having removed the shirt and underclothing worn through the day, and put on a nightshirt or other clothing to be worn only while sweating, and during the night, if the bath is taken at bedtime. He is then seated on a high windsor, or wooden-bottomed chair, or, instead thereof, a bench or board may be placed on a common open-bottomed chair, care being taken that the bottom is so covered that the flame will not burn him. After seating himself, a large blanket or coverlet is thrown around him from behind, covering the back part of his head and body, as well as the chair, and another must be passed around him in front, which last is to be pinned at the neck, loosely, so that he can raise it and cover his face, or remove it down from his face, from time to time, as occasion requires, during the operation of the bath. The blankets must reach down to the floor, and cover each other at the sides, so as to retain the vapor and prevent it from passing off.

"This having been done, a saucer or tin vessel, into which is put 1 or 2 tablespoonfuls of whiskey, brandy, spirits, alcohol, or any liquor that will burn, is then placed upon the floor, directly under the center of the bottom of the chair, raising a part of the blanket from behind to place it there; then light a piece of paper, apply the flame to the liquor, and as soon as it kindles, let down the part of the blanket which has been raised, and allow the liquor to burn till it is consumed, watching it from time to time to see that the blankets are not burned. As soon as consumed, put more liquor into the saucer, about as much as before, and again set it on fire, being very careful to pour no liquor into the saucer while the flame exists, as there would be danger of burning the patient, blankets, and perhaps the house. Continue this until the patient sweats or perspires freely, which in a majority of cases will be in 5 or 10 minutes.

"If, during the operation, the patient feels faint or thirsty, cold water must be sprinkled or dashed in his face, or he may drink 1 or 2 swallows of it; and in some cases, the head may be bathed with cold water.

"As soon as free perspiration is produced, wrap the blankets around him, place him in bed, and cover him up warm, giving him about 1 pint of either good tea, ginger, or some herb tea to drink, as warm as he can take it. After 2 or 3 hours, remove the covering, piece by piece, at intervals of 20 or 25 minutes between each, that he may gradually cease perspiring.

"There is no danger of taking cold after this hot-air bath, if the patient uses ordinary precaution; and if his disease will allow, he can attend to his business on the next day the same as usual. In fact, the whole is a very easy, safe, agreeable, and beneficial operation, much more so than a mere reading of the above explanation would lead one to suppose. Chairs have been manufactured expressly for this purpose.

"This bath is much employed by many physicians, and is highly beneficial in *colds*, *pleurisy*, and all *febrile* and *inflammatory attacks*, *diarrhœa*, *dysentery*, *sluggishness of cutaneous vessels*, and in all *chronic disease* where there is an abnormal condition of the skin. In acute diseases, it may be repeated once a day, if required; in chronic diseases, once or twice a week, or once in a fortnight, according to indications.

"Where it can be done, it is always preferable to bathe the patient with an alkaline wash, both before and after this vapor-bath" (J. King).

HÆMOSPASIS.—*Cupping, Hæmospastic medication, Dry cupping.* "This is a powerful revulsive treatment. Anything which draws the blood to a part may be said to act hæmospastically. Dry cupping does so; it not only draws the blood from the internal parts to the surface, but likewise attracts morbid action, and thus affords relief. Common ½ pint tumblers will answer for adults very well, in place of ordinary cupping glasses. A piece of paper or cotton, rolled up and fired, and dropped into the tumbler, and allowed to burn a minute or two, fits the tumbler for application to the spot. One, two, or more may be applied, and repeated so often as may be desirable; they should remain until ready to fall off. Rubber cups are now to be had which are easily applied by first compressing the bulb to create a vacuum, then applying the cup to the affected part, and finally relaxing the pressure on the bulb. *Intermittent fever* has been asserted to have been invariably cured by M. Condret, by applying 8 to 10 middle-sized cupping-glasses, on each side of the spinal column, from the neck downward, and allowing them to remain for about 30 or 40 minutes. To be applied at the commencement of the cold stage. One to 4 applications effect the cure. Also useful in cases of difficult respiration from *congestion of the lungs* or *mucous membrane of the bronchii*, etc." (J. King).

HÆMOSTASIS "is a term applied to the retention of venous blood in the extremities by ligature. Tie a handkerchief, or any suitable cord, around the upper part of the arms, and the thighs, and then, by means of a piece of wood, twist or turn the cord sufficiently tight to check the circulation of the venous blood, but not the arterial, which may be known by the action of the pulse. In a short time the legs and arms will be much distended, and an amount of blood removed from the trunk and retained in the limbs, which the most heroic practitioner dare not remove by the lancet. If the subject faint, promptly loosen or remove the ligatures; if he be plethoric and of firm, vigorous constitution, he must be reduced by cathartics, diuretics, sudorifics, and be under the influence of gentle nauseants, at the time of the operation. This has been found very useful in *uterine hemorrhage, hemoptysis,* and other *hemorrhages, inflammations of the brain, lungs, bowels,* etc., *congestions, puerperal convulsions,* and wherever it is deemed advisable to lessen the amount of blood in the head and trunk, without injuring the system" (J. King).

FIRING.—*Firing, Button coutery.* "Obtain a thick iron-wire shank, abont 2 inches long, and inserted into a small wooden handle; on its extremity, which must be slightly curved, affix a disk or button of iron, exactly ¼ inch thick, and ½ inch in diameter. The whole instrument to be only 6 inches in length. The face of the disk for application must be flat.

Mode of Application.—"Light a small spirit-lamp and hold the button over the flame, keeping the forefinger of the hand holding the instrument, at the distance of about ½ inch from the bottom. As soon as the finger feels uncomfortably hot, the instrument is ready for use, and the time required for heating it to this degree, will be about ½ minute. It is to be applied as quickly as possible to the parts, the skin being tipped successively, at intervals of ½ inch, over the affected part, as lightly and rapidly as possible, always taking care to bring the flat surface of the disk fairly in contact with the skin. In this way the process of firing a whole limb, or the loins, making about 100 applications, does not occupy a minute, and the one heating by the lamp suffices. To ascertain whether the heat be sufficient, look sidewise at the spots as you touch them, and each spot will be observed to become of a glistening white, much whiter than the surrounding skin. In from 5 to 30 minutes the skin becomes bright red, and a glow of heat is felt over the part. The iron must never be made red hot—it is very little hotter than boiling water—should never make an eschar, and rarely raise a blister. On the next day after its application a number of circular red marks will be seen on the skin, the cuticle not even being raised, and the surface ready, if necessary, for a fresh application. There is no discharge whatever, and in most cases the patient is unconscious of what has been done. It is vastly superior to a blister in many cases; even the most delicate female will not object to its frequent repetition when required.

"A powerful counter-irritant. Recommended by Dr. Corrigan in *paralysis, local muscular rheumatism, sciatica, lumbago, neuralgic pains,* etc., and wherever a counter-irritant is required. Also applied each side of the spinal column, in *intermittents, epilepsy, mania,* and other diseases" (J. King). This procedure is now seldom practiced.

MOXA.—Moxa is a term derived from the Portuguese language and applying to a variety of cylinders of combustible vegetable materials which burn without fusing, and were formerly used for revulsive effects in deep-seated inflammations, etc. Species of *Artemisia* furnish *Chinese moxa,* while the mature pith of the sunflower, *Helianthus annuus,* which contains a large proportion of potassium nitrate, has also been used. Moxas are also prepared by saturating paper, hemp, cotton, etc., impregnated with a weak nitre solution, and by means of adhesive material forming them into cylinders, which should be about 1 inch long by ¼ to ⅓ inch thick. The custom of using the moxa is a very ancient one. The cylinder is grasped by a forceps or other holder and the end is applied to the skin. Protecting the surrounding tissues by a damp cloth, alum-paper, or other means, the other end of the cylinder is ignited, and combustion supported by blowing the breath upon it, or by means of a bellows. Any degree of inflammation, even to destruction of the skin, may be produced by regulating the time of application. Deep cauterization may be prevented by applying ammonia water immediately after the use of the moxa. It should be applied only where the hard tissues have a good muscular covering. The application is said to be at first agreeable, but finally becomes quite painful. It has been used for deep-seated *inflammations* and *nervous*, *vascular*, or *other forms of local irritation*. The galvanic cautery, which can be better used upon the deeper structures, even to the osseous tissues, has largely superseded the moxa.

SISYMBRIUM.—HEDGE MUSTARD.

The seeds and herb of *Sisymbrium officinale*, Scopoli (*Erysimum officinale*, Linne). *Nat. Ord.*—Cruciferæ.

COMMON NAME: *Hedge mustard.*

Botanical Origin.—This is an annual, herbaceous plant, with a round, more or less hairy, branching stem, from 1 to 3 feet high. The leaves are runcinate; the lower ones 3 to 8 inches long by 1 to 3 wide, the lower segments placed at right angles to the midvein, or pointing backward, and the terminal segment largest; the upper ones in 3 lanceolate segments placed at right angles. The flowers are small, yellow, and terminate the slender, virgate raceme, which becomes 1 or 2 feet long. Siliques or pods subulate, erect, sessile, and closely appressed to the rachis. Seeds in a single row in each cell, ovoid, and marginless (W.—G.).

History and Chemical Composition.—This is an unsightly weed, inhabiting the United States and Europe, growing in waste places, and flowering from May to September. Its taste is herb-like, faintly resembling that of mustard. The seeds, leaves, and flowering tops are used; the former possess the greatest pungency and yield oil of mustard (Pless). Water extracts its active properties by infusion.

Action, Medical Uses, and Dosage.—Hedge mustard is reputed expectorant, and has been used with advantage in *hoarseness, old coughs, asthma*, and *ulcerated throat;* likewise said to exert some influence as a diuretic in *urinary obstructions.* The powdered seeds may be used internally in the dose of from 5 to 30 grains, or an infusion may be given every 2 or 3 hours in tablespoonful doses. The juice rubbed up with sugar or honey is also used.

Related Species.—*Sisymbrium sophia*, or *Flax weed*, with bipinnately-divided leaves, the lobes oblong-linear, incised; pedicels four times the length of the calyx; petals smaller than the sepals; is a very intensely pungent plant. Its seeds have been recommended in *gravel*, and to remove *worms;* and a fomentation of the leaves as an application to *obstinate ulcers.*

Sisymbrium muralis (*Diloplaxis muralis*) has been employed by the French alone or in a syrup, with potassium iodide, as a remedy for *blood dyscrasia*, especially in *scorbutic and scrofulous affections.*

Sisymbrium Alliaria, Scopoli (*Erysimum Alliaria*, Linné; *Alliaria officinalis*, Andrew), or *Hedge garlic*, contains a bitter body and volatile oil, consisting of oil of mustard (90 per cent) and oil of garlic (10 per cent); it imparts to the plant an alliaceous odor (Pless, 1846).

SODA (U. S. P.)—SODA.

FORMULA: NaOH. MOLECULAR WEIGHT: 39.96.

SYNONYMS: *Sodium hydrate, Sodium hydroxide, Caustic soda, Soda caustica, Natrium hydricum, Natrum causticum, Sodæ hydras, Hydrate of soda.*

"Soda should be kept in well-stoppered bottles made of hard glass"—(*U. S. P.*).

Preparation.—Caustic soda may be prepared by the interaction of sodium carbonate with milk of lime (compare *Potassa*). The process of the *British Pharmacopœia* (1885) is to rapidly evaporate solution of soda (see *Liquor Sodæ*) in a silver or clean iron vessel until there remains an oily fluid, which solidifies on cooling. In recent years, caustic soda is prepared on a large scale by the electrolytic decomposition of brine, resulting in chlorine gas and metallic sodium, which, as soon as formed, decomposes water with formation of solution of caustic soda (see *Pharm. Jour. Trans.*, Vol. XXV, 1894–95; and *Amer. Jour. Pharm.*, 1896, p. 114). The *British Pharmacopœia* (1898, appendix) recognizes three grades of sodium hydroxide: (1) The caustic soda of commerce, containing as impurities alumina, carbonates, chlorides, phosphates, silicates, and sulphates. (2) Purified sodium hydroxide, obtained by dissolving caustic soda in ethylic alcohol, filtering, and evaporating to dryness in a silver dish. The product is free from phosphates and sulphates, and contains but traces of carbonate, but is not quite free from alumina. (3) A solution of pure sodium hydroxide, free from alumina, is prepared either by the action of metallic sodium on water, or by the interaction of pure barium hydroxide and sodium sulphate, as follows: $Ba(OH)_2+Na_2SO_4 = BaSO_4+2NaOH$.

Description.—Soda, as demanded by the *U. S. P.*, occurs in "dry, white, translucent pencils, or fused masses, showing a crystalline fracture, odorless, and having an acrid and caustic taste. Great caution is necessary in tasting and handling it, as it rapidly destroys organic tissues. Exposed to the air, it rapidly deliquesces, absorbs carbon dioxide, and becomes covered with a dry coating of carbonate. Soluble in 1.7 parts of water at 15° C. (59° F.), and in 0.8 part of boiling water; very soluble in alcohol. When heated to about 525° C. (977° F.), soda melts to a clear, oily liquid, and at a bright-red heat it is slowly volatilized unchanged. When introduced into a non-luminous flame, it imparts to it an intense, yellow color. A solution of soda, even when greatly diluted gives a strongly alkaline reaction with litmus paper"—(*U. S. P.*).

Tests.—"The aqueous solution (1 in 20) should be perfectly clear and colorless (absence of organic matter), and, after being acidulated with acetic acid, separate portions of it should yield no precipitate on the addition of platinic chloride T.S., or sodium cobaltic nitrite T.S., or excess of tartaric acid T.S. (limit of potassium). If 1 Gm. of soda be dissolved in 10 Cc. of water and the solution slightly supersaturated with acetic acid, 10 Cc. of the solution should not be colored or rendered turbid by the addition of an equal volume of hydrogen sulphide T.S. (absence of arsenic, copper, lead, etc.), nor by the subsequent addition of ammonia water in slight excess (absence of iron, aluminum, etc.). The remainder of the acidulated solution should not be rendered turbid by ammonium oxalate T.S. (absence of calcium). If a solution of 1.2 Gm. of soda in 10 Cc. of water be slightly supersaturated with nitric acid, then 0.5 Cc. of decinormal silver nitrate V.S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of silver nitrate V.S. (limit of chloride). If to a solution of 2.5 Gm. of soda in 10 Cc. of water, strongly supersaturated with hydrochloric acid, 0.1 Cc. of barium chloride T.S. be added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of barium chloride T.S. (limit of sulphate). If 0.7 Gm. of soda be dissolved in 1.5 Cc. of water, and the solution added to 10 Cc. of alcohol, not more than a slight, white precipitate should occur within 10 minutes (limit of silicate, etc.). After boiling this alcoholic solution with 5 Cc. of calcium hydrate T.S., and filtering, not the slightest effervescence should take place on adding the filtrate to an excess of diluted hydrochloric acid (limit of carbonate). If 0.2 Gm. of soda be dissolved in 2 Cc. of water and carefully mixed with 5 Cc. of pure sulphuric acid and 3 drops of indigo T.S., the blue color should not be entirely discharged (limit of nitrate)"—(*U. S. P.*). From 2 to 3 per cent of sodium nitrate has been added to caustic soda by manufacturers, in order to obtain a product of pure whiteness (*Amer. Jour. Pharm.*, 1887, p. 78, from *Pharm. Centralhalle*, 1888). "To neutralize 0.4 Gm. of soda should require not less than 9 Cc. of normal sulphuric acid (each cubic centimeter corresponding to 10 per cent of pure sodium hydrate), phenolphtalein being used as indicator"—(*U.S.P.*). (Also compare *Potassa.*)

Action, Medical Uses, and Dosage.—Soda is largely employed in pharmacy in the production of various sodium salts. As a medicine, it is but little used, though it might be employed in place of caustic potash as an escharotic, on account of its lesser deliquescent properties. Its poisonous and chemical actions resemble those of potassium hydroxide, and the antidotes are the same for both. Internally, the carbonate and bicarbonate of sodium are generally preferred to soda, which, however, may be given in solution (*Liquor Sodæ, U. S. P.*) in doses of 10 to 30 drops, largely diluted with water, or 5 to 15 grains of the salt may be given, dissolved in a large quantity of water.

Sodium and Its Compounds.—SODIUM, *Natrium*. Symbol: Na. Atomic Weight: 23. Sodium occurs abundantly in nature, combined with chlorine, in the form of rock-salt, and dissolved in sea water, salt lakes, etc. It occurs in the ashes of plants growing near the sea, and is prepared by exposing to a white heat a mixture of sodium carbonate, coal, and chalk (compare *Potassium*). A considerably lower heat is required when reducing sodium by Castner's process (*Amer. Jour. Pharm.*, 1886, p. 541), which consists in heating the fused sodium hydroxide or carbonate with metallic carbides, or with carbon intimately mixed, in definite proportions, with finely divided metals. With iron carbide, the reaction takes place as follows: $6NaOH+2FeC_2=3Na_2+Fe_2+2CO+2CO_2+3H_2$. Metallic sodium was obtained by Sir Humphry Davy, in 1807, by the electrolytic decomposition of sodium chloride. Sodium is a soft and malleable metal, exhibiting a silver-white lustre on freshly-cut surfaces. Its specific gravity is 0.97, it melts at 95.6° C. (204° F.), and volatilizes at a red heat. It retains its softness and malleability at 0° C. (32° F.). Exposed to the air, it oxidizes readily, but less so than potassium. Large pieces may be kept in well-closed vessels without changing, except being oxidized on the surface. Smaller pieces are best kept under petroleum or petrolatum. When particles of sodium are thrown on water, they rapidly move about on its surface, and decompose the water with formation of sodium hydroxide (see *Soda*) and hydrogen gas. Unless the water is warm, or thickened with gum, the heat evolved is not high enough to ignite the gas (compare *Potassium*). Sodium and its salts impart to the non-luminous flame of the Bunsen burner a bright-yellow color, which is not visible through blue cobalt glass. With oxygen, sodium forms two oxides—the *monoxide* (Na_2O), which combines with water to form the strong alkali, *sodium hydroxide*, as follows: $Na_2O+H_2O=2NaOH$; and the *dioxide* or *peroxide* (Na_2O_2), a yellowish powder soluble in water with evolution of much heat and liberation of oxygen, of which it yields 20 per cent. Although prepared as early as 1815, by Gay Lussac, it is only in recent years that this substance came into use as a powerful bleaching agent. It is obtained by burning metallic sodium in dry air or oxygen, or by strongly heating sodium oxide in a current of air. Sodium combines with mercury, forming an *amalgam*, which is used in the process of extracting gold from auriferous rocks. Sodium also forms a liquid alloy with metallic potassium. The various medicinal sodium salts will be described each under its appropriate head.

SODII ACETAS (U. S. P.)—SODIUM ACETATE

FORMULA: $NaC_2H_3O_2+3H_2O$. MOLECULAR WEIGHT: 135.74.

SYNONYMS: *Acetate of soda, Sodæ acetas, Acetas sodicus, Acetas natricus, Terra foliata, Tartari crystallisata.*

"Sodium acetate should be kept in well-stoppered bottles"—(*U. S. P.*).

Preparation.—Acetate of sodium, formerly called *Crystallized foliated earth of tartar* (J. F. Meyer, 1767), was first obtained by Duhamel in 1736, and may be prepared in several ways, either by dissolving sodium carbonate in distilled pyroligneous (acetic) acid, or by double decomposition between calcium acetate (see *Acidum Aceticum*) and sodium sulphate (Glauber's salt), and recrystallizing the product, or by the interaction of lead acetate and sodium carbonate. (For details see this *Dispensatory*, preceding edition.)

Description.—As described by the *U. S. P.*, sodium acetate consists of "colorless, transparent, monoclinic prisms, or a granular, crystalline powder, odorless, and having a cooling, saline taste. Efflorescent in warm, dry air. Soluble, at 15° C. (59° F.), in 1.4 parts of water, and in 30 parts of alcohol; in 0.5 part of boiling water, and in 2 parts of boiling alcohol. When heated to 60° C. (140° F.), the salt begins to liquefy. At 123° C. (253.4° F.), it becomes dry and anhydrous; at 315° C. (599° F.), it is decomposed, with evolution of inflammable, empyreumatic vapors, leaving a black residue of sodium carbonate and carbon, which imparts to a non-luminous flame an intense, yellow color, gives an alkaline reaction with litmus paper, and effervesces with acids"—(*U. S. P.*). (On an explosive mixture of sodium acetate and potassium nitrate, see *Amer. Jour. Pharm.*, 1873, p. 128.)

Tests.—"The aqueous solution (1 in 20) of the salt colors litmus paper or T.S. blue, but does not redden phenolphtalein T.S. unless carbonate be present"—(*U. S. P.*). C. E. Smith (*Digest of Criticisms on the U. S. P.*, Part II, 1898) and Fr. Collischonn (*Chemiker Zeitung*, 1892, p. 1921, and *Amer. Jour. Pharm.*, 1893, p. 69) observe that the salt, even when crystallized from solution slightly acidulated with acetic acid, distinctly reddens phenolphtalein. "If 5 Cc. of the aqueous solution (1 in 20) be heated with 1 Cc. of sulphuric acid and 0.5 Cc. of alcohol, acetic ether will be formed, recognizable by its odor"—(*U. S. P.*). The reaction takes place as follows: $2NaC_2H_3O_2+2C_2H_5OH+H_2SO_4=2CH_3.COOC_2H_5+Na_2SO_4+2H_2O$. When sodium acetate is treated with sulphuric acid only, acetic acid is evolved. With the above aqueous solution (1 in 20) of the salt, the *U. S. P.* further directs: "On the addition of a few drops of ferric chloride T.S., the solution assumes a deep red color, and, when boiled, yields a brown precipitate"—

(*U. S. P.*). The deep red color is that of ferric acetate ($Fe_2[C_2H_3O_2]_6$), and the precipitate is basic ferric acetate ($Fe_2[OH]_2[C_2H_3O_2]_4$). "If a non-luminous flame be colored by the introduction of the salt, and viewed through a blue glass, the yellow color should entirely disappear, no red color taking its place (absence of potassium). If to 5 Cc. of the aqueous solution (1 in 20), slightly acidulated with acetic acid, an equal volume of hydrogen sulphide T.S. be added, no color or turbidity should appear, either at once (absence of arsenic, lead, zinc, etc.), or after adding ammonia water in slight excess (absence of iron, etc.)"—(*U. S. P.*). The *German Pharmacopœia* directs that 20 Cc. of the solution (1 in 20) should not be altered by the addition of 0.5 Cc. of solution of potassium ferrocyanide (absence of iron, copper, etc.). "The aqueous solution, acidulated with acetic acid, should not be rendered turbid by ammonium oxalate T.S. (absence of calcium). If a solution of 1 Gm. of the salt in 50 Cc. of water be slightly acidulated with nitric acid, then 0.5 Cc. of decinormal silver nitrate V.S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of silver nitrate V.S. (limit of chloride). If to a solution of 2 Gm. of the salt in 10 Cc. of water, acidulated with hydrochloric acid, 0.1 Cc. of barium chloride T.S. be added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of barium chloride T.S. (limit of sulphate)"—(*U. S. P.*). To test for the possible presence of sodium formiate, Hager (*Handbuch der Pharm. Praxis*, 1886) recommends to boil the aqueous solution with addition of silver nitrate solution. A reduction to metallic silver takes place if sodium formiate is present. "If 1.36 Gm. of sodium acetate be completely decomposed at a red heat, and the residue dissolved in water, it should require, for complete neutralization, 10 Cc. of normal sulphuric acid (corresponding to 100 per cent of the pure salt), methyl orange being used as indicator"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Acetate of sodium possesses the diuretic properties of acetate of potassium, but in a feebler degree, but it has the advantage over the potassium salt, in not being deliquescent. Moreover, being milder, it is less apt to provoke gastric disturbances. Its dose is from 20 grains to 1 or 2 drachms, largely diluted with water. Larger doses, and sometimes even 1 drachm of it, proves laxative.

SODII ARSENAS (U. S. P.)—SODIUM ARSENATE.

FORMULA: $Na_2HAsO_4+7H_2O$. MOLECULAR WEIGHT: 311.46.

SYNONYMS: *Sodii arsenias* (*Pharm.*, 1880), *Sodium arseniate*, *Arseniate of soda*, *Sodæ arsenias*, *Arsenias natricus*, *Arsenias sodicus*, *Natrium arsenicum*, *Arsenate of soda*.

"Sodium arsenate should be kept in well-stoppered bottles"—(*U. S. P.*).

Preparation.—This salt is prepared by melting in a clay crucible arsenic trioxide (*arsenous anhydride*), dried sodium carbonate and sodium nitrate, lixiviating the product of fusion with water and allowing to crystallize (see detailed directions in *Br. Pharm.*, 1885). Or, arsenic trioxide may be dissolved in solution of sodium hydroxide, the solution evaporated to dryness and the mass fused with sodium nitrate. This avoids volatilization of the noxious arsenic trioxide. The fused mass contains *sodium pyro-arsenate* ($Na_4As_2O_7$), analogous to sodium pyrophosphate ($Na_4P_2O_7$), but dissolves in water with formation of the *ortho-arsenate* as follows: $Na_4As_2O_7+H_2O=2AsO_4HNa_2$. This arsenate of sodium is used to some extent in medicine, as in the preparation of *Liquor Sodii Arsenitis*, but is more largely used as a clearing agent after the use of mordants in calico-printing. The *British Pharmacopœia* (1898) recognizes the anhydrous salt Na_2HAsO_4, obtained by exposing crystallized sodium arsenate to a temperature of 148.9° C. (300° F.).

Description and Tests.—Sodium arsenate is described by the *U. S. P.* as occurring in "colorless, transparent, monoclinic prisms, odorless, and having a mild, alkaline taste (the salt is very poisonous). Efflorescent in dry air, and somewhat deliquescent in moist air. Soluble in 4 parts of water at 15° C. (59° F.), and very soluble in boiling water; very sparingly soluble in cold, but soluble in 60 parts of boiling alcohol. When gently heated, the salt loses 5 molecules of water (28.8 per cent), and is converted into a white powder. At 148° C. (298.4° F.) the rest of the water of crystallization is lost, the salt fuses, and at a red heat is converted into pyro-arsenate. It imparts an intense, yellow color to a non-luminous flame"—(*U. S. P.*). Curtmann and Power state that "the salt with 7 molecules of water does not readily effloresce, while that with 12 molecules, which is generally sold, effloresces readily. The salt does not lose the remainder of its water at 148° C., but only 2 molecules. The rest is lost at about 690° C. (1274° F.), or at a bright-red heat. Below 30° C. (86° F.) the salt crystallizes with 12 molecules of water, of which 5 are lost spontaneously. Above 33° C. (91.4° F.), crystals form with 7 molecules" (*Digest of Criticisms on the U. S. P.*, Part II, 1898). "The aqueous solution (1 in 20) of the salt yields a white precipitate with barium chloride T.S., or with calcium chloride T.S., and a dark-red precipitate with silver nitrate T.S., all of which precipitates are soluble in nitric acid"—(*U. S. P.*). These precipitates are the arsenates of the metals named, and are analogous to the corresponding phosphates. Sodium arsenate also forms a characteristic crystalline ammonium-magnesium salt ($AsO_4NH_4Mg+6H_2O$), isomorphous with the corresponding ammonium-magnesium phosphate (see *Magnesii Sulphas*). "If 0.5 Cc. of the aqueous solution (1 in 20) be mixed with 2 Cc. of hydrochloric acid, and a drop of this mixture be placed upon a bright piece of copper-foil, upon applying a gentle heat, a dark steel-gray film will be deposited from the drop upon the copper"—(*U. S. P.*). This is Reinsch's test for arsenic; the gray film consists of this element. "If to 2 Cc. of the aqueous solution (1 in 20) 5 Cc. of decinormal silver nitrate V.S. be added, and the precipitate redissolved by excess of ammonia water, no black precipitate of reduced silver should appear on boiling (absence of arsenite). If to 5 Cc. of the aqueous solution 1 Cc. of ammonium sulphide T.S. be added, no turbidity or coloration should appear (absence of lead, copper, iron, etc.)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—The uses of this salt are similar to those of arsenous acid and Fowler's solution. It is claimed to be less irritating than the latter and less likely to produce arsenical phenomena. It is but little employed, however, and chiefly in the form of *Liquor Sodii Arsenatis*. It has been used with success in nervous affections, as *chorea*, and is asserted useful in *saccharine diabetes*. It may be used hypodermatically in doses of from $\frac{1}{20}$ to $\frac{1}{8}$ grain; internally in double these doses. *Antiasthmatic cigarettes* are made from paper which has been saturated with an aqueous solution (1 in 30) of sodium arsenate and dried.

SODII BENZOAS (U. S. P.)—SODIUM BENZOATE.

FORMULA: $NaC_7H_5O_2$. MOLECULAR WEIGHT: 143.71.

SYNONYMS: *Benzoas sodicus, Natrium benzoicum, Sodæ benzoas, Benzoate of soda.*

"Sodium benzoate should be kept in well-stoppered bottles"—(*U. S. P.*).

Preparation.—Take of pure benzoic acid (made from gum benzoin), 8 parts; bicarbonate of sodium, 5½ parts; distilled water, 6 parts. Mix the benzoic acid, with the distilled water, in a capacious porcelain capsule; raise the temperature, by means of a water-bath, to 65.5° C. (150° F.), then add the bicarbonate of sodium, stirring constantly with a porcelain spatula. When a clear solution is produced, and effervescence ceases, filter; then evaporate the filtrate upon a water-bath, with constant stirring, until a dry salt is obtained. The yield will be 12 parts. The reaction takes place according to the equation $C_6H_5.COOH+NaHCO_3=C_6H_5COONa+H_2O+CO_2$. Instead of bicarbonate of sodium, the carbonate or the hydroxide may be employed. Benzoate of sodium came into use during the latter part of 1879.

Description.—As obtained by the above process, sodium benzoate is a "white, amorphous powder, odorless, or having a faint odor of benzoin, and a sweetish, astringent taste. Permanent in the air"—(*U. S. P.*). When allowed to crystallize, the salt has the composition $C_7H_5O_2Na+H_2O$, but loses its water by efflorescence. The anhydrous salt is "soluble, at 15° C. (59° F.), in 1.8 parts of water, and in 45 parts of alcohol; in 1.3 parts of boiling water, and in 20 parts of boiling alcohol"—(*U. S. P.*). Benzoate of sodium is insoluble in ether and chloroform. "When heated, the salt melts, emits vapors having the odor of benzoic acid, then chars, and finally leaves a residue of sodium carbonate and carbon. To a non-luminous flame it imparts an intense yellow color. The aqueous solution is neutral to litmus paper"—(*U. S. P.*).

Tests.—"If a few drops of ferric chloride T.S. be added to an aqueous solution of the salt, a flesh-colored precipitate will be deposited. If 5 Cc. of diluted nitric acid be added to a solution of 1 Gm. of the salt in 10 Cc. of water, a white precipitate of benzoic acid will be produced, which, after being thoroughly washed, should conform to the test of purity given under *Acidum Benzoicum*"—(*U. S. P.*). Especially should it not have a urinous odor, which would indicate that hippuric acid was the source of the benzoic acid employed. "The filtrate from the precipitated benzoic acid should not be rendered turbid by silver nitrate T.S. (absence of chloride), nor by barium chloride T.S. (absence of sulphate). Five Cc. of the aqueous solution (1 in 20) should not give a precipitate with 0.5 Cc. of sodium cobaltic nitrite T.S. (limit of potassium). If to 5 Cc. of the aqueous solution (1 in 20) an equal volume of hydrogen sulphide T.S. be added, no coloration or turbidity be perceptible, either before or after the addition of 1 Cc. of ammonia water (absence of lead, iron, etc.). If 2 Gm. of sodium benzoate be ignited in a porcelain capsule until most of the carbonaceous matter is destroyed, and the residue be then dissolved in 20 Cc. of water, it should require for complete neutralization not less than 13.9 Cc. of normal sulphuric acid (corresponding to at least 99.8 per cent of the pure salt), methyl-orange being used as indicator"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Benzoate of sodium was introduced into therapeutics as an antipyretic and a decided antiseptic. It is said to reduce *fever* less rapidly than quinine, and more permanently. It has been employed not only as a prophylactic against *diphtheria*, but likewise as a curative agent. It has also been used with variable success in *pharyngitis* and *tonsillitis.* In Germany, many cases of this disease have been recorded, in which it proved successful. Klebs and Hoffmann have derived great benefit from its administration in *erysipelas*, in *albuminuria*, and in some cases of *acute rheumatism.* Petersen succeeded in recovering a patient from an almost hopeless *puerperal fever*, giving it in daily doses of 154 grains in solution; he advises its further trial. More recently it has been recommended in *malarial, infectious*, and *eruptive fevers.* Dr. J. B. Berkhart reports the cure of a case of *syphilitic lupus* from its use. Partzersky, of Moscow, reports the drug a specific in *uræmic poisoning*, as under his administration of it, it promptly controlled the headache, pupillary dilatation, albuminuria, and convulsions of 10 cases of *nephritis*, 3 of which were of the interstitial variety, and the balance of the parenchymatous form. Webster (*Dynam. Therap.*) suggests its remembrance in the *albuminuria of pregnancy.* From the statements made by many physicians who have experimented with this agent, it appears to have valuable therapeutical properties. The salt prepared with the natural benzoic acid should only be employed. Its dose varies from 10 to 20 grains, in solution, repeated every 1, 2, or 4 hours; large doses, even when continued for a long time, give rise to no unpleasant after-effects. A 5 per cent solution of this salt, inhaled into the lungs, has been advised in the treatment of *phthisis* (Rokitansky); no confidence can be placed in its inhalation as a remedial means in this disease. By inhalation or atomization, it is of service in fetid *catarrhal* and *bronchial discharges.*

Related Preparations.—POTASSII BENZOAS. Formula: $KC_7H_5O_2.3H_2O$. Molecular Weight: 213.62. Potassium benzoate is prepared like the corresponding sodium salt, employing benzoic acid (10 parts) and potassium bicarbonate (8.2 parts). The yield is 17.5 parts. It crystallizes, though not readily, in small, efflorescent lamellæ, easily dissolved by water or alcohol.

SODII SULPHOBENZOAS, *Sodium sulphobenzoate* ($C_6H_4[NaSO_3]COONa$).—Twenty-five grains of this salt in a pint of water, is claimed by Heckel as a superior and non-poisonous antiseptic for use upon *wounds.*

SODII BORO-BENZOAS (N. F.), *Sodium boro-benzoate.*—"Sodium borate, in fine powder, 3 parts; sodium benzoate, 4 parts. Mix them intimately"—(*Nat. Form.*, 1st ed.).

SODII BICARBONAS (U. S. P.)—SODIUM BICARBONATE.

FORMULA: $NaHCO_3$. MOLECULAR WEIGHT: 83.85.

SYNONYM: *Bicarbonate of soda, Baking soda, Acid sodium carbonate, Sodium hydrocarbonate, Bicarbonas sodicus, Natrium carbonicum acidulum, Sodæ bicarbonas, Sodium hydrogen carbonate.*

"Sodium bicarbonate should be kept in well-closed vessels, and in a cool place"—(*U. S. P.*).

Preparation.—Sodium bicarbonate may be prepared by allowing crystallized sodium carbonate ($Na_2CO_3+10H_2O$) to lie in contact with carbonic acid gas, evolved from marble or limestone by means of hydrochloric acid. The gas is rapidly absorbed by the salt with formation of bicarbonate, as follows: $Na_2CO_3+10H_2O+CO_2=2NaHCO_3+9H_2O$. The bicarbonate being much less soluble in water than the monocarbonate, the excess of the latter is removed by washing with cold water. By this method sodium bicarbonate may be prepared both on a small and a large scale. The largest quantities of the salt are made by the Solvay or ammonia-soda process, which is that pursued in the Syracuse (N.Y.) Soda Works, as well as in England and partly on the continent of Europe. It consists in saturating a mixture of sodium chloride (common salt) and aqueous ammonia with carbonic acid gas under pressure. Sodium bicarbonate being with difficulty soluble, precipitates, while ammonium chloride remains in solution. The reaction takes place as follows: $NaCl+NH_3+CO_2+H_2O=NaHCO_3+NH_4Cl$. This process is also carried further, namely, to the manufacture of neutral sodium carbonate (see *Sodii Carbonas*).

Description.—The salt, as required by the *U. S. P.*, must contain at least 98.6 per cent of bicarbonate. The *U. S. P.* (1880) admitted, in addition to the pure compound, a commercial salt (of 95 per cent purity) under the name *Sodii Bicarbonas Venalis*. A bicarbonate used in baking powder, as a substitute for commercial potassium bicarbonate (*sal aëratus*, which see), has been called *Soda sal aëratus*. The sodium bicarbonate now official is "a white, opaque powder, odorless, and having a cooling, mildly alkaline taste. Permanent in dry, but slowly decomposed in moist air. Soluble in 11.3 parts of water at 15° C. (59° F.); above that temperature the solution loses carbon dioxide, and at a boiling heat the salt is entirely converted into normal carbonate. Insoluble in alcohol and in ether. When heated, the salt is decomposed into normal carbonate, water, and carbon dioxide, and finally, at 100° C. (212° F.), loses about 36.3 per cent of its weight. At a bright-red heat it melts. To a non-luminous flame, it imparts an intense yellow color. The solution, when freshly prepared with cold, distilled water, without shaking, gives a very faint alkaline reaction with litmus paper. The alkalinity increases by standing, agitation, or increase of temperature. With acids, the solution effervesces strongly"—(*U. S. P.*). Bicarbonate of sodium is, therefore, incompatible with acids, acid salts, also with lime-water, ammonium chloride, and the salts of heavy metals. Sulphate of magnesium does not decompose it, but precipitates with not too dilute a solution of monocarbonate.

Tests.—Sodium carbonate is usually quite pure. It is liable to contain traces of sodium chloride, ammonium bicarbonate, potassium salts, etc., and always contains a small percentage of normal carbonate. The *U. S. P.* test, given below, makes allowance for about 1.76 per cent of sodium carbonate. The *German Pharmacopœia* allows 2 per cent. Its presence is due partly to insufficient saturation, or to loss of carbonic acid gas by exposure. The *U. S. P.* gives the following tests: "If 1 Gm. of the salt be dissolved in 19 Cc. of water, it should yield a perfectly clear and colorless solution, leaving no residue. If 5 Cc. of the aqueous solution (1 in 20) be slightly supersaturated with hydrochloric acid, the liquid should not be colored red by a drop of ferric chloride T.S. (absence of sulphocyanate). If 1 Gm. of the salt be dissolved in 3 Cc. of acetic acid, it should yield no precipitate within an hour after being mixed with 0.5 Cc. of sodium cobaltic nitrite T.S. (limit of potassium). If 0.6 Gm. of the salt be dissolved, without agitation, in 10 Cc. of cold water, and 0.1 Cc. of normal sulphuric acid added, no red color should appear upon the addition of 2 drops of phenolphtalein T.S. (limit of normal carbonate)"—(*U. S. P.*). This test is based upon the conversion of normal sodium carbonate, which reddens phenolphtalein, into bicarbonate, which is neutral to this indicator. The following reaction takes place: $2Na_2CO_3+H_2SO_4=2NaHCO_3+Na_2SO_4$. Care must be taken that no carbonic acid gas escapes; for this reason, the employment of 50 Cc. of water in this test is recommended (C. E. Smith. *Digest of Criticisms on the U. S. P.*, Part II, 1898). The *U. S. P.* further directs: "If 5 Cc. of the aqueous solution (1 in 20) be slightly supersaturated with hydrochloric acid, the solution should not be rendered turbid by the addition of an equal volume of hydrogen sulphide T.S., either at once (absence of arsenic, etc.), or after the addition of ammonia water in slight excess (absence of iron, aluminum, etc.).

Five Cc. of the aqueous solution, acidulated with acetic acid, should not be rendered turbid by 0.5 Cc. of ammonium oxalate T.S. (absence of calcium). If 1.2 Gm. of sodium bicarbonate be dissolved in 10 Cc. of diluted nitric acid, then 0.5 Cc. of decinormal silver nitrate V.S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of silver nitrate V.S. (limit of chloride). If 2.5 Gm. of the salt be dissolved in 11 Cc. of diluted hydrochloric acid, then 0.1 Cc. of nitric acid and 0.1 Cc. of barium chloride added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of barium chloride T.S. (limit of sulphate, sulphite, and hyposulphite)"—(*U. S. P.*). The addition of nitric acid is made in order to convert the sulphite and hyposulphite into sulphate, which is then precipitated by barium chloride. "If sodium bicarbonate be heated in a test-tube, no ammonical vapor should be emitted"—(*U. S. P.*). If ammonia is evolved, white clouds are to be seen when a glass rod, moistened with hydrochloric acid, is held in the mouth of the test-tube. "To neutralize 0.85 Gm. of sodium bicarbonate should require not less than 10 Cc. of normal sulphuric acid (corresponding to at least 98.6 per cent of the pure salt), methyl-orange being used as indicator"—(*U. S. P.*). The *German Pharmacopœia* directs that 100 parts of the salt, previously dried over sulphuric acid, upon ignition, should not leave more than 63.8 parts of residue. This corresponds to the presence of 2 per cent of sodium carbonate, as stated above. The loss, upon ignition, consists in the escape of water and carbonic dioxide, according to the equation: $NaHCO_3 = Na_2CO_3 + CO_2 + H_2O$. Thus, 100 parts of the bicarbonate yield 63.095 parts of sodium carbonate, 10.714 parts of water, and 26.191 parts of carbonic dioxide. Mr. H. M. J. Schroeter (*Amer. Jour. Pharm.*, 1888, p. 602) records the analytical results obtained from 16 specimens of commercial sodium bicarbonate. He ignites a weighed quantity of the commercial salt in a combustion tube, determines the quantity of water and carbonic acid gas evolved; upon afterward determining the total quantity of carbonic acid gas present, the amount of moisture and the percentage of mono- and of bicarbonate may be calculated. (Also see formula by Prof. W. T. Wenzell, *ibid.*, 1894, p. 504.)

Action, Medical Uses, and Dosage.—Bicarbonate of sodium possesses properties similar to the bicarbonate of potassium, though less actively diuretic. It also resembles the carbonate of sodium in its action, but is much less irritating, and milder to the taste. It is an excellent antacid, and has been used in *urinary diseases*, attended with *uric acid formations;* but its use should not be continued too long after the removal of these formations, else deposits of the phosphates will occur. The bicarbonate is, however, less apt to produce this result than the carbonate of sodium, more especially when it is administered in carbonic acid water. It has also been recommended as a remedy in *croup*, *membranous sore throat*, *diphtheria*, *tonsillitis*, and to diminish the saccharine matter of *diabetic urine*. It is also useful in *suppression of urine* from *epithelial nephritis*. In *inflammatory diseases*, it is supposed to remove any abnormal increase of fibrin in the blood, and thus aid in effecting a solution of the disease. In *rheumatism*, particularly of the joints, with acid and heavily loaded renal secretions, acid perspiration, high fever, pallid mucous membranes, and white-coated tongue, sodium bicarbonate, both internally and locally, is a very useful agent. Large doses are required. Under such conditions, it is likewise valuable in many cases of *biliary calculi*. Taken after meals, sodium bicarbonate is useful as a palliative, and only as a palliative in *acid dyspepsia*, with cardialgia, sour eructations, flatulence, vomiting, and sour, fluid alvine discharges. Continued for a long time, as it frequently is by persons troubled with "sour stomach," it is apt to increase the difficulty and produce an incurable form of dyspepsia. It is a good agent to control excessive acidity in *fevers*, and a teaspoonful of the salt, in a glass of warm water, relieves *sick headache*, due to *gastric acidity*. In case there is deficient secretion of gastric juice, it should be given ½ hour before meals. *Flatulent colic* is quickly relieved by it, as is also *diarrhœa*, with acid, green discharges. Ten-grain doses, every 2 hours, in infusion of uva ursi, have given good results in *acute cystitis*.

Locally, a solution of sodium bicarbonate forms an exceedingly efficient application to *burns* and *scalds*, *poisoning by Rhus Toxicodendron*, and *pruritus vulvæ*, due to acid urine. It is useful in some forms of *indolent ulcers*. A weak solution has been injected in *gonorrhœa*. A dilute solution is valued to soften *ceruminous masses*, and in *inflammation of the external ear and attic*, and a 10 per cent solution is useful to remove the crusts which form in *ciliary blepharitis*. Large doses of sodium bicarbonate have recently been advised to break up *acute colds*, and the salt enters into the formation of several *catarrh* lotions. In powder, sodium bicarbonate has been recommended to be applied directly to the parts in *acute tonsillitis*, and, with an equal quantity of borax, is reputed to render *diphtheritic deposits* soft. A solution of it is frequently employed as a wash in *acid leucorrhœa*. The dose of bicarbonate of sodium is from 5 to 40 grains in a glass of common soda or carbonated water; the dose for children in proportion.

Specific Indications and Uses.—Pallid mucous membranes, with a filmy, white coat upon the tongue; acid dyspepsia; cardialgia; sour eructations; sour green diarrhœa; flatulent colic; rheumatic pain, with acid urine and sour sweat high fever and sour diarrhœa; uric acid deposits; sick headache, from sour stomach. Locally, to burns, scalds, and dermatitis venenata, and to pruritic states, from uric acid diathesis.

Related Preparations.—SODA POWDERS, or EFFERVESCING POWDERS, are prepared by placing in one paper tartaric acid, 25 grains, and in another bicarbonate of sodium, 30 grains. When to be used, they are dissolved in separate portions of water, to which some aromatic syrup may be added, and then mixed. Effervescence immediately ensues, during which the liquid is to be drank. It forms a cooling and slightly laxative draught, which is very agreeable and invigorating, especially in *fevers*. The effervescence is occasioned by the escape of carbonic acid gas, which is set free from the bicarbonate by the tartartic acid, which unites with the sodium, forming a tartrate of sodium.

BAKING POWDERS.—These are usually composed of sodium bicarbonate and an acid ingredient which, in contact with the former, decomposes it with evolution of carbonic acid gas. A method of making baking powder, long in use as such, is by mixing 2 (or 2½) parts of pure bitartrate of potassium and 1 part of bicarbonate of sodium.

SODII BICARBONAS SACCHARATUS (N. F.), *Saccharated sodium bicarbonate.*—"Sodium bicarbonate (*U. S. P.*), in very fine powder, seven hundred and fifty grammes (750 Gm.) [1 lb. av., 10 ozs., 199 grs.]; sugar, in very fine powder, two hundred and fifty grammes (250 Gm. [8 ozs. av., 358 grs.]. Triturate the powders together until intimately mixed, and preserve the product in well-stoppered bottles. *Note.*—This saccharate, when dissolved in water with an equal weight of saccharated citric acid (F. 5), or of saccharated tartaric acid (F. 8), will form a neutral solution, and it is introduced into the formulary for the convenient preparation of effervescent powders. This saccharate contains 75 per cent of sodium bicarbonate"—(*Nat. Form.*).

SODII BISULPHIS (U. S. P.)—SODIUM BISULPHITE.

FORMULA: $NaHSO_3$. MOLECULAR WEIGHT: 103.86.

SYNONYMS: *Sodæ bisulphis, Bisulphite of soda.*

"Sodium bisulphite should be kept in a cool place, in small, well-stoppered bottles, filled as full as possible"—(*U. S. P.*).

Preparation and Uses.—Bisulphite of sodium may be obtained by passing a current of sulphurous acid gas through a solution of 1 part of crystallized carbonate of sodium in 2 parts of water, until the acid is in excess, and then concentrating, being careful to exclude the air. The bisulphite forms 4-sided rectangular prisms on cooling. This salt is Chaudet's *leucogène*, and is employed in the arts for the purpose of bleaching wool, etc., and as an *antichlor*, instead of sodium hyposulphite (which see), to remove excess of chlorine when used in bleaching wood-pulp, paper, etc. It is likewise employed as a preservative for meats, eggs, etc., and as an antiferment. An important use is now made of this salt in the manufacture and purification of essential oils, owing to its property of forming crystallizable addition products with aldehydes and ketones, *e. g.*, cinnamic aldehyde, citral, etc. (see Gildemeister and Hoffmann, *Die Ætherischen Oele*, 1899, pp. 212, 221, 505, etc.).

Description and Tests.—"Opaque, prismatic crystals, or a granular powder, exhaling an odor of sulphur dioxide, and having a disagreeable, sulphurous taste. Exposed to the air, the salt loses sulphur dioxide, and is gradually oxidized to sulphate. Soluble, at 15° C. (59° F.), in 4 parts of water, and in 72 parts of alcohol; in about 2 parts of boiling water, and in 49 parts of boiling alcohol. When strongly heated, the salt decrepitates, emits vapors of sulphur and of sulphur dioxide, and leaves a residue of sodium sulphate. To a non-luminous flame it imparts an intense, yellow color. The aqueous solution gives an acid reaction with litmus paper. On the addition of hydrochloric or sulphuric acid, the aqueous solution of the salt evolves sulphur dioxide, which is recognized by its odor, and by its blackening a strip of paper dipped into mercurous nitrate T.S. and held over the escaping gas. If 1.2 Gm. of sodium bisulphite be dissolved in 10 Cc. of diluted nitric acid, and the solution heated sufficiently to expel the gases, then 0.5 Cc. of decinormal silver nitrate V.S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of silver nitrate V.S. (limit of chloride). If 2.5 Gm. of sodium bisulphite be dissolved in 11 Cc. of diluted hydrochloric acid with the aid of sufficient heat to expel the sulphur dioxide, the solution should not be turbid (absence of hyposulphite). After adding to it 0.15 Cc. of barium chloride T.S., and removing the precipitate, if any, by filtration, a portion of the clear filtrate should remain unaffected by the further addition of barium chloride T.S. (limit of sulphate). If to 5 Cc. of the preceding filtrate an equal volume of hydrogen sulphide T.S. be added, no turbidity or coloration should occur (absence of arsenic, etc.). If 0.26 Gm. of sodium bisulphite be dissolved in 20 Cc. of water, recently boiled to expel air, and a little starch T.S. be added, at least 45 Cc. of decinormal iodine V.S. should be required to produce a permanent blue tint after agitation (corresponding to at least 90 per cent of pure sodium bisulphite)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This salt has been preferred by some physicians to the sodium hyposulphite, in the *vomitings* and *aphthous ulcerations* referred to under magnesium sulphite and sodium hyposulphite; it being remarked that when the hyposulphite is decomposed by the hydrochloric acid of the stomach, not only is sulphurous acid set free, but sulphur is precipitated which is not a desirable agent—that is not the case with the bisulphite. The dose of the bisulphite of sodium is from 10 to 60 grains.

SODII BORAS (U. S. P.)—SODIUM BORATE.

FORMULA: $Na_2B_4O_7+10H_2O$. MOLECULAR WEIGHT: 380.92.

SYNONYMS: *Borax*, *Boras sodicus*, *Sodium pyroborate*, *Sodium tetraborate*, *Natrium pyroboricum*, *Natrium biboricum* or *biboracicum*, *Sodæ biboras*, *Biborate of soda*, *Borate of soda*.

Source, History, and Preparation.—Borax occurs in nature in several forms; as crystallized crude borax it is found on the borders of various lakes in Persia and Thibet, and is obtained in large quantities also from the beds of the borax lakes of Nevada and California, as well as the sandy soils of these regions (see account by Arthur Robottom, *Amer. Jour. Pharm.*, 1887, pp. 80–86; also see *ibid.*, 1882, p. 472, and 1885, p. 304). That formerly imported from Asia by way of Venice and Holland, was called *tinkal* or *crude borax*, and required special methods of purification owing to its being coated with a fatty substance (see this *Dispensatory*, preceding edition). Native borax also occurs near Potosi (Peru). In the form of *boro-natrocalcite* or *tiza* (hydrated sodium-calcium borate) it is found in South America (Chili and Peru), and in Nevada and California and other countries. Considerable quantities of the borax of commerce are now prepared from boric acid, which in turn is derived either from the Tuscany occurrence (see *Acidum Boricum*), or from borate minerals (*boracite* [magnesium borate and magnesium chloride], *boro-natrocalcite*, *ulexine*, etc.) by decomposition with sulphuric or hydrochloric acids. In order to prepare borax, coarsely pulverized boric acid is added to solution of sodium carbonate, and the product allowed to crystallize. The crude borax is refined by crystallization from hot water with addition of some sodium carbonate. Another method of preparing borax consists in fusing together crude boric acid with a definite amount of sodium carbonate, dissolving in water, filtering and evaporating to crystallization.

Description and Tests.—Crystallized borax ($B_4O_7Na_2+10H_2O$), as usually obtained, crystallizes in the monoclinic system and is called *common* or *prismatic borax*, while *octohedral borax* ($B_4O_7Na_2+5H_2O$) crystallizes in the regular system, in octohedra, and is obtained by allowing a concentrated solution of borax in water to crystallize above 56° C. (132.8° F.). Prismatic borax, as required by the *U. S. P.*, occurs in "colorless, transparent, monoclinic prisms, or a white powder, inodorous, and having a sweetish, alkaline taste. Slightly efflorescent in warm, dry air. Soluble in 16 parts of water at 15° C. (59° F.), and in 0.5 part of boiling water; insoluble in alcohol. At 80° C. (176° F.) it is soluble in 1 part of glycerin"—(*U. S. P.*). Glycerin and other polyhydric alcohols, *e. g.*, sugars, react with borax, decomposing it into sodium metaborate ($Na_2B_2O_4$) and free boric acid; the liberation of the latter induces secondary reactions, *e. g.*, formation of ethers (see *Glycerinum*). "When heated, the salt at first loses part of its water, then melts, and, when further heated, swells up and forms a white, porous mass. At a red heat it loses all its water of crystallization (47.14 per cent), and fuses to a colorless glass. To a non-luminous flame it imparts an intense, yellow color"—(*U. S. P.*). The transparent mass formed when borax is fused is called *vitrified borax, glass of borax, borax-glass;* it is anhydrous borax ($Na_2B_4O_7$). Borax glass, melted in the flame of a blow-pipe, dissolves oxides of metals, some, *e. g.*, cobalt salts, with characteristic color, hence its use as a dry-way test for certain metallic salts. When borax is fused with sodium carbonate in equimolecular proportions, the fused mass upon crystallization from water yields crystals of *sodium metaborate* ($Na_2B_2O_4+8H_2O$). When borax is added to a mucilage it soon thickens it into a firm, tremulous jelly, which is soluble in syrup. A few drops of diluted acetic acid added to the mucilage or emulsion will prevent this action of borax.

Tests and Uses.—The following tests are characteristic for borax and boric acid: "The aqueous solution (1 in 20) colors red litmus paper blue, and yellow turmeric paper reddish-brown. After being acidulated with hydrochloric acid, the solution colors blue litmus paper red; yellow turmeric paper remains unchanged at first, but, on drying, becomes brownish-red, and this color is temporarily changed to bluish-black by moistening with ammonia water. If a drop of the solution of the salt in glycerin be held in the flame, a transient bright-green color will appear"—(*U. S. P.*). This coloration is due to a glycerin ether of boric acid. "If a slight excess of sulphuric acid be added to a hot, saturated, aqueous solution of the salt, shining, scaly crystals of boric acid will separate on cooling, which impart a green color to the flame of alcohol"—(*U. S. P.*).

Borax is rarely adulterated. In one instance, borax contained 20 per cent of phosphate of sodium. This was separated mechanically by exposing the salt to the heat of a drying-room for a few hours, when the phosphate effloresced and could be picked out and tested with the usual reagents.

The usual contaminations of borax are chlorides and sulphates which are rarely absent. The *U. S. P.* gives the following directions for the detection of impurities: "With 19 Cc. of water, 1 Gm. of the salt should yield a perfectly clear and colorless solution, leaving no residue. The aqueous solution (1 in 20) should not effervesce with acids (absence of carbonate). It should not be rendered turbid by ammonium sulphide T.S. (absence of iron, aluminum, etc.); nor after being acidulated with hydrochloric acid, by an equal volume of hydrogen sulphide T.S. (absence of arsenic, lead, etc.). When acidulated with acetic acid, the solution should not be rendered turbid by ammonium oxalate T.S. (absence of calcium). The aqueous solution (1 in 20) should not be rendered turbid by magnesia mixture (absence of phosphate). If 0.48 Gm. of the salt be dissolved in 15 Cc. of water, then 1 Cc. of diluted nitric acid and 0.2 Cc. of decinormal silver nitrate V.S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of silver nitrate V.S. (limit of chloride). If 2.5 Gm. of the salt be dissolved in 50 Cc. of water, then 10 Cc. of diluted hydrochloric acid and 0.1 Cc. of barium chloride T.S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of barium chloride T.S. (limit of sulphate). If 1 Gm. of the salt be dissolved in 20 Cc. of diluted sulphuric acid by the aid of heat, and 3 drops of indigo T.S. be added, the blue color should not be discharged (absence of nitrate)"—(*U. S. P.*).

Borax is frequently used in the arts, being employed in the glazing of brick, tiling, earthenware utensils, etc., as well as the enameling of iron vessels. Meat packers consume large quantities of it. It is used as a flux in metallurgical manipulations, and is employed in laundries to impart a gloss to starched garments. Many toilet and medicinal soaps contain it. Borax, recrystallized, has been suggested as a possibly useful agent in standardizing volumetric acid solutions (see W. A. Puckner, *Pharm. Archives*, 1898, p. 182).

Action, Medical Uses, and Dosage.—In very large doses borax is a poison acting as a depressant upon the heart and spinal axis. In general its effects closely resemble those of boric acid. The chief toxic symptoms are mental depression, enfeebled heart action with either slow or rapid, but very weak, pulsation, reduced temperature, and an erythema accompanied with itching and tumefaction and followed by exfoliation of the skin; ecchymotic discolorations are sometimes observed, the respiration is disordered, the urine and fæces are involuntarily discharged and coma, followed by death, ensues. The mental faculties are usually active until near dissolution. Borax has been largely used as an antiseptic agent. Its action upon bacteria is said to be less pronounced than its power of preventing putrefactive changes (Sternberg).

The medicinal actions of borax are but imperfectly known. It is supposed to be a diuretic, refrigerant, antilithic, emmenagogue, and aphrodisiac. It has been found an excellent remedy in *renal diseases* and *gravel*, when uric acid is present in excess, and may be used in doses of from 20 to 40 grains, well diluted with water. It is rarely used as a parturient agent, yet there is no doubt that it exerts an action on the uterus. It has been successfully used in *amenorrhœa*, *dysmenorrhœa*, especially for the radical cure of the membranous form, in *uterine hemorrhage*, and to promote *parturition*, or expedite the delivery of the placenta. In such instances it has been used alone, or combined with other agents, as ergot, blue cohosh, cinnamon, etc. Ten grains given for a dose, and repeated 3 or 4 times a day for several days, have produced abortion, attended with pains all over the system, and excessive debility of the joints, which remained for several months in a greater or less degree. It is an aphrodisiac, and will excite the venereal appetite when taken internally; but its aphrodisiac effects are said to be more marked when a solution of it is injected into the rectum, and retained there 1 or 2 hours. A solution of 10 or 15 grains to the fluid ounce of water, injected, will, in 2 or 3 hours, produce a powerful venereal excitement. And if the strength of the solution be doubled, it will cause powerful erections, and several copious seminal emissions. These aphrodisiac effects, however, will often be found to fail with certain individuals. Small doses of borax (1 grain, 3 or 4 times a day) have been employed with asserted success in *sterility* where conception was prevented by leucorrhœal discharges. In nervous diseases borax has been used somewhat, particularly in *epilepsy*. The results, however, have not been such as to warrant the extravagant statements made in favor of it. Small doses of borax are especially valuable in the *summer disorders of children*, and in *fetid dysentery*. In the latter disorder an injection of solution of borax is also of value. For internal administration, Prof. J. M. Scudder, M. D., recommended teaspoonful doses of a solution of from 1 to 5 grains of borax "in *persistent sore mouth; dyspepsia*, with sense of constriction; gnawing pain; uneasy stools; frequent desire to pass urine, the last part of the discharge being muco-pus; dragging pain in the back, and *acrid leucorrhœa*" (*Spec. Med.*, p. 93).

In the strength of from 1 to 4 drachms to 1 pint of water, borax forms a good antiseptic wash and dressing for "*wounds, injuries*, and *surgical operations*." It is in extensive use as an external application in *aphthous* and *inflammatory conditions of the mouth and throat*, and in *scaly diseases of the skin*. A solution of 1 drachm in 5 fluid ounces of water, with a little sugar or honey, forms one of the best applications for use as a gargle in the early stage of *mercurial salivation*, and also in all varieties of *aphthous ulceration of the mouth and throat*. No remedy is more efficient in the *aphthous sore mouth of infants*. Equal parts of borax and loaf-sugar triturated together may be employed, sprinkling the mixture upon the sores several times a day. For older persons and especially for the *aphthous ulcerations of phthisis*: ℞ Borax, ʒiii; honey, ℥ss; infusion of sage, q. s. Oj. Apply freely (Locke). With myrrh and honey it is efficient in *sponginess of the gums*. It is a good remedy for *thrush* in infants and for *sore nipples* and *aphthous conditions of the vulva and vagina*. Borax ʒss to cold cream ʒss, forms a good application for *chilblains*, and both in lotion and ointment the salt is considered efficient for *falling of the hair*. In *liver spots* (*pityriasis versicolor*) a lotion of borax has also been found beneficial, as it has in *freckles*, and other *blemishes of the skin*, and alone or combined with morphine, it is an exceedingly soothing application in *pruritis vulvæ*. Combined with sugar it forms an excellent collyrium, and enters into several cooling or refrigerant lotions. Powdered borax blown into the nostrils will be found useful in many instances of *chronic catarrh*, and *chronic inflammation of the mucous membrane lining the nasal and faucial passages*. A wash of borax is frequently used in the same affections. It forms a useful injection for *gonorrhœa*, a bladder wash in *cystitis*, with unhealthy discharges, and a good dressing for the *bites of animals*. It is universally employed as an injection for *inflammatory states of the vagina*. In *leucorrhœa* it is best adapted where the secretion is glairy, colored, and profuse; a strong solution should be employed. Borax forms a good dry dressing for *chancroid*, and in solution is effective in the treatment of *bubo*. It forms a good wash in *diphtheria*, but of course is not curative. In aural practice it is used to soften *inspissated ceruminous masses*, and to cleanse the meatus and middle ear of pus, being even preferable to boric acid for the latter purpose. In *ocular disorders* it is used in removing corneal *opacites*, in *muco-purulent conjunctivitis*, *corneal ulceration*, and to remove the crusts in *ciliary blepharitis*. For use upon the eye it should be used of the strength of 5 grains to 1 fluid ounce of water. Sprinkled around libraries, pantries, etc., borax will be found effectual in driving away cockroaches and other insects. One drachm of borax dissolved in 2 fluid ounces of distilled vinegar, is said to be an excellent lotion for *ringworm of the scalp* (C.). The dose of borax is from 10 to 30 grains, dissolved in water, or in infusion of elm or flaxseed.

Specific Indications and Uses.—Uric acid diathesis; gravel; persistent sore mouth; dyspepsia, with feeling of constriction; gnawing pains, uneasiness at stool, urging to urinate, the discharge being finally of muco-pus; dragging pain in the back; acrid leucorrhœa. Locally in aphthous conditions of the mouth, throat, vulva and vagina; a wash for catarrhal discharges; leucorrhœa with glairy, colored, and copious discharge; pruritis vulvæ; freckles; a cleansing antiseptic.

Derivative of Borax.—Soluble Cream of Tartar, *Tartarus boraxatus*, *Cremor tartari solubilis*, is obtained by dissolving 3 parts of cream of tartar and 1 part of borax in 8 parts of water, boiling for 2 or 3 minutes, and filtering when cool. Upon evaporating the solution on a steam-bath, a gummy, acid mass is obtained, soluble in water. It absorbs moisture from the atmosphere and must be kept in a well-closed vessel, The *French Codex* (1884) employs boric acid, and gives the following directions: One part of crystallized boracic acid, 4 parts of powdered bitartrate of potassium, and 10 parts of water, are exposed, in a silver vessel, to ebullition with constant agitation, until evaporation has reduced the mixture to a thick mass; this mass is detached in portions, spread on plates, and dried in a heated stove at a temperature of 40° to 50° C. (104° to 122° F.). The dry product is then broken into pieces and preserved in well-closed bottles. It is soluble in water in all proportions. (As to the chemical composition of these preparations, see E. Jahns, *Archiv der Pharm.*, 1878, p. 224.)

SODII BROMIDUM (U. S. P.)—SODIUM BROMIDE.

Formula: NaBr. Molecular Weight: 102.76.

"Sodium bromide should be kept in well-stoppered bottles"—(*U. S. P.*).

Preparation.—Sodium bromide may be prepared by the action of bromine upon solution of sodium hydroxide, evaporating the solution of sodium bromide and bromate to dryness, mixing the residue with charcoal, and igniting in a Hessian crucible, dissolving in water, and allowing to crystallize. Or, the salt may be obtained by double decomposition between solutions of sodium carbonate and ferrous bromide, as follows: $FeBr_2 + Na_2CO_3 = FeCO_3 + 2NaBr$ (compare *Potasii Bromidum*). From hot, concentrated solutions, the salt is obtained in anhydrous, cubical crystals; from solutions evaporating at ordinary temperatures, monoclinic prisms are formed, holding 2 molecules of water ($NaBr.2H_2O$). The anhydrous salt contains more bromine (77.62 per cent) than its corresponding potassium salt (67.13 per cent).

Description and Tests.—The *U. S. P.* describes sodium bromide as occurring in "colorless or white, cubical crystals, or a white, granular powder, odorless, and having a saline, slightly bitter taste. From air the salt attracts moisture without deliquescing. Soluble, at 15° C. (59° F.), in 1.2 parts of water, and in 13 parts of alcohol; in 0.5 part of boiling water, and in 11 parts of boiling alcohol. When heated to a bright-red heat, the salt melts, and, at a somewhat higher temperature, slowly volatilizes, without decomposition. To a non-luminous flame, it imparts an intense, yellow color. The aqueous solution is neutral, or at most very feebly alkaline, to litmus paper. If a few drops of chloroform be poured into 10 Cc. of the aqueous solution (1 in 20), then 1 Cc. of chlorine water added, and the mixture agitated, the liberated bromine will dissolve in the chloroform, imparting to it a yellow or brownish-yellow color, without a violet tint. The aqueous solution (1 in 20) should be clear and colorless, and should not be rendered turbid by sodium bitartrate T.S., nor by sodium cobaltic nitrite T.S. (limit of potassium); nor by ammonium oxalate T.S. (absence of calcium); nor by barium chloride T.S. (absence of sulphate). If the aqueous solution be slightly acidulated with hydrochloric acid, it should not be rendered turbid by the addition of an equal volume of hydrogen sulphide T.S., either at once (absence of arsenic, lead, etc.), or after adding ammonia water in slight excess (absence of iron, aluminum, etc.). If diluted sulphuric acid be dropped upon some of the powdered salt, no yellow color should appear at once (absence of bromate). If 5 Cc. of the aqueous solution (1 in 20) be mixed with a few drops of starch T.S., and then 0.5 Cc. of chlorine water added, no blue color should appear (absence of iodine). If 1 Gm. of the powdered salt be kept for 20 minutes at a temperature of 100° C. (212° F.), or slightly above it, it should not lose more than 0.03 Gm. in weight (limit of moisture). If 0.3 Gm. of the well-dried salt be dissolved in 10 Cc. of water, and 2 drops of potassium chromate T.S. be added, it should not require more than 29.8 Cc. of decinormal silver nitrate V.S. to produce a permanent red color (corresponding to at least 97.29 per cent of the pure salt"—(*U. S. P.*). By this test, allowance is made for about 2.6 per cent of chloride.

Action, Medical Uses, and Dosage.—Sodium bromide is practically identical with the potassium salt in its effects upon the system, except in point of activity, being somewhat less of a nerve sedative and hypnotic. It has the advantage over potassium bromide in that it seldom occasions the dullness of mind and lethargy so common to the former, nor is its effect upon the nervous system so depressing. It has the further advantage of a pleasanter taste, and comparative freedom from the tendency to produce acneiform eruptions, fetid breath, and other symptoms of bromism. For the general purposes for which the bromides are indicated, it may be preferred to the potassic salt, except in severe cases of *epilepsy*, when the more powerful action of the latter will be required. In milder cases the sodium salt will answer, and it may be substituted in cases where the bromides are necessary, and yet the potassium compound can not be tolerated. It is especially to be preferred in the disorders of children. Like potassium bromide, a condition of plethora is the indication for it, and it is especially useful in *insomnia*, with excitement, from bodily and mental fatigue; the excitation of *delirium tremens*, *cardiac palpitations*, purely nervous, and the result of masturbation, sexual excesses, and the immoderate use of alcohol, tobacco, cigarettes, etc., and in the various phases of nervous irritability attending the climacteric. Dose, from 2 to 60 grains, and gradually increased, if necessary, to 120 grains. It should be well diluted with water.

Specific Indications and Uses.— Practically the same as for *Potassii Bromidum* (which see).

SODII CARBONAS (U. S. P.)—SODIUM CARBONATE.

FORMULA: $Na_2CO_3+10H_2O$. MOLECULAR WEIGHT: 285.45.

SYNONYMS: *Sal sodæ depuratus*, *Pure carbonate of sodium*, *Soda carbonas*, *Carbonas sodicus*, *Sal soda*, *Washing soda*, *Carbonate of soda*.

"Sodium carbonate should be kept in well-closed vessels"—(*U. S. P.*).

Source, Preparation, and History.—Carbonate of sodium exists in several mineral springs, in the alkali lakes of Egypt, Venezuela, Mexico, California, Wyoming, etc., and in the surface of certain soils in the form of an efflorescence, *e. g.*, near Tripoli, in north Africa, and Hungary. It is also to be found in the ashes of seaweeds and salt-marsh plants. The soda from Egypt is called *trona*, and is composed of carbonate and bicarbonate of sodium. *Barilla* and *kelp* are preparations from the ashes of marine plants; the former contains about 30 per cent of sodium carbonate. At one time 20.000 persons were engaged in the manufacture of kelp in the Orkneys and Hebrides Islands.

The two chief sources from which sodium carbonate is now made on a large scale, are *common salt* and the mineral *cryolite*, occurring in Greenland in large quantities. Common salt is converted into sodium carbonate by two different methods: (1) The *Leblanc* process (1794), and (2) the *ammonia-soda* process of Solvay (1861).

The LEBLANC PROCESS consists in converting the sodium chloride first into sodium sulphate (*salt-cake process*) by means of sulphuric acid, hydrochloric acid being obtained as a by-product, as follows: $2NaCl + H_2SO_4 = Na_2SO_4 + 2HCl$. The sulphate, being thoroughly dried, is intimately mixed with calcium carbonate (limestone) and coal in certain proportions. The mixture is then subjected to a strong heat in a reverberatory furnace (or in a large revolving drum; see illustration in Roscoe and Schorlemmer's *Chemistry*) until a pasty, dark mass is obtained, called *black soda-ash*. The chief constituents of the latter are water-soluble sodium carbonate (about 44 per cent) and insoluble calcium sulphide (about 30 per cent), and are formed as follows: $Na_2SO_4 + C_4 = Na_2S + 4CO$; $Na_2S + CaCO_3 = Na_2CO_3 + CaS$. When this mass is lixiviated, and the solution evaporated to dryness. the sodium carbonate is obtained as a white or gray compact substance which is called *soda-ash* or *white soda-ash*. The carbonate of sodium, or *sal soda*, of commerce, is obtained by dissolving the white soda-ash in water, separating the impurities by filtration or sedimentation, running the solution into vats, and allowing it to crystallize. This mode of manufacturing carbonate of sodium was formerly employed almost exclusively.

The SOLVAY PROCESS is that pursued in the United States. The bicarbonate obtained in this process (see *Sodii Bicarbonas*) is heated to redness, and the monocarbonate formed is dissolved in water and crystallized. The bicarbonate, when heated to dull-redness, is decomposed according to the equation: $2NaHCO_3 = Na_2CO_3 + H_2O + CO_2$.

From CRYOLITE ($Al_2Fl_6.6NaFl$), sal soda is obtained by mixing the finely-powdered mineral with chalk or with caustic lime, and heating to redness, short of fusion. Insoluble calcium fluoride and soluble sodium aluminate are formed as follows: $Al_2Fl_6.6FlNa + 6CaO = 6CaFl_2 + Al_2O_3.3Na_2O$. The sodium aluminate is dissolved in water, and decomposed by carbonic acid gas into insoluble aluminum hydroxide and soluble sodium carbonate, according to the equation: $Al_2O_3.3Na_2O + 3CO_2 + 3H_2O = Al_2(OH)_6 + 3Na_2CO_3$.

Description.—The ordinary form met with in commerce, under the names *sal soda* and *washing soda*, is the impure article, known as *Sodii Carbonas Venalis* (*Sal sodæ, Soda cruda*). When purified by repeated crystallization from hot water, it yields the pharmacopœial salt. The latter is described as occurring in "colorless, monoclinic crystals, odorless, and having a strongly alkaline taste. In dry air, the salt effloresces, and, if left exposed, soon loses about half of its water of crystallization (31.46 per cent of its weight), and becomes a white powder. Soluble in 1.6 parts of water at 15° C. (59° F.), and in 0.09 part at 38° C. (100.4° F.), and in 0.2 part of boiling water; insoluble in alcohol and in ether; soluble in 1.02 parts of glycerin. When heated to 32.5° C. (90.5° F.), the crystals fuse in their water of crystallization, and lose some water. At a higher temperature, the salt continues to lose water, until, at last, an anhydrous residue is left, corresponding to 37 per cent of the weight of the crystals. At a bright-red heat the anhydrous salt fuses. To a non-luminous flame it imparts an intense, yellow color. The aqueous solution gives an alkaline reaction with litmus paper, and effervesces strongly with acids. On treating the salt with 20 parts of water. a clear and colorless solution should be formed. and no insoluble residue should be left"—(*U.S.P.*). Its incompatibilities are acids. metallic and earthy salts, solutions of lime, bitartrate of potassium, chloride of ammonium. solutions of metallic salts. etc.

Tests.—Carbonate of sodium is distinguished from potassium carbonate by its disposition to effloresce, while the latter tends to absorb moisture. The potassium salt, in solution, may be readily identified by yielding a crystalline precipitate with an excess of tartaric acid. From sodium bicarbonate, the monocarbonate may be roughly distinguished by its greater solubility in water, by yielding a white precipitate with magnesium sulphate. and a reddish-brown one with corrosive sublimate. The *U. S. P.* ascertains the purity of sodium carbonate by the following tests: "If 5 Cc. of the aqueous solution (1 in 20) be slightly supersaturated with hydrochloric acid, the liquid should not be colored red by a drop of ferric chloride T.S. (absence of sulphocyanate). If to 5 Cc. of the aqueous solution, slightly supersaturated with hydrochloric acid, an equal volume of hydrogen sulphide T.S. be added, no turbidity should be produced, either before or after the addition of ammonia water in slight excess (absence of arsenic, lead, iron, aluminum, etc.). If 5 Cc. of the aqueous solution be slightly supersaturated with acetic acid, the addition of 0.5 Cc. of ammonium oxalate T.S. should produce no turbidity (absence of calcium). If 5 Cc. of the aqueous solution be slightly supersaturated with acetic acid, the addition of 0.5 Cc. of sodium cobaltic nitrite T.S. should not render it turbid within 1 hour (limit of potassium). If 1.2 Gm. of the salt be dissolved in 10 Cc. of diluted nitric acid, then 0.5 Cc. of decinormal silver nitrate V.S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of silver nitrate V.S. (limit of chloride). If 2.5 Gm. of the salt be dissolved in 10 Cc. of diluted hydrochloric acid, then 0.1 Cc. of nitric acid and 0.1 Cc. of barium chloride T.S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of barium chloride T.S. (limit of sulphate, sulphite, and hyposulphite). If the crystallized salt be heated in a test-tube, the vapor of ammonia should not be evolved. To neutralize 1 Gm. of anhydrous sodium carbonate (deprived of its water of crystallization by heat immediately before being weighed) should require not less than 18.7 Cc. of normal sulphuric acid (corresponding to not less than 98.9 per cent of the pure salt), methyl orange being used as indicator"—(*U. S. P.*). (For method of quantitative determination of monocarbonate, when mixed with bicarbonate, see *Sodii Bicarbonas;* for determination of carbonate in the caustic alkali, see *Potassa.*)

Action, Medical Uses, and Dosage.—In large doses, carbonate of sodium will prove very injurious, producing a softening and disorganization of the tissues of the stomach. In smaller ones, it acts as an antacid and diuretic. The antidotes to an improper dose are vegetable acids, as vinegar, lemon-juice, sour wine, solution of cream of tartar, citric or tartaric acids; sweet oil, largely administered, will also modify its destructive action. As a remedy it has been used in *gastric acidity*, in *urinary affections*, with *uric acid deposits*, *gastro-cephalagia* or *sick headache*, *pertussis*, *goitre*, *scrofula*, etc. It is usually preferred to the potassium salt on account of its more pleasant taste. As with all the alkaline carbonates, if too long employed, it may bring on phosphatic gravel through the alkalinity of the urine; on this account, the bicarbonates dissolved in carbonic acid water and taken, are preferable, as the excess of carbonic acid tends to keep the phosphates in solution. It has been found useful in some *cutaneous diseases*, used internally and applied locally, in solution, 15 or 20 grains or even more of the carbonate, to 2 fluid ounces of water; or a bath may be prepared of similar proportions. The skin disorders most benefited by it, are those of a dry or scaly character. The strength of the bath or lotion must be regulated according to their effects. It is regarded as less valuable in the *vesicular and pustular skin diseases*, in which, as a rule, the bath must be very much diluted. A weak solution is of service, locally, in *pruritis vulvæ*. Continued large doses of this salt have produced, in a very few days, marked symptoms of a scorbutic character. It is but little used at the present day. The dose of carbonate of sodium is from 5 to 20 grains, in well diluted solution.

SODII CARBONAS EXSICCATUS (U. S. P.)—DRIED SODIUM CARBONATE.

FORMULA: $Na_2CO_3 2H_2O$. MOLECULAR WEIGHT: 141.77.

SYNONYMS: *Sodii carbonas exsiccata*, *Dried carbonate of soda*.

Preparation—"Sodium carbonate, two hundred grammes (200 Gm.) [7 ozs. av., 247 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.] Break the crystals into small fragments, and allow them to effloresce for several days in warm air, at a temperature not exceeding 25° C. (77° F.), until they are completely disintegrated, then dry the white powder at a temperature of about

45° C. (113° F.), until its weight is reduced to one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Pass the powder through a sieve, and preserve it in well-stoppered bottles"—(*U. S. P.*). The composition of the crystallized sodium carbonate being $Na_2CO_3+10H_2O$, a loss of 50 per cent of its weight results in a compound retaining a little over 3 molecules of water. By allowing the salt to effloresce at the moderate temperature directed (32.5° C. [90.5° F.]), a light and bulky powder is obtained. If the salt be heated so as to remove all its water of crystallization, as directed by the *British Pharmacopœia*, a denser, heavier, anhydrous product is formed.

Description and Tests.—"A loose, white powder, conforming to the reactions and tests given under *Sodii Carbonas*. To neutralize 1 Gm. of the salt should require not less than 13.8 Cc. of normal sulphuric acid (corresponding to about 73 per cent of anhydrous sodium carbonate), methyl orange being used as indicator"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Dried or anhydrous carbonate of sodium possesses properties similar to the crystallized carbonate. It is antacid and antilithic, and is useful in *urinary affections with excess of uric acid*. It may be given in powder or in pill, with extracts, soap, etc., though, on account of its irritant properties, these are bad forms of exhibition. It is better given very largely diluted with water. The dose is from 5 to 15 grains, rather less than the carbonate, on account of its loss of water of crystallization.

SODII CHLORAS (U. S. P.)—SODIUM CHLORATE.

FORMULA: $NaClO_3$. MOLECULAR WEIGHT: 106.25.

SYNONYMS: *Natrium chloricum*, *Chloras sodicus*.

"Sodium chlorate should be kept in glass-stoppered bottles, and *great caution* should be observed in handling the salt, as dangerous explosions are liable to occur when it is mixed with organic matters (cork, tannic acid, sugar, etc.), or with sulphur, antimony sulphide, phosphorus, or other easily oxidizable substances, and either heated directly, or subjected to trituration or concussion"—(*U. S. P.*).

Preparation.—Sodium chlorate is obtained from potassium chlorate by double decomposition with sodium salts of such acids as will produce difficultly soluble potassium salts, *e. g.*, sodium fluosilicate, or sodium bitartrate (Wittstein). In the latter case, the following reaction takes place: $KClO_3+NaHC_4H_4O_6=NaClO_3+KHC_4H_4O_6$ (cream of tartar).

Description and Tests.—This salt parts with its oxygen so readily that the caution above given is exceedingly appropriate. The *U. S. P.* describes this body as occurring in "colorless, transparent crystals (principally regular cubes, with tetrahedral facets), or a crystalline powder, odorless, and having a cooling, saline taste. Permanent in dry air. Soluble, at 15° C. (59° F.), in 1.1 parts of water, and in about 100 parts of alcohol; in 0.5 part of boiling water, and in about 40 parts of boiling alcohol; also soluble in 5 parts of glycerin. When heated, the salt melts, then gives off oxygen (about 45 per cent of its weight), and finally leaves a residue of sodium chloride, readily soluble in water, and yielding, with silver nitrate T.S., a white, curdy precipitate, insoluble in nitric acid. To a non-luminous flame, it imparts an intense, yellow color"—(*U. S. P.*). Decomposition upon heat takes places as follows: $NaClO_3 = NaCl+O_3$. If a trace of organic matter—*e.g.*, potassium or sodium tartrate is present in the salt, some chlorine will also be given off, and the residue has an alkaline reaction (see *Tests*, below; and F. Holberg, *Amer. Jour. Pharm.*, 1886, p. 15). "The aqueous solution is neutral to litmus paper. When a crystal of the salt is dropped into hydrochloric acid, the liquid assumes a deep greenish-yellow color, and emits the odor of chlorine. A saturated, aqueous solution should not be rendered turbid by sodium bitartrate T.S. (limit of potassium). An aqueous solution of the residue left after igniting a portion of the salt, should not give an alkaline reaction with litmus paper (absence of tartrate). The aqueous solution (1 in 20), slightly acidulated with acetic acid, should not be rendered turbid by the addition of an equal volume of hydrogen sulphide T.S., either at once (absence of arsenic, lead, etc.), or after the addition of ammonia water in slight excess (absence of iron, aluminum, etc.). The aqueous solution (1 in 20) should not be rendered turbid by adding to it a few drops of ammonia water, and then sodium phosphate T.S. (absence of magnesium, etc.). The solution (1 in 20), slightly acidulated with acetic acid, should not be rendered turbid by ammonium oxalate T.S. (absence of calcium); nor by barium chloride T.S. (absence of sulphate); nor should silver nitrate T.S. produce in it more than a slight opalescence (limit of chloride) "—(*U. S. P.*).

Action, Medical Uses, and Dosage.—The only advantage this salt has over the corresponding potassium chlorate, whose properties are identical, but stronger, is its greater solubility, so that stronger solutions may be employed. It is seldom used in medicine. Solutions of from 1 to 5 per cent may be used as a lotion or gargle. The dose ranges from 1 to 20 grains.

SODII CHLORIDUM (U. S. P.)—SODIUM CHLORIDE.

FORMULA: NaCl. MOLECULAR WEIGHT: 58.37.

SYNONYMS: *Common salt*, *Sea salt*, *Table salt*, *Sal culinare*, *Sal commune*, *Chloruretum sodicum*, *Muriate of soda*, *Sodæ murias*.

Source, History, and Preparation.—Chloride of sodium has been known and employed as an indispensable seasoner of food since the very origin of the human race. It exists in unlimited quantity in the waters of the ocean, which contain about 2½ per cent of chloride of sodium, with other mineral salts, and is also found in many mineral waters, springs, and lakes (Dead Sea in Palestine, Salt Lake in Utah). It is also met with in the solid form as cubical *Rock-salt* (*Fossil-salt*, *Gem-salt*, *Sal Gemmæ*, etc.) near Cardona in Spain, at Wieliczka in Poland, at Stassfurt in Germany, Reichenhall in Austria, in England, and many other parts of the globe. In the United States the salt wells of New York and Michigan furnish the greater portion of the salt in this country. Salt is contained in marine plants, and in animal fluids, *e. g.*, the blood, sweat, urine, etc. From sea water, the salt may be obtained by spontaneous evaporation in flat basins by exposure to sun and wind. This process is carried out in France, and along the borders of the Mediterranean, and the salt produced is the *sea salt* or *bay salt* of commerce. In countries with cold winters the brine is concentrated by freezing and removing the pure ice. The mother liquors from the manufacture of sea salt are rich in magnesium and potassium chlorides, sulphates, and bromides.

Salt from rock-salt deposits is obtained by mining, that from saline springs by evaporation in pans. In certain parts of Germany, preliminary evaporation of diluted salt solutions is effected by allowing the latter to trickle down over fagots formed into a high pile.

Description.—Chloride of sodium, upon slow evaporation, crystallizes in colorless, transparent cubes, but when rapidly evaporated, in hollow, 4-sided, pyramid-like bodies. At ordinary temperatures, salt does not crystallize with water; at a low temperature it crystallizes with 2, and at still lower temperature with 10 molecules of water. The *U. S. P.* describes sodium chloride as in "colorless, transparent, cubical crystals, or a white, crystalline powder, odorless, and having a purely saline taste. Permanent in dry air"—(*U. S. P.*). In a damp atmosphere, salt becomes moist, especially when it contains traces of magnesium or calcium chloride. Sodium chloride is "soluble in 2.8 parts of water at 15° C (59° F.), and in 2.5 parts of boiling water; almost insoluble in alcohol: insoluble in ether or chloroform"—(*U. S. P.*). It is also insoluble in concentrated hydrochloric acid. A solution of sodium chloride in water is precipitated when the solution is saturated with hydrochloric acid gas. "When heated, the salt decrepitates. At a red heat it fuses, and at a white heat it is slowly volatilized and partly decomposed. To a non-luminous flame it imparts an intense, yellow color. The aqueous solution of the salt is neutral to litmus paper"—(*U. S. P.*). Sodium chloride is incompatible with nitric and sulphuric acids, with carbonate of potassium, nitrate of silver (see below), and mercurous oxide. Solutions containing salt should not be kept in galvanized iron vessels, owing to the solvent action of sodium chloride on zinc.

Tests.—The usual impurities in sodium chloride are salts of potassium, sulphates of sodium and calcium, and chlorides of calcium and magnesium, traces of bromides, iodides, and iron, the latter impurity due to the solvent action of impure brine upon the iron of the evaporating pan. The *U. S. P.* directs the following tests for solution of sodium chloride: "With silver nitrate T.S. the solution yields a white, curdy precipitate insoluble in nitric acid"—(*U. S. P.*). The precipitated silver chloride (AgCl) is soluble in aqueous ammonia. "No turbidity should be produced in 5 Cc. of the aqueous solution (1 in 20) by the addition of 0.5 Cc. of sodium cobaltic nitrite T.S. (limit of potassium). The aqueous solution, slightly acidulated with acetic acid, should not be rendered turbid by ammonium oxalate T.S. (absence of calcium); nor by barium chloride T.S. (absence of sulphate); nor by an equal volume of hydrogen sulphide T.S., either before or after addition of ammonia water in slight excess (absence of arsenic, lead, zinc, iron, aluminum, etc.). No turbidity should be produced in the aqueous solution by the addition of sodium phosphate T.S. and a few drops of ammonia water (absence of magnesium, etc.). If 2 Gm. of the finely powdered salt be digested for some hours with 25 Cc. of warm alcohol, and, after cooling, the undissolved salt be removed by filtration, then the filtrate evaporated to dryness and the residue dissolved in 1 Cc. of water and mixed with a few drops of starch T.S., the addition of chlorine water, drop by drop, should produce neither a blue nor a yellow tint (absence of iodide or bromide). If 0.195 Gm. of well-dried sodium chloride be dissolved in 10 Cc. of water, and the solution mixed with a few drops of potassium chromate T.S., it should require not less than 33.4 Cc. of decinormal silver nitrate V.S. to produce a permanent red color (corresponding to at least 99.9 per cent of the pure salt)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—From 2 to 4 drachms of chloride of sodium will purge, and sometimes vomit; and in still greater quantity it will induce free emesis without causing prostration. In smaller doses it is a mild irritant, alterative, and vermifuge. It is useful in all chronic diseases characterized by a pale color of the tongue with a white coat or fur. A teaspoonful or so of salt, swallowed without being in solution, will frequently check *hemorrhage from the lungs;* and for this purpose, as well as to act as an astringent in *diarrhœa* and *dysentery*, it has been combined with lemon juice, or a solution of citric acid. As a tonic or alterative it is very useful in *scrofula* and all *strumous diseases*. Used moderately as a condiment it improves the digestive powers, and corrects the disposition to generate *worms*. It should be freely eaten by strumous children, and those troubled with worms; it invigorates the digestive organs. It is serviceable as an antidote in *poisoning by nitrate of silver*. Certain kinds of *dyspepsia* are benefited by it. It is most beneficial in those cases in which the food decomposes in the stomach giving rise to *gastralgia*, *acidity*, *flatulence*, and *constipation* or *diarrhœa*. It exerts a salutary influence upon the system, even during health, when taken in very small quantity, but an undue amount of it used daily, does, undoubtedly, in many persons dispose to plethora and corpulency. Excessive doses, long continued, give rise to changes in the vocal cords, sore throat, constipation, or chronic diarrhœa, catarrh, abscesses, deposits, thins the blood, and give a pale waxy color to the individual. Skin affections with dryness of the cuticle, which sweats easily upon exertion, and dandruff, have also been attributed to the inordinate use of salt (*Ec. Med. Jour.*, 1895, p. 412). In the fact the symptoms of scurvy and those of the sodium chloride habit are very similar. In *spasms* of an epileptic or apoplectic character, the effects of intemperance, salt and mustard, 1 or 2 teaspoonfuls of each, given in warm water, every 10 or 15 minutes, until free emesis is produced, will be found the most efficient emetic. In these cases, counter-irritation may be produced by bastinadoing the feet, and after the vomiting, the patient may drink freely of good fresh milk. During the *cholera* of 1849–50–51, in Cincinnati, much benefit was derived from the following mixture: Black pepper, in powder, fine table salt, of each, 1 teaspoonful; vinegar, 5 teaspoonfuls; hot water, ½ tumblerful. Dose, 1 tablespoonful every 5, 10, or 15 minutes, as circumstances required. It speedily checked vomiting, abated the watery discharges, and removed the cramps. It succeeded in many cases, where every other means had failed (J. King). A small pinch of salt should occasionally be given to patients suffering with *fevers* and other complaints in which but little nourishment can be taken. As Dr. Scudder aptly remarks, attention to this matter "may be the difference between life and death." Salt should be added in small amounts to the food of bottle-fed children suffering from *infantile dyspepsia* and *cholera infantum*. Salt and bicarbonate of sodium combined are frequently used to allay *sour stomach* and check *sick headache;* sometimes the combination acts as a gentle emetic. A teaspoonful of salt in a glass of cold water taken before breakfast will often overcome *obstinate constipation*. The specific indications for its selection should be observed. A solution of salt or salt and mustard forms a good emetic in cases of *narcotic poisoning*. At one time salt was recommended as a remedy in *phthisis*, in which it is needless to say it proved a failure, and as a remedy for *intermittent fever*. If the stomach was loaded it was emptied with an emetic dose of the salt, administered during the apyrexia; if not, from 10 to 30 grains of the salt were given every 3 hours. The cases benefited were those in which the tongue was broad and pale, or natural in color, but easily pitted by the teeth. The entire absence of salt in the food, gives rise to a cachectic condition, and other morbid states, with the formation of an abundance of intestinal worms. Externally, salt in solution in water or whiskey, is a topical stimulant, frequently useful in *contusions*, *sprains*, and *glandular enlargements*. Hot salt bags are useful to allay *local pains*, as in *neuralgia*, *earache*, *toothache*, *colic*, *rheumatism*, and *dysmenorrhœa*. The external application of hot salt solutions by means of saturated compresses is often very effectual in relieving *visceral inflammations*, particularly *acute kidney affections*, *inflammation of brain*, *spinal cord*, *glands*, *pleura*, etc. *Rheumatic*, *traumatic*, or *tubercular forms of arthritis* are likewise benefited by its local application, hot or cold, as is most grateful to the patient. In powder or solution it has likewise proved efficient as an application in some *ophthalmic diseases*. In *muco-purulent conjunctivitis* a 1 per cent solution is very useful, and a solution of salt should be applied after the use of silver nitrate upon the ocular membranes. It is sometimes useful in *trachoma*. In aural practice a solution is useful in *inflammation of the attic and of the middle ear* resulting from *scarlet fever*, using it after the discharge has become established. It is also used for irrigating purposes after *mastoid operations*. In ear affections 1 drachm of salt should be dissolved in 1 pint of water. Added to injections it renders them more stimulating. Weak solutions are useful in *acute and chronic nasal catarrh*, *ozena*, and *pharyngitis* and *tonsillitis;* and stronger solutions may be used as a wash in *leucorrhœa*, *gleet*, *pruritis vulvæ*, *mercurial and indolent ulcers*, *bites*, *stings*, etc. A salt water enema is useful in *ascarides*, and when sufficiently strong may be used for its derivative effects in *cerebral congestion*.

Normal Saline Solution, *Physiological Salt Solution*.—This solution is now largely used after surgical operations in the treatment of *shock*, and particularly if much blood has been lost. It is composed of sodium chloride, 1 drachm; sodium bicarbonate, 15 grains; distilled water, 2 pints (*Amer. Text-book of Surgery*). In an emergency sodium chloride alone (1 drachm) may be dissolved in 1 pint of sterilized water. The following saline solution has also been advised: Calcium chloride, 4 grains; potassium chloride, 1½ grains; sodium chloride, 135 grains; sterilized water, 1 quart (*Amer. Text-book of Surgery*). These solutions are used in extreme emergencies, where death is imminent, by *transfusion* into the veins, or more generally, and in less severe cases, by *hypodermoclysis*, or injection into the subcutaneous areolar tissue, changing the point of injection as necessary and rubbing the parts continually to aid dispersion under the skin. Large quantities, 1 to 2 quarts, may be used, but smaller amounts, from 10 to 40 ounces, repeated as the effects of the solution begin to wane, are preferable. The injection should be used at about 104° F. to 112° F., according to method of introduction. High rectal enema (held in by means of a compress) of the same may be administered alone or in conjunction with the above methods. The use of the normal saline solution is considered the best and most reliable method of stimulation after *shock*, in *profuse hemorrhage*, *violent diarrhœas*, and in *Asiatic cholera*. Other indicated treatment must be followed at the same time, particularly the application of external heat. When employed by transfusion, care must be taken that no air passes into the vein. The apparatus required for the use of these solutions is a funnel with rubber tubing and needle attached. A pitcher and tube may be used like a siphon. All apparatus should be thoroughly sterilized.

The dose of salt as a tonic or alterative, is from 10 to 60 grains; as an enema, ½ to 1 ounce; as a cathartic, 2 to 4 drachms; as an emetic, ½ to 1 ounce.

Specific Indications and Uses.—Tongue broad and pale with white coat or fur; broad tongue, natural in color, but easily pitted by the teeth; poisoning by nitrate of silver.

Artificial Sea Water.—Artificial sea water, for a *vivarium* or *marine aquarium*, in which to keep marine animalcules, sea plants, diatoms, etc., is composed of chloride of sodium, 43¼ ounces; sulphate of magnesium, 7½ ounces; chloride of magnesium, 6 ounces; sulphate of calcium, 2¾ ounces; chloride of potassium, 1¼ ounces; bromide of magnesium, carbonate of calcium each, 21 grains; soft spring or rain water, 10 gallons. Mix. Dissolve and filter through a sponge in a glass funnel.

SODII CITRO-TARTRAS EFFERVESCENS.—EFFERVESCENT CITRO-TARTRATE OF SODIUM.

Synonyms: *Sodæ citro-tartras effervescens*, *Effervescent citro-tartrate of soda*.

Preparation.—This preparation is official in the *British Pharmacopœia*. "Take of sodium bicarbonate, in powder, 51 ounces (Imp.); tartaric acid, in powder, 27 ounces (Imp.); citric acid, in powder, 18 ounces (Imp.); refined sugar, in powder, 15 ounces (Imp.). Mix the powders thoroughly; place the mixture in a dish or pan of suitable form heated to between 93.3° and 104.4° C. (200° and 220° F.). When the mixture, by aid of careful manipulation, has assumed a granular character, separate it into granules of uniform and convenient size by means of suitable sieves. Dry the granules at a temperature not exceeding 54.4° C. (130° F.). The product should weigh about 100 ounces"—(*Br. Pharm.*, 1898).

This preparation, when mixed with water, briskly effervesces with the escape of carbon dioxide. The same ingredients, merely mixed, readily decompose, but if prepared as described, the heat dispels all the water so that no reaction ensues until water is added to it. The preparation should be preserved in well-stoppered bottles.

Action, Medical Uses, and Dosage.—This combination is laxative and refrigerant, and is employed to reduce *fever*, cause *diaphoresis*, and to correct *excessive acidity*, for these purposes being sometimes used in *febrile* and *inflammatory states*, to allay nausea and vomiting, and in the acute forms of *rheumatism of the joints*, with excessively acid urine. Dose, 1 to 2 fluid drachms largely diluted with water.

SODII HYPOPHOSPHIS (U. S. P.)—SODIUM HYPOPHOSPHITE.

Formula: $NaPH_2O_2+H_2O$. Molecular Weight: 105.84.

Synonyms: *Hypophosphite of soda*, *Hypophosphis sodicus*, *Sodæ hypophosphis*, *Natrium hypophosphorosum*.

"Sodium hypophosphite should be kept in well-stoppered bottles"—(*U.S.P.*).

Preparation.—Hypophosphite of sodium is prepared by double decomposition between hypophosphite of calcium (see *Calcii Hypophosphis* and *Acidum Hypophosphorosum*) and crystallized carbonate of sodium. Take of hypophosphite of calcium, 6 ounces; crystallized carbonate of sodium, 10 ounces; water, a sufficient quantity. Dissolve the hypophosphite in 4 pints of water, and the carbonate in 1½ pints, mix the solutions, pour the mixture on a filter and wash the precipitate of carbonate of calcium, after draining with water, till the filtrate measures 6 pints. Evaporate this liquid carefully till a pellicle forms, and then stir constantly, continuing the heat until it granulates. In order to crystallize it, treat the granulated salt with alcohol of specific gravity 0.835, evaporate the solution until syrupy, and set it in a warm place to crystallize (Prof. W. Procter, Jr., 1858). The reaction is as follows: $Ca(PH_2O_2)_2+Na_2CO_3=CaCO_3+2NaPH_2O_2$. In a moist state, under exposure to sand-bath or even water-bath heat, neutral sodium hypophosphite has been known to explode with violence (see *Amer. Jour. Pharm.*, 1860, p. 87). Therefore great care should be taken in evaporating the solution that the temperature be kept below that of the boiling point of water. It is largely used in the preparation of *Syrup of the Hypophosphites*.

Description.—The *U. S. P.* demands this salt in "small, colorless, transparent, rectangular plates of a pearly lustre, or a white granular powder, odorless, and having a bitterish-sweet, saline taste. Very deliquescent on exposure to moist air.

Soluble, at 15° C. (59° F.), in 1 part of water, and in 30 parts of alcohol; in 0.12 part of boiling water, and in 1 part of boiling alcohol; slightly soluble in absolute alcohol; insoluble in ether. When heated in a test-tube, the salt at first loses its water of crystallization, and at about 200° C. (392° F.) it is decomposed, evolving hydrogen and hydrogen phosphide, which burn with a bright, yellow flame. Finally there is left a residue of sodium pyrophosphate and metaphosphate, sometimes mingled with a little red phosphorus. To a non-luminous flame the salt communicates an intense, yellow color. On triturating or heating sodium hypophosphite with nitrates, chlorates, or other oxidizing agents, it detonates violently. The aqueous solution is neutral to litmus paper"—(*U. S. P.*).

Tests.—Sodium hypophosphite is a strongly reducing agent. Thus, "a 5 per cent aqueous solution of the salt yields, with silver nitrate T.S., a white precipitate, which rapidly turns brown or black, owing to the separation of metallic silver. When an aqueous solution of the salt (1 in 20), acidulated with hydrochloric acid, is added in small quantity to an excess of mercuric chloride T.S., a white precipitate of mercurous chloride is formed. On further addition of the solution, the precipitate is reduced to metallic mercury"—(*U. S. P.*). The hypophosphite in these reactions is oxidized to sodium phosphate or to phosphoric acid. With mercuric chloride, the following reactions take place: $4HgCl_2+HPO_2H_2+2H_2O=4HgCl+4HCl+H_3PO_4$; and $4HgCl+HPO_2H_2+2H_2O=4Hg+4HCl+H_3PO_4$. Likewise, sodium hypophosphite, upon warming with cupric sulphate, produces copper hydride, and subsequently, metallic copper (see *Acidum Hypophosphorosum*). A delicate test for hypophosphites is as follows: Nitric acid solution of ammonium molybdate is mixed with solution of a hypophosphite; if a small quantity of sulphurous acid is now added, a blue precipitate, or in diluted solution, a blue coloration is produced, which becomes more intense upon warming. Phosphoric and phosphorous acid and their salts do not give this reaction, which is interfered with, however, by chlorates, sulphides, and thiosulphates; but their effect can be removed by boiling with diluted hydrochloric acid (E. J. Millard, *Amer. Jour. Pharm.*, 1889, p. 129). The *U. S. P.* tests for possible impurities of sodium hypophosphite, are as follows: "A solution of 0.5 Gm. of the salt in 1 Cc. of water, should yield no precipitate upon the addition of 1 Cc. of sodium bitartrate T.S. (limit of potassium). The aqueous solution (1 in 20) should not be colored red by the addition of a drop of phenolphtalein T.S., nor effervesce on the addition of an acid (absence of caustic alkali or carbonate); nor should it be rendered turbid by ammonium oxalate T.S. (absence of calcium). In the aqueous solution (1 in 20), acidulated with hydrochloric acid, an equal volume of hydrogen sulphide T.S. should not produce any turbidity (absence of arsenic, lead, etc.). After heating 10 Cc. of the aqueous solution (1 in 20) with 1 Cc. of nitric acid, separate portions of the solution should remain clear upon the addition of silver nitrate T.S. (absence of chloride), and of barium chloride T.S. (absence of sulphate). Not more than a slight cloudiness should be produced in the aqueous solution of the salt by magnesia mixture (limit of phosphate). Potassium ferrocyanide T.S. should not produce in the acidulated solution any blue color (absence of iron). If 0.1 Gm. of dry sodium hypophosphite be dissolved in 10 Cc. of water, mixed with 7.5 Cc. of sulphuric acid and 40 Cc. of decinormal potassium permanganate V.S., and the mixture boiled for 15 minutes, it should require not more than 3 Cc. of decinormal oxalic acid V.S. to discharge the red color corresponding to at least 97.96 per cent of the pure salt"—(*U. S. P.*). (In this connection, see an extensive investigation into the quantitative determination of hypophosphites, by Frank X. Moerk, *Amer. Jour. Pharm.*, 1889, pp. 326 and 386.)

Action, Medical Uses, and Dosage.—The hypophosphites are administered in Eclectic practice when it is desired to improve the nutrition of the nerve centers, and thereby increase the general nutrition of the body. Introduced along with other hypophosphites, by Dr. Churchill, as a remedy for *consumption*, it has, like all other agents, proved a failure in that direction, so far as a cure is concerned. It does, however, prove of benefit in this complaint, as well as in *chronic bronchitis*, *anemia*, *syphilis*, *scrofula*, and *bone diseases*, with insufficient osseous material, so far as to correct the serious loss of nerve power or nerve depression, which accompanies them. This, in fact, is its chief value. The dose is from 2 to 25 grains, given, preferably after meals.

Pharmaceutical Preparation.—NUTRITIVE HYPOPHOSPHITES (*Syrup of hypophosphites compound*, with quinine, strychnine, and manganese). This preparation is a specialty of the Wm. S. Merrell Chemical Co., of Cincinnati, O. It is a tonic and reconstructive, representing the combined virtues of the hypophosphites of calcium, sodium, potassium, iron, manganese, quinine, and strychnine.

SODII HYPOSULPHIS (U. S. P.)—SODIUM HYPOSULPHITE.

FORMULA: $Na_2S_2O_3+5H_2O$. MOLECULAR WEIGHT: 247.64.

SYNONYMS: *Sodium thiosulphate*, *Natrium subsulphurosum*, *Natrium hyposulphurosum*, *Hyposulphis sodicus*.

"Sodium hyposulphite should be kept in well-stoppered bottles"—(*U. S. P.*).

Preparation.—Take of crystallized carbonate of sodium, 32 parts; distilled water, 64 parts: sublimed sulphur, 10 parts. Dissolve the carbonate in the water, add the sulphur, and pass a stream of sulphurous acid gas through the solution. When the gas is in excess, being no longer dissolved, hyposulphite of sodium is in solution. Boil for a few minutes, filter, evaporate by a gentle heat to a third of its volume, and set aside in a cool place to crystallize. This process practically consists in the formation of sodium sulphite and simultaneous absorption of sulphur to form hyposulphite, as follows: $Na_2CO_3+3O_2=Na_2SO_3+CO_2$; and $Na_2SO_3+S=Na_2S_2O_3$.

Description.—Sodium hyposulphite should, preferably, be named *sodium thiosulphate*, because it is not the salt of hyposulphurous acid (H_2SO_2), a deep-yellow liquid, having strongly reducing properties, discovered by Schützenberger, and named by him *hydrosulphurous acid*. The sodium salt of this acid has the formula $NaHSO_2$, and is obtained when zinc is allowed to act upon a cold solution of sodium bisulphite in water, while contact with air is avoided. The salt, in aqueous solution, is spontaneously converted into *thiosulphate*, as follows: $2NaHSO_2=S_2O_3Na_2+H_2O$; hence the latter may be regarded as the anhydride of the true sodium hyposulphite. Similarly, free hyposulphurous acid decomposes, in aqueous solution, into water and thiosulphuric acid, the latter, being very unstable, is then decomposed into sulphur, water, and sulphur dioxide, as follows: $S_2O_3H_2=S+H_2O+SO_2$ (see *Tests*, below). In commercial usage, the wrong term, sodium hyposulphite for the thiosulphate, is firmly established. The salt, as described by the *U. S. P.*, occurs in "colorless, transparent, monoclinic prisms, odorless, and having a cooling, afterward bitter taste. Permanent in the air below 33° C. (91.4° F.), but efflorescent in dry air above that temperature. Soluble in 0.65 part of water at 15° C. (59° F.), and in about 0.5 part at 20° C. (68° F.); at a boiling heat, the solution is rapidly decomposed. Insoluble in alcohol, slightly soluble in oil of turpentine. When rapidly heated to about 50° C. (122° F.), the salt melts. When slowly heated until it is effloresced, and afterward to 100° C. (212° F.), it loses all its water of crystallization (36.3 per cent), and at a red heat is decomposed, sulphur being evolved, while a residue of sodium sulphide and sulphate remains. To a non-luminous flame it imparts an intense, yellow color. The aqueous solution is neutral to litmus paper"—(*U. S. P.*). Its solution, kept in closed vessels, deposits sulphur, and changes into sulphite; in warm air it becomes sulphate of sodium, depositing sulphur. "An aqueous solution of the salt readily dissolves many salts of silver (chloride, bromide, iodide, oxide, etc.), and discharges the color of a solution of iodine or of starch iodide"—(*U. S. P.*). Upon the dissolving power of sodium hyposulphite for silver chloride, etc., depends its well-known use in photography, to fix the image on an exposed plate, a process which consists in dissolving out the silver salt unacted upon by light. With silver chloride a soluble, double salt ($NaAgS_2O_3$) is formed. If iodine acts on sodium hyposulphite, the following reaction takes place: $2Na_2S_2O_3+I_2=2NaI+Na_2S_4O_6$ (sodium tetrathionate). Upon this reaction depends its useful application in iodometry (see *Tests*, below). Similarly, the salt converts chlorine into sodium chloride; hence it is used as an *antichlor*, to remove from paper-pulp and fabrics, the chlorine which may have been retained in the bleaching process (compare *Sodii Bisulphis*).

Tests.—The *U. S. P.* directs for sodium hyposulphite the following tests: "If ferric chloride T.S. be dropped into the aqueous solution (1 in 20), a dark violet color will be produced, which disappears rapidly upon agitation. Addition of sulphuric or hydrochloric acid to the aqueous solution liberates from it sulphur dioxide (known by its odor, and by its blackening a strip of paper moistened with mercurous nitrate T.S., and held in the escaping gas), and causes a white precipitate of sulphur (distinction from sulphite or bisulphite). If to 5 Cc. of the aqueous solution (1 in 20) an equal volume of hydrogen sulphide T.S. be added, no coloration or turbidity should be perceptible either before or after the addition of 1 Cc. of ammonia water (absence of lead, iron, etc.). The aqueous solution should not be rendered turbid by the addition of ammonium oxalate T.S. (absence of calcium). The aqueous solution of the salt (1 in 20) should not be colored red by a drop of phenolphtalein T.S. (absence of caustic alkali or carbonate); nor should a drop of silver nitrate T.S. produce a brown or a black precipitate in 5 Cc. of this solution (absence of sulphide)"—(*U. S. P.*). It must be remembered, however, that sodium hyposulphite (thiosulphate) produces with silver nitrate a white precipitate of silver hyposulphite ($Ag_2S_2O_3$), which turns black upon warming, silver sulphide (Ag_2S) being formed as follows: $Ag_2S_2O_2+H_2O+Ag_2S+H_2SO_4$. "In a dilute aqueous solution (1 in 80), barium chloride T.S. should produce no turbidity (absence of sulphate). If 0.25 Gm. of sodium hyposulphite be dissolved in 10 Cc. of water and a few drops of starch T.S. added, it should require at least 9.9 Cc. of decinormal iodine V.S. to produce a permanent blue color (corresponding to at least 98.1 per cent of the pure salt"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Hyposulphite of sodium acts as a resolvent, alterative, and sudorific. It has been used as a substitute for the natural sulphurous waters, in *chronic diseases of the skin*, *secondary syphilis*, *gout*, *rheumatism*, *piles*, etc., and in *biliary calculi*, in which it is said to exert a solvent action. Later it was introduced and has been advantageously used as an azymotic, etc. (see *Magnesii Sulphis* for full description of its antizymotic uses). All fungous and low forms of vegetation are destroyed by sodium thiosulphate, and it will arrest fermentative and putrefactive changes within or without the body. It deodorizes putrid discharges from any part of the system. For this deodorizing property, it has been very successfully employed in *carcinomatous affections*, and in *pulmonary gangrene* and *fetid bronchitis*, often curing the last-named complaint. Here it is used internally and by atomization. Internally, it has been found efficient in a species of *water-brash*, in which the fluid ejected is very frothy, and contains a fungous growth, or plant, called *sarcina ventriculi*. Any *acidity of the stomach* must first be removed, after which give a tablespoonful of a mixture composed of infusion of quassia, 3 fluid ounces; hyposulphite of sodium, 1 or 1½ drachms. If given before acidity has developed, it will prevent the fluids of the stomach becoming sour, and check any fermentative changes that may be going on in the stomach or bowels. It has also been employed successfully in *diphtheritic* and *aphthous ulcerations of the mouth*, both internally and as a local application. Externally, it has been employed in *pruritis vulvæ*, *favus*, *sycosis*, *impetigo*, etc. For many of the purposes to which the salt is applied, sodium sulphite will be found preferable. Sodium hyposulphite will remove the stains of iodine from garments, bedding, utensils, etc. Its dose is from 10 to 60 grains in pills or aqueous solution. A syrup is composed of 1 drachm of the hyposulphite, 2 ounces and 7 drachms of sugar, and 1½ fluid ounces of water; dissolve with gentle heat, and filter. The dose is from 1 to 4 tablespoonfuls. A bath (*Balneum Sodæ Hyposulphitis*) is also prepared from it as follows: From 1 to 4 ounces of the sodium salt, as may be required, is added to enough water to form a bath. If a small quantity of diluted sulphuric acid, or of vinegar, be added to the bath while the patient is immersed, sulphurous acid and sulphur are set free.

Specific Indications and Uses.—Fermentative dyspepsia, with yeasty vomiting; pallid mucous membranes, with white, pasty, or dirty-white exudate upon the tongue.

Related Salt.—SODII ET ARGENTI HYPOSULPHIS, *Sodium and silver hyposulphite* ($NaAgS_2O_3+H_2O$). This salt is said to act locally like silver nitrate, though less severely, and, when pure, stains neither the skin nor clothing. It is useful in *urethral discharges*, a solution of 1 or 2 parts in 200 parts of water being about the proper strength. The salt is prepared by dissolving freshly prepared silver oxide in an aqueous solution of sodium hyposulphite and crystallizing by careful evaporation at the ordinary temperature.

SODII IODIDUM (U. S. P.)—SODIUM IODIDE.

FORMULA: NaI. MOLECULAR WEIGHT: 149.53.

"Sodium iodide should be kept in well-stoppered bottles"—(*U. S. P.*).

Preparation.—Sodium iodide may be prepared by the action of iodine upon solution of caustic soda in the manner described under *Potassii Iodidum;* or, preferably, obtained by double decomposition between solution of ferrous iodide (previously prepared by the action of iodine upon iron filings in the presence of water) and sodium carbonate, as follows: $FeI_2+Na_2CO_3 = FeCO_3+2NaI$. After filtering from the precipitated ferrous carbonate, the solution of sodium iodide is evaporated to dryness, and the salt is at once put into dry, well-stoppered bottles (compare *Sodii Bromidum*). Like sodium bromide, this salt crystallizes in two forms, dependent on the temperature of the crystallizing solutions. From hot solutions, cubical, anhydrous crystals are produced. If allowed to crystallize spontaneously, at ordinary temperatures, monoclinic prisms or plates are formed, containing 2 molecules of water, and efflorescent in dry air.

Description.—Sodium iodide of the *U. S. P.* forms "colorless, cubical crystals, or a white, crystalline powder, odorless, and having a saline and slightly bitter taste. In moist air, it deliquesces and becomes partially decomposed into sodium carbonate and free iodine, assuming, thereby, a reddish color. Soluble, at 15° C. (59° F.), in 0.6 part of water, and in about 3 parts of alcohol; in 0.33 part of boiling water, and in 1.4 parts of boiling alcohol. When heated, the salt melts, and at a bright-red heat it is slowly volatilized and partly decomposed. To a non-luminous flame it imparts an intense, yellow color. The aqueous solution is neutral or but feebly alkaline to litmus paper"—(*U. S. P.*).

Tests.—"If to 5 Cc. of the aqueous solution (1 in 20) 1 Cc. of chlorine water be added, iodine will be liberated, and impart to the solution a yellow color. On agitating this mixture with a few drops of chloroform, the latter will acquire a violet color. If the salt be in distinct crystals, only few monoclinic prisms (containing 2 molecules of water) should be found among the regular cubes of the anhydrous salt. On drying 1 Gm. of the salt at 100° C. (212° F.), it should not lose more than 0.05 Gm. in weight (absence of more than 5 per cent of water.). A solution of 1 Gm. of the salt in 1 Cc. of water, should yield no precipitate with 1 Cc. of sodium bitartrate T.S. (limit of potassium). The aqueous solution (1 in 20), slightly acidulated with acetic acid, should remain clear after the addition of ammonium oxalate T.S. (absence of calcium), or of an equal volume of hydrogen sulphide T.S. (absence of arsenic, etc.). The addition of ammonium sulphide T.S., should not produce either a coloration or a turbidity in the aqueous solution (absence of zinc, iron, aluminum, etc.). If 1 Gm. of the salt be dissolved in water, and 0.05 Cc. (1 drop) of decinormal oxalic acid V.S. added, no red color should be produced by the addition of a drop of phenolphtalein T.S. (limit of alkali). The aqueous solution, slightly acidulated with hydrochloric acid, should not be colored blue upon the addition of potassium ferrocyanide T.S. (absence of iron). If 0.5 Gm. of the salt be dissolved in 10 Cc. of freshly boiled, distilled water, and the solution mixed with a few drops of starch T.S., no blue color should appear either at once (absence of free iodine), or after the addition of a drop of diluted hydrochloric acid (absence of iodate)"—(*U. S. P.*). The addition of hydrochloric acid liberates both iodic and hydriodic acids, which react upon each other with liberation of iodine, as follows: $IO_3H+5IH = 6I+3H_2O$. "If 5 Cc. of the aqueous solution (1 in 20) be acidulated with hydrochloric acid, and 0.5 Cc. of barium chloride T.S. added, no immediate turbidity should appear (limit of sulphate). If 5 Cc. of the aqueous solution be gently heated with 1 drop of ferrous sulphate T.S. and 0.5 Cc. of potassium hydrate T.S., no blue color should appear after acidulating the mixture with hydrochloric acid (absence of cyanide)"—(*U. S. P.*). Cyanide may possibly be present, because iodine nearly always contains iodine cyanide (*Digest of Criticisms on the U. S. P.*, Part I, 1897). "If 1 Gm. of the salt be mixed with 0.5 Gm. of iron filings and 0.5 Gm. of powdered zinc, and heated in a test-tube with 5 Cc. of sodium hydrate T.S., no ammoniacal vapors should be evolved (absence of nitrate or nitrite). If 0.5 Gm. of the well-dried salt be dissolved in 10 Cc. of water, and 2 drops of potassium chromate T.S. added, it should not require more than 34.5 Cc. nor less than 33.4 Cc. of decinormal silver nitrate V.S. to produce a permanent red color (corresponding to at least 98 per cent of the pure salt)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Locally, this salt is stimulant, antiseptic, and deodorant, and for these purposes it has been used upon *offensive ulcers*. It has been proposed as a substitute for potassium iodide internally, its admirers claiming that it is less likely to produce gastro-intestinal and broncho-pulmonic irritation, and skin eruptions. On the other hand, it is claimed to be a much feebler therapeutic agent. It is especially recommended in cases of *syphilis* and *eczema*, in which the potassium salt is apparently indicated, but where the system is greatly depressed.

SODII NITRAS (U. S. P.)—SODIUM NITRATE.

FORMULA: $NaNO_3$. MOLECULAR WEIGHT: 84.89.

SYNONYMS: *Chili saltpetre, Cubic nitre, Nitrum cubicum, Sodæ nitras, Nitras sodicus, Azotas sodicus, Nitrate of soda.*

"Sodium nitrate should be kept in well-stoppered bottles"—(*U. S. P.*).

Source and History.—Sodium nitrate was prepared as early as 1683, by Bohn. A commercial grade was later termed *South American saltpetre*, although the term saltpetre properly belongs to the potassium salt. It is found in south Peru and Chili, imbedded in large tracts of soil a few feet below the surface. The nitrate deposits occupy a stretch of about 120 miles in length and 2 miles wide, and are found below a layer of clay and sand. The nitrate occurs mixed with about 20 to 30 per cent of sodium chloride, also with calcium and magnesium sulphates and chlorides, bromides, and iodides. This saline deposit, known to the natives as *caliche* or *terra salitrosa*, is removed by blasting. After undergoing a process of crystallization, the product is put into sacks and exported in the form of moist masses of crystals, containing from 1 to 2 per cent of sodium chloride (see *Amer. Jour. Pharm.*, 1872, p. 319). Commercial grades have been differentiated as *white crystalline, gray crystalline, yellow, white compact* and *gray compact*. Upon reaching this country the salt is purified by recrystallization from water.

Description and Tests.—Sodium nitrate forms rhombohedral crystals, resembling a cube (*cubical nitre*), and isomorphous with calcspar. The shape of the crystals, and the yellow color it communicates to flame, distinguish it from nitrate of potassium. Its therapeutical effects are similar to those of nitrate of potassium, without so readily disturbing digestion. It is chiefly used in the manufacture of nitric and sulphuric acids, and in the making of fireworks, but is an unfit ingredient for gunpowder, on account of its deliquescence. Nitrate of potassium is prepared from it by decomposing it with chloride of potassium (see *Potassii Nitras*). It is also used in preparing sodium arsenate (which see). The *U. S. P.* describes it as in "colorless, transparent, rhombohedral crystals, odorless, and having a cooling, saline, and slightly bitter taste. Deliquescent in moist air. Soluble, at 15° C. (59° F.), in 1.3 parts of water, and in about 100 parts of alcohol; in 0.6 part of boiling water, and in 40 parts of boiling alcohol. When heated to 312° C. (593.6° F.), the salt melts without decomposition. At a higher temperature, it evolves oxygen, and is reduced to nitrite. On red-hot charcoal, it deflagrates. To a non-luminous flame, it imparts an intense, yellow color. The aqueous solution is neutral to litmus paper. If the aqueous solution be mixed in a test-tube with a drop of diphenylamine T.S., and sulphuric acid carefully poured in, so as to form a separate layer, a deep-blue color will appear at the line of contact. A solution of 0.5 Gm. of the salt in 1 Cc. of water, should not be precipitated or rendered turbid by 1 Cc. of sodium bitartrate T.S. (limit of potassium). The aqueous solution (1 in 20) should not be colored or rendered turbid by the addition of hydrogen sulphide T.S., or ammonium sulphide T.S. (absence of arsenic and metallic impurities); nor by the addition of equal parts of ammonia water and sodium phosphate T.S. (absence of calcium, magnesium, etc.). If the aqueous solution be mixed with a few drops, each, of hydrogen sulphide T.S. and starch T.S., and then some chlorine water poured carefully upon the mixture, no blue color should appear at the line of contact (absence of iodate and iodide). No turbidity should be produced within 5 minutes in the aqueous solution, acidulated with nitric acid, on the addition of either barium chloride T.S. (limit of sulphate), or silver nitrate T.S. (limit of chloride)"—(*U. S. P.*). (Also compare *Potassii Nitras.*)

Action, Medical Uses, and Dosage.—The action of large doses of sodium nitrate resembles that of potassium nitrate. The continued use of doses ranging from 20 to 90 grains, does not affect the appetite and bowels, but slows and weakens the heart's action, causes emaciation, pallid countenance, mental weakness, and general debility. On account of its mildly purgative action, it has been successfully used in *dysentery* and *diarrhœa*, from 1 to 2 ounces, largely diluted, being given in 24 hours. It is likewise diuretic, and, on account of its marked property of effecting a solution of false membranes, it has been used locally in *diseases of the throat*, characterized by these fibrinous deposits. Not only is the salt diuretic, but, in doses of 2 or 3 drachms, it greatly increases the excretion of urea, besides acting upon the skin, and influencing the vegetative system of nerves, "controlling irritation and inflammation" (Scudder). Concerning this agent, Prof. Scudder writes: "The indications for its use in acute diseases are a swollen and puffed tongue, covered with a white or yellowish mucus; the mouth may be dry or moist, but the tongue must never show contraction, be elongated, or pointed, or deep-red. In other words, we must observe the general indications for the administration of an alkali. Probably the special cases in which it will be found of most advantage are these: When the pulse is full, the surface flushed, slightly dusky or purplish; eyes injected, though not dry; an increased perspiration, though the skin remains hot" (*Spec. Med.*, p. 91). Dose, 1 drachm to 2 ounces, largely diluted, in 24 hours.

Specific Indications and Uses.—These have been sufficiently indicated above.

SODII NITRIS (U. S. P.)—SODIUM NITRITE.

FORMULA: $NaNO_2$. MOLECULAR WEIGHT: 68.93.

SYNONYM: *Nitrite of soda.*

"Sodium nitrite should be kept in well-stoppered bottles"—(*U. S. P.*).

Preparation.—Sodium nitrite is produced by the reduction of sodium nitrate with charcoal or starch, etc., at a red heat. The mass is lixiviated with water and crystallized. By another process, a product, containing not less than 98 per cent of the salt, may be obtained by melting *pure* sheet-lead (2½ parts, by weight) with sodium nitrate (1 part), in a shallow iron vessel, with continuous agitation. Yellow oxide of lead (litharge) is formed. Cool the mass, lixiviate with water, concentrate, and allow to crystallize. (For further details, see *Amer. Jour. Pharm.*, 1889, p. 618.) This salt was made official because of its use in the preparation of spirit of nitrous ether.

Description and Tests.—Sodium nitrite is officially described as forming "white, opaque, fused masses, usually in the form of pencils, or colorless, transparent, hexagonal crystals; odorless, and having a mild, saline taste. When exposed to the air, the salt deliquesces and is gradually oxidized to sodium nitrate. Soluble in about 1.5 parts of water at 15° C. (59° F.), and very soluble in boiling water; slightly soluble in alcohol. When heated, the salt melts, and at a red heat it is decomposed, yielding oxygen, nitrogen, nitrogen dioxide, and sodium oxide. To a non-luminous flame it imparts an intense, yellow color. The aqueous solution gives an alkaline reaction with litmus paper. If the aqueous solution of the salt be mixed with some potassium iodide T.S., and a few drops of an acid added, iodine will be liberated, and nitrogen dioxide gas will escape with effervescence"—(*U. S. P.*). Upon this reaction is based the quantitative test for the purity of the salt as given below. The reaction takes place as follows: $HNO_2+HI=H_2O+I+NO$. "The salt should readily dissolve in 20 parts of water, forming a colorless solution, and leaving no insoluble residue (absence of insoluble impurities). If 1 drop of hydrochloric acid and a few drops of starch T.S. be added to 5 Cc. of the aqueous solution, no blue coloration should appear (absence of iodide). If 5 Cc. of the aqueous solution be mixed with an equal volume of hydrogen sulphide T.S., no coloration or precipitate should be produced (absence of lead, arsenic, copper, etc.). If 0.15 Gm. of sodium nitrite be dissolved in 5 Cc.

of water, and introduced into a nitrometer, then followed by a solution of 1 Gm. of potassium iodide in 6 Cc. of water and 15 Cc. of normal sulphuric acid, the liberated nitrogen dioxide gas should measure not less than 50 Cc. at 15° C. (59° F.), or 51.7 Cc. at 25° C. (77° F.), corresponding to not less than 97.6 per cent of the pure salt"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Sodium nitrite acts upon the system exactly as amyl nitrite and nitroglycerin do, except that its effects are more uniform, less pronounced, and continue longer. This is accounted for by the lesser solubility of the drug and from the fact that it is less rapidly eliminated from the system (see *Amyl Nitris*). Serious symptoms have been observed from the use of the drug, for when first introduced it was given in doses but little short of toxic. The conditions in which it is of value are those in which the other nitrites have been found so serviceable, viz.: It relieves the pain and spasm of *angina pectoris* in which its action is more prolonged than that of glonoin or amyl nitrite, *nervous asthma*, *dyspnœa* from transient pulmonic obstruction, *hemicrania*, and other *headaches* depending chiefly upon cerebral anemia and in the milder forms of *convulsions* and *epileptoid seizures* where the bromides are contra-indicated. In the latter, its effects have been unsatisfactory. It has been used with marked results in *double aortic disease*, *insomnia*, from cardiac affections, *renal disorders*, with relaxed blood pressure, and in *granular disease of the kidney*, associated with a *dilated heart*. The indications are dyspnœa, frontal headache, or dizziness. As a heart stimulant, it may be used whenever the innervation of that organ is impaired; when the heart muscle is undergoing degeneration or when the valves are diseased or imperfect in action. As the salt does not decompose in water it has been preferred to other nitrites. The dose is from 1 to 2 grains, repeated as necessary, or gradually increased until the desired effect is produced. A single dose should not exceed 2 grains. POTASSIUM NITRITE has been found to possess similar properties.

Specific Indications and Uses.—(See *Amyl Nitris.*)

SODII PHOSPHAS (U. S. P.)—SODIUM PHOSPHATE.

FORMULA: $Na_2HPO_4+12H_2O$. MOLECULAR WEIGHT: 357.32.

SYNONYMS: *Sodium orthophosphate, Phosphate of soda, Sodæ phosphas, Phosphas natricus, Phosphas sodicus, Disodium hydrogen phosphate, Medicinal tribasic phosphate of sodium.*

"Sodium phosphate should be kept in well-stoppered bottles, in a cool place"—(*U. S. P.*).

Source and Preparation.—Sodium phosphate is a constituent of the urine of the carnivora, and is prepared from the calcium phosphate of bones by treating the latter material with sulphuric acid and water, which produces soluble acid calcium phosphate and insoluble calcium sulphate, as follows: $Ca_3(PO_4)_2+2H_2SO_4=2CaSO_4+(PO_4H_2)_2Ca$. After filtering, the solution, while hot, is neutralized with solution of sodium carbonate, until it is distinctly alkaline to litmus paper, the desired phosphate being formed according to the equation: $(PO_4H_2)_2Ca+2Na_2CO_3=2PO_4HNa_2+Ca_3CO+CO_2+H_2O$. The liquid is then evaporated to crystallization. For analytical purposes, it is better to add pure crystallized carbonate of sodium to pure phosphoric acid solution, in a porcelain dish, as long as it causes an effervescence, and until the reaction is alkaline. It is placed in the cold to crystallize, the crystals are separated, spread on filtering paper to dry, and kept in a cool place. The mother liquor, on evaporation, yields fresh quantities of crystals.

Description.—Sodium phosphate occurs in "large, colorless, monoclinic prisms, odorless, and having a cooling, saline taste. The crystals effloresce in the air, and gradually lose 5 molecules of their water of crystallization (25.1 per cent). Soluble in 5.8 parts of water at 15° C. (59° F.), and in somewhat less than 1.5 parts of boiling water; insoluble in alcohol. When heated to about 40° C. (104° F.), the salt fuses, yielding a colorless liquid. At 100° C. (212° F.) it loses all its water of crystallization (60.3 per cent), and at a red heat it is converted into sodium pyrophosphate. It imparts to a non luminous flame an intense, yellow color. The aqueous solution is slightly alkaline to litmus paper, but not to phenolphtalein paper"—(*U. S. P.*).

According to more recent experiments, however, pure sodium phosphate does redden phenolphtalein (see C. E. Smith, *Digest of Criticisms on the U. S. P.*; and Brunner, *Amer. Jour. Pharm.*, 1898, p. 548). "A 5 per cent aqueous solution of the salt yields a white precipitate with magnesia mixture"—(*U. S. P.*). The latter is a mixture of magnesium sulphate, ammonium chloride, and ammonia water (see *Test Solutions*), and the crystalline precipitate has the formula $PO_4NH_4Mg+6H_2O$ (compare *Sodii Arsenas*). With the 5 per cent aqueous solution, the *U. S. P.* further directs: "With silver nitrate T.S. it yields a yellow precipitate, soluble in ammonia water and in nitric acid"—(*U. S. P.*). This precipitate is tribasic silver phosphate (Ag_3PO_4); it is formed according to the equation: $Na_2HPO_4+3AgNO_3=Ag_3PO_4+2NaNO_3+HNO_3$. Thus, the solution becomes acid. Silver chloride differs from silver phosphate in being white, and insoluble in nitric acid. "If 0.5 Cc. of the aqueous solution (1 in 20) be mixed with 1 Cc. of ammonium molybdate T.S., the mixture will at once assume a yellow color, and, after a few minutes, yield a yellow precipitate, the appearance of which is hastened by a gentle heat"—(*U. S. P.*). The precipitate is ammonium phospho-molybdate, having the approximate composition $10MoO_3+PO_4(NH_4)_3$. The precipitate is insoluble in diluted acids, but soluble in aqueous ammonia and fixed alkalies. From the colorless ammonia solution, magnesia mixture precipitates the crystalline compound above mentioned. Phosphate of sodium is incompatible with magnesia, soluble calcium salts, and solutions of metallic salts, with all of which it forms insoluble phosphates; it is also incompatible with alkaloids, and with mineral acids. Neither the commercial nor the pharmacopœial salt is favored by Eclectic physicians who prefer a dried powdered form nearly free from water and much stronger than the crystalline compound.

Tests.—Commercial sodium phosphate at one time contained large quantities (20 to 60 per cent) of sodium sulphate (*Amer. Jour. Pharm.*, 1875, p. 371, also 1881, p. 511). To test sodium phosphate for impurities, the *U. S. P.* directs as follows: "No residue should be left on dissolving the salt in water (absence of calcium, etc.). No turbidity or coloration should be produced in the aqueous solution by the addition of a small quantity of ammonium sulphide T.S.; or of an equal volume of hydrogen sulphide T.S. after the addition of a few drops of hydrochloric acid (absence of metallic impurities). If 1 Gm. of the powdered salt be shaken with 3 Cc. of stannous chloride T.S. (see *List of Reagents*, Bettendorff's Test for Arsenic), then a small piece of pure tin-foil added, and a gentle heat applied, no brown coloration should appear within 15 minutes (limit of arsenic). If 0.5 Gm. of the salt be dissolved in 4 Cc. of water, and 1 Cc. of sodium bitartrate T.S. then added, the solution should remain perfectly clear (limit of potassium). No effervescence should occur on the addition of hydrochloric or nitric acid to a solution of the salt (absence of carbonate). On adding to 5 Cc. of the aqueous solution (1 in 20) 0.5 Cc. of silver nitrate T.S., a pure yellow precipitate will be formed, which should not become dark-colored by heating (absence of hypophosphite, etc.), and which, upon the addition of nitric acid, should yield a perfectly clear, or, at most, only a very slightly opalescent, liquid (limit of chloride). If to 5 Cc. of the aqueous solution, acidulated with hydrochloric acid, 0.5 Cc. of barium chloride T.S. be added, the solution should not be rendered more than very slightly opalescent (limit of sulphate)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Phosphate of sodium, formerly known as *subphosphate of soda*, is a mild, saline cathartic, but very apt to gripe, and at a time when cathartics were more in vogue than at present, it was considered well adapted to *febrile* and *inflammatory diseases*, and for children and others whose stomachs are delicate or irritable. As a laxative and cholagogue, however, it is mild and very efficient when administered in small doses. In children's disorders it is a particularly valuable remedy. In *infantile constipation* or *diarrhœa*, with white and green foul-smelling stools, and especially in the *bowel disorders* of bottle-fed children, from 3 to 5-grain doses, 3 times a day, act as a mild laxative and correct the unpleasant symptoms. It is equally valuable in *infantile dyspepsia* with pallid tongue and membranes, and sour eructations, and occasionally colic. Associated often with inactivity of or irritation of the bowels is a general condition of *malnutrition* which is corrected by this drug, which, under the specific conditions named above, acts as a valuable restorative. Here the dose should be from 1 to 3 grains 3 times a day administered with the food, and particularly with milk. It is a good remedy in many *hepatic troubles.* When the pallid tongue and membranes indicate it it may be given with confidence in the *jaundice* of small children associated with impairment of nutrition. It is a good remedy for *jaundice* resulting from *biliary catarrh* in adults, using from 20 to 30 grains of the salt in a day's time, and the smaller dose in a wineglassful of water after each meal persisted in from 2 to 3 months, will radically cure *hepatic colic*, employing, when the paroxysms come on, an inhalation of chloroform (Locke). For habitual and recurring *bilious headache* in weak and nervous individuals, with loaded tongue and sallow skin, give from 10 to 15 grains of the salt, in water or milk, 5 times a day; and for *obstinate* or *habitual constipation*, with or without *colic* and *indigestion*, give a drachm in a couple of ounces of water, night and morning. The dose, for cathartic purposes, is from 6 to 12 drachms, in water, milk, soup, gruel, or broth; as a laxative for adults, 10 to 30 or 60 grains; for children, 3 to 5 grains; as a restorative, 1 to 3 grains. The salt is best given in water or warm milk. The salt employed by Eclectic physicians is the dried, powdered sodium phosphate, known as specific sodium phosphate.

Specific Indications and Uses.—Pale tongue and membranes, general malaise and inanition; tender abdominal muscles and anorexia; restless, yet with strong inclination to sleep, but frequently awakening; dirty tongue and sallow skin; tongue coated golden-yellow and moist, or a dry, furred coating upon a pallid tongue; white and green diarrhœa, with malnutrition; or stools, hard, white, pasty, or spongy, which float upon water; infantile constipation, with impaired nutrition; habitual constipation, with hard, dry fæces; acid eructations; biliary colic; bilious headache; jaundice.

SODII PYROPHOSPHAS (U. S. P.)—SODIUM PYROPHOSPHATE.

FORMULA: $Na_4P_2O_7+10H_2O$. MOLECULAR WEIGHT: 445.24.

SYNONYMS: *Natrium pyrophosphoricum, Pyrophosphas sodicus.*

Preparation and History.—Allow crystallized sodium phosphate (10 ounces) to effloresce in warm air, then expose the salt to a dull-red heat, until a small portion of the ignited mass, dissolved in water, causes a white precipitate, without a yellow tinge, with silver nitrate. Dissolve the mass in 5 pints of water at 100° C. (212° F.), filter, and allow to crystallize. This produces 6 ounces of sodium pyrophosphate. (Compare *Sodii Phosphas;* also see Dr. Squibb's process, *Amer. Jour. Pharm.*, 1860, p. 36.)

Description and Tests.—"Colorless, transparent, monoclinic prisms, or a crystalline powder, odorless, and having a cooling, saline, and feebly alkaline taste. Permanent in cool air, slightly efflorescent in warm air. Soluble in 12 parts of water at 15° C. (59° F.), and in 1.1 parts of boiling water: insoluble in alcohol. When heated to 100° C. (212° F.), the salt loses its water of crystallization (40.34 per cent) without previous fusion. At a higher temperature it fuses, forming a transparent liquid, which, on cooling, solidifies to a crystalline mass. To a non-luminous flame, it imparts an intense, yellow color. Its aqueous solution is feebly alkaline to litmus and to phenolphtalein paper. A 5 per cent aqueous solution of the salt yields with magnesia mixture a white precipitate; with silver nitrate T.S., it yields a precipitate of a pure white color (distinction from *orthophosphate*), soluble in ammonia water and nitric acid. With ammonium molybdate T.S., no precipitate is formed within 15 or 20 minutes, even when a gentle heat is applied (distinction from *orthophosphate*)"—(*U. S. P.*). The behavior of sodium pyrophosphate toward salts of various metals can be utilized to effect the analytical separation of some of these metals (G. Vortmann, *Amer. Jour. Pharm.*, 1888, p. 421). "No turbidity or coloration should be produced in the aqueous solution (1 in 20) by the addition of a small quantity of ammonium sulphide T.S.; or of an equal volume of hydrogen sulphide T.S. after the addition of a few drops of hydrochloric acid (absence of metallic impurities). If 1 Gm. of the powdered salt be shaken with 3 Cc. of stannous chloride T.S. (see *List of Reagents*, Bettendorff's Test for Arsenic), then a small piece of pure tin-foil added, and a gentle heat applied, no brown coloration should appear within 15 minutes (limit of arsenic). If 0.5 Gm. of the salt be dissolved in 6 Cc. of water, and 1 Cc. of sodium bitartrate T.S. then added, the solution should remain perfectly clear (limit of potassium). No effervescence should occur on the addition of hydrochloric or nitric acid to a solution of the salt (absence of carbonate). In the aqueous solution of the salt, rendered acid by nitric acid, not more than a very slight opalescence should be produced by silver nitrate T.S. (limit of chloride), or by barium chloride T.S. (limit of sulphate)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This salt is of value chiefly on account of its use in preparing ferric pyrophosphate. Its action and uses are those of sodium phosphate, being, however, a third stronger, consequently the dose should be correspondingly less.

SODII SALICYLAS (U. S. P.)—SODIUM SALICYLATE.

FORMULA: $NaC_7H_5O_3$. MOLECULAR WEIGHT: 159.67.

"Sodium salicylate should be kept in well-stoppered bottles, protected from heat and light"—(*U. S. P.*).

Preparation.—Mix together, in a glass or porcelain vessel, pure salicylic acid (33 parts) and sodium bicarbonate (20 parts), and gradually add 20 parts of pure distilled water. Carbon dioxide is rapidly disengaged, and solution of sodium salicylate is formed. The proportions given insure a slight excess of acid, whereby a perfectly white salt is obtained. After most of the carbonic acid gas has escaped, expel the remainder by evaporating to dryness on a water-bath at a temperature not exceeding 60° C. (140° F.). Recrystallize the residue from 95 per cent alcohol. Instead of the foregoing, pure salicylic acid (100 parts) and uneffloresced crystallized sodium carbonate (103 parts), with sufficient water to produce a paste, may be employed, and, after straining through clean muslin, if necessary, proceed as directed in the first process. Excess of alkali would produce a brownish product. Contact with iron must be avoided, and the salicylic acid, as well as the carbonate should be pure.

Description and Tests.—This compound is described by the *U. S. P.* as "a white, amorphous powder, odorless, and having a sweetish, saline taste. Permanent in cool air. Soluble in 0.9 part of water, and in 6 parts of alcohol at 15° C. (59° F.); very soluble in boiling water or alcohol; also soluble in glycerin"—(*U. S. P.*). If the salt does not entirely dissolve in water, the residue is liable to consist of salicylic acid. "When heated, the salt is decomposed, giving off inflammable vapors and an odor of phenol, and finally leaves a residue of sodium carbonate. To a non-luminous flame, it imparts an intense, yellow color. The aqueous solution slightly reddens blue litmus paper. Ferric chloride T.S. added to an excess of a concentrated solution of the salt, produces a red precipitate, but when added to a very dilute solution (1 in 100), it produces a deep violet-blue color. If copper sulphate T.S. be added to the aqueous solution (1 in 20), a green color will be produced. On adding to about 0.2 Gm. of the salt, in a test-tube, about 1 Cc. of concentrated sulphuric acid, and then, cautiously, about 1 Cc. of methylic alcohol in drops, on heating the mixture to boiling, the odor of methyl salicylate will be evolved. Hydrochloric or sulphuric acid produces in a concentrated aqueous solution of the salt a voluminous, white precipitate, which, after being separated by filtration, and washed, should conform to the reactions and tests given under *Acidum Salicylicum*. The aqueous solution should be colorless, even when concentrated, and should not effervesce on the addition of acids (absence of carbonate). When the solution (1 in 20) is mixed with a small quantity of ammonium sulphide T.S., or with an equal volume of hydrogen sulphide T.S., no coloration or turbidity should appear (absence of metallic impurities). If 1 Gm. of the salt be dissolved in a mixture of 50 Cc. of alcohol and 25 Cc. of water, then acidulated with nitric acid and filtered, a portion of the filtrate should not be rendered turbid by the addition of a few drops of barium chloride T.S. (absence of sulphate). Another portion of the filtrate should remain clear on the addition of a few drops of silver nitrate T.S. (absence of chloride). If 1 part of the salt be agitated with 15 parts of cold, concentrated sulphuric acid, no brown color should be produced within 15 minutes (absence of readily carbonizable, organic impurities)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—The action and uses of sodium salicylate are practically those of salicylic acid (which see), whose dangerous qualities it also shares. From the fact that salicylic acid is practically insoluble in water, this salt has largely superseded it, for, as a rule, an alkali is generally employed to render the acid soluble, thus converting it into an alkaline salt of salicylic acid. Sodium salicylate is much less apt to prove irritant to the gastric membranes than the acid, which, in itself, is a sufficient recommendation for its selection. The chief use for salicylate of sodium is in *acute articular* and *muscular rheumatism*. It does not, however, cure all cases, but is adapted to those in which the tongue is full, purplish, or leaden in color, and when the rheumatic parts are reddened, with a slight purplish discoloration, when pressed upon (Scudder). It is said to render relapses more frequent, and not to lessen mortality from rheumatic complaints. It is valuable in some disorders dependent upon a *rheumatic diathesis*, as *rheumatic pharyngitis*, *rheumatic iritis* and *ophthalmia*, and *detachment of the retina of rheumatic origin*. The pains of *dysmenorrhœa*, *pleurisy*, *sciatica*, and *biliary colic* are often relieved by it, and, for its antiseptic properties, it has been used in some of the *summer diarrhœal disorders*. Locally, it is useful in *catarrhal disorders*. Prof. Ellingwood (*Mat. Med. and Therap.*, p. 559) praises it in *acute coryza*, with supraorbital and frontal fullness, sneezing, watery secretions, chilliness, malaise, and general depression; also in *supraorbital pain* of catarrhal, neuralgic, or rheumatic origin; in *whooping-cough* (2 or 3 grains, 2 or 3 times a day), and in *nervous cutaneous pruritus* (15 grains, 3 times a day). About 5 to 20 grains are the ordinary doses for sodium salicylate, repeating, in severe rheumatic disorders, every 4 hours. The heart should be carefully watched (compare *Acidum Salicylicum*).

Specific Indications and Uses.—Antirheumatic, when the tongue is full, purplish, or leaden-hued, showing spots when the fur is lifted, fever is not especially high, and the affected parts are red, with some purplish discoloration, particularly when pressed upon.

Related Salts.—POTASSIUM SALICYLATE ($2KC_7H_5O_3.H_2O$). Take salicylic acid, 100 parts, and potassium bicarbonate, 72 parts, proceeding as in the preparation of sodium salicylate. Forms readily soluble, silky needles, which are stable in a dry atmosphere.

SODIO-THEOBROMINE SALICYLATE ($C_7H_7NaN_4O_2.NaC_7H_5O_3$).—This is the recently introduced *Diuretin*, a body produced by mixing equal molecular weights of sodium salicylate and sodium theobromine, both in aqueous solution, and evaporating to dryness. Theoretically, it should contain of theobromine, 49.7 per cent, and of salicylic acid, 38.1 per cent. It is a white, odorless powder, possessing a saline, bitterish, alkaline taste. It is soluble in warm alcohol, and in half its weight of warm water; upon cooling, the solution remains clear. Ether and chloroform do not dissolve it. Acids, and even the carbon dioxide of the air, readily decompose it, freeing the theobromine in insoluble form; hence, it should be well secured from air, and should not be dispensed in powders (compare *Pharm. Centralhalle*, 1890, p. 311; and *Amer. Jour. Pharm.*, 1890, p. 617). According to Dr. W. Cohnstein (*Berlin. Klin. Woch.*, Jan., 1893), diuretin acts by directly irritating the renal-secreting elements. Diuretin has little or no physiological action upon the heart and nervous system, except in large doses. It occasionally disorders the stomach and bowels, producing vomiting and diarrhœa, headache, fever, ecchymoses, etc. Therefore, it should be used with caution. Great prostration has been observed from 5 to 7 grammes, hence, not more than from 3 to 4 grammes should be given in a day (Askanazy). Diuretin is used chiefly as a remedy for *dropsy*. By its stimulating power upon the renal epithelium, a pronounced and persistent diuresis is the result, but the kidneys must be in a good condition to act. It is of little value in ascites of hepatic origin, but in *renal dropsy* and *cardiac dropsy*, with valvular lesions, it is an efficient agent. Its diuretic action is less when chronic nephritis is present than when dropsy depends upon diseases of the heart and blood vessels. It has proved itself a fairly constant and good remedy in *angina pectoris*, *cardiac asthma*, and *chronic cardiac dyspnœa*, when due to *aortic diseases* or *chronic nephritis* (Askanazy). According to Keyes (*Therap. Gazette*, 1893), it does not uniformly avert *urethral* or *urinary fever*, a condition for which he first thought it efficient. Dose, 10 to 20 grains, every 4 hours, in water or mint-water, or in powder with sugar, and sometimes with 1½ grains of digitalis leaves, as indicated.

SODIUM SULPHOSALICYLATE ($C_6H_3[OH]CO_2HSO_3Na$).—Sulphosalicylic acid ($C_6H_3.SO_3H.OH.CO_2H$) is first prepared by the action of sulphuric acid upon pure salicylic acid; then the sulphosalicylic acid is neutralized with sodium carbonate. Colorless crystals of the above salt are formed. Soluble in about 30 parts of water, the solution being acid in reaction. Employed as a remedy for *articular rheumatism* in place of sodium salicylate.

SODIUM DIIODOSALICYLATE ($2C_6H_2.OH.I_2.COONa$ $5H_2O$).—Iodine and iodic acid are allowed to act upon salicylic acid in alcoholic solution, whereby diiodosalicylic acid is produced. By neutralizing this acid with sodium carbonate, long, flat, acicular crystals, or laminæ, of a white salt of the above composition are formed. It is soluble in about 50 parts of slightly warmed water. It is employed in broken doses (from 20 to 40 grains daily) as an analgesic, antiseptic, and antipyretic. It is said to control the heart's action, producing sedation, and is employed in *skin diseases of a parasitic type*.

Sodium Dithiosalicylate.—If molecular amounts of salicylic acid and sulphur chloride be mixed and heated, for a time, to a temperature between 120° and 150° C. (248° and 302° F.), hydrogen chloride is evolved, and yellowish, resin-like *dithiosalicylic acid* (see below) is formed, which is, in reality, a mixture of isomeric acids. This mixture is dissolved in solution of sodium carbonate, and sodium chloride is now added, which has the effect of precipitating *salt No. 1*, while *salt No. 2* remains in solution. Salt No. 1 is non-crystalline, yellowish, hygroscopic, alkaline, and soluble in water with a brown color. It is employed chiefly in veterinary medicine, a 5 per cent solution being used. Salt No. 2, the one preferred in medical practice, is a non-crystalline, gray-white, extremely hygroscopic powder, very soluble in water and forming an alkaline, brown-black solution. Alcohol dissolves this salt but not salt No. 1. Sulphur bromide or iodide may be substituted for sulphur chloride in the preparation of these compounds. This agent is claimed to be a better antiseptic than sodium salicylate, and has been employed in *rheumatic fever*, *gonorrhœal rheumatism*, and in *acute articular rheumatism*. It is said not to produce unpleasant tinnitus and other head symptoms. Dose, 3 grains, night and morning. Larger doses (30 to 80 grains) have been given, however, but caution should be excercised in the use of such larger doses.

Sodium Formate ($NaCHO_2.H_2O$).—Sodium salicylate occasionally induces renal congestion, and sodium formate has been proposed as a substitute under such circumstances. It has not, however, been used to any extent. It is a colorless, crystalline compound, odorless, saline, and bitter, very deliquescent in moist air, and freely soluble in water. It melts in its water of crystallization. It is produced by neutralizing pure sodium carbonate (or bicarbonate) with formic acid.

Dithiosalicylic Acid ($[C_6H_3[OH]COOH.S]_2$).—A light-yellow powder, dissolving easily in alcohol, glacial acetic acid, and benzene. It is produced, as stated above, by heating equal molecular quantities of salicylic acid and sulphur chloride to a temperature between 120° and 150° C. (248° and 302° F.), dissolving the fused mass in caustic soda solution, and precipitating with hydrochloric acid. It was introduced as a substitute for salicylic acid, and its sodium salt is even preferred by some to the acid or to sodium salicylate, the advantage claimed being the greater energy of the compound, and the comparative freedom from gastric disturbances. Tinnitus aurium, nausea, and diaphoresis result from 10-grain doses. The usual dose for *rheumatism*, and as an antiseptic, is 3 grains, repeated as the exigencies of the case may require.

Antispasmin.—A white, somewhat hygroscopic powder, said to be composed of 1 molecule of narceine-sodium and 3 molecules of sodium salicylate combined. Of narceine about 50 per cent is present. With water it forms a quite permanent solution. According to Demme, in doses of ½ to 1 grain, it is analgesic and hypnotic, and is recommended for *cramps with pain*.

SODII SANTONINAS.—SODIUM SANTONINATE.

Formula: $2NaC_{15}H_{19}O_4.7H_2O$. Molecular Weight: 696.50.

Preparation.—Add to solution of soda (3½ ounces), water (1 ounce). Heat the solution on a water-bath. Then add santonin (1 ounce); digest until dissolved; filter; wash the strainer with a small amount of boiling water; set aside and allow to crystallize by cooling. By evaporating the decanted mother liquor to a smaller bulk more of the salt is yielded. Continue evaporation as long as colorless crystals are produced. Should colored crystals form, acidulate the liquor with hydrochloric acid and recover the santonin which is thus freed. About 1¼ ounces of the sodium salt are obtained by this method. Another process consists in converting santonin into calcium santonate, and decomposing this by sodium carbonate (*Amer. Jour. Pharm.*, 1877, p. 174).

Description.—If this salt be crystallized from alcohol it forms small prisms, or a fine mass of needles. When crystallized from water it corresponds to the description given below. On account of its changing to a yellow color under the action of light, it should be kept in well-stoppered, dark, amber-colored bottles, in a dark place. The *U. S. P.* (1880) describes this salt as "colorless, transparent, tabular, rhombic crystals, slowly colored yellow by exposure to light, slightly efflorescent in dry air, odorless, having a mildly saline and somewhat bitter taste, and a slightly alkaline reaction. Soluble in 3 parts of water and in 12 parts of alcohol at 15° C. (59° F.); in 0.5 part of boiling water, and in 3.4 parts of boiling alcohol. When heated to 100° C. (212° F.), until it ceases to lose weight, the salt loses 18 per cent of its weight (water of crystallization). At a higher heat it chars and finally leaves an alkaline residue, which imparts an intense yellow color to a non-luminous flame. The aqueous solution, on the addition of hydrochloric acid, deposits a crystalline precipitate, which is soluble in chloroform, and

113

which yields, with alcoholic solution of potassa, a scarlet-red liquid, gradually becoming colorless"—(*U. S. P.*, 1880).

Tests.—"A 5 per cent aqueous solution of the salt should not be precipitated nor be rendered turbid by test solution of carbonate of sodium (absence of alkaline earths), nor by picric or tannic acids (absence of alkaloids)"—(*U. S. P.*, 1880). Ferric chloride should not produce a violet coloration with its aqueous solution (absence of salicylates). (Also compare *Santonin.*)

Action, Medical Uses, and Dosage.—This agent is more soluble than santonin, which property also renders it more liable to absorption and consequent poisonous effects, and thereby leaving less of the santonin to produce the effect intended—that of expelling *lumbricoid worms.* This it does, less efficiently, however, than santonin. The dose for a child is from 1 to 5 grains with sugar, twice a day; for adults, 5 to 10 grains. A purgative should follow on the next day. An aqueous enema of this salt has been employed to remove "*thread worms.*"

Related Compound.—SODII SANTONINAS ALBUMINATUS. Take santonin (1 part), sodium bicarbonate (4 parts), and dry, perfectly soluble albumen (2 parts), and digest the mixture with water (50 parts) at about 60° C. (140° F.), until dissolved. Filter, evaporate by gently heating, and dry the product on glass (Pavesi, 1876). This compound forms pearly-lustrous, brilliant white scales, having both an alkaline and bitter taste. Water dissolves it; the solution when treated with hydrochloric acid precipitates albumen and santonin, while carbon dioxide escapes with effervescence. This salt is an anthelmintic, especially used locally for *rectal worms* (*ascarides*) and internally for *lumbricoids.* Mixed with sugar, from 2 to 5 grains may be given twice a day to children; from 5 to 10 grains to adults. Follow on second day with a laxative.

SODII SULPHAS (U. S. P.)—SODIUM SULPHATE.

FORMULA: $Na_2SO_4+10H_2O$. MOLECULAR WEIGHT: 321.42.

SYNONYMS: *Glauber's salt, Sodæ sulphas, Sulfas sodicus, Sulfas natricus, Sulphate of soda, Sal mirabile Glauberi, Vitriolated soda.*

"Sodium sulphate should be kept in well-closed vessels"—(*U. S. P.*).

History and Preparation.—Sulphate of sodium is also known as *Vitriolated soda* and *Glauber's salt*, so named from Glauber who first described it in 1658. It occurs more or less abundantly in the mineral springs of Carlsbad, Cheltenham, Sulphur Springs of Virginia, in the Geyser springs, and the Andes. Extensive deposits are found near Tiflis in the Caucasus, and in the small lakes of New Mexico and other parts of the United States. Sodium sulphate is also found in the ashes of some marine plants and in the blood, urine, and other animal fluids. Sodium sulphate is obtained in large quantities as a by-product in the making of sodium carbonate by the Léblanc process (see *Sodii Carbonas*). It is also formed in many other processes involving double decomposition, *e. g.*, in the preparation of ammonium chloride by the sublimation of a mixture of ammonium sulphate and sodium chloride; in the preparation of nitric acid, or of magnesium carbonate, etc., and on a large scale by exposing a mixture of concentrated solution of sodium chloride and magnesium sulphate as occurring, for example, in the mother liquors obtained in the preparation of sea salt (see *Sodii Chloridum*), at a low temperature, the following reaction taking place: $2NaCl+MgSO_4=MgCl_2+Na_2SO_4$. The salt prepared from the Friedrichshall Mineral Spring, as early as 1767, and known as *Sal Aperitivum Friedericianum*, was sodium sulphate.

Description.—Sulphate of sodium crystallizes in large, monoclinic prisms; when rapidly crystallized, the crystals are small and acicular, still containing the same quantity of water of crystallization. The salt resembles in appearance the sulphates of magnesium and zinc. The *U. S. P.* describes it as occuring in "large, colorless, transparent, monoclinic prisms, or granular crystals, odorless, and having a bitter, saline taste. The salt effloresces rapidly in the air, and finally loses all its water of crystallization"—(*U. S. P.*). According to the formula $Na_2SO_4+10H_2O$, it loses about 56 per cent of its weight upon efflorescence. A salt of the formula $Na_2SO_4+7H_2O$, crystallizing in the rhombic system, has also been obtained. Above 34° C. (93.2° F.), only the anhydrous salt (Na_2SO_4) can exist. Glauber's salt is "soluble at 15° C. (59° F.), in 2.8 parts of water. The solubility increases up to 34° C. (93.2° F.), when its maximum is attained, 1 part of the salt then dissolving in somewhat less than 0.25 part of water; from thence it gradually decreases with rising temperature, until 1 part requires 0.47 part of boiling water for solution. Insoluble in alcohol; soluble in glycerin. When heated to 33° C. (91.4° F.), the salt fuses, and, on being heated to 100° C. (212° F.), loses all its water (55.9 per cent). At a red heat the anhydrous salt fuses without decomposition. To a non-luminous flame it imparts an intense, yellow color. The aqueous solution is neutral to litmus paper"—(*U. S. P.*). Sulphate of sodium is incompatible with the hydroxides of barium, calcium, and potassium, and soluble salts containing these bases, and with mercurous salts and the salts of silver and lead, sulphates of these metals being precipitated.

Tests.—"A 5 per cent aqueous solution of the salt yields, with barium chloride T.S., a white precipitate insoluble in nitric acid. If to 5 Cc. of the aqueous solution (1 in 20) 1 Cc. of sodium phosphate T.S. and 0.5 Cc. of ammonia water be added, no turbidity or precipitate should be produced, even after agitation (absence of magnesium, etc.). The solution should not effervesce on the addition of an acid (absence of carbonate). It should not be colored or rendered turbid by the addition of ammonium sulphide T.S.; or of an equal volume of hydrogen sulphide T.S., after being acidulated with hydrochloric acid (absence of arsenic and metallic impurities). After acidulation with nitric acid, the aqueous solution should remain clear, or at most be rendered only very slightly opalescent, on the addition of silver nitrate T.S. (limit of chloride)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Sulphate of sodium is a mild but efficient cooling laxative or purgative, promoting secretion and exhalation from the gastro-intestinal membrane, without causing inflammation or fever. It appears to impede the coagulation of blood, and also causes endosmosis of the serum. On account of its disagreeable taste, it has been gradually displaced by the sulphate of magnesium. Its usual dose is 6 or 8 drachms dissolved in 8 or 10 fluid ounces of water; when its water of crystallization is removed by drying or efflorescence the dose must be decreased to 3 or 4 drachms. As a diuretic, the dose must be smaller, and diluted with considerable water. A few drops of aromatic sulphuric acid may be advantageously added to lessen its bitter taste; or some citric acid, lemonade, or sweetened carbonated water. As a purgative it has been successfully used to relieve *plethoric conditions*, and it has given good results in *gastric ulcers*, *dropsy*, and *dysentery*. In the latter condition it was formerly much used in Eclectic practice in the form of the *white liquid physic*, which contains it. According to M. de Luca, crystallized sulphate of sodium has the property of holding the fibrin of the blood in solution, and acts favorably in causing *opacities* and *spots on the cornea* to wholly or partially disappear; he reduces this salt to a very fine powder, and by means of a camel's-hair pencil deposits it upon the eyeball, repeating the process twice a day; it causes no unpleasant sensation, and after several days of treatment the opacities commence to gradually disappear.

Sodium sulphate has a specific use outside of its cathartic application, and that is to stimulate retrograde metamorphosis and excretion. When the tissues are pale, full, and sodden, the tongue pallid and full and easily pitted by the teeth, the remedy will be specifically indicated. For this purpose an aqueous solution (grs. x to xx to Oj) may be freely taken. In this manner it forms a good remedy for *biliary calculi*. A 3 x trituration is said by Prof. Webster to control green *diarrhœa* accompanying childhood affections, as *teething*, *cholera infantum*, *entero-colitis*, etc. He also values it in *typhlitis*, and in *irritable conditions of the liver* bordering upon inflammation, the organ being swollen and sensitive to pressure. Under the Schüessler doctrine sodium sulphate is a good remedy (3 x trituration) in *cough* with thick, ropy, greenish expectoration, such as may be present in *bronchitis* and *humid asthma*. This class of practitioners also value it in faulty elimination of the fluids of the body, and especially where this gives rise to *bilious headache*, *thin bilious diarrhœa*, *bilious vomiting*, *diabetes*, *gout*, *moist skin eruptions*, *puffy erysipelas*, and *non-inflammatory œdema*. Solution of sodium sulphate is a good antidote to *acute poisoning with carbolic acid* and with *lead*. In *chronic lead poisoning* it will be borne longer by the stomach than iodide of potassium. Dose for purgation, 4 to 8 drachms, largely diluted; for specific purposes, the fraction of a grain to 2 grains.

Specific Indications and Uses.—Tissues pale, full and sodden; tongue full, pallid, and easily pitted by the teeth; watery or greenish diarrhœa; hepatic fullness and tenderness; biliousness. Large doses in dysentery, lead poisoning and poisoning by carbolic acid.

Other Forms of Sodium Sulphate.—SODII SULPHAS EXSICCATUS, *Dried sodium sulphate.* Four parts of the dried form of sodium sulphate are equivalent to 8 of the crystallized salt. According to the *German Pharmacopœia*, it is prepared by allowing the crystallized sulphate to effloresce at a temperature not exceeding 25° C. (77° F.). It is then dried at a temperature between 40° and 50° C. (104° and 122° F.) until it has lost one-half its weight. Hence it retains some of its water of crystallization (see *Sodii Sulphas*). The white powder is then passed through a sieve and placed in well-stoppered vials.

SODII SULPHAS EFFERVESCENS (*Br. Pharm.*), *Effervescent sulphate of sodium.*—Take of sulphate of sodium, in crystals, 50 ounces (Imp.); bicarbonate of sodium, in powder, 50 ounces (Imp.); tartaric acid, in powder, 27 ounces (Imp.); citric acid, in powder, 18 ounces (Imp.)." Dry the sodium sulphate until it has lost 56 per cent of its weight; powder the product and mix it with the other ingredients. Place the whole in a dish or pan of suitable form heated to between 93.3° and 104.4° C. (200° and 220° F.). When the mixture, by aid of careful manipulation of the powder, begins to aggregate, stir it assiduously until it has assumed a granular character; then separate it into granules of uniform size by means of suitable sieves. Dry the granules at a temperature not exceeding 54.4° C. (130° F.). The product should weigh about 100 ounces (*Br. Pharm.*, 1898). This is a laxative to be taken in cold water while it is still effervescing. The dose ranges from ¼ to ½ ounce.

Related Salts.—SODII SULPHOVINAS, *Sodium sulphovinate* ($NaC_2H_5SO_4.H_2O$), *Sodium ethylsulphate.* To prepare this compound, 1 part of sulphuric acid is gradually added to an equal amount of alcohol. The mixture develops heat, and sulphovinic acid ($C_2H_5HSO_4$) is formed. The sodium salt is obtained by removing the excess of sulphuric acid by means of sodium carbonate and the addition of sufficient alcohol to precipitate the sodium sulphate. The sodium sulphovinate is in alcoholic solution, and is obtained by evaporating the solution to dryness. Or, chalk is added to the crude sulphovinic acid, which precipitates the excess of sulphuric acid as calcium sulphate, while in solution is calcium sulphovinate, which is then decomposed with sodium carbonate (see Charles Rice, *Amer. Jour. Pharm.*, 1873, p. 60, and *ibid.*, 1877, p. 443). Sodium sulphovinate forms hexagonal transparent tables, or if obtained by evaporation, a granular powder. Both forms readily effloresce on exposure to a dry atmosphere and deliquesce in moist air. The crystals fuse at about 80° C. (176° F.), losing some of their water of crystallization. If crystallized from alcohol they contain alcohol in the place of water of crystallization. They decompose above 100° C. (212° F.), giving off inflammable alcoholic vapors; the residue consists of sodium bisulphate ($HNaSO_4$). To test-paper the salt is neutral. It is soluble in water, glycerin, and alcohol, and sparingly in absolute alcohol. Ether does not dissolve it. It has a feebly bitter, and subsequently sweetish taste. This salt is proposed as a tasteless laxative not likely to produce colic. It is, however, an unstable preparation. Dose, about ½ ounce.

SODIUM SULPHOMETHYLATE ($NaCH_3SO_4.H_2O$).—Prepared like the preceding salt, using methyl alcohol instead of ethyl alcohol (see M. Rabuteau, *Amer. Jour. Pharm.*, 1880, p. 220). Its properties are those of sulphovinate of sodium. It is unstable, not unpleasant in taste. Declared a cathartic without producing colicky pains or cramps. Dose, about ½ ounce.

SODII SULPHIS (U. S. P.)—SODIUM SULPHITE.

FORMULA: $Na_2SO_3+7H_2O$. MOLECULAR WEIGHT: 251.58.

SYNONYMS: *Natrum sulphurosum, Sulfis sodicus, Sulfis natricus.*

"Sodium sulphite should be kept in well-stoppered bottles, in a cool place"—(*U. S. P.*).

Preparation.—First produce *sodium bisulphite* (see *Sodii Bisulphis*) by saturating a solution of a definite quantity of sodium carbonate with sulphur dioxide, and then add an equal quantity of sodium carbonate. The following reaction takes place: $2NaHSO_3+Na_2CO_3=2Na_2SO_3+H_2O+CO_2$. Evaporate to crystallization, being careful to exclude the air. (On the preparation of several sulphites, see *Amer. Jour. Pharm.*, 1889, p. 584, and 1890, p. 150.)

Description.—The *U. S. P.* describes the salt as in "colorless, transparent, monoclinic prisms, odorless, and having a cooling, saline, sulphurous taste. In air the salt effloresces, and is slowly oxidized to sulphate. Soluble in 4 parts of water at 15° C. (59° F.), and in 0.9 part of boiling water; sparingly soluble in alcohol. When gently heated, the salt softens somewhat, but does not fuse. Above 100° C. (212° F.), the crystals lose all their water (50 per cent), without fusing or changing their shape. At a red heat, the salt fuses to a reddish-yellow mass of sodium sulphate and sodium sulphide. To a non-luminous flame, the salt imparts an intense, yellow color. The aqueous solution is neutral or feebly alkaline to litmus paper"—(*U. S. P.*). The form generally employed by Eclectic physicians is the finely-powdered anhydrous salt (Na_2SO_3). It is less liable to changes than the hydrated compound ($Na_2SO_3+7H_2O$).

Tests.—"Upon the addition of hydrochloric acid to the salt or its solution, sulphur dioxide gas is liberated, which is recognized by its odor, and by its blackening a strip of paper moistened with mercurous nitrate T.S. and held in the escaping gas; the solution remains clear, no sulphur being separated (distinction from *hyposulphite*). The aqueous solution (1 in 20) should not be colored or rendered turbid by the addition of an equal volume of hydrogen sulphide T.S., either before or after the addition of ammonia water in slight excess (absence of metallic impurities). If a solution of 2.5 Gm. of the salt in 11 Cc. of diluted hydrochloric acid be heated sufficiently to expel the sulphur dioxide, then 0.15 Cc. of barium chloride T.S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unaffected by the further addition of barium chloride T.S. (limit of sulphate). If 1.2 Gm. of sodium sulphite be dissolved in 10 Cc. of diluted nitric acid, the solution heated to expel the gases, then 0.4 Cc. of decinormal silver nitrate V.S. added, and the precipitate, if any, removed by filtration, the clear filtrate should remain unchanged by the further addition of silver nitrate V.S. (limit of chloride). If 0.63 Gm. of the salt be dissolved in 25 Cc. of water recently boiled to expel air, and a little starch T.S. be added, at least 48 Cc. of decinormal iodine V.S. should be required to produce a permanent blue tint (each cubic centimeter corresponding to 2 per cent of the pure salt)"—(*U. S. P.*). The latter determination is based upon the oxidation of the sulphite to sulphate, as follows: $Na_2SO_3+H_2O+I_2=2IH+Na_2SO_4$. Analysis of four commercial specimens, according to Wm. A. Puckner (*Western Druggist*, 1897, p. 254), showed only 54, 66.5, 74, and 92.5 per cent of the pure salt, instead of 96 per cent. Large amounts of sulphate were present.

Action, Medical Uses, and Dosage.—Sulphite of sodium, as well as the bisulphite, were introduced to the profession, along with other sulphites, by M. Polli, as azymotics, as described under *Magnesii Sulphis* (which see). These several sulphites are employed in the same diseases, and for the same purposes, both internally and externally, and their efficacy in the diseases in which they have been recommended is now generally acknowledged by the medical profession. Whether used internally or externally, it evolves sulphurous acid, upon which the remedial virtues of all the sulphites appear chiefly to depend. Besides this, the alkaline element is present, thus overcoming conditions of excessive acidity. It agrees well with the stomach, has no local irritating properties, and acts as a diuretic. Dr. Astrié highly recommends the sulphite of sodium as a remedy to the *effects of mercury* upon the system; the thick precipitate formed by the union of white of egg and a solution of corrosive sublimate, is at once restored to a transparent fluid by a few drops of a solution of the sulphite of sodium.

The special use of sulphite of sodium in the Eclectic school, is in that very common condition met with in many diseases—the broad, pallid tongue, with white or dirty-white coating, and extremely fetid breath, although the latter is not always present. With these conditions present, the name of the disease is immaterial, and the prompt response to the action of the remedy will do more to convert one to a belief in the specific action of medicines than all of the arguments which may be presented. There are special disorders in which it is especially recommended, following the indications as laid down above, and these are *fermentative and putrefactive conditions*, *typhoid and other fevers*, *erysipelas*, *smallpox*, *tonsillitis* and other forms of *sore throat*, *herpes*, *scabies*, *ringworm*, etc. The dose of the sulphite of sodium is from 10 to 60 grains, 3 times a day.

Specific Indications and Uses.—Pallid, broad tongue, with white or dirty-white, pasty exudate, and pallid mucous membranes; fetor; fermentative and putrefactive processes; parasitic skin affections.

SODII SULPHOCARBOLAS (U. S. P.)—SODIUM SULPHOCARBOLATE.

FORMULA: $NaSO_3C_6H_4(OH)+2H_2O$. MOLECULAR WEIGHT: 231.56.

SYNONYMS: *Sodium paraphenolsulphonate*, *Sulphocarbolate of sodium*.

Preparation.—Dissolve 2 parts of sulphocarbolate of calcium (see *Related Compounds*) in 4 parts of distilled water, and stir into it solution of sulphate of sodium until in slight excess; rather more than 1½ parts of crystallized sulphate of sodium will be required. Permit the mixture to stand a few hours, then filter, and wash the precipitate with distilled water until the runnings are nearly tasteless. Evaporate the filtrate to dryness, on a steam or water-bath, and dissolve the residue in boiling alcohol (about 10 parts), then filter, and place it in a cold situation to crystallize. In case a trace of sulphate of sodium is not objectionable, the crystallization from alcohol may be dispensed with. The aqueous solution should then be evaporated until a skin forms upon the surface, and then be allowed to crystallize.

Description and Tests.—As thus prepared, sulphocarbolate of sodium is in the form of small, needle-like crystals, white, very soluble in water, less so in alcohol, and insoluble in ether. The *U. S. P.* describes the salt as occurring in "colorless, transparent, rhombic prisms, odorless, and having a cooling, saline, slightly bitter taste. Somewhat efflorescent in dry air. Soluble, at 15° C. (59° F.), in 4.8 parts of water, and in 132 parts of alcohol; in 0.7 part of boiling water, and in 10 parts of boiling alcohol. When heated a little above 100° C. (212° F.), the salt loses all its water (15.5 per cent) and becomes white. At a higher temperature it chars, emits inflammable vapors having the odor of phenol, and finally leaves a residue of sodium sulphate amounting to 30.6 per cent of the original weight. To a non-luminous flame, it imparts an intense, yellow color. The aqueous solution is neutral to litmus paper"—(*U. S. P.*). It does not precipitate with barium chloride. If a small crystal be boiled with nitric acid, and the liquid be then neutralized with solution of caustic potash, a yellow color will result (carbazotate or picrate of potassium). This test is not distinctive, as it applies to carbolic acid and carbolates as well as sulphocarbolates. "A dilute solution (1 in 100) of the salt is rendered pale-violet by ferric chloride T.S., but remains clear; barium chloride T.S. leaves the solution clear, but if a portion of the salt be ignited, and the residue dissolved in water, the same reagent will produce in the solution a copious, white precipitate. In the aqueous solution (1 in 20) neither hydrogen sulphide T.S. nor ammonium sulphide T.S. should produce any turbidity or coloration (absence of metallic impurities); nor should more than a faint opalescence be produced by barium chloride T.S. (limit of sulphate), or by silver nitrate T.S. (limit of chloride)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Sulphocarbolate of sodium is simply a disinfectant. At one time it was highly extolled as an efficient internal remedy in *scarlatina*, *diphtheria*, *typhoid fever*, in *septicæmic diseases* generally, and even in *phthisis pulmonalis*, but well-conducted trials of it in these affections have not sustained such marvellous assertions. It undoubtedly exerts a good influence in the fermentative forms of *dyspepsia* and *diarrhœa*, and destroys *thrush*. The *vomiting of pregnancy* is sometimes relieved by it. It has been found more useful as a local application, employed in aqueous solution in the form of spray; used in this manner, it has been sometimes beneficial in *gangrenous conditions*, and in the removal of the *pseudo-membranous exudations* encountered in *aphthæ*, *scarlatina*, and *diphtheria;* and, in these cases, it owes its properties to the phenic acid present. Its dose, internally, is from 5 to 25 grains, in solution.

Related Compounds.—SULPHOCARBOLATES, *Sulphophenates*. Sulphocarbolates are salts prepared respectively from *ortho* and *para* phenol-sulphonic acids ($C_6H_4.SO_3H.OH$). When concentrated sulphuric acid and carbolic acid are mixed together in equal proportions, and the mixture digested at from 40° to 50° C. (104° to 122° F.), the *ortho* acid is mainly formed. When the temperature is increased to 149° C. (300° F.), this acid changes to the *para* phenol-sulphonic acid. Neither acid is known in an absolute state. In commerce, distinctions are not made in the salts derived from the two, and, perhaps, their therapeutical actions are identical. The *para* sulphocarbolates are very easily prepared, and consequently are found almost exclusively in the markets. The salts of both acids are all soluble in water, generally soluble in hot alcohol and glycerin, but insoluble in ether. Most of the ortho salts are more soluble than the corresponding para salts. Commercial sulphocarbolates are made very easily by mixing equal parts of sulphuric and carbolic acids, and heating the mixture to 149° C. (300° F.). The mixture, upon cooling, is diluted with water, neutralized with the necessary quantity of carbonate, and evaporated to crystallization. Adhering sulphates are removed by dissolving the salt in warm water, and recrystallizing. This forms the *para* sulphocarbolates, which are usually obtained in nice large crystals. (See an extensive study of the sulphocarbolates, by F. B. Power and E. J. Ræuber, in *Pharm. Rundschau*, 1889, pp. 103–110.

CALCII SULPHOCARBOLAS, *Sulphocarbolate of calcium*. Formula: $Ca2C_6H_5SO_4$. Molecular Weight: 385.18.—Melt 16 troy ounces of carbolic acid, in a porcelain dish, and, with constant stirring, pour into it 16 troy ounces of concentrated sulphuric acid, and then apply the heat of an expanded steam or water-bath for 24 hours. Dilute the mixture with 8 pints of cold distilled water, and gradually stir into it powdered carbonate of calcium, until effervescence ceases; then permit the mixture to stand for a few hours, filter, wash the precipitate with water, and evaporate the mixed filtrates to dryness over a water-bath. The product (about 20 troy ounces) will be impure sulphocarbolate of calcium, usually of a pink color. To purify it, redissolve it in water, filter, and again evaporate to dryness. When the sulphuric and carbolic acids are mixed, the result is a deep pink-colored liquid, or often brownish-red, from impurities in the latter acid. This coloring matter adheres most persistently to the salt. The yield is never so large as theory would indicate. To purify the salt, uncombined sulphuric acid is thrown out as sulphate of calcium, upon addition of the carbonate of calcium, and the subsequent heat evaporates the free carbolic acid. Sulphocarbolate of calcium may be used to prepare the other sulphocarbolates. The more expensive barium carbonate may be substituted for calcium carbonate in the foregoing operation, and sulphocarbolate of barium be formed in like manner as the sulphocarbolate of calcium. Neither sulphocarbolate of calcium nor sulphocarbolate of barium are used as medicines.

Sodii Carbolas, *Sodium carbolate, Sodium phenate* (NaC_6H_5O).—The alkaline carbolates have been highly extolled for uses similar to the acid. The carbolate of sodium (*Phénol Sodique*), is the one more commonly used. It is an easily decomposed preparation, soluble in water and carbolic acid, and may be made by neutralizing pure crystallized carbolic acid in solution with caustic soda; press the resulting crystals between bibulous paper, and then dry them under a bell-glass over a dish of sulphuric acid. As a local application, this will be found very useful in *burns, scalds, stings of bees, wasps, bites of spiders*, etc.; in *chilblain, erysipelas*, many *cutaneous affections, hemorrhoids*, and *soft, spongy, swollen*, or *ulcerated gums;* when applied by means of compresses, it arrests *hemorrhage from leech bites, cuts, spongy gums*, etc.; when sprinkled around places infested by insects, parasites, or animalculæ, it destroys them, or drives them away. The fumes of this preparation are said to relieve *whooping-cough*, and it has been used internally in *scarlet fever*. Dose, 5 to 30 grains. It is a good deodorizer and checks putrefaction (see also *Liquor Sodii Carbolatis*).

Magnesii Sulphocarbolas, *Magnesium sulphocarbolate* ($Mg[SO_3C_6H_4.OH]_2.7H_2O$).—Forms in rhombic prisms or acicular crystals.

Potassii Sulphocarbolas, *Potassium sulphocarbolate* ($KSO_3C_6H_4[OH]$), also forms shining acicular crystals.

SODII VALERIANAS.—SODIUM VALERIANATE.

Formula: $NaC_5H_9O_2$. Molecular Weight: 123.77.

Synonyms: *Sodæ valerianas, Natrium valerianicum, Valerianus natricus, Valerianas sodicus.*

Preparation.—This salt is prepared by very careful oxidation of *amylic alcohol* or *fusel oil* ($C_5H_{11}OH$), with diluted sulphuric acid and potassium bichromate in a distilling apparatus, neutralizing the distilled valerianic acid ($C_5H_{10}O_2$) accurately with sodium hydroxide, and evaporating to dryness. (For details regarding this process, see *Br. Pharm.*, 1885, and this *Dispensatory*, preceding edition.)

Description and Tests.—Valerianate of sodium crystallizes with difficulty, but may be obtained in the form of a cauliflower-like mass. It fuses at 140° C. (284° F.), and on cooling forms a white solid mass, which has a greasy or soapy feel. Its odor is like valerianic acid; its taste sweet but nauseous. It is very deliquescent, soluble in alcohol or water, and should not be alkaline in reaction. When treated with sulphuric acid a powerful odor of valerian is evolved. Neither hydrogen sulphide nor ammonium sulphide should produce colorations with its aqueous solution (absence of metals), nor should a precipitate be occasioned in acid solution by barium chloride (absence of sulphates).

Action, Medical Uses, and Dosage.—Valerianate of sodium is not used to any extent as a medicine, but for the preparation of the valerianates of iron, quinine, etc., by double decomposition of the sodium salt with salts of the respective bases. It might be used with advantage in *nervous* and *irritable habits*, attended with *acidity of the stomach*, but probably has no advantages over the corresponding ammonium compound. Dose, 1 to 5 grains.

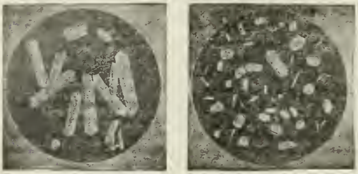
SOLANUM CAROLINENSE.—HORSE-NETTLE.

The root and fruit of *Solanum Carolinense*, Linné.

Nat. Ord.—Solanaceæ.

Common Names: *Horse-nettle, Bull-nettle, Sand-brier, Treadsoft, Treadsaf.*

Fig. 231.



Solnine, from Solanum Carolinense.

Botanical Source.—Horse-nettle is an herbaceous perennial plant, from 8 to 18 inches high. The stem is simple and erect, though sometimes prostrate and branching from the root. The more or less contorted root is from $\frac{1}{8}$ to $\frac{1}{4}$ inch in diameter, having a thick bark surrounding a slender woody center; it descends deeply and vertically into the soil. The leaves are alternate, oblong, ovate; obtusely lobed, wavy, with yellowish prickles on midrib and larger veins of both surfaces, and extending along the petiole and main stem, where they become quite stout. The surfaces of stems and leaves are stellate (4, 6, or 8-rayed) pubescent. The flowers are borne in simple cymes or racemes, becoming lateral in fruit. Flowers regular, calyx 5-parted, sepals pointed, corolla rotate, with 5 ovate lobes and pale-blue, violet, or more rarely white. Stamens 5, yellow, inserted on the corolla; anthers 4-celled, 4 times as long as the filaments, and opening by pores at the tip. They are counivent and form a cone around the pistil. The style and stigma are single. The fruit, when ripe, is an orange- or lemon-colored berry from $\frac{1}{2}$ to $\frac{3}{5}$ inch in diameter; 2-celled, the seeds being attached to the central placenta. The seeds are pale-yellow, smooth, shining, oval, and flattened. The dried fruit has a shrunken or reticulated appearance. (Also see microscopy and illustration of Solanum Carolinense, by C. J. Johnson, in *Amer. Jour. Pharm.*, 1897, pp. 76–84, and by M. C. Thrush, *ibid.*, pp. 84–89.)

History.—Horse-nettle is a common and abundant wild plant flourishing in waste places and around cultivated fields, frequently in patches in almost all parts of our country. It grows from Connecticut to Iowa, and southward to the Gulf of Mexico. It frequently grows so abundantly as to be a nuisance, preferring sandy or gravelly slopes, railroad grades, etc., with a south sunny exposure. The root and berries are employed medicinally. Specific solanum carolinense is prepared from the root. Attention was called to this plant by Porcher (*Report on Indigenous Medical Plants of South Carolina*) in the middle of the present century, who quotes from a French work (Mérat and De Lens *Dictionnaire Univ. de Matière Médicale*, Paris, Vol. VI, 1837) that M. Louis Valentin used the berries in idiopathic or non-traumatic tetanus (see also A. Clapp, M. D., *Report on Medical Botany*, 1850–51; and Robert Hogg, *Natural History of the Vegetable Kingdom*, 1858). Porcher also refers to an article (*Journal Gén. de Méd.*, Vol. XL, p. 13), which gives "*A notice of the different methods of treating Tetanus in America, with observations on the good effects of the S. Carolinense.*" According to Porcher, it possessed "some reputation among the negroes of this state (South Carolina) as an aphrodisiac." Its revival as a medicine was due to reports by Dr. J. L. Napier, of Blenheim, S. C. (*Medical World*, 1889; and *Amer. Therapist*, 1892).

Chemical Composition.—Complete chemical analyses of the root-bark, leaves and berries of Solanum Carolinense were made by G. A. Krauss (*Amer. Jour. Pharm.*, 1890, p. 601, and 1891, pp. 65 and 216); of the berries, also by Harry Kahn (*ibid.*, 1891, p. 126). From the root-bark Krauss obtained by consecutive extraction with petroleum-ether and ether, an alkaloid crystallizing in hard, shining prisms, soluble in ether, benzol, and chloroform, and being non-glucosidal. Alcohol then abstracted a glucosidal alkaloid which showed the reactions for *solanine*. The ether-soluble alkaloid, the author believes to be probably *solanidine* (compare *Dulcamara*). The leaves and the berries contained the same substances. Prof. J. U. Lloyd (*Amer. Jour. Pharm.*, 1894, p. 161) independently obtained from the root of this plant an ether-soluble, well-crystallizable alkaloid (see illustration, above), which he provisionally named *solnine*. It is practically insoluble in water and diluted ammonia water, soluble in diluted acids and in cold chloroform; from boiling alcohol it crystallizes in needles resembling hydrastine. Its melting point is 131° C. (267.8° F.), thus differing markedly from solanine, which melts at 235° C. 455° F.), also differing from solanidine, the melting point of which, according to Watt's *Dictionary*, is 191° C. (375.8° F.). The root-bark contains about 0.4 per cent, the berries about 1.3 per cent, of total alkaloids, the presence of which explains the toxic action of the drug. (For further constituents of volatile oil, starch, *solanic acid*, etc., see the papers quoted.)

Action, Medical Uses, and Dosage.—This agent is reputed antispasmodic, and has been recommended chiefly for convulsive disorders. It was early used by Valentin in *non-traumatic tetanus* (see *Medical History*). While success with has been recorded in *chorea*, *puerperal eclampsia*, *infantile*, and *hysterical convulsion* its chief use has been in *epilepsy*, and particularly that form in which the paroxysms are severest at or brought on at the menstrual periods. The drug needs further investigation. The dose of the fluid extract is from 10 to 60 drops; of specific solanum carolinense, 10 to 30 drops.

SOLIDAGO.—SWEET-SCENTED GOLDENROD.

The tops and leaves of *Solidago odora*, Aiton.

Nat. Ord.—Compositæ.

COMMON NAMES: *Sweet goldenrod*, *Sweet-scented goldenrod*, *Fragrant-leaved goldenrod*, *Blue mountain tea*.

Botanical Source.—This plant has a perennial, woody, much branched, and creeping root, and a slender, round, yellowish-green stem, smooth or slightly pubescent below, pubescent at top, often reclined, and 2 or 3 feet in height. The leaves are closely sessile, linear-lanceolate, broad at base, entire, acute, rough at the margin, but otherwise smooth, with a prominent midrib, and covered with small pellucid dots. The flowers are of a deep golden-yellow color, in a terminal compound, and usually secund-paniculate raceme, the branches of which are very slender, rigid, and spread almost horizontally, are each accompanied by a small leaf, and support the flowers on downy pedicels, which put forth from the upper side of the peduncle, and have small, linear, subulate bracts at their base. Scales of the involucre oblong, acute, smooth, or slightly pubescent, the lower ones are shorter, and closely imbricating the rest. Florets of the ray few, with oblong, obtuse, yellow ligules, those of the disk funnel-shaped, with acute segments. The pappus is shorter than the florets of the disk. The leaves of this plant are from 1½ to 3 inches long by from 3 to 5 lines broad, with a strong, yellowish midvein, but no veinlets (L.—G.—W.).

History, and Chemical Composition.—This plant is common to the United States, growing in dry, fertile woodlands and sunny hills, and flowering from July to October. There are many species of this genus growing throughout the country, and which differ from each other in their degree of astringency and fragrance. The leaves and tops are the parts used; they have an odor, when bruised, resembling anise and sassafras, and a slightly astringent, spicy, rather pleasant taste; they contain a volatile oil, which may be procured by distilling them with water; it is of a pale-yellowish color. The oil obtained from the flowers is said to differ from that yielded by the leaves. When properly dried, the leaves form an excellent substitute for tea, and are collected and used for this purpose, under the name of "Blue mountain tea," among the German population in central Pennsylvania. The leaves impart their virtues to alcohol or boiling water; but boiling injures their properties. From the whole plant of *Solidago rugosa*, Wm. P. Oberhauser (*Amer. Jour. Pharm.*, 1893, p. 122) obtained 0.996 per cent of volatile oil; the odor of the oil from the flowers and the leaves resembles that of origanum. The flowers of *S. bicolor*, also growing in Pennsylvania, contain volatile oil and 2.5 per cent of a bitter resin (Adam Conrath, *ibid.*, 1873, p. 253). The flowering and fresh herb of *S. canadensis* yields 0.63 per cent of volatile oil, chiefly consisting of *pinene*, with *borneol*, *bornyl-acetate*, and *cadinene* (Gildemeister and Hoffmann, *Die Ætherischen Oele*, 1899).

Action, Medical Uses, and Dosage.—Sweet-scented goldenrod is gently stimulant and carminative, and, in warm infusion, diaphoretic. It may be given in infusion in *flatulent colic*, *amenorrhœa*, *sickness at the stomach*, and as a pleasant drink in convalescence from severe *dysentery*, *diarrhœa*, *cholera morbus*, etc.; and may also be added to nauseating medicines to render them more agreeable to the taste. The oil is carminative and diuretic; and its tincture or essence has been used as a diuretic in *suppression of urine among infants*, and as a local application in some forms of *headache*. Its essence is useful to remove *flatulency*, check *vomiting*, relieve *cramp of the stomach*, and to mask the unpleasant flavor of nauseous medicines. The flowers are said to be aperient, tonic, astringent, and diuretic and have been found beneficial in *gravel*, *urinary obstructions*, *ulceration of the bladder* and in the early stage of *dropsy;* taken in infusion (herb ℥i to water Oj) in doses of 1 or 2 fluid ounces; the oil, from 1 to 3 drops.

Related Species.—*Solidago rigida*, Linné, *Hard-leaf goldenrod*. This plant is also termed *Rigid goldenrod*. It has a simple stem, corymbose above, terete, striate, rough, minutely hairy, very leafy, 3 to 5 feet in height. Leaves 1 to 4 inches long, ovate-oblong, rough. with minute rigid hairs; upper ones entire, veiny, thick, rigid; lower closely sessile by a broad base, slightly serrate; radical ones lanceolate, acuminate, nerved, petiolate, sometimes nearly 1 foot long, 2 or 2½ inches broad. Flowers yellow, in a terminal, compound, close, compact, paniculate raceme. Heads very large, about 34-flowered; rays twice the length of the obtuse involucre, deep-yellow, from 7 to 10, and about 3 lines by 1. Scales of the involucre round-obtuse, nerved, membranaceous at the edges (W.—G.). This is a tall species, growing in dry fields and rocky woods throughout the United States, and is abundant in the western prairies, flowering in August and September. It is the styptic plant of old Dr. Bone, of New Jersey, who is said to have suppressed *hemorrhages* from large blood-vessels by applying it locally, in the powdered state; a property likewise attributed to the variable *Solidago virga aurea*, Linné, or *European goldenrod*, found in this country and Europe. The leaves and blossoms of *S. rigida* are the parts employed. They have an astringent taste, and yield their virtues to water or alcohol. Hard-leaf goldenrod is tonic, astringent, and styptic. In powder or infusion, it is beneficial in all *external hemorrhages*, *epistaxis*, *hemoptysis*, *hematemesis*, and *hemorrhage from the bowels*. Applied with excellent effect, in form of poultice, to *old ulcers*. The oil is diuretic. This plant deserves further investigation.

Solidago virga aurea, Linné, *European goldenrod*, has been revived as a diuretic and remedy for *urinary disorders*.

Solidago gigantea, Aiton, *Smooth three-ribbed goldenrod*, will likewise be found to possess similar virtues.

Chrysopsis argentea, *Silver aster*, also named *C. graminifolia*, belonging to this family of plants, forms a very powerful styptic application to *wounds*, and said to be the sheet-anchor in field-surgery among the Cherokees. Internally, it is beneficial in *diarrhœa*, *dysentery*, *aphthous ulceration of the mouth*, etc.

SOPHORA.—SOPHORA.

The seeds of *Sophora speciosa*, Bentham.

Nat. Ord.—Leguminoseæ.

ILLUSTRATION: *Amer. Jour. Pharm.*, 1886, p. 466.

Botanical Source, History, and Chemical Composition.—An evergreen shrub, or tree, with odd-pinnate, smooth leaves, the leaflets of which are in pairs of 3 to 5. The leaflets are ovate in outline, about an inch long, either obtuse or pointed, pale-green below, and glossy and deep-green on the upper surface. The flowers are blue, sometimes tinted with white, have 10 stamens, small campanulate calices, are very fragrant, and borne in close racemes. The fruit is a nearly round, indehiscent pod, 2 or 3 inches long, tough, slightly constricted, at intervals separated by the seeds, and coated with a pubescence of a light brown-gray color. The subglobular seeds are of a red color, are depressed at the hilum, and less than ½ inch in length. *Sophora speciosa* grows in Texas, and yields a bean which, it is said, is sometimes employed as a medicine by the Indians of southwestern Texas, producing delirious exhilaration and subsequent sleep of 2 or 3 days. Not more than ½ bean is taken, it being asserted that an entire bean will kill a man. Dr. H. C. Wood (*Amer. Jour. Pharm.*, 1877, p. 617, and 1878, p. 283) prepared, from specimens of the bean, an alkaloid, soluble in ether and diluted acids, and named it *sophorine*. Prof. Plugge (*Archiv der Pharm.*, 1891, p. 563) believes it to be identical with the alkaloid *cytisine* (see *Laburnum*). (A complete quantitative analysis of the seeds, with description and illustration of the plant, is given by M. Kalteyer and W. E. Neil, in *Amer. Jour. Pharm.*, 1886, p. 465.)

Action, Medical Uses, and Dosage.—Of the alkaloid, *sophorine*, a mere speck paralyzed a frog, and $\frac{1}{20}$ grain caused a cat to sleep many hours. From an overdose, death followed in a few hours. Its action is similar to that of the calabar bean. It appears to be a spinal sedative, and occasions death through the respiration. This remedy deserves investigation. According to Dr. Scudder, "it may be employed as a stimulant to the cerebro-spinal centers, when there is a defect of reflex action, imperfect respiration, and *threatened paralysis*. It also relieves the excited innervation from atony, and thus gives rest and sleep" (*Spec. Med.*, p. 247). A tincture of the seeds, with 98 per cent alcohol, is suggested, 5 drops of which may be added to 4 fluid ounces of water, the dose of the dilution being a tablespoonful.

Related Species.—*Sophora japonica*, Linné. This is a fine tree, a native of China or Japan. The flowers, under the name *Wai-fa* or *Wai-hwa*, are used in those countries for dyeing silk a yellow color, and to produce a beautiful green, when mixed with a proper proportion of blue. All parts of the tree are purgative, and persons who prune it, as well as workmen who are engaged in turning the dry wood, are affected by it. Foerster 1882 obtained from it the yellow glucosid, *sophorine*, which splits into *sophoretin* and *isodulcite* when treated with diluted sulphuric acid also see R. Wachs, *Amer. Jour. Pharm.*, 1894, p. 35).

Sophora sericea, Nuttall.—Nebraska to California. The seeds and root of this small herb yielded F. A. Wentz *United States Agricultural Report*, 1879) an impure liquid alkaloid, thought to be identical with *sophorine*.

Sophora tomentosa yielded Greshoff (*Pharm. Jour. Trans.*, Vol. XII) a fluid alkaloid, which Prof. Plugge (1891; see *Sophora speciosa*) regarded identical with *cytisine*.

SORBUS.—MOUNTAIN ASH.

The fruit of *Pyrus aucuparia*, Gærtner (*Sorbus aucuparia*, Linné; *Mespilus aucuparia*, Scopoli).

Nat. Ord.—Rosaceæ.

Botanical Source.—This tree, which is of medium size, bears odd-pinnate leaves composed of obtuse leaflets, which are pubescent or downy upon their under surface. The fruit, or part employed, is bright-red, globular, berry-like, and of small size. The remains of the calyx-limb cap the fruit, which is acid to the taste, and contains 3 or 4 two-seeded cells.

History and Chemical Composition.—The tree yielding mountain ash berries is indigenous to Europe and the western portions of Asia. It is known as the *Rowan tree*, and is sometimes cultivated in America for its landscape effects. The ripe fruits contain much malic acid, with citric acid. The unripe fruits contain tartaric acid (Liebig). In addition, the following principles were found: (1) The sugar *sorbin* (*sorbinose*, $C_6H_{12}O_6$), discovered by Pelouze (1852) in fermented juice of the berries; it is isomeric with dextrose, as sweet as cane-sugar, non-fermentable, crystallizing in rhombic prisms, lævo-rotatory, and capable of reducing Fehling's solution; remains unaffected by boiling with diluted acids; (2) *sorbite* ($C_6H_{14}O_6$) isomeric with mannite and dulcite, insoluble in water, soluble in boiling alcohol, optically inactive, not reducing Fehling's solution; discovered by Boussingault (1872); (3) *sorbic acid* ($C_6H_8O_2$) is an unsaturated crystallizable acid, volatile with the vapors of water; discovered by A. W. Hofmann (1859) in the juice of the unripe berries. A peculiar tannin (*sorbitannic acid* of Vincent and Delachanal) is also present in the fruits. Wicke (1852) found bitter amygdalin in the bark and the buds.

Action, Medical Uses, and Dosage.—The ripe fruit of sorbus, when infused with water, furnishes an acidulous and astringent gargle for acute *diseases of the pharyngeal vault and tonsils*, with excessive secretion. The bark and the unripe fruit are employed in infusion, or decoction in *scurvy* and *diarrhœa*, and topically to *relaxations of the anal or vaginal walls and throat*, all with profuse secretion. The very astringent qualities of sorbus render it a good agent for poultices when one of such a character is desired.

Related Species.—*Pyrus Americana*, De Candolle (*Sorbus Americana*, Marshall), and the *Pyrus sambucifolia*, Chamisso et Schlechtendal (*Sorbus sambucifolia*, Rœmer), are two indigenous species resembling the European tree but bearing smaller fruits. Both are known as *American mountain ash*.

Cratægus.—The bark, fruit, and leaves of this genus of plants are sometimes employed as astringents and tonics. (See also *Cratægus Oxyacantha.*)

Pyrus coronaria, Linné, *Crab apple*, *Pyrus arbutifolia*, Linné filius, *Chokeberry*. Both of these species have the properties of sorbus.

SPARTEINÆ SULPHAS (U. S. P.)—SPARTEINE SULPHATE.

FORMULA: $C_{15}H_{26}N_2H_2SO_4+4H_2O$. MOLECULAR WEIGHT: 403.23.

"The neutral sulphate of an alkaloid obtained from scoparius"—(*U. S. P.*).

Preparation.—*Sparteine* ($C_{15}H_{26}N_2$), the volatile alkaloid contained in broom (see *Scoparius*), was discovered in 1853 by Stenhouse, and is prepared by extracting the plant with water acidulated with sulphuric acid, concentrating the fluid and distilling with caustic soda. The distillate is neutralized with hydrochloric acid, evaporated to dryness, and the residue distilled with solid caustic potash. Ammonia gas escapes first, then the base distills. Sparteine, when freshly prepared, is a colorless, thick oil of bitter taste; its odor resembles that of aniline. It is heavier than water and boils at 288° C. (550.4° F.). It is soluble in alcohol, chloroform, and ether, almost insoluble in water, and not at all soluble in benzol or benzin. Upon dry distillation it yields pyridine (C_5H_5N) and derivatives of the latter. It forms salts with acids. To prepare the sulphate, neutralize the base with sulphuric acid and allow to crystallize.

Description and Tests.—Sparteine sulphate occurs in "colorless, white, prismatic crystals, or a granular powder, odorless, and having a slightly saline and somewhat bitter taste. Liable to attract moisture when exposed to damp air. Very soluble in water and alcohol. When heated to about 83° C. (181.4° F.), the salt begins to lose its water of crystallization, all of which escapes at 100° C. (212° F.). At about 136° C. (276.8° F.) it melts, and, upon ignition, it is consumed, leaving no residue. The salt is neutral to litmus paper. If 25 Cc. of ether be added to about 0.1 Gm. of sparteine sulphate in a test-tube, then a few drops of dilute ammonia water, so that the latter shall not be in excess, and an ethereal solution of iodine (1 in 50) be afterward added until the liquid, when shaken, turns from an orange to a dark reddish-brown color, the bottom and sides of the test-tube will, after a short time, be found coated with minute, dark greenish-brown crystals, distinctly seen with a lens after the liquid has been poured out"—(*U. S. P.*). In consequence of a similar reaction taking place, sparteine sulphate is incompatible with potassium iodide (see *Amer. Jour. Pharm.*, 1891, p. 595). "On shaking 0.05 Gm. of the salt, in a test-tube, with 5 Cc. of potassium or sodium hydrate T.S., the liquid will at first be turbid, and small drops of sparteine will gradually collect on the surface. If a strip of moistened red litmus paper be suspended in the mouth of the test-tube, and a gentle heat then applied, the test-paper will gradually acquire a blue color, but no ammoniacal odor should be perceptible (absence of ammonium salts)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Sparteine, and scoparius, from which it is derived, are employed to regulate the heart's action, and to produce diuresis, both of which effects they sometimes fail to accomplish. The diuretic virtues of the latter are believed to reside more largely in scoparine than in sparteine, though the former has not been well investigated. As a rule sparteine does not produce diuretic effects in the healthy individual (Masius). Dr. J. V. Laborde was the first to point out the action of sparteine upon the heart, and his views were subsequently confirmed in the main by Masius, Germain Sée, and others. The toxic symptoms in the lower animals from the administration of sparteine are muscular trembling, incoordinate movements, impeded respiration, convulsions, both tonic and clonic, quickened pulse, with feeble heart-action, while finally all of the functions are feebly performed and death occurs from asphyxiation. Both the centers of motion in the spinal axis and of respiration are paralyzed by it. A tendency to somnolence and dilated pupils has also been observed in animals. In man the chief effects that have been observed from over-doses are nausea, dizziness, heaviness of the limbs, and irregular heart-action.

Therapeutically, sparteine is employed chiefly in *cardiac diseases* to augment in force the action of the heart and arteries, and to regulate arhythmical movements of the former. It appears that when the cardiac action is abnormally slow as from functional exhaustion (Sée), and when the pulsations are abnormally rapid (Clarke), the heart is spurred to action by it in the first instance and gradually slowed to normal in the second. By some it is regarded as superior to digitalis as a heart tonic and is free from cumulative effects; others regard it as only secondary to that drug as a heart remedy. It has the advantage of acting quickly, in from $\frac{1}{2}$ to $\frac{3}{4}$ of an hour, reaching its maximum power in 5 or 6 hours, and its effects sometimes last nearly a week. The affections in which it has received praise as a remedy are: *irregular heart-action from valvular lesions*, or *debility of the cardiac muscle; slow heart-action due to functional exhaustion; obstructive heart disease with palpitation, and tumultuous heart-action; functional palpitation* (prompt results); *mitral regurgitation*, and *aortic regurgitation with irritable and enlarged heart.* In *mitral stenosis* its effects are less beneficial, but in *exophthalmic goitre* its action is said to be pronounced. In *asthma* with cardiac complications it has proved a good but slow remedy. In the obstructive heart diseases the smaller or fractional doses ($\frac{1}{20}$ to $\frac{1}{10}$ grain) produce the best effects, whereas large doses (1 to 2 grains) are apt to induce pain, præcordial tightness, and other distressing symptoms. Sparteine has favorably influenced the course of *dropsy* only when dependent upon cardiac diseases, other forms of dropsy being totally unaffected by it. The salt of sparteine usually administered is the sulphate. In the matter of dosage there is a wide variance among authorities on heart affections, the most universally employed doses ranging from $\frac{1}{20}$ to $\frac{1}{2}$ grain 4 times a day. The daily amount recommended by Sée was 2 grains; by Houde, $1\frac{2}{3}$ to $7\frac{1}{2}$ grains; by Clarke, $\frac{1}{2}$ grain, which may be gradually increased without toxic effects to 12 grains. The dose, according to Voight, is from $\frac{1}{64}$ to $\frac{1}{16}$ grain. The beginning dose of sparteine sulphate should not be greater than $\frac{1}{6}$ grain, to be increased as circumstances warrant.

Specific Indications and Uses.—Functional heart diseases, with enfeebled heart-action; cardiac palpitation, with tumultuous heart-action; weak, irregular heart; dropsy of cardiac origin.

SPERGULARIA.—SAND-SPURREY.

The roots and plant of *Spergularia rubra*, Presl. (*Arenaria rubra*, Linné; *Lepigonum rubrum*, Fries; *Spergularia rubra*, var. *campestris*, Gray's *Manual; Buda rubra*, Dumortier).

Nat. Ord.—Caryophylleæ.

Common Names: *Sand-spurrey, Red-sandwort, Spurrey-sandwort.*

Botanical Source.—The Spergularia rubra is an inconspicuous annual weed, found both in the United States and Europe, in dry, sandy situations, more commonly near the coast, but not in brackish places. The stems are many, and from the same root, matted, much branched, from 6 to 12 inches in length, and lying prostrate on the sand. The leaves are linear, fleshy, and about 1 inch long; they are opposite, and have, generally, smaller leaves clustered in their axils; they are surrounded, at the base, by 2 dry, triangular, scale-like stipules. The flowers are small, numerous, axillary, and appear throughout the summer; they are borne on slender peduncles, about $\frac{1}{2}$ inch long, which are reflexed in fruit. The calyx has 5 scarious-edged sepals. The corolla has 5 rose-colored, entire petals, about the length of the sepals. The fruit is a dry, many-seeded pod, opening by 3 valves.

Spergularia salina (Presl.) and *Spergularia media* (Presl.), the only other native species of Spergularia, are found in brackish, sandy places. They closely resemble the *S. rubra*, and have, probably, the same properties. *Spergularia arvensis*, Linné, a naturalized weed, has a similar appearance to *Spergularia rubra*, but can be distinguished by having whorled leaves.

History and Chemical Composition.—Spergularia rubra has been recommended as a remedy, and, it is said, has long been employed in Malta and Sicily. It was analyzed by M. Legout, of Algiers, where the plant is very abundant; by Dr. Jacquème, of Marseilles; and by Vigier, of Paris. The latter finds (*Jour. Pharm. Chim.*, 1879, Vol. XXX, p. 375) that the medicinal action of the plant is due to the large proportion of alkalies and aromatic resins which it contains. One hundred parts of the dry plant yielded, upon incineration, 8.72 grammes of a deliquescent ash, 87 per cent of which was soluble in water. The ash contained no lithium.

Action, Medical Uses, and Dosage.—This plant was employed in Sicily and neighboring countries as a secret remedy, for many years, in the form of a tisane, and sold at exorbitant prices. A specimen of the plant having been obtained by an individual, who had been benefited by the use of the tisane, was analyzed by M. Legout, a pharmacist, and its therapeutic action tested in some of the Paris hospitals by M. Bertherand and others. It has been found very efficient in the treatment of *gravel*, having been largely experimented with in Europe. The best preparation for administration is a decoction, which exerts a stimulating action upon the circulation and the secretions, especially those of the urinary organs. The discharge of gravel through the ureters is facilitated under its use, and *nephritic colic*, when present, is promptly relieved. Five drachms of the plant to a pint of water is the medium dose, to be taken daily; it may be sweetened, if desired. Pills or syrup may be substituted for the decoction, in doses of 15 grains, every 1, 2, or 3 hours. M. Vigier advises the following powder as preferable to the other preparations: Take of aqueous extract of Spergularia rubra, 154 grains; powdered white sugar (free from glucose), 461 grains; mix thoroughly together, and divide into 5 equal papers or packets; 1 of these to be added to a quart of water, and to be drank during the day. A similar quantity of extract in 1½ fluid drachms of pure glycerin and 3 fluid ounces of distilled water, gives a solution that keeps well, and of which the dose is a teaspoonful, to be repeated 5 times a day—equivalent to a quart of the decoction. With regard to this plant, as a therapeutic agent, a writer observes: "We can understand that a plant so rich in constituent elements, in chloride of potassium and sodium, in alkalies, and in aromatic principles, must have a powerful action upon the animal economy. Combined with the albuminous juices of the vegetable, the chlorides must act otherwise than in the free state."

SPIGELIA (U. S. P.)—SPIGELIA.

The rhizome and roots of *Spigelia marilandica*, Linné.
Nat. Ord.—Loganiaceæ.
COMMON NAMES: *Pinkroot*, *Carolina pink*, *Maryland pink*, *Worm-grass.*
ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 180.

Botanical Source.—Carolina pink is an herbaceous, indigenous plant, with a perennial, very fibrous, yellow root, which sends up several erect, simple, nearly smooth, 4-angled stems, of a purplish color, 6 to 20 inches high. The leaves are opposite, sessile, ovate-lanceolate, acute or acuminate, entire and smooth, with the margin and veins roughish-hairy; they are 3 or 4 inches long by 1½ or 2½ inches broad; the stipules are scarcely perceptible. The flowers are few in number, in a terminal secund spike, supported on short pedicels; they are somewhat club-shaped, scarlet externally, yellow internally, from 1½ to 2 inches in length. The calyx is persistent, with 5 long, linear, subulate, finely-serrulate divisions, which are reflexed in the ripe fruit. The corolla is funnel-shaped, 4 times as long as the calyx, the tube inflated in the middle and angular at top, divided into 5 acute, spreading segments, the edges of which are slightly tinged with green. Stamens short, inserted into the mouth of the corolla between the segments; anthers oblong, heart-shaped, and exserted. Ovary small, superior, and ovate; style about the length of the corolla, jointed near its base, and terminating in a linear, fusiform, fringed stigma, projecting considerably beyond the corolla. The capsule is double, consisting of 2 cohering, 1-celled, globular carpels attached to a common receptacle, and containing numerous, small, angular seeds (L.—W.—G.—B.).

Fig. 232.

Spigelia marilandica.

History.—Botanists have varied in their classification of this plant. Besides the above-given order, *Loganiaceæ*, we find it classed in the natural order *Gentianaceæ*, also *Spigeliaceæ* and *Rubiaceæ;* suborder, *Spigeliæ*. It is usually known as the *Carolina pink* or *Worm-grass*. This plant is a native of the United States, growing in dry, rich soils, and on the borders of woods in the southern states, and flowering in May and June. The plant, of which several varieties exist, was used by the natives as an anthelmintic long before the discovery of America, and through them a knowledge of it was imparted to the early settlers, who used it for some years before it was introduced to the profession. Drs. Lining, Chalmers, and Garden, of South Carolina, acquainted the medical public with its uses, since which time it has become an official remedy. It is generally received in bales or casks from the western states, in which section it has been found growing in great abundance. The part used is the rhizome and its roots.

Description.—Pinkroot is composed of a number of delicate, crooked, corrugated fibers, of a dark-brown color externally, issuing from a short, dark-brown rhizome. Age impairs the virtues of pinkroot. Often the roots of other plants, particularly those of *Phlox Carolina*, Linne, also known as *Carolina pink* and *Georgia pink*, will be found mixed with those of spigelia; they, together with the stalks and leaves of the latter, should be carefully removed before preparing the medicine for administration.

The *U. S. P.* describes pinkroot as "of horizontal growth, about 5 Cm. (2 inches) or more long, 2 or 3 Mm. ($\frac{1}{12}$ or $\frac{1}{8}$ inch) thick, dark purplish-brown, bent, somewhat branched, on the upper side with cup-shaped scars; on the lower side with numerous, thin, brittle, lighter-colored roots, about 10 Cm. (4 inches) long; the rhizome internally with a whitish wood and a pith which is usually dark-colored or decayed; odor somewhat aromatic, taste sweetish, bitter and pungent. It should not be confounded with the underground portion of *Phlox Carolina*, Linné (*Nat. Ord.*—Polemoniaceæ), the roots of which are brownish-yellow, rather coarse, straight, and contain a straw-colored wood underneath a readily removable bark"—(*U. S. P.*). Prof. Maisch suggests (*Amer. Jour. Pharm.*, 1883, p. 631) that the virtues ascribed to spigelia might, in reality, be those of phlox, since this root has long been used in the southern states. Prof. Trimble (*ibid.*, 1886, p. 479) found in the root of phlox a peculiar camphor (*phloxol*), which is soluble in petroleum-ether with red fluorescent color. Spigelia does not yield such a substance, hence petroleum-ether may be used to distinguish phlox from spigelia chemically. (For the microscopic characteristics of phlox, also see H. G. Greenish, *Pharm. Jour. Trans.*, Vol. XXI, 1891, p. 839.) *Phlox glaberrima*, Linné, has like properties, and is said to resemble spigelia more than Georgia pinkroot does.

Chemical Composition.—Wackenroder found in the root, fixed oil (a trace), acrid resin, tannic acid, a bitter, acrid principle, etc. Dr. R. H. Stabler, in a later analysis of pinkroot, found it to contain a volatile oil, tannic acid, wax, inert resin, salts, etc. He believes the activity to reside in a bitter, acrid principle, which is soluble in water or alcohol, insoluble in ether, non-volatile, neutral, and deliquescent. The alkaline carbonates do not diminish its activity. Water and alcohol are equally good solvents for its medicinal virtues (*Amer. Jour. Pharm.*, 1857, p. 511). In 1879, Mr. W. L. Dudley (*Amer. Chem. Jour.*, Vol. I, p. 104) found the active constituent to be a volatile alkaloid, *spigeline*, yielding precipitates with alkaloidal reagents, and resembling coniine and nicotine. It was obtained by distilling ground pinkroot with calcium hydroxide.

Action, Medical Uses, and Dosage.—Pinkroot is an active and certain vermifuge, especially among children. In large doses, it is very apt to purge, and produce various unpleasant symptoms, as increased action of the heart and arteries, dizziness, dilatation of the pupils, imperfect vision, and muscular spasms, often terminating in convulsions, together with various other indications of narcosis. One of its more frequent effects is spasmodic twitchings of the eyelids. These symptoms seldom happen when catharsis is produced, either by the drug alone, or exhibited in combination with a purgative. The toxic effects are counteracted by the diffusible stimulants, alcohol, ammonia, and ammonium carbonate. The powdered root may be given to a child from 2 to 4 years of age, in doses of 5 to 20 grains; or 1 or 2 fluid ounces of a strong infusion, administering it twice a day for a few days, and then giving an active purgative. A jelly has been recommended as an agreeable form of administration, as follows: To 16 fluid ounces of water add 8 ounces of pulverized pinkroot, and 4 drachms of Corsican moss, and boil down to 10 fluid ounces. The decoction should then be decanted into a saucepan containing 2½ ounces of white sugar, and again boil down, carefully stirring with a silver spoon, until 4 ounces of jelly are obtained. Then strain through a sieve into a jar containing 2 drops of the essence of citron or caraway. It will keep for some time in a cool place, and its flavor may be improved by substituting syrup of raspberries, strawberries, gooseberries, or mulberries, etc., for the sugar. It is also useful in those conditions of the system, caused by *worms*, which resemble *infantile remittent* and other *febrile diseases*, and *hydrocephalus*. A well-known worm tea is composed of pinkroot, ½ ounce; senna, 2 drachms; savine, ½ drachm; manna, 2 drachms. Mix, and infuse in a pint of water. Dose, 1 to 2 fluid ounces. Anthelmintic dose of powdered pinkroot, for an adult, 1 to 2 drachms. Spigelia is a remedy for *endocardial troubles*, but is regarded as inferior to the *Spigelia Anthelmia*, Linné, both being used for the same purposes in *cardiac affections* (see *Related Species*).

Related Species.—*Spigelia Anthelmia*, Linné (*Anthelmia quadriphylla*), *Demerara pinkroot*. An annual of the West Indies and South America. The root has been used by the natives of those countries for centuries as an anthelmintic. It is the form of spigelia official in the *Homœopathic Pharmacopœia* (1890), and possesses decided narcotic qualities. It was introduced into Europe by Dr. Browne, in 1751. The French gave it the name *Brinvilliers*, after the Marchioness de Brinvillière, the celebrated poisoner, executed in 1676, and who is said to have used this drug upon her victims. The fresh plant is very poisonous, and contains the volatile alkaloid, *spigeliin* (Boorsma, in Dragendorff's *Heilpflanzen*, 1899). This drug is said to act specifically upon the heart, and particularly the endocardium. It is valued by some practitioners in *cardiac palpitation* and *endocarditis*, especially the rheumatic form, and to guard against relapses of *cardiac rheumatism*. *Painful conditions of the heart*, the pain extending along the arm, *angina pectoris*, and *cardiac neuralgia*, with palpitation, are conditions in which it is employed with asserted success. Large doses debilitate the heart. Browne (1751 compared its narcotic power to that of opium. The usual method of administering this drug is to add from 10 to 15 drops of the Homœopathic mother tincture to 4 fluid ounces of water, the dose of which is a teaspoonful every 2 hours.

Other Anthelmintics.—*Vernonia anthelmintica*. East Indies. The bitter, nauseous, black seeds of this plant, in doses of 50 to 60 grains, are valued in Ceylon as an anthelmintic.

Sethia acuminata.—Ceylon. The juice of this plant and the dried, powdered leaves are reputed vermifuge. Dose, 15 grains.

SPILANTHES.—PARA CRESS.

The herb and flower-heads of *Spilanthes oleracea*, Jacquin.

Nat. Ord.—Compositæ.

Common Name: *Para cress.*

Botanical Source and Description.—The genus Spilanthes is a tropical family of (mostly) annual weeds, with opposite leaves, and terminal, stalked, flower-heads. It is closely allied to Bidens, differing, chiefly, in the achenia, which are plano-convex, with a membranous winged margin. The pappus consists of 2 short awns. The receptacle is conical and paleaceous. *Spilanthes oleracea* is a native of South America, and is often cultivated in tropical countries, where it is used as a salad. It is known under the name *Para cress.* It is a small, erect herb, of rapid growth, and has cordate stalked leaves. The flowers are small, yellow, and solitary, on terminal peduncles. The Chinese derive a blue coloring matter from *Spilanthes tinctoria*, Loureiro, similar to indigo. *Spilanthes Acmella*, Linné, an East Indian species, has properties akin to those of *Spilanthes oleracea*. Spilanthes oleracea has an acrid, aromatic taste, resembling, but more powerful than, peppermint. Analysis has shown it to contain volatile oil, an acrid resin, tannin, etc., and an alkaloid (Buchheim). When chewed spilanthes occasions a copious flow of saliva.

Action, Medical Uses, and Dosage.—Spilanthes is an acrid, aromatic sialagogue, and which, like the galanga root, has been recommended in *flatulence*, to improve the appetite and digestive functions, and to overcome *nausea* and *vomiting*. It may also be used in *non-mercurial ptyalism*, and in *inflammations of the mouth and throat*, using fractional doses of a strong tincture (recent herb, ℥viij to alcohol, 98 per cent, Oj). The natives of the countries to which it is indigenous, are stated to have employed it advantageously in *gouty and rheumatic affections*, in *uric acid gravel*, in *dropsical effusions*, and even to remove *intestinal worms*. A tincture of it placed on cotton, and introduced into the cavity of a decayed tooth, will, it has been remarked, promptly relieve *toothache*. It is not employed in this country.

SPIRÆA.—HARDHACK.

The herb of *Spiræa tomentosa*, Linné.

Nat. Ord.—Rosaceæ.

Common Names: *Hardhack*, *Meadow-sweet*, *White-leaf*, *Silver-leaf*, *Steeple-bush*, *Whitecap*.

Fig. 233.

Spiræa tomentosa.

Botanical Source.—This plant is a small shrub, about 3 or 4 feet in height, with several simple, straight, round, ferruginous-tomentose, hard, brittle stems. The leaves are alternate, simple, ovate-lanceolate, smoothish and dark-green above, rusty white with a dense tomentum beneath, unequally serrate, crowded, on short petioles—they are 1½ to 2 inches in length, and about one-half as wide. The flowers are small, very numerous, light-purple or rose-colored, in a short, dense, slender, terminal spike, or pyramidal cluster of some beauty. Stamens numerous, exserted, and conspicuous; styles 5; carpels 5, distinct, and woolly; seeds awl-shaped at each end (W.—G.).

History.—This is a beautiful shrub, common in low grounds and moist meadows, throughout the United States, flowering from May to August. The herbaceous part is used, especially the leaves and bark. It has an odor somewhat resembling that of black tea, and a very astringent, bitter taste, which properties it imparts to boiling water in infusion. It appears to contain tannic and gallic acids, volatile oil, and bitter extractive. The fruit is persistent, remaining through the winter, and furnishing food for the snowbird.

Action, Medical Uses, and Dosage.—Hardhack has been found an excellent astringent in *summer complaint of children*, *diarrhœa*, and other diseases requiring this class of remedies, and is less offensive to the stomach than most agents of this kind. It has likewise proved efficient as a tonic in cases of *debility*, *convalescence from diarrhœa*, *dysentery*, etc., and to improve the digestive functions. *Passive hemorrhages*, and *menorrhagia* have been treated with it, while as an injection good results have been obtained from its use in *gleet* and *leucorrhœa*. It is generally given in infusion, the dose being 1 or 2 fluid ounces. A very elegant extract, not inferior to catechu, may be made by carefully evaporating an infusion made by percolation, and which may be given in doses of from 2 to 20 grains. A tincture, well representing the virtues of spiræa, may be prepared from 8 ounces of the fresh leaves and bark to 1 pint of 76 per cent alcohol.

Related Species.—*Spiræa Ulmaria*, Linné. This plant bears small white flowers in corymbs supported on long peduncles. It is indigenous to Europe, where it is known as *Meadow-sweet* and *Queen of the meadow*. It has been introduced into this country and is frequently found in cultivation, in which case the flowers are usually double. The chief constituent of this plant is *oil of meadow-sweet*, first observed in 1835 by Pagenstecher. It is heavier than water, strongly aromatic, solidifies at —20° C. (—4° F.), and produces a deep-violet color with solution of ferric chloride. It consists chiefly of *salicylic aldehyde* ($C_6H_4OH.CHO$) (Dumas, Ettling, 1839), formerly called *salicylous acid;* some free *salicylic acid*, a small quantity of *methyl salicylate* (Schneegans and Gerock, 1892), and traces of *piperonal* (see *Piperinum*) and *vanillin;* also very little of a camphor-like body and a terpene (Ettling). According to Schneegans and Gerock, salicylic aldehyde does not preexist in the flowers, but is formed during distillation by the action of a ferment upon a substance as yet unknown; it is not salicin. See details regarding the chemistry of the oils obtainable from the different parts and species of Spiræa, in Gildemeister and Hoffmann, *Die Ætherischen Oele*, 1899, p. 550. This plant is diuretic, astringent, and tonic. It has been employed in *fevers*, like Virginia snakeroot, in *dropsy*, and in *retention of urine* due to *prostatic enlargement*. It relieves urino-genital irritation, influences the prostate gland checking *prostatorrhœa*, and is useful in *gleet*, *chronic cervicitis*, and *chronic vaginitis with leucorrhœal discharges*.

Spiræa filipendula, Linné.—Europe. The pyriform or moniliform tubers found upon the long radicles of this plant are reputed useful in restraining excessive mucous discharges. *Hydrophobia* has also been treated with it. The root contains sugar, starch, and tannin, and when recent an essential oil, probably that common to other species of Spiræa, and salicylic aldehyde, for the latter is known to be present in the branches and leaves of this plant.

Spiræa Aruncus, Linné.—Europe and United States. A perennial herb, with slender racemes of many, small white blossoms. The herb has an aromatic bitterish, astringent taste, and the odor is pleasant. The flowers, upon distillation with water, yield salicylic aldehyde, while the herb yields none, but produces hydrocyanic acid. For further details, see Gildemeister and Hoffmann, *loc. cit.;* also see *Amer. Jour. Pharm.*, 1892, p. 306.

SPIRITUS.—SPIRITS.

Spirits, as now prepared, are simply alcoholic solutions of essential oils or other volatile bodies. Formerly they were made by the distillation of mixtures of water and aromatic substances, hence their name. As many of the oils usually entering into spirits do not vaporize at the boiling point of alcohol, it is customary, in distilling them, to dilute the alcohol with a sufficient amount of distilled water to insure the volatile substances being carried over into the condenser with the aqueous vapors. When aromatic plants are used, they should be first macerated in the alcohol for a few days, and then distilled by means of steam or a salt-water bath. In the *German Pharmacopœia*, *Spiritus* is the official term for *alcohol*.

SPIRITUS ACIDI FORMICI (N. F.)—SPIRIT OF FORMIC ACID.

SYNONYMS: *Spiritus formicarum* (*Ger. Pharm.*), *Spirit of ants*.

Preparation.—"Formic acid, thirty-five cubic centimeters (35 Cc.) [1 fl℥, 88 ♏]; distilled water, two hundred and twenty-five cubic centimeters (225 Cc.) [7 fl℥, 292 ♏]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the formic acid with the distilled water, and add enough alcohol to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. *Note.*—Formic acid is required by the *German Pharmacopœia* to have a specific gravity of 1.060 to 1.063"—(*Nat. Form.*). Formerly, *Spiritus Formicarum* was made by macerating recently collected ants (10 parts) with alcohol (15 parts) and water (15 parts), and distilling off 20 parts.

Uses.—(See *Acidum Formicum.*) Dose, 10 to 60 minims.

SPIRITUS ÆTHERIS (U. S. P.)—SPIRIT OF ETHER.

SYNONYM: *Liquor anodynus mineralis Hoffmanni.*

Preparation.—"Ether, three hundred and twenty-five cubic centimeters (325 Cc.) [10 fl℥, 475 ♏]; alcohol, six hundred and seventy-five cubic centimeters (675 Cc.) [22 fl℥, 396 ♏]. To make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix them"—(*U. S. P.*)

Action, Medical Uses, and Dosage.—Spirit of ether is employed like *Hoffmann's Anodyne*, its pain-relieving property being due to the ether it contains. The dose is from 1 to 3 fluid drachms, in sweetened water.

SPIRITUS ÆTHERIS COMPOSITUS (U. S. P.)—COMPOUND SPIRIT OF ETHER.

SYNONYM: *Hoffmann's anodyne.*

Preparation.—"Ether, three hundred and twenty-five cubic centimeters (325 Cc.) [10 fl℥, 475 ♏]; alcohol, six hundred and fifty cubic centimeters (650 Cc.) [21 fl℥, 470 ♏]; ethereal oil, twenty-five cubic centimeters (25 Cc.) [406 ♏]. To make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix them"—(*U. S. P.*).

History.—Commercial Hoffmann's anodyne is not always prepared by the official process, but may be a hydro-alcoholic solution of the last fraction of distillate obtained in the rectification of ether, which contains both light and heavy oils of wine. Only that produced by the official directions (see *Oleum Æthereum*), and which alone contains the heavy oil of wine, should be employed in medicine.

Description and Test.—Compound spirit of ether is a colorless liquid, having an aromatic and ether-like odor, and a feebly sweetish, pungent taste. It is neutral or but slightly acid to litmus paper. The almost imperceptible residue left upon igniting the fluid, in a porcelain or glass dish, is acid to both taste and test-paper. Water is rendered slightly opalescent by a very small quantity of the spirit (40 drops to 1 pint), and larger amounts produce a turbidity from the separation of the ethereal wine. If oily globules appear upon the surface, they are to be tested for fixed oil by allowing them to be absorbed by filtering paper; should the latter, when exposed to heat, remain greasy, fixed oil is present.

Action, Medical Uses, and Dosage.—This agent is used very much as ether is used internally, but is more permanent in its effects. It is stimulant, antispasmodic, and anodyne. In the absence of active fever, it may be used to give rest in various forms of *nervousness*, as *hysteria*, *restlessness*, *insomnia*, etc. It relieves pain, and is useful in *flatulent*, *biliary*, and *menstrual colic*. It is an excellent remedy for *depression of spirits* and *melancholia*, and is useful when asphyxia is threatened, and as a nerve stimulant in the depression of low forms of *fever*. It lowers temperature, and, locally applied, proves serviceable to check vascular excitation, and sometimes gives relief in *strangulated hernia*. Dose, ½ to 2 fluid drachms, in sweetened water.

SPIRITUS ÆTHERIS NITROSI (U. S. P.)—SPIRIT OF NITROUS ETHER.

"An alcoholic solution of ethyl nitrite ($C_2H_5N_2O$=74.87), yielding, when freshly prepared, and tested in a nitrometer, not less than 11 times its own volume of nitrogen dioxide (NO=29.97)"—(*U. S. P.*).

SYNONYMS: *Spiritus nitri dulcis*, *Sweet spirit of nitre* (*niter*), *Spiritus nitrico-æthereus*, *Spiritus ætheris nitrici*.

Preparation.—"Sodium nitrite, six hundred and thirty-five grammes (635 Gm.) [1 lb. av., 6 ozs., 175 grs.] (see Dr. Charles Rice, *Digest of Criticisms on the U. S. P.*, Part I, 1897); sulphuric acid, five hundred and twenty grammes (520 Gm.) [1 lb. av., 2 ozs., 150 grs.]; sodium carbonate, ten grammes (10 Gm.) [154 grs.]; potassium carbonate, completely deprived of water by drying, thirty grammes (30 Gm.) [1 oz. av., 25 grs.]; deodorized alcohol, water, each, a sufficient quantity. Dissolve the sodium nitrite in one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of water, and put the solution into a suitable flask, connected with a condenser kept cold by ice-cold water; then add five hundred and fifty cubic centimeters (550 Cc.) [18 fl℥, 287 ♏] of deodorized alcohol, and mix well. Through a cork, fitted into the mouth of the flask, insert a funnel-tube, dipping below the surface of the liquid. With the condenser connect a receiver, and keep this surrounded by a mixture of common salt and crushed ice. Then gradually introduce into the flask, through the funnel-tube, the sulphuric acid, previously diluted with one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of water. Distillation will usually commence before the whole of the acid has been added. When all the acid has been introduced, regulate the distillation by the application or withdrawal of a gentle heat until no more nitrous ether distills over. Wash the distillate, first, with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of ice-cold water, to remove any alcohol which may have passed over, and then remove any traces of acid by washing the ether with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of ice-cold water, in which the sodium carbonate had previously been dissolved. Carefully separate the ether from the aqueous liquid, and agitate it, in a well-stoppered vial, with the potassium carbonate, to remove traces of water. Then filter it through a pellet of cotton, in a covered funnel, into a tared bottle, containing two thousand cubic centimeters (2000 Cc.) [67 fl℥, 301 ♏] of deodorized alcohol. Ascertain the weight of the nitrous ether filtered into the alcohol by noting the increase of weight of the tared bottle and contents, and then add enough deodorized alcohol to make the mixture weigh twenty-two (22) times the weight of the nitrous ether added. Lastly, transfer the product to small, dark, amber-colored, well-stoppered vials, and keep them in a cool place, remote from lights or fire"—(*U. S. P.*).

In this process, sulphuric acid liberates nitrous acid from sodium nitrite, which at once reacts with the alcohol present to form ethyl nitrite, as follows $HNO_2+C_2H_5OH = C_2H_5.NO_2+H_2O$. Instead of preparing the pure ether as an intermediary product, as directed by the *U. S. P.*, Prof. Feil (*Amer. Jour. Pharm.*, 1899, p. 500) recommends the preparation of the finished product direct, by allowing sulphuric acid (20 grammes) to flow into a mixture of sodium nitrite (30 grammes) and alcohol (300 grammes) contained in a liter flask, and connected with a reflux condenser. After the reaction is completed by the aid of heat, the product is filtered, and alcohol added to make 450 grammes, the yield being about 75 per cent of the theoretical.

The spirit of nitrous ether of the *U. S. P.*, 1880, was prepared by distillation of alcohol, nitric acid, and sulphuric acid. The reaction depended on the reduction of nitric to nitrous acid by the alcohol; in consequence, the latter was partly oxidized, and a number of by-products, *e. g.*, ethylic aldehyde, were formed. The *British Pharmacopœia* prepares the spirit by distillation of alcohol and nitric acid in the presence of copper.

Description and Tests.—The *U. S. P.* describes sweet spirit of nitre as "a clear, mobile, volatile, and inflammable liquid of a pale-yellowish, or faintly greenish-yellow tint, having a fragrant, ethereal, and pungent odor, free from acridity, and a sharp, burning taste. Specific gravity about 0.836 to 0.842 at 15° C. (59° F.). When freshly prepared, or even after being kept for some time with but little exposure to light and air, it is neutral to litmus paper. When long kept, or after having been freely exposed to air and light, it acquires an acid reaction, but it should not effervesce when a crystal of potassium bicarbonate is dropped into it. If a test-tube be half filled with the spirit, and put into a water-bath heated to 65° C. (149° F.), until it has acquired this temperature, the spirit should boil distinctly upon the addition of a few small pieces of broken glass. If 10 Cc. of the spirit be mixed with 5 Cc. of potassium hydrate T.S., previously diluted with 5 Cc. of water, the mixture will assume a yellow color, which should not turn decidedly brown within 12 hours (limit of aldehyde). If 5 Cc. of recently prepared spirit of nitrous ether be introduced into a nitrometer, and followed, first, by 10 Cc. of potassium iodide T.S., and then by 10 Cc. of normal sulphuric acid, the volume of nitrogen dioxide generated at the ordinary indoor temperature (assumed to be at or near 25° C. or 77° F.), should not be less than 55 Cc. (corresponding to about 4 per cent of pure ethyl nitrite)"—(*U. S. P.*). This method was suggested by A. H. Allen, in 1885 (see *Amer. Jour. Pharm.*, 1885, p. 187), and is based upon the following reaction: $2C_2H_5NO_2+2IK+H_2SO_4=2C_2H_5OH+K_2SO_4+N_2O_2+I_2$. Accordingly, the volume of nitrogen dioxide gas evolved is in proportion to the quantity of pure ether present. Other methods, based on the determination of the quantity of iodine liberated in this reaction, have not proved successful, owing to secondary reactions (see R. Fischer and J. A. Anderson, *Pharm. Archives*, 1898, p. 169). A more reliable method seems to be that which depends on the reaction between ethyl nitrite and potassium chlorate in nitric acid solution, whereby hydrochloric acid is formed, the quantity of which may be determined by silver nitrate V.S. The reaction is principally as follows: $3C_2H_5NO_2+HClO_3+3H_2O=3C_2H_5OH+3HNO_3+HCl$. (For further details regarding this method, see Carl E. Smith, *Amer. Jour. Pharm.*, 1898, p. 273.) Spirit of nitrous ether, when kept for a long time, even in well-closed bottles, undergoes various changes—among these, decrease of ethyl nitrite, increase of acidity, formation of aldehyde, acetic acid, and acetic ether. (For details as to the keeping qualities of spirit of nitrous ether, see, among other papers, P. MacEwan, in *Amer. Jour. Pharm.*, 1884, pp. 378–385, from *Pharm. Jour. Trans.;* and John C. Hunter, *ibid.*, 1888, p. 349; also see an extensive bibliography of spirit of nitrous ether, by W. O. Richtmann and J. A. Anderson, in *Pharm. Archives*, July, 1899.)

Action, Medical Uses, and Dosage.—Spirit of nitrous ether, when inhaled, is a narcotic poison; its accidental inhalation during sleep is said to have caused death. The symptoms produced by its inhalation are quickening of the pulse, arterial throbbing, giddiness, headache, nausea, leaden-hued lividity of the lips and finger tips, followed by flushed countenance, and, in excessive quantities, muscular debility, mental confusion, rapid, irregular, thready pulse, dyspnœa, cyanosis, and convulsions. If sufficiently prolonged, death takes place. Internally, excessive doses cause gastro-intestinal irritation, with colic and vomiting. When the preparation becomes old, free nitrous acid is formed, and its internal administration will be followed by pain in the stomach and gripings. Pareira gives the following mode of treatment for persons who have inhaled spirit of nitrous ether, as well as carbonic acid gas: "Remove the patient immediately into the open air, and place him on his back, with his head somewhat elevated. Produce artificial respiration by pressing down the ribs, forcing up the diaphragm, and then suddenly removing the pressure. Dash cold water over the body, apply bottles of hot water to the feet, with frictions, inhalations of ammonia, and other stimulants.

When not adulterated with water or alcohol, spirit of nitrous ether is a stimulant and antispasmodic, in its actions closely resembling those of sulphuric ether, but less energetic. As a diuretic, it is considered useful in *dropsy*, associated with diseased heart, more so than when connected with diseased kidney; being a stimulant diuretic, it is best adapted to asthenic conditions. In dropsy, it may be advantageously combined with syrup of squill, acetate, bicarbonate, or nitrate of potassium, or tincture of digitalis. It is useful in *strangury*, especially that produced by cantharis, *ardor urinæ*, and is a good addition to copaiba as a diuretic for diminishing the acrimony of the urine, and in the latter stages of *gonorrhœa*. However, it will be found an uncertain diuretic, not always exerting this influence in cases where it is administered. If the patient be kept warm, it is more likely to act upon the skin than kidneys, producing diaphoresis. It is useful in *inflammatory disorders of the urinary tract*. If the inflammatory condition is mild, it acts better than when very active. It is of service in *painful and difficult urination of children*, and overcomes *urethral spasm* and some cases of *spasmodic stricture*. For these troubles it should be given in infusion of watermelon-seed or spearmint. For *suppression of urine* in children it is a positive remedy. It is not, however, the remedy for *retention* of the urine, for, being diuretic, it increases the flow into an already over-filled bladder, only to increase the discomfort and pain. Here the catheter is demanded. In *Bright's disease*, with congestion and scanty urine, it may be used temporarily only.

Sweet spirit of nitre is often used in *fevers* as a sedative and mild diaphoretic, and may be given alone, or in conjunction with other agents, to cause diuresis and perspiration. As a rule, the dose administered is too large. The small doses, as a teaspoonful of 1 fluid drachm, in 4 fluid ounces of water, are far preferable. It thus slows the pulse, reduces temperature, and promotes secretion. It is especially adapted to the *fevers of childhood*, where the skin, though hot, is moist. Its effects in *ephemeral fevers* are pronounced. If fever and inflammation are very active, other agents will do better work, but in asthenic conditions, as *low grades of fever*, with marked irritation of the nerve centers, with tendency to spasm, it may be used with confidence. When there is unrest, gastric irritability, nausea, and vomiting, it allays the general irritability and often induces sleep. As a carminative, it is frequently useful in relieving *flatulence*, and allaying *nausea*. It is also useful in *gastrodynia* and *intestinal spasms*. On account of its volatility, it may be applied externally to produce cold by its evaporation.

Locally, this agent may give relief in *local pains*, as in *neuralgic headache*. In *inflammatory swellings*, in *threatened boils*, *carbuncles*, and *abscesses*, in *mumps*, in *glandular enlargements*, and in *rhus poisoning* it is said to be very efficient, and for *bites* and *stings*, is reputed unequalled. In all these cases it should be freely applied and allowed to evaporate, lest blistering occurs. Only recently prepared sweet spirit of nitre should be employed locally, as the free acid of old preparations frequently produces cutaneous irritation. The dose of spirit of nitrous ether is from a fraction of a drop to 1 fluid drachm, according to the indications to be fulfilled. It should be given well diluted.

Specific Indications and Uses.—Increased temperature, frequent pulse, dry skin, renal inactivity, and nervous irritability; nausea, flatulence, and intestinal spasms. Best adapted to asthenic conditions.

SPIRITUS AMMONIÆ (U. S. P.)—SPIRIT OF AMMONIA.

"An alcoholic solution of ammonia (NH_3 = 17.01) containing 10 per cent, by weight, of the gas"—(*U. S. P.*).

SYNONYMS: *Ammoniated alcohol, Spiritus ammoniaci caustici dzondii, Liquor ammonii caustici spirituosus.*

Preparation.—"Stronger ammonia water, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; alcohol, recently distilled, and, after distillation, kept in glass vessels, a sufficient quantity. Pour the stronger ammonia water into a flask provided with a safety funnel, and connected, by means of a glass condenser, with a well-cooled receiver containing five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of alcohol, the delivery tube of the condenser reaching to near the bottom of the receiver. Heat the flask carefully, and very gradually, to a temperature not exceeding 60° C. (140° F.), and maintain it at that temperature for about 10 minutes. Then disconnect the receiver, and, having ascertained the ammoniacal strength of the contents by means of normal sulphuric acid (rosolic acid test-solution being used as indicator), add enough alcohol to make the product contain ten (10) per cent, by weight, of ammonia. Keep the spirit in glass-stoppered bottles, in a cool place"—(*U. S. P.*).

The process of 1870 (*U. S. P.*) directed the generation of ammonia gas from lime and ammonium chloride, a process which we prefer. Care should be taken to use redistilled alcohol and to keep it in glass vessels if it is not to be used at once. Alcohol from barrels contains organic matters which are colored deep yellow by the action of ammonia. The solution contains 10 per cent (by weight) of ammonia gas.

Description.—"A colorless liquid, having a strong odor of ammonia, and a specific gravity of about 0.810 at 15° C. (59° F.). When diluted with water, it should respond to the tests for identity and purity mentioned under ammonia water (aqua ammoniæ). If 3.4 Gm. (or 4.2 Cc.) of spirit of ammonia be diluted with water, it should require, for complete neutralization, 20 Cc. of normal sulphuric acid (each cubic centimeter corresponding to 0.5 per cent of ammonia). rosolic acid being used as indicator"—(*U. S. P.*).

It should not effervesce with diluted hydrochloric acid; should it do so it has become carbonated. (As to its keeping qualities, see J. U. Lloyd, *Amer. Jour. Pharm.*, 1896, p. 301.)

Action, Medical Uses, and Dosage.—This spirit is seldom used internally, the aromatic spirit being preferred. Its action is that given under *Aqua Ammoniæ*. It dissolves resinous and other bodies precipitated by water, hence it is frequently added to liniments of which it should constitute not more than ⅐ part. Dose, 10 to 30 drops, largely diluted with water.

SPIRITUS AMMONIÆ AROMATICUS (U. S. P.)—AROMATIC SPIRIT OF AMMONIA.

SYNONYMS: *Spiritus ammoniæ compositus, Sal volatile.*

Preparation.—"Ammonium carbonate, in translucent pieces, thirty-four grammes (34 Gm.) [1 oz. av., 87 grs.]; ammonia water, ninety cubic centimeters (90 Cc.) [3 fl℥, 21 ♏]; oil of lemon, ten cubic centimeters (10 Cc.) [162 ♏]; oil of lavender flowers, one cubic centimeter (1 Cc.) [16 ♏]; oil of nutmeg, one cubic centimeter (1 Cc.) [16 ♏]; alcohol, seven hundred cubic centimeters (700 Cc.) [23 fl℥, 321 ♏]; distilled water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. To the ammonia water, contained in a flask, add one hundred and forty cubic centimeters (140 Cc.) [4 fl℥, 352 ♏] of distilled water, and afterward the ammonium carbonate reduced to a moderately fine powder. Close the flask and agitate the contents until the carbonate is dissolved. Introduce the alcohol into a graduated bottle of suitable capacity, add the oils, then gradually add the solution of ammonium carbonate, and afterward enough distilled water to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Set the liquid aside during 24 hours in a cool place, occasionally agitating, then filter it through paper, in a well-covered funnel. Keep the product in glass-stoppered bottles, in a cool place"—(*U. S. P.*).

It was formerly made as follows: Take of chloride of ammonium, 5 ounces; carbonate of potassium, 8 ounces; cinnamon, cloves, each, bruised, 2 drachms; lemon peel, 4 ounces; alcohol, water, each, 5 pints. Mix them, and distill off 7½ pints (*Lond.*).

Description.—"A nearly colorless liquid when freshly prepared, but gradually acquiring a somewhat darker tint. It has a pungent, ammoniacal odor and taste. Specific gravity about 0.905 at 15° C. (59° F.)"—(*U. S. P.*). Oil of pimenta was substituted for oil of nutmeg in the *U. S. P.*, 1880, but caused the formation of an undesirable deep-red or brown color (see Andrew Blair, *Amer. Jour. Pharm.*, 1885, p. 79).

Action, Medical Uses, and Dosage.—The aromatic spirit of ammonia is antacid, stimulant, and aromatic; it is a good diffusible stimulant, and is used in *sick headache, hysteria, flatulent colic, fainting*, etc., in doses of from 30 to 60 drops, or more, in sweetened water.

SPIRITUS AMMONIÆ FETIDUS.—FETID SPIRIT OF AMMONIA.

Preparation.—Take of asafœtida, 1½ ounce (Imp.); strong solution of ammonia, 2 fluid ounces (Imp.); alcohol (90 per cent), a sufficient quantity. "Break the asafœtida into small pieces, and macerate it in a closed vessel in 15 fluid ounces of the alcohol for 24 hours; distill until alcoholic vapors cease to be condensed; mix the distillate with the strong solution of ammonia, and add sufficient alcohol to make 1 pint"—(*Br. Pharm.*, 1898).

Some oil of asafœtida passes over in distillation so that the product is an alcoholic solution of asafœtida oil mixed with strong ammonia water.

Test.—"Twenty-five cubic centimeters should require for neutralization at least 42.5 Cc. of the volumetric solution of sulphuric acid, corresponding to at least 2.88 Gm. of ammonia (NH_3) in 100 Cc."—(*Br. Pharm.*).

Action, Medical Uses, and Dosage.—A general stimulant and nerve stimulant combined. Useful in *hysterical complaints*, and in *flatulent colic* with *gastric acidity* and *indigestion*. Dose, ½ to 1 fluid drachm, well diluted with water.

SPIRITUS AMYGDALÆ AMARÆ (U. S. P.)—SPIRIT OF BITTER ALMOND.

SYNONYM: *Essence of bitter almond.*

Preparation.—"Oil of bitter almond, ten cubic centimeters (10 Cc.) [162 ♏]; alcohol, eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏]; distilled water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the oil in the alcohol, and add enough distilled water to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Action and Medical Uses.—This agent should be very carefully employed, each fluid ounce containing about 5 minims of oil of bitter almonds. It is employed very largely as a flavoring substance, but a few drops being necessary to produce the desired flavor. It is an unsafe preparation.

SPIRITUS ANISI (U. S. P.)—SPIRIT OF ANISE.

SYNONYMS: *Tinctura olei anisi, Tincture of oil of anise, Essence of anise.*

Preparation.—"Oil of anise, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; deodorized alcohol, nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏]; to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix them"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This preparation is aromatic, antispasmodic, and carminative, and may be employed in *flatulency, cough, cramp of the stomach*, and to flavor other preparations. The dose is from 20 to 60 drops for an adult, in sweetened water. The following forms a very pleasant preparation for cough: Take of aqua ammoniæ, tincture of opium, each, 1 fluid ounce; essence of anise, ½ fluid ounce. Mix. Dose, from 20 to 60 drops.

SPIRITUS AROMATICUS (N. F.)—AROMATIC SPIRIT.

Preparation.—"Compound spirit of orange (*U. S. P.*), sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; deodorized alcohol, nine hundred and thirty-five cubic centimeters (935 Cc.) [31 fl℥, 272 ♏]. Mix them. Preserve the product, if it is to be kept in stock, in completely filled and well-stoppered vials or bottles, and stored in a cool and dark place. Aromatic spirit may also be prepared in the following manner: Sweet orange peel, fresh, and deprived of the inner, white portion, six hundred and seventy-five grammes (675 Gm.) [1 lb. av., 7 ozs., 354 grs.]; lemon peel, fresh, eighty-five grammes (85 Gm.) [3 ozs. av.]; coriander, bruised, eighty-five grammes (85 Gm.) [3 ozs. av.]; oil of star-anise, one and one-half cubic centimeters (1.5 Cc.) [24 ♏]; deodorized alcohol, a sufficient quantity to make five thousand cubic centimeters (5000 Cc.) [169 fl℥, 33 ♏]. Macerate the solids during 4 days with forty-five hundred cubic centimeters (4500 Cc.) [152 fl℥, 78 ♏] of deodorized alcohol; then add the oil of star-anise, filter, and pass enough deodorized alcohol through the filter to make the product measure five thousand cubic centimeters (5000 Cc.) [169 fl℥, 33 ♏]. *Note.*—When good, fresh essential oils can not be readily obtained for preparing the compound spirit of orange, the second formula may be used. But the product obtained by it should not be employed in mixtures containing *iron*, as the latter would cause a darkening of the mixture"—(*Nat. Form.*).

Uses.—This agent enters into the formation of many of the *elixirs*, being the chief constituent of *Aromatic Elixir* (*Elixir Aromaticum*).

SPIRITUS AURANTII (U. S. P.)—SPIRIT OF ORANGE.

Preparation.—"Oil of orange peel, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; deodorized alcohol, nine hundred and fifty cubic centimeters (950 Cc.) [32 fl℥, 59 ♏]; to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix them"—(*U. S. P.*).

Uses.—Employed in flavoring mixtures.

SPIRITUS AURANTII COMPOSITUS (U. S. P.)—COMPOUND SPIRIT OF ORANGE.

Preparation.—"Oil of orange peel, two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏]; oil of lemon, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; oil of coriander, twenty cubic centimeters (20 Cc.) [325 ♏]; oil of anise, five cubic centimeters (5 Cc.) [81 ♏]; deodorized alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix them. Keep the product in completely filled, well-stoppered bottles, in a cool and dark place"—(*U. S. P.*).

This process is essentially that of the *National Formulary* (1st ed.), which comments as follows: "The essential oils used in this preparation, particularly those of orange and lemon, must be as fresh as possible, and *absolutely free* from any terebinthinate odor or taste. They should be diluted as soon as received, with a definite quantity of deodorized alcohol, which will retard deterioration. They should not be kept in stock, undiluted, for any length of time, or should at least be kept in bottles completely filled, and in a dark place. The alcoholic solution should be kept in the same manner. If oil of Curaçao orange of good quality can be obtained, it is advisable to use this, in place of ordinary oil of orange, as it imparts to the spirit a finer flavor"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—This is a pleasant carminative and flavoring agent, used chiefly, for the latter purpose, in the preparation of the official *Aromatic Elixir* (*Elixir Aromaticum*). Dose, 1 fluid drachm, well diluted with water.

Related Preparation.—SPIRITUS CURASSAO (N. F.), *Spirit of Curaçao.* "Oil of Curaçao orange, one hundred and sixty-five cubic centimeters (165 Cc.) [5 fl℥, 278 ♏]; oil of fennel, three cubic centimeters (3 Cc.) [49 ♏]; oil of bitter almond, three-fourths of a cubic centimeter (0.75 Cc.) [12 ♏]; deodorized alcohol, eight hundred and thirty-two cubic centimeters (832 Cc.) [28 fl℥, 64 ♏]. Mix the oils with the deodorized alcohol, and keep the spirit in completely filled and well-corked bottles, and stored in a cool and dark place. *Note.*—The essential oils used in this case must be as fresh as possible, and *absolutely free* from any terebinthinate odor or taste. Oil of Curaçao orange may be obtained without difficulty in the market, but it should be carefully examined as to its quality, immediately upon receipt, and should not be kept in stock, for any length of time, without special precautions. A still finer quality of oil of orange is that derived from Citrus nobilis, which is known in the market as oil of mandarin"—(*Nat. Form.*).

SPIRITUS CAMPHORÆ (U. S. P.)—SPIRIT OF CAMPHOR.

SYNONYMS: *Tinctura camphoræ, Tincture of camphor.*

Preparation.—"Camphor, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the camphor in eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of alcohol, filter through paper, and pass enough alcohol through the filter to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*). The assay of spirit of camphor may be readily accomplished by means of the polariscope (see *Amer. Jour. Pharm.*, 1893, p. 382).

Action, Medical Uses, and Dosage.—This tincture is stimulant and antispasmodic. It is used externally as a stimulant and anodyne in *sprains, bruises, chilblains, paralysis*, and *chronic rheumatism*. Internally, it is used for various purposes, in commencing *diarrhœa*, in *flatulency, nausea, griping pains*, and wherever a stimulating or antispasmodic action is required. The dose is from 10 to 60 drops, in mucilage or syrup, or merely added to water or gruel. (For other uses, see *Camphora*.)

SPIRITUS CARDAMOMI COMPOSITUS (N. F.)—COMPOUND SPIRIT OF CARDAMOM.

Preparation.—"Oil of cardamom, two cubic centimeters (2 Cc.) [33 ♏]; oil of caraway, three-fourths cubic centimeter (0.75 Cc.) [12 ♏); oil of cinnamon, cassia, one-half cubic centimeter (0.50 Cc.) [8 ♏]; alcohol, five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]; glycerin, sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the oils in the alcohol, add the glycerin, and lastly, enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. *Note.*—This preparation is intended as a flavoring ingredient, being equivalent to the official *Tinctura Cardamomi Composita*, without the coloring matter"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—This spirit is carminative and is chiefly employed in flavoring mixtures. Dose, 1 fluid drachm, diluted.

SPIRITUS CARUI.—SPIRIT OF CARAWAY.

SYNONYMS: *Tinctura olei carui, Tincture of oil of caraway, Essence of caraway.*

Preparation.—Take of oil of caraway, 1 fluid ounce; stronger alcohol, 11 fluid ounces. Mix with agitation.

Action, Medical Uses, and Dosage.—This is aromatic, carminative, and antispasmodic. It may be used in *flatulency, nausea*, etc., and to flavor mixtures. The dose is from 20 to 60 drops, in sweetened water.

SPIRITUS CHLOROFORMI (U. S. P.)—SPIRIT OF CHLOROFORM.

SYNONYMS: *Chloric ether, Spirit of chloric ether.*

Preparation.—"Chloroform, sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏]; alcohol, nine hundred and forty cubic centimeters (940 Cc.) [31 fl℥, 377 ♏]; to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix them"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—At one time this spirit was used under the name *chloric ether*, as an anæsthetic, but as such it is not now employed. It is a good form for the internal exhibition of chloroform, and is particularly valuable in the various forms of *colic—flatulent*, *biliary*, *hepatic*, and *menstrual*—and in *visceral neuralgia* and other forms of *abdominal pain*. Dose, 10 to 40 minims, well diluted.

SPIRITUS CINNAMOMI (U. S. P.)—SPIRIT OF CINNAMON.

Synonyms: *Tinctura olei cinnamomi*, *Tincture of oil of cinnamon*, *Essence of cinnamon*.

Preparation.—"Oil of cinnamon, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; alcohol, nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏]; to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix them"—(*U. S. P.*)

Action, Medical Uses, and Dosage.—This tincture possesses the stimulant and aromatic properties of cinnamon, and may be beneficially employed in *menorrhagia* and *uterine hemorrhage*, for which a teaspoonful may be taken in a wineglass of sweetened water, every 5, 10, or 30 minutes, according to the urgency of the symptoms.

SPIRITUS FRUMENTI (U. S. P.)—WHISKEY.

"An alcoholic liquid obtained by the distillation of the mash of fermented grain (usually of mixtures of corn, wheat, and rye), and at least 2 years old"—(*U. S. P.*).

Synonym: *Whisky*.

Source and History.—According to the *Standard Dictionary* the name "*whiskey*" is derived from the Gælic *uisgebeatha*, meaning "water of life" (*uisge*, water, + *beatha*, life). Whiskey, in this country, is generally distilled from the fermented mash made from mixtures of corn, wheat, and rye. In Great Britain barley, rye, and oats are most commonly used, while in Germany potatoes are the raw materials chiefly employed. Whiskey is generally named from its source as *Rye whiskey*, *Corn whiskey*, *Potato whiskey*, and when prepared from cider, as it sometimes is, *Apple whiskey* or *Brandy*. Scotch whiskey is distilled from barley. In all cases, a certain quantity of malted barley, must be mixed with the cereals, etc., in order that their starch be converted into sugar (*maltose*) which subsequently undergoes fermentation (see *Alcohol*). Sometimes conversion of the starchy material into sugar (*dextrose*) is effected by means of diluted acids (see *Saccharum*). To obtain the whiskey from the fermented mash, distillation followed by rectification is resorted to. The result of the first distillation is called *low wines*. These are rectified by a second distillation which first yields a milky spirit containing oily matters and is called *foreshot;* the clear spirit which follows is called *high wines*. The freshly distilled product, known as *raw spirit* or *raw whiskey*, is harsh and unfit for use. It is put into casks or tanks where it is allowed to remain for at least 2 years (ageing process), when it becomes mellowed and pleasanter in flavor, certain compound-ethers being developed.

Individual cereals have distinctive volatile constituents which impart to the whiskey a peculiar flavor and odor, and an expert may readily detect these distinctive differences. A most objectionable contamination of whiskey is the *grain oil* or *fusel oil* (*amylic alcohol*), which is generated during fermentation of the mash. Its boiling point being much above that of water and of ethyl alcohol, the greater part of it remains behind if the distillation be carefully conducted. Still, traces of fusel oil are generally present in whiskey. Amylic alcohol is the substance which imparts to raw spirit its disagreeable odor. In the ageing of the spirit, fusel oil is believed to be gradually oxidized and forms valerianic ether but some contend that it is partially converted into free valerianic acid. Among other constituents present in small quantities is *œnanthylic acid;* in old whiskey both acetic and valerianic acids are present, giving to the liquid a feeble acid reaction. (For an interesting account of the manufacture of whiskey, see C. K. Gallagher, *Proc. Amer. Pharm. Assoc.*, 1883, pp. 375 and 477.)

Description and Tests.—Whiskey varies in color from pale-amber to deep-brown. When first prepared it is colorless, but upon standing in casks or tanks, it gradually assumes a brown color, which is also sometimes imparted to it by the addition of caramel. Both the odor and taste of aged whiskey is agreeable to most persons. It is officially demanded to be at least 2 years old, and to conform to the following requirements: "An amber-colored liquid, having a distinctive odor and taste, and a slightly acid reaction. Its specific gravity should not be more than 0.930, nor less than 0.917, corresponding, approximately, to an alcoholic strength of 44 to 50 per cent by weight, or 50 to 58 per cent by volume. If 100 Cc. of whiskey be very slowly evaporated in a tared capsule on a water-bath, the last portions volatilized should not have a harsh or disagreeable odor (absence of more than traces of fusel oil from grain); and the residue, when dried at 100° C. (212° F.), should not weigh more than 0.25 Gm. This residue should have no sweet or distinctly spicy taste (absence of added sugar, glycerin, or aromatic substances). It should almost completely dissolve in 10 Cc. of cold water, forming a solution which is colored not deeper than light green by a few drops of dilute ferric chloride T.S. made by mixing the latter with 10 volumes of water (absence of more than traces of oak tannin from casks). To render 100 Cc. of whiskey distinctly alkaline to litmus should not require more than 1.2 Cc. of potassium hydrate V.S. (limit of free acid)"—(*U. S. P.*). Mr. Joseph W. England (*Amer. Jour. Pharm.*, 1897, p. 584) finds that the acid standard for a good whiskey should be at least 1.4 or 1.5 Cc. of *decinormal* caustic potash solution, neutralizing 10 Cc. of whiskey, phenolphtalein being used as indicator.

Action and Medical Uses.—Locally, whiskey is applied to *wounds*, etc., for its antiseptic and stimulant effects. Internally it is employed for the purposes named under alcohol (see *Alcohol*). While less agreeable and less efficient than brandy, and differing considerably in action, even as one grade of whiskey or brandy may differ from another, it has come into almost universal employment instead of brandy on account of its inexpensiveness and comparative freedom from adulterants. It is less constipating than brandy but is more liable to offend the stomach, and to produce gastric, renal, and hepatic affections.

SPIRITUS GAULTHERIÆ (U. S. P.)—SPIRIT OF GAULTHERIA.

SYNONYM: *Essence of wintergreen.*

Preparation.—"Oil of gaultheria, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; alcohol, nine hundred and fifty cubic centimeters (950 Cc.) [32 fl℥, 59 ♏]; to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix them"—(*U. S. P.*).

Uses.—Chiefly used as a flavoring essence.

SPIRITUS GLONOINI (U. S. P.)—SPIRIT OF GLONOIN.

"An alcoholic solution of glonoin (glyceryl [or propenyl] trinitrate, or nitroglycerin; $C_3H_5[NO_3]_3=226.58$), containing 1 per cent, by weight, of the substance. Spirit of glonoin should be kept and transported in well-stoppered tin cans, and should be stored in a cool place, remote from lights or fire. Great care should be exercised in handling, packing, transporting, or storing the spirit, since a dangerous explosion may result if any considerable quantity of it be spilled and the alcohol be partly or wholly lost by evaporation" (*U. S. P.*).

SYNONYMS: *Spirit of nitroglycerin*, *Liquor trinitrini* (*Br.*), *Liquor glonoini*, *Liquor nitroglycerini*, *Solution of glonoin*, *Solution of trinitrin*, *Solution of nitroglycerin.*

Description.—"A clear, colorless liquid, possessing the odor and taste of alcohol. Caution should be exercised in tasting it, since even a small quantity of it is liable to produce a violent headache. The same effect is produced when it is freely applied to the skin. It is neutral to litmus paper. Specific gravity 0.826 to 0.832 at 15° C (59° F.). On diluting 10 Cc. of the spirit with 15 Cc. of water—both liquids, as well as the mixture, when measured, being brought to 15° C. (59° F.)—the liquid will exhibit at most a faint cloudiness, but the addition of a further portion of 5 Cc. of water should produce a white turbidity. If the specific gravity of the spirit be higher than 0.840, or if 10 Cc. of it be rendered turbid by less than 10 Cc. of water, the spirit should be rejected"—(*U.S.P.*). J. B. Nagelvoort tests a 10 per cent spirit of nitroglycerin by pouring a measured volume into excess of water, and collecting and measuring the volume of the oil after it has completely settled (*Amer. Jour. Pharm.*, 1894, p. 527). (See below.)

Nitroglycerin.—This body is variously known as *glonoin*, *glonoine*, *pyroglycerin*, *nitroglycerine*, *trinitrin*, *trinitrine*, and *propenyl* (or *glyceryl*) *trinitrate*. It was first prepared by Sobrero, of Turin, in 1847. It is a very dangerous article to prepare, and we shall not give the process. Nitroglycerin is an oily, colorless, or light-yellow fluid, having a specific gravity from 1.595 to 1.600. At —20° C. (—4° F.), it solidifies and forms long needles. Heated carefully to 160° C. (320° F.), it is decomposed, evolving red vapors, without any detonation. At about 250° C. (518° F.), it detonates violently. By placing a drop on an anvil and striking it with a hammer, it instantly detonates. When properly prepared and free from acid, it may be kept for any length of time. Sulphuric acid added to its ethereal solution, decomposes it, precipitating a large amount of sulphur. When exposed to light or a warm temperature, glonoin undergoes decomposition. It is an exceedingly dangerous substance, and may even explode spontaneously, and always by percussion, or when dropped on a moderately hot iron, although touching it with a flame does not cause its explosion. Infusioral earth, impregnated with nitroglycerin, gives it a compact form, which constitutes the well-known substance, *dynamite*. It likewise forms the basis of *glyoxylin*, *giant powder*, *dualin*, and similar blasting explosives. It was introduced as a blasting material by Alfred Nobel, a Swede, in 1862. According to this engineer, 1 volume of nitroglycerin, exploded, liberates nearly 10,400 volumes of gas, whereas but 800 volumes are liberated by a like amount of gunpowder.

Glonoin (or nitroglycerin), for medicinal purposes, is usually procured by wholesale dealers in drugs directly from the factory where it is made, in form of a 10 per cent solution in alcohol. Such a solution is non-explosive, and may be diluted, as occasion requires, to the strength of 1 per cent. It should be noted, however, that exposure to a cold atmosphere will cause some nitroglycerin to separate (see J. B. Nagelvoort, *loc. cit.*, who gives an assay method for this solution). The specific gravity of the 10 per cent solution is 0.863 at 15° C. (59° F.). Solutions of glonoin, particularly the stronger (10 per cent), should always be transported or kept in tin cans, and *never in glass* or other fragile vessels. Should the container of a solution of glonoin be broken, and the contents be soaked up by wood, or packing material, the latter may become dangerously explosive when the alcohol has evaporated. Dr. V. Coblentz recommends (*Handbook of Pharmacy*, 1895, p. 255) that, in case nitroglycerin is spilled, a solution of caustic potash or soda be poured over the spot, which causes the decomposition of nitroglycerin into its harmless constituents. Should the proportion of glonoin to porous material be not more than 70 parts of the former, and not less than 30 parts of the latter, the compound will be non-explosive (except by a detonator); and if the proportions are not more than 52 parts of the former, and not less than 48 parts of the latter, the compound can not even be detonated. But, in the presence of substances readily yielding oxygen, such as nitrates, chlorates, etc., so small a proportion as 5 per cent of glonoin will produce a dangerously explosive combination. When handling an alcoholic solution of glonoin, care should be taken that it be not brought in prolonged or extended contact with the skin, as it is readily absorbed, and will then cause its characteristic physiological effects (distressing headache, nausea, etc.). (Adapted from *Nat. Form.*, 1st ed.)

Action, Medical Uses, and Dosage.—The effects of nitroglycerin are precisely similar to those of *Amyl Nitris* (which see). Its effects, however, are less transient, but more slowly produced. In some individuals, a fraction of a drop is sufficient to cause distressing symptoms. Violent headache, with arterial throbbing, is frequently produced by a 1-drop dose of a 1 per cent solution. Ten drops have produced giddiness, weariness, violent-throbbing headache, as if the head would burst, and semi-unconsciousness. In its administration the smallest amounts must be first administered, the dose being gradually increased as indicated. Toleration sometimes becomes established, so that 8 or 10 drops may be taken at a dose. The treatment for overdoses of spiritus glonoini, or nitroglycerin, and amyl nitrite should consist in the use of such remedies as produce contraction of the blood vessels, thus raising arterial tension and diminishing the blood supply to the brain and nerve centers. Belladonna (or atropine), ergot (or sclerotinic acid), and strychnine are physiologically antagonistic. Inhalations of ammonia, ammonia internally, atropine or ether subcutaneously, recumbent posture, warmth to the body and cold to the head, sinapisms to epigastrium or to feet, may be resorted to in case of serious results from these agents. Fortunately, the effects of nitroglycerin and amyl nitrite are quite transient, and death is not likely to occur from ordinary doses, even though such doses may occasion, in susceptible individuals, alarming symptoms.

Spirit of glonoin (or nitroglycerin in pill has come to be an important remedy in troubles due to *cerebral anemia*. Thus it often proves a prompt remedy for *anemic headache*, and for cases of *sunstroke*, where there is a pale face and other evidence of anemia of the brain. In minute doses (second or third dilution of spirit of glonoin, gtts. x to xv, to water, 4 fluid ounces; teaspoonful every 2 or 3 hours it has been advised in *sunheat*, *headache*, aggravated by solar heat, *menstrual headache*, and other non-febrile, full, throbbing headaches, *flushing of the face* at the climacteric, and in *neuralgic dysmenorrhœa*. Foltz obtained good results from nitroglycerin in *tinnitus aurium*, dependent upon faulty heart-action due to organic changes in the heart. Its great reputation has been acquired in the treatment of *cardiac pain*, particularly *angina pectoris*, and for *dyspnœa* and *pseudo-angina*. In these cases, it acts similarly to amyl nitrite, and may well follow the more prompt effects of that drug to insure greater permanency of action. It is less apt than amyl nitrite to produce flushing of the face, which, as a rule, is but slight. *Cardiac neuralgia* is well treated with it. It has an important place in the treatment of *asthma*, *asphyxiation by drowning*, *carbon dioxide or other gases*, *opium poisoning*, with uræmic symptoms, *poisoning by chloroform*, *sea-sickness*, *hydrophobia*, and *tetanus*. According to A. W. Mayo Robson, it is a good remedy for *acute* and *chronic nephritis*, with great arterial tension, and a remedy to relieve *vascular tension in the aged*. It has also been advised to ward off the chill in *intermittents*, and as a remedy for *pernicious malarial disease*. Mikhalkine, of Russia, declares it one of the best of remedies for *sciatic neuralgia*. He advises the following solution: Spirit of glonoin, 5 grammes; tincture of capsicum, 7.5 grammes; peppermint-water, 15 grammes. Dose, 5 to 10 drops, 3 times a day. Nitroglycerin may be employed for the other conditions mentioned under *Amyl Nitris*. The dose of nitroglycerin ranges from $\frac{1}{200}$ to $\frac{1}{25}$ grain, in pill; of spiritus glonoini, from a fraction of a drop to 8 drops, the larger doses being employed only where toleration has become established. For angina pectoris, Murrell (*Man. of Mat. Med. and Therap.*) proposes the following formula: Nitroglycerin, $\frac{1}{100}$ grain; amyl nitrite, $\frac{1}{4}$ grain; menthol. $\frac{1}{50}$ grain; capsicum, $\frac{1}{100}$ grain, these being the proportions and amounts for a single pill, which should be coated.

Specific Indications and Uses.—Tensive spasmodic disorders of the heart, as in angina pectoris; cardiac pain; neuralgic pain, with anemia; fluttering, irregular pulse; depression; cerebral anemia; nervous spasms, with cerebral anemia; nervous headache, with pallor; dyspnœa, from cardiac hypertrophy; asthmatic breathing.

SPIRITUS JUNIPERI (U. S. P.)—SPIRIT OF JUNIPER.

Preparation.—"Oil of juniper, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; alcohol, nine hundred and fifty cubic centimeters (950 Cc.) [32 fl℥, 59 ♏]; to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix them"—(*U. S. P.*). A more agreeable spirit may be prepared if oil of juniper berries, as directed, instead of common oil of juniper, be employed. It is improved by keeping.

Action, Medical Uses, and Dosage.—Diuretic and carminative, and frequently added to diuretic medicines, to enhance their value in *ascites*. Dose, $\frac{1}{2}$ to 1 fluid drachm.

SPIRITUS JUNIPERI COMPOSITUS (U. S. P.)—COMPOUND SPIRIT OF JUNIPER.

Preparation.—"Oil of juniper, eight cubic centimeters (8 Cc.) [130 ♏]; oil of caraway, one cubic centimeter (1 Cc.) [16 ♏]; oil of fennel, one cubic centimeter

(1 Cc.) [16 ♏]; alcohol, fourteen hundred cubic centimeters (1400 Cc.) [47 fl℥, 163 ♏]; water, a sufficient quantity to make two thousand cubic centimeters (2000 Cc.) [67 fl℥, 301 ♏]. Dissolve the oils in the alcohol, and gradually add enough water to make the product measure two thousand cubic centimeters (2000 Cc.) [67 fl℥, 301 ♏]"—(*U. S. P.*). This preparation is closely related to *Holland gin*, and is designed as a substitute therefor. Age improves it, its flavor is pleasant, provided good essential oils are used, and it is more uniform in composition than ordinary gin.

Action, Medical Uses, and Dosage.—Compound spirit of juniper is carminative and diuretic, and is frequently added to diuretic mixtures to increase their efficiency in *ascites*. The dose is from 1 to 4 fluid drachms.

SPIRITUS LAVANDULÆ (U. S. P.)—SPIRIT OF LAVENDER.

Preparation.—"Oil of lavender flowers, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; deodorized alcohol, nine hundred and fifty cubic centimeters (950 Cc.) [32 fl℥, 59 ♏]; to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix them"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Spirit of lavender is a pleasant carminative and stimulant. Externally it is used as a cooling lotion in *headache* and *febrile complaints*, and as an agreeable perfume. The dose is from ½ to 1 fluid drachm, in sweetened water.

Related Preparation.—SPIRITUS OPHTHALMICUS (N. F.), *Ophthalmic spirit, Alcoholic eyewash.* "Oil of lavender, two cubic centimeters (2 Cc.) [33 ♏]; oil of rosemary, six cubic centimeters (6 Cc.) [97 ♏]; alcohol, ninety-two cubic centimeters (92 Cc.) [3 fl℥, 53 ♏]. Mix them by agitation, and, if necessary, filter the liquid through paper"—*Nat. Form.*).

SPIRITUS LIMONIS (U. S. P.)—SPIRIT OF LEMON.

SYNONYM: *Essence of lemon.*

Preparation.—"Oil of lemon, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; lemon peel, freshly grated, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; deodorized alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the oil of lemon in nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of deodorized alcohol, add the lemon peel, and macerate for 24 hours. Then filter through paper, and add, through the filter, enough deodorized alcohol to make the spirit measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Uses.—Spirit of lemon is used simply as a flavoring substance for medicinal mixtures.

SPIRITUS MENTHÆ PIPERITÆ (U. S. P.)—SPIRIT OF PEPPERMINT.

SYNONYMS: *Essence of peppermint, Tinctura olei menthæ piperitæ, Tincture of oil of peppermint.*

Preparation.—"Oil of peppermint, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; peppermint, bruised, ten grammes (10 Gm.) [154 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the oil of peppermint in nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of alcohol, add the peppermint, and macerate for 24 hours. Then filter through paper, and add, through the filter, enough alcohol to make the spirit measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*). The purpose of adding peppermint is to give the preparation a green color.

Action, Medical Uses, and Dosage.—Tincture of oil of peppermint, more commonly known as *essence of peppermint*, is carminative and antispasmodic. It may be used in *nausea, colic, flatulency, cramp*, or *griping of the bowels*, etc. The dose is from 10 to 30 drops, on sugar or in sweetened water.

SPIRITUS MENTHÆ VIRIDIS (U. S. P.)—SPIRIT OF SPEARMINT.

SYNONYMS: *Essence of spearmint, Tinctura olei menthæ viridis, Tincture of oil of spearmint.*

Preparation.—"Oil of spearmint, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; spearmint, bruised, ten grammes (10 Gm.) [154 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the oil of spearmint in nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of alcohol, add the spearmint, and macerate for 24 hours. Then filter through paper, and add, through the filter, enough alcohol to make the spirit measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This preparation is antispasmodic, carminative, and diuretic, and may be employed similarly to the essence of peppermint. Added to solution of potassium acetate it adds to the diuretic efficiency of the latter, by increasing the watery constituents of the urine, whereas the solid constituents are removed by the potassium salt. The dose is from 20 to 40 drops, on sugar or mixed with sweetened water.

SPIRITUS MYRCIÆ (U. S. P.)—SPIRIT OF MYRCIA.

SYNONYM: *Bay rum.*

Preparation.—"Oil of myrcia, sixteen cubic centimeters (16 Cc.) [260 ♏]; oil of orange-peel, one cubic centimeter (1 Cc.) [16 ♏]; oil of pimenta, one cubic centimeter (1 Cc.) [16 ♏]; alcohol, twelve hundred and twenty cubic centimeters (1220 Cc.) [41 fl℥, 121 ♏]; water, a sufficient quantity to make two thousand cubic centimeters (2000 Cc.) [67 fl℥, 301 ♏]. Mix the oils with the alcohol, and gradually add water until the solution measures two thousand cubic centimeters (2000 Cc.) [67 fl℥, 301 ♏]. Set the mixture aside, in a well-stoppered bottle, for 8 days, then filter it through paper, in a well-covered funnel"—(*U. S. P.*).

History and Description.—Bay rum as prepared in the West Indies is distilled from the fresh leaves of the *Myrcia acris*, Swartz. The best quality is produced when the leaves and the ripe berries are distilled together with a good grade of St. Croix rum by means of steam. (For an interesting article by A. H. Riise, regarding the history and manufacture of bay rum, see *Amer. Jour. Pharm.*, 1882, p. 278; also see *Oleum Myrciæ.*) But little bay rum is prepared in this country directly from the leaves, much of the spirit now employed being the substitute, the alcoholic solution of oils as directed by the *Pharmacopœia*. In the official process the water is directed to be gradually added; this is to insure against a milkiness that is apt to ensue when solutions of essential oils in alcohol are rapidly diluted with water. Treatment with paper-pulp removes such cloudiness as may remain in the liquid after unsuccessful filtration. Bay rum, as prepared by the official process, is an almost colorless or pale-yellowish liquid having a refreshing spice-like and characteristic fragrance.

Action and Medical Uses.—Bay rum is used almost exclusively as an agreeable perfume and a cooling and refreshing application to the head, in *nervous headache*, *syncope*, and various mild *nervous affections*. It also soothes *irritated* or *chafed parts*, and is extensively used by barbers to subdue any irritation which may have been produced by shaving.

SPIRITUS MYRISTICÆ (U. S. P.)—SPIRIT OF NUTMEG.

SYNONYM: *Essence of nutmeg.*

Preparation.—"Oil of nutmeg, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; alcohol, nine hundred and fifty cubic centimeters (950 Cc.) [32 fl℥, 59 ♏]; to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix them"—(*U. S. P.*).

Action, Medical Uses, and Dosage. This spirit is employed occasionally for flavoring purposes. Dose, from ½ to 1 fluid drachm.

SPIRITUS ODORATUS.—PERFUMED SPIRIT.

Synonyms: *Spiritus coloniensis*, *Aqua coloniensis*, *Alcoolatum fragrans*, *Cologne water*.

Preparation.—The formula of the *National Formulary*, which differs slightly in the proportions given by the *U. S. P.*, 1880, is as follows: "Oil of bergamot, fifteen cubic centimeters (15 Cc.) [243 ♏]; oil of lemon, eight cubic centimeters (8 Cc.) [130 ♏]; oil of rosemary, seven cubic centimeters (7 Cc.) [114 ♏]; oil of lavender flowers, four cubic centimeters (4 Cc.) [65 ♏]; oil of orange flowers, four cubic centimeters (4 Cc.) [65 ♏]; acetic ether, two cubic centimeters (2 Cc.) [33 ♏]; water, one hundred and twenty cubic centimeters (120 Cc.) [4 fl℥, 28 ♏]; alcohol, eight hundred and forty cubic centimeters (840 Cc.) [28 fl℥, 194 ♏). Dissolve the oils and the acetic ether in the alcohol, and add the water. Set the mixture aside, in a well-closed bottle, for 8 days, then filter through paper in a well-covered funnel"—(*Nat. Form.*). (For other formulæ, see *Amer. Jour. Pharm.*, 1887, p. 187, and 1888, p. 102, etc.)

Uses.—This spirit is used only as a perfume.

SPIRITUS OLEI VOLATILIS (N. F.)—SPIRIT OF VOLATILE OIL.

Preparation.—"Any spirit or alcoholic solution of a volatile oil, for which no formula is given by the *U. S. P.*, or by this *Formulary*, should be prepared in accordance with the following general formula: Any volatile oil, sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; deodorized alcohol, nine hundred and thirty-five cubic centimeters (935 Cc.) [31 fl℥, 272 ♏]. Dissolve the volatile oil in the deodorized alcohol. *Note.*—The strength of the spirit thus prepared is approximately 5 per cent, by weight, provided the specific gravity of the oil is in the neighborhood of 0.900"—(*Nat. Form.*).

SPIRITUS PHOSPHORI (U. S. P.)—SPIRIT OF PHOSPHORUS.

Synonym: *Tincture of phosphorus.*

Preparation.—"Phosphorus, one and two-tenths grammes (1.2 Gm.) [19.5 grs.]; absolute alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Weigh the phosphorus in a tared capsule containing water, then dry it carefully and quickly with blotting paper, and introduce it into a flask containing one thousand cubic centimeters (1000 Cc.) 33 fl℥, 391 ♏] of absolute alcohol. Connect the flask with an upright condenser supplied with cold water, and apply the heat of a water-bath, so that the alcohol may be kept gently boiling, until the phosphorus is dissolved. Then allow the liquid to become cold, and, if necessary, add to it enough absolute alcohol to make it measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Lastly, transfer the spirit to small, dark, amber-colored vials, which should be securely stoppered, and kept in a cool and dark place"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—(See *Phosphorus.*) This spirit furnishes a convenient method for the administration of phosphorus, about $\frac{1}{15}$ grain being contained in 1 fluid drachm. "This preparation is intended for preparing the elixir of phosphorus. It is unsuited for internal administration without corrigents. Care should be taken that it be not confounded with Thompson's solution of phosphorus (see *Liquor Phosphori*, N. F.)"—(*Nat. Form.*, 1st ed.). The dose is from 10 to 60 minims.

SPIRITUS RECTIFICATUS (BR.)—ALCOHOL (90 PER CENT).

"A liquid containing 90 parts, by volume, of ethyl hydroxide (C_2H_5OH) and 10 parts, by volume, of water, obtained by the distillation of fermented saccharine liquids"—(*Br. Pharm.*, 1898). (See *Alcohol.*)

Synonym: *Rectified spirit.*

"Alcohol (90 per cent) is only slightly stronger than the rectified spirit of the *British Pharmacopœia*, 1885, containing, by volume, 1.35 per cent, or, by weight, 1.65 per cent, more ethyl hydroxide"—(*Br. Pharm.*, 1898).

Diluted alcohol is official in the present *British Pharmacopœia*, in four grades, containing, respectively, 70, 60, 45, and 20 per cent of ethyl hydroxide, by volume. The *Spiritus Tenuior* (*Proof Spirit*) of the *British Pharmacopœia*, 1885, containing about 57 per cent of absolute alcohol, by volume, is no longer official.

SPIRITUS ROSMARINI.—SPIRIT OF ROSEMARY.

SYNONYM: *Spiritus anthos.*

Preparation.—"Take of oil of rosemary, 1 fluid ounce; rectified spirit, 49 fluid ounces. Dissolve"—(*Br. Pharm.*, 1885). The spirit of rosemary of the *British Pharmacopœia*, 1898, contains 5 times the proportion of oil of rosemary present in the spirit of rosemary of the *British Pharmacopœia*, 1885.

Action, Medical Uses, and Dosage.—This agent is an efficient nerve stimulant, and may be employed in *hysteroidal affections.* Externally, it is applied to assuage *local pains.* Dose, 1 fluid drachm.

SPIRITUS SAPONATUS (N. F.)—SPIRIT OF SOAP.

Preparation.—"Castile soap, in shavings, one hundred and seventy-five grammes (175 Gm.) [6 ozs. av., 76 grs.]; alcohol, six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Introduce the soap into a bottle, add the alcohol and two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of water, cork the bottle, and immerse it in hot water, frequently shaking. When the soap is dissolved, allow the bottle and contents to become cold, then add enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and filter. *Note.*—The *Spiritus Saponatus* of the *German Pharmacopœia*, is prepared by saponifying olive oil with potassa, and then adding alcohol and water. If time permits, the spirit ought to be set aside, in a moderately cold place, for about 12 hours, before it is filtered"—(*Nat. Form.*).

Action and Medical Uses.—This agent is employed like *Liniment of Soft Soap* (*Linimentum Saponis Mollis, U. S. P.*) in the treatment of numerous *skin affections.*

SPIRITUS SASSAFRAS.—SPIRIT OF SASSAFRAS.

SYNONYMS: *Tinctura olei sassafras, Tincture of oil of sassafras, Essence of sassafras.*

Preparation.—Take of oil of sassafras, 1 fluid ounce; stronger alcohol, 11 fluid ounces. Mix with agitation.

Action, Medical Uses, and Dosage.—This tincture is stimulant, carminative, diuretic, and alterative. Its principal use is to flavor syrups and other fluid preparations. The dose is from 10 to 30 drops on sugar, or mixed with sweetened water.

SPIRITUS SINAPIS (N. F.)—SPIRIT OF MUSTARD.

Preparation.—"Volatile oil of mustard, two grammes (2 Gm.) [31 grs.]; alcohol, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Mix them. *Note.*—This preparation is official in the *German Pharmacopœia*"—(*Nat. Form.*).

Action and Medical Uses.—This agent should never be used internally. Externally, it is a powerful rubefacient, and may be cautiously employed where a counter-irritant effect is desired.

SPIRITUS VINI GALLICI (U. S. P.)—BRANDY.

"An alcoholic liquid obtained by the distillation of the fermented, unmodified juice of fresh grapes, and at least 4 years old"—(*U. S. P.*).

SYNONYM: *Spirit of French wine.*

Source and History.—Brandy is the product obtained by distilling wine. The *U. S. P.* formerly required that French wines be used, but now admits the product of any grape wine that meets the official requirements. The greatest brandy-producing country is France, and the French brands most esteemed are known as Cognac and Armagnac, both of which are mild and agreeable in flavor. Next in order are the brandies of Bordeaux and Rochelle. Spain, Portugal, and Germany also produce considerable brandy. California and the vine-growing sections of the states now furnish large amounts of this spirit. As distilled from the wine in France it is first colorless and is known as *white brandy;* this is then put into casks made of new oak, which wood after a time imparts to the spirit a pale amber hue, when it is known as *pale brandy.* A preparation used as an addition to brandies or for making the imitation of brandy by mixing it with alcohol, is prepared in that country from the wine-lees and grape-marc, and has the name *eau de vie de marc.* It contains a large amount of odorous constituents, and when wholly or partially deprived of its alcohol constitutes commercial *oil of grapes.* California now furnishes large amounts of good brandy. The chief Ohio and Mississippi valley brandy is the *Catawba*, which, when prepared from the lees, has the Catawba wine flavor, but when prepared from the marc contains fusel oil and at first is unpleasant to the taste, but becomes mellow as it ages. All brandies are improved by age. There is marked variation in the flavor of different brandies depending upon the kind and condition of the grapes employed in making the wine, the care exercised in the preparation of it, and the age of the wine employed. The most fragrant brandy is that distilled from old wines. Compounded brandies are frequently on the market.

Description and Tests.—The *U. S. P.* demands that brandy conforms to the following description: "A pale amber-colored liquid, having a distinctive odor and taste, and a slightly acid reaction. Its specific gravity should not be more than 0.941, nor less than 0.925, corresponding, approximately, to an alcoholic strength of 39 to 47 per cent by weight or 46 to 55 per cent by volume"—(*U. S. P.*). The odor of brandy is due to certain ethers which occur in minute amounts; the chief of these are œnanthic and acetic ethers, and possibly propylic and related ethers (see enumeration of volatile constituents in *Amer. Jour. Pharm.*, 1886, p. 427). Tannin from the oak casks and altered sugar from the caramel often employed to color it are present. The odor of good brandy remains for several hours distinct in the glass from which it has been poured.

"If 100 Cc. of brandy be very slowly evaporated in a tared capsule on a water-bath, the last portions volatilized should have an agreeable odor free from harshness (absence of fusel oil from grain or potato spirit); and the residue, when dried at 100° C. (212° F.), should not weigh more than 1.5 Gm. This residue should have no sweet or distinctly spicy taste (absence of added sugar, glycerin, or aromatic substances). It should almost completely dissolve in 10 Cc. of cold water, forming a solution which is colored not deeper than light-green by a few drops of dilute ferric chloride T.S. made by mixing the latter with 10 volumes of water (absence of more than traces of oak tannin from casks). To render 100 Cc. of brandy distinctly alkaline to litmus should require not more than 1 Cc. of potassium hydrate V.S. (limit of free acid)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—The general effects of brandy are those mentioned under alcohol (see *Alcohol*). It is, however, when pure, more palatable and grateful to the stomach than other alcoholics, and is less likely to occasion renal and hepatic diseases. Mixed with milk and sweetened with sugar it is extensively used in *low forms of fever*, and in *threatened collapse* it may be injected hypodermatically. The dose of brandy is determined largely by the condition of the patient demanding it.

SPONGIA.—SPONGE.

The skeleton of *Spongia officinalis*, Linné.

Class: Poriphera. *Order:* Ceratospongia.

ILLUSTRATION: *Amer. Jour. Pharm.*, 1881, p. 182.

Source, Description, and History.—The familiar article, known as *sponge*, is the skeleton of a marine growth that was once classed as a *zoophyte*, or plant animal. It grows attached to submarine rocks, and consists of three parts the horny skeleton, the gelatinous, dark-colored, fleshy matter, called *sarcode*, and the curious and beautiful spicules, anchor-like spines of calcareous or silicious substance, which hold the fleshy mass together. The latter is transversed by a system of channels, which end in numerous surface pores, the larger ones being called *oscula*. Through these openings the sea water, from which the sponge draws its nourishment, is continually propelled by special organs of the animal. The shape of the sponge, the distribution of the oscules on the surface, the fineness of the texture, and the elasticity of the sponge, determine its quality. *Turkey* or *Mediterranean sponge*, from Smyrna, collected in the Grecian Archipelago, Syria, and the Red Sea, is the finest grade, usually cup-shaped, and the oscules are crowded near the center of the cup. The less valuable grades occur in shallow waters, while the finest kinds grow at a depth of 20 to 30 fathoms (120 to 180 feet), and are secured by divers. (For an interesting account, see *Amer. Jour. Pharm.*, 1875, p. 272, from *Scientific American*, and *ibid.*, p. 322; also 1872, p. 369.) *West India* or *Bahama sponge*, collected along the Bahama Islands, is much coarser, oblong or convex, and, according to Hyatt (1876), is distinguished as *reef* or *glove sponge*, *sheep's-wool sponge*, *abaco-velvet*, *cay-velvet*, *grass*, *hard-head*, and *yellow sponge* (see description of each, by E. M. Holmes, in *Amer. Jour. Pharm.*, 1887, pp. 258–262). Considerable sponge-fishing is also carried on along the west and south coast of Florida, where, by means of hooks attached to a long pole, the sponges are torn from the rocks on which they grow. They grow there at a depth of from 3 to 6 fathoms (18 to 36 feet), and can be plainly seen from the surface of the water when viewed through a glass plate, which forms the bottom of a wooden bucket. (For much interesting details, see W. B. Burk, *Amer. Jour. Pharm.*, 1895, pp. 21–26.)

When first taken from the sea, sponge has a fishy odor, and has to be squeezed and washed to free it from gelatinous matter, otherwise it would speedily putrefy. Sometimes it is first buried in sand for a few days to remove the gelatinous matter, and, afterward, soaked, squeezed, and washed. The sponge of commerce is soft, light, flexible, and compressible, absorbs water, and thereby swells up, burns with an animal odor, is dissolved by liquor potassæ, and is colored yellow by nitric acid. To prepare it for use, it should first be beaten and well shaken, then placed in water for 1 or 2 days, beaten again, dried, and shaken to remove sand and other foreign substances, after which it may be placed in very dilute hydrochloric or sulphuric acid, to dissolve the earthy concretions, and finally washed in several waters to free it from acid. Solution of sulphurous acid, or chlorine gas, is usually employed to *bleach* sponge. A good method is to soak the sponge for not longer than 10 minutes in a solution of potassium permanganate (2 per cent), and subsequently dipping it in a solution of oxalic acid (2 per cent), previously slightly acidulated with sulphuric acid. Several other methods are suggested (see below).

Chemical Composition.—Edward C. C. Stanford gives the following analysis of true Turkish sponge: Water, 19.4 per cent; organic matter, 69.39 per cent; ash, soluble in water, 2.21 per cent (containing iodine, 0.2 per cent); ash, insoluble in water (sand, etc.), 9 per cent (*Amer. Jour. Pharm.*, 1884, p. 584; also see Preuss, following page). The organic matter of sponge is called *spongin*. It is a nitrogenous body allied to, but different from, *sericin* (*fibroin*), which composes silk-cocoon and spider-webs. Boiling with diluted sulphuric acid produces *glycocoll* and *leucin*, while sericin yields *tyrosin* and *serin*.

Action and Uses.—Sponge, when properly prepared, is of much utility to the surgeon, on account of the facility with which it absorbs fluids, and is much used for removing blood during operations, which would otherwise interfere with their safe and rapid termination; to imbibe acrid discharges from *wounds* and *ulcers*, and to check *external hemorrhages* from small blood vessels, by pressing it upon the bleeding part. Sponges that have been used in surgical operations, or for any of the above purposes, must be thoroughly washed with boiling water before being used again, and, even then, should be subjected to antiseptic treatment. Gauze, cotton, or compressed lint are far safer than sponges for the above-named purposes. Sponge has likewise been used for dilating *sinuses*, *wounds*, etc., and producing premature delivery, by introducing a piece of sponge tent, of a conical form, into the mouth of the uterus, and allowing it to remain there for a time, and then changing it until, by its swelling and the irritation it produces, uterine contractions are caused. The same procedure is sometimes instituted for the relief of *dysmenorrhœa* (see also *Spongia Usta*). However, for the latter purpose specially constructed dilators are preferred to the sponge tent.

Related Products and Derivatives.—Spongia Usta, *Burnt sponge, Spongia tosta.* Cut the sponge in pieces, and bruise it, so as to free it from foreign matters adhering to it; burn it in a covered iron vessel, until it becomes black and friable; afterward reduce it to a very fine powder (Dunc.—*Lond.*). The burning or roasting should not be carried further than carbonization, and until a sample taken out is easily pulverizable. The yield of burnt sponge is about 50 per cent. According to Pereira, its efficacy is due to the presence of iodine and bromine compounds. Preuss obtained from sponge, by calcination, iodide of sodium, 2.14 per cent; bromide of magnesium, 0.76 per cent; carbon and silicious matter, 32.7 per cent; sodium chloride, 11.2 per cent; calcium sulphate, 16.4 per cent; calcium carbonate, 10.3 per cent; calcium phosphate, 3.5 per cent; oxide of iron, 2.87 per cent; magnesia, 0.47 per cent. Burnt sponge, if good, should evolve violet fumes (*vapor of iodine*), when treated with concentrated sulphuric acid in a flask. Said to be alterative and antiscrofulous, and has been efficient in *scrofula, bronchocele, diseases of the skin,* and *tuberculous affections* generally. Its dose is from ½ to 2 or even 3 drachms. There is no doubt of the efficacy of spongia usta in *goitre*, but since it was learned that its virtues probably depended upon the iodine it contains, the agent has been largely superseded by iodine itself. There are some, however, who contend that it will cure cases that resist the action of iodine. Homœopaths employ burnt sponge, under the name of *Spongia* or *Spongia tosta*, in *affections of the larynx*, particularly *croup, croupous cough, coughs of laryngeal phthisis, in goitre,* and many other conditions. In homœopathic pharmacy, Turkey sponge is employed and roasted brown (not burnt), and, finally, tinctured in alcohol (see *Homœopathic Pharmacopœia*, 1890). This is usually administered in the second and third attenuations. A pill, which has acquired some considerable reputation in the cure of *scrofula* and *tuberculous maladies* generally, called the *iodine pill*, and which I made known to the profession several years since, is made as follows: Take of iodine, 50 grains; sulphate of morphine, 10 grains; burnt sponge, 100 grains. Triturate these well together, and into a fine powder, and then form the mixture into a pill mass, by the addition of molasses or other compatible medium, and divide into 100 pills. To be kept in a dry place. Dose, 2 or 3 pills, daily (J. King).

Spongia Decolorata (N. F.), *Decolorized sponge, Bleached sponge.*—"Sponge, potassium permanganate, sodium hyposulphite, hydrochloric acid, water, each, a sufficient quantity. Free the sponge from sand and any other obvious impurities or damaged portions by beating, washing, and trimming; then soak it for about 15 minutes in a sufficient quantity of solution of potassium permanganate, containing fifteen grammes (15 Gm.) [231 grs.] to the liter (33 fl℥, 391 ♏), wringing the sponge out occasionally, and replacing it in the liquid. Then remove it and wash it with water, until the latter runs off colorless. Wring out the water, and then place the sponge into a solution of sodium hyposulphite, containing sixty grammes (60 Gm.) [2 ozs. av., 51 grs.] to the liter. Next add for every liter of the last-named solution used, sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏] of hydrochloric acid, diluted with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water. Macerate the sponge in the liquid for about 15 minutes, expressing it frequently and replacing it in the liquid. Then remove it, wash it thoroughly with water, and dry it. In the case of large and dark-colored sponges, this treatment may be repeated until the color has been removed as far as possible. *Note.*—If it is desired to keep the sponge soft, and to prevent it from shrinking when dry, it may be dipped, after having been finally washed, into a mixture of 1 volume of glycerin and 5 volumes of water, after which it is to be wrung out and allowed to dry"—(*Nat. Form.*).

Spongia Cerata, or Sponge Tent.—The sponge tent, made by impregnating sponge with melted wax, pressing it between two iron plates, and then forming it into size and shape required, is not resorted to as frequently as formerly, in enlarging *sinus orifices* and *canals*, particularly the os uteri.

Spongia Compressa, *Compressed sponge, Sponge tent.*—Compressed sponge may be prepared by cutting perfectly clean sponge, of best quality, while still moist, into elongated strips of desired size, and securely winding them with twine, so that, when dried, a cylindrical form is obtained. Compressed sponges, tampons, etc., may also readily be made by first moistening the sponge with water, then cut or mold it into any shape, or press it into a tube of the required diameter, and immerse it in alcohol of 95 per cent. The sponge permanently retains the shape given to it. To remove this firmness, it is only required to moisten the sponge with water. The *National Formulary* directs as follows: "Sponge, a sufficient quantity; mucilage of acacia (*U. S. P.*), 1 volume; water, 9 volumes. Mix a sufficient quantity of mucilage of acacia and of water, in the proportion of 1 volume of the former to 9 volumes of the latter, and immerse in the liquid the sponge, previously freed from sand and other obvious impurities, and cut into suitable pieces. When the sponge has been thoroughly impregnated, firmly wrap twine around it so as to bring it to the desired shape, and then dry it. *Note.*—Sponge thus prepared is best preserved with the twine wrapped around it. If the twine is removed, special care should be taken to protect the sponge against damp air"—(*Nat. Form.*).

Vegetable Sponge, Gourd Towel.—The fibrillated network of a cucurbitaceous plant, the *Luffa ægyptiaca*, Miller (*Momordica Luffa*, Linné). Used like sponge. Also *Luffa fœtida*, Cavanilles, and *Luffa Petola*, Seringe.

Antiseptic Sponge.—For information concerning antiseptic sponges, see for example, *Amer. Jour. Pharm.*, 1889, pp. 21 and 473.

STANNUM.—TIN.

SYMBOL: Sn. ATOMIC WEIGHT: 118.8.

Source and Preparation.—This metal is found in nature in the form of a dioxide (SnO_2) termed *tinstone* or *cassiterite*, and *wood tin*, or more rarely as a sulphide, mixed with iron, and called *tin pyrites*. It occurs in East India, in Saxony, and in England (Cornwall and Devonshire), Austria, Australia, and the United States. The bulk of the tin produced comes from England, but the purest is the Asiatic (*Banca tin*). When the oxide is found in loose grains, it is called *stream tin*, from which *grain tin* is obtained by smelting the oxide with charcoal in a reverberatory furnace. Another variety of the oxide, *mine tin*, when crushed, washed, roasted, and smelted with coal and limestone, yields *block tin*. *Malacca tin* occurs commercially in quadrangular pyramids with flattened bases, and *Banca tin* in wedge-shaped pieces.

Description, Tests, and Uses.—Pure tin is of a nearly silver-white color, but a freshly cut surface, when exposed to the air, soon loses its brilliant luster and becomes grayish. Tin is very malleable and may be beaten into leaves $\frac{1}{2000}$ of an inch thick (*tin-foil*). Tin is flexible, producing, when pure, a crackling noise upon being bent (*tin-cry*), due to the internal friction of its crystals. At a low temperature, tin disintegrates into small crystals. It melts at 235° C. (455° F.) and volatilizes at a white heat. When heated to whiteness with access of air, it burns with a brilliant light, tin dioxide (SnO_2) being formed. It is sparingly ductile, and has a specific gravity of 7.3. Tin is soluble in hot hydrochloric acid, forming a colorless solution of stannous chloride ($SnCl_2$); when solution of chloride of gold is added, a dark purplish precipitate, *purple of Cassius*, is formed. Tin dissolves in aqua regia with formation of stannic chloride ($SnCl_4$). Nitric acid oxidizes tin to insoluble metastannic acid ($SnO_2.H_2O$). Tin forms two lines of salts: *stannous*, derived from the stannous oxide (SnO), and *stannic salts*, derived from stannic or dioxide (SnO_2). Stannous salts form a brown precipitate with hydrogen sulphide (SnS), stannic salts a light-yellow precipitate (SnS_2); both are soluble in ammonium polysulphide with formation of ammonium sulpho-stannate ($SnS_2.S[NH_4]_2$). Impurities liable to be present in even the best grade of tin, are traces of copper, lead, or iron. The inferior grades contain arsenic, antimony, lead, zinc, bismuth, copper, iron, etc. Arsenic or antimony may be detected in Marsh's apparatus (see *Acidum Arsenosum*). These elements will mostly be given off during the solution of the metal in hydrochloric acid, as hydrides (hydrogen compounds) of arsenum and antimony; any portion which is not thus volatilized will form a blackish deposit in the liquid, and when washed, dried, and heated on charcoal before the blowpipe, arsenic will be detected by the garlic odor, and antimony by the white volatile film and metallic globules on the charcoal. Sulphur, another frequent impurity in tin, is also evolved in combination with hydrogen, as hydrogen sulphide, recognizable by its blackening a strip of paper saturated with solution of lead acetate. Copper is detected by adding to the solution of tin in hydrochloric acid, excess of ammonia water; this precipitates the stannous hydroxide while copper goes into solution and imparts to the supernatant liquor a blue color. Iron is discovered by the deep-red color with sulphocyanide of potassium, if the tin solution has been treated with aqua regia to convert the iron into chloride. If lead is present in a small quantity, it is detected by solution of sulphate of sodium, which causes an almost insoluble precipitate of sulphate of lead. If present in large quantities, chloride of lead will crystallize from solution of the impure tin in hydrochloric acid. Tin is much used in the arts, for tinning copper and iron vessels, and as a constituent of some important alloys with copper and other metals in varying proportions, *e. g.*, *bronze*, *gun-metal*, *bell-metal*, *mirror-metal*, etc. With lead it forms *solder*. In medicine tin has been used as a vermifuge, in two or three forms. Pure tin is not considered poisonous, though fats, acids, etc., which have remained for some time in tin vessels, are said to have caused colic and vomiting. The following preparations have been used.

Tin Preparations and Salts.—STANNI PULVIS, *Powder of tin*, *Granulated tin*. Prepared by triturating melted tin while it cools. The powder thus produced has been administered for the expulsion of *tape-worm* and the *lumbricoides* and has also proved beneficial in *epilepsy* produced by worms. The dose is ½ ounce, in syrup or molasses, repeated every morning before breakfast, and, after it has thus been taken for several days in succession, an active purgative should be given. *Tin filings* (*stanni limatura*) have also been used. Powder of tin should not be administered when it becomes oxidized nor when it contains other metals, notably lead. Undoubtedly tin acts both mechanically and by some inherent quality of its own. The practice, however, is a barbarous one and has justly been abandoned.

STANNI BISULPHIDUM (SnS_2), *Bisulphide of tin.*—Also known by the names of *Aurum musivum* or *Mosaic gold.* It is obtained by placing a mixture of 12 parts of tin, 7 parts of sulphur, 3 parts of mercury, and 3 parts of sal ammoniac in a black-lead crucible, which is adjusted so as to form part of a retort, and exposing the whole to a strong heat for 8 hours. A complicated reaction takes place, as the result of which the mosaic gold (SnS_2) remains. According to Pelletier it may also be prepared by heating together in a retort, a mixture of equal parts of sulphur and oxide of tin. It is in the form of light, golden-yellow scales, which are insoluble in water or alcohol, soluble in hot liquor potassæ forming a green solution of potassium stannate (K_2SnO_3) and thiostannate (K_2SnS_3). It is soluble and decomposed when boiled in nitro-hydrochloric acid, stannic chloride ($SnCl_4$) being formed, but is not acted upon by either nitric or hydrochloric acids. Its specific gravity is from 4.4 to 4.6. It forms a *bronze powder* much used in the arts, especially by the manufacturers of paper hangings. In medicine, 10 to 20 grains of the bisulphide, as a dose, mixed with honey, and repeated 2 or 3 times a day, have been used to remove *tapeworm* (P.).

STANNI BICHLORIDUM, *Chloride of tin, Stannous chloride* ($SnCl_2.2H_2O$).—Also known as *Protochloride of tin, Dichloride of tin, Salt of tin*, etc. It may be prepared by dissolving granulated tin, 1 part, in boiling hydrochloric acid (specific gravity 1.130), 4 parts, until no more action is perceptible on the metal, then evaporating the solution so that it may crystallize. The crystals have the composition $SnCl_2+2H_2O$. Their aqueous solution decomposes upon standing with formation of a white insoluble oxychloride $Sn(OH)Cl$. An excess of hydrochloric acid prevents this decomposition. Stannous chloride is a strongly reducing agent. It reduces metallic mercury from solution of mercuric chloride, as follows: $2HgCl_2+SnCl_2=2HgCl+SnCl_4$; $2HgCl+SnCl_2=2Hg+SnCl_4$. Chloride of tin has been used as a vermifuge against *tapeworm;* as an antispasmodic in *epilepsy, chorea*, and other *spasmodic diseases;* as a stimulant to paralyzed muscles in *paraplegia;* as an antidote in *poisoning by corrosive sublimate;* and as an external application in *chronic cutaneous diseases.* Internally, the dose is from $\frac{1}{16}$ grain to ½ grain, 2 or 3 times a day, in the form of pills, or taken in the spirit of hydrochloric ether. Externally, it possesses astringent, irritant, and caustic properties, and, after being absorbed, like the antimonials acts powerfully on the skin. It has been used in solution, ⅛ grain to 1 grain in a fluid ounce of distilled water. As a poison, it causes spasmodic movements of the muscles of the extremities and of the face, and sometimes paralysis; its antidotes are milk, and other albuminous substances (P.). More recently this salt has been recommended as a disinfectant in surgery.

STANNI TETRACHLORIDUM, *Tetrachloride of tin, Stannic chloride, Spiritus fumans Libavii.*—Obtained by dissolving tin in aqua regia, or by conducting chlorine gas over melted tin. A fuming liquid decomposing upon boiling. With ammonium chloride it forms a double salt, *pink salt* ($SnCl_4.2NH_4Cl$), used as a mordant in dyeing.

STAPHISAGRIA (U. S. P.)—STAPHISAGRIA.

The seed of *Delphinium Staphisagria*, Linné (*Staphisagria macrocarpa*, Spach *Nat. Ord.*—Ranunculaceæ.

COMMON NAME AND SYNONYMS: *Stavesacre; Semen staphisagriæ, Staphisagriæ semina, Staphidisagriæ, Semina pedicularis.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 4.

Botanical Source.—*Delphinium Staphisagria* is an elegant, stout, upright herb, and about the same height as the *Delphinium Consolida* (1½ to 2 feet). The stems and petioles are hispid, with long, soft hairs. The leaves are broad, palmated, petioled, and 5 to 9-cleft. The flowers are bluish-gray, in terminal, lax racemes, with hairy pedicels at least an inch long, and bracts inserted at their base. Petals 5, dirty-white, the 2 lower spatulate. Spur hardly 2 lines long. Capsules 3, large, villous, containing many globose, 3-cornered, thick, black seeds (L.).

History and Description.—The *Delphinium Staphisagria* is a native of the south of Europe, growing in waste places. The seeds are the official part. They are about the size of rye-grains, somewhat triangular, sometimes quadrangular, slightly arched, blackish-brown, and wrinkled externally, and containing a white, oily nucleus; their odor is faint, but unpleasant, and their taste acrid, bitter, pungent, and disagreeable. They yield their properties to water or alcohol (P.—T.). They are officially described as about 5 Mm. (⅕ inch) long, 3 or 4 Mm. (⅕ to ⅙ inch) broad, flattish-tetrahedral, one side convex, brown or brownish-gray, with reticulate ridges, containing a whitish, oily albumen, and a straight embryo; nearly inodorous; taste bitter and acrid"—(*U. S. P.*). The roots and flowers have also been used in medicine.

Chemical Composition.—The seeds of staphisagria contain some volatile and fatty oil, gum, etc., and several alkaloids (a total of about 1 per cent), which were discovered as early as 1819 by Brandes, and by Lassaigne and Feneulle, and given the collective name, *delphinine.* Marquis and Dragendorff (1877) isolated crystallizable *delphinine* and *delphisine*, and amorphous *delphinoidine*, all soluble in ether, and amorphous *staphisagrine*, very little soluble in ether (1 in 855). The latter base, according to Stojanow (*Amer. Jour. Pharm.*, 1890, p. 394), is a mixture of at least four alkaloids. F. B. Ahrens (*ibid.*, 1899, p. 413) obtained from the seeds a new alkaloid, *staphisagroine* ($C_{20}H_{24}NO_4$). Marquis isolated his alkaloids by extracting the bruised seeds with alcohol acidulated with tartaric acid; the alcohol is then distilled off, the residual acid-liquid shaken out with petroleum-ether, which takes up a green, fatty oil; the acid-liquid is then neutralized with sodium bicarbonate, and the solution shaken out with ether. This, upon evaporation, yields crystals of *delphinine*, mixed with *delphisine* and *delphinoidine*. From the aqueous solution which yielded these alkaloids to ether, *staphisagrin* is abstracted by means of chloroform. *Delphinine* and *delphisine* (both of the formula $C_{31}H_{49}NO_7$, Stojanow) give no color reactions with sulphuric acid, nor with Fröhde's reagent; both readily dissolve in chloroform and alcohol. *Delphinine* has an acrid and benumbing taste, and is closely related to aconitine physiologically. It is but faintly alkaline, and melts at 191° C. (375.8° F.) (Stojanow). *Delphisine* is bitter in alcoholic solution, with burning after-taste. It melts at 189° C. (390.2° F.). *Delphinoidine* is bitter, scarcely acrid, and has a narcotic action. With sulphuric acid, it produces red-brown, with Fröhde's reagent (molybdic and sulphuric acids), blood-red, turning cherry-red. It melts at 152° C. (306.6° F.). *Staphisagroine*, of Ahrens, does not give any of the above color reactions.

Fig. 234.

Delphinium Staphisagria.

Action, Medical Uses, and Dosage.—Staphisagria possesses the same properties as the *Delphinium Consolida* (see *Related Species*), but in a higher degree. In large doses, they are irritant poisons; in medicinal doses, the former is emetic, cathartic, and narcotic, but its action is too violent and uncertain for these indications. An infusion of the seeds of stavesacre may, however, be advantageously used both by the mouth and in injection, as a vermifuge. The powdered seeds, mixed with lard, have been found useful in some forms of *cutaneous disease*, and to destroy *lice* in the hair; a tincture or infusion of the bruised seeds, in vinegar, may be employed for the same object. The seeds have likewise been used in some countries to intoxicate fish.

Delphinine possesses the peculiar properties of the seed in an eminent degree. It is very poisonous, expending its force more especially upon the brain and nerves; 6 grains of it dissolved in vinegar killed a dog in 40 minutes. The symptoms are vomiting, giddiness, and convulsions. Dr. Turnbull states that pure delphinine may be given in doses of ½ grain, to the extent of 3 or 4 grains a day, without any unpleasant results. It sometimes purges, mostly promotes diuresis, and occasions feelings of heat and tingling in various parts of the body. If used at all, it should be with excessive caution. Externally, it has been successfully used in *neuralgia*, *earache*, *rheumatism*, and *paralysis*. It is applied by friction over the part in the form of ointment or alcoholic solution, in proportions varying from 10 to 30 grains of delphinine to 1 ounce of the vehicle, and the friction should be continued until some redness and burning are produced. Its local action much resembles that of veratrine. Later investigators do not seem to agree as to the action of delphinine, some contending that it acts but little on the periphereal nerves, but chiefly upon the circulation and respiration, and that in poisoning by it, artificial respiration may avert fatal effects; on the other hand, it has been contended that it acts chiefly as an analgesic, though its asphyxiating properties are admitted. Staphisagrine is less energetic than delphinine, does not induce convulsions, depress the pulse, nor affect the cerebrum, but, like the latter, it kills by asphyxiation. Undoubtedly, the action of the combined alkaloids of staphisagria closely resembles that of aconitine (Kobert).

Staphisagria is chiefly employed for its effects upon the genito-urinal apparatus of both the male and female, though its action upon the nervous system is peculiar and pronounced. The latter is best exhibited in *hysteria* and *hypochondriasis*, with depression of spirits, despondence, moroseness, and "violent outbursts of passion" (Scudder). It is a remedy for *chronic inflammation and atony of the renal and reproductive organs*, though its use is contraindicated in active inflammatory conditions. Prof. J. M. Scudder, M. D., considered staphisagria almost, if not quite, a specific in controlling *irritation of the urino-genital apparatus*, as in *prostatorrhœa*, resulting from masturbation; in *chronic irritation of the neck of the bladder*, especially when the result of *gonorrhœa* or *cold*, and associated with temporary *enlargement or irritation of the prostate;* in *chordee;* and in *gonorrhœal prostatitis*. He has also found it useful in *uterine affections*, attended with deep-seated soreness, dragging, bearing-down pain, painful or scalding micturition, and *leucorrhœa;* in *gonorrhœa*, in *amenorrhœa*, in *mental irritability and restlessness* attending painful or exhausting diseases, in *hysteria* and *hypochondria*, and in *prolapsus uteri*, where there are evidences of feeble circulation in the reproductive organs. He gave a teaspoonful, 3 or 4 times a day, of a mixture of 1 fluid drachm of specific staphisagria in 4 fluid ounces of water. Staphisagria, in therapeutical doses, appears to be a permanent stimulant, somewhat resembling nux vomica, increasing innervation, stimulating free circulation, improving the appetite and digestion, giving tone to the sexual organs, and removing morbid mental depression. I have found it decidedly useful in *chronic irritable states of the bladder* (J. King). It gives marked relief in that form of *urinal incontinence* in old men, with vesical and prostatic irritation and frequent teasing or urgent desire to micturate. *Irritability of the vesiculæ seminales and the prostatic ducts* is relieved by it. *Catarrh of the bladder* is often cured with it. In *menstrual disorders*, it is indicated when the intermenstrual periods are prolonged, and the flow continues too long when established. It lessens *sea-sickness* and the *vomiting of pregnancy*. As a rule, it is not a curative agent in *spermatorrhœa*, but does good work when the parts are irritable and the patient is nervous and anemic. Here it is contraindicated by plethora. *Facial and cervical neuralgia* are often relieved by staphisagria, and it is of some service in *ophthalmic affections*, evidenced particularly by itching and irritation. For this purpose, it has been used successfully in *ophthalmia*, *amaurosis*, and in *scrofulous affections of the eyes*, with glutinous secretions. Staphisagria may be administered when, in reading, black spots appear before the eyes (Locke). The dose of specific staphisagria (the preparation is most employed) is from 1 to 5 drops, the fractional doses being generally preferred. Delphinine may be given in doses of from $\frac{1}{60}$ to $\frac{1}{10}$ grain; tincture of staphisagria, 1 to 20 drops.

Specific Indications and Uses.—Irritation and chronic inflammatory conditions of the genito-urinal tract; painful, scalding micturition; prostatorrhœa; urinal incontinence of aged men; urethral irritation, with a sensation of incomplete urethral evacuation—a sensation as if a drop of urine were rolling along in the canal; menstrual derangements, with long intermenstrual intervals, and prolonged flow; spermatorrhœa in anemic subjects; depression of spirits; hypochondriasis; hysteria, with uterine or ovarian irritation, despondence, moroseness, and violent outbursts of passion; black specks before the eyes in reading; mental irritability and restlessness in painful and exhaustive diseases; uterine disorders, with feeble pelvic circulation, deep-seated soreness, dragging, and bearing-down pains; leucorrhœa; and painful urination. Contraindicated by active inflammation.

Related Species.—*Delphinium Consolida*, Linné, variously known as *Larkspur*, *Knight's spur*, and *Lark's claw*. Delphinium Consolida is an annual herb, with a simple, slender root, and a suberect, leafy stem, from 1½ to 2 feet high, with alternate spreading branches. Leaves sessile, in many deep divisions, which are 3-cleft, subdivided into narrow, linear, acute segments. Flowers bright-blue or purple, in terminal, lax, few-flowered racemes; bracts single or divided, longer than the pedicels. Corolla monopetalous; two spurs combined in one. Carpels solitary, smooth, follicular; seeds numerous, dark-brown or black, angular, very rough (L.). Delphinium Consolida is a native of Europe, and has become naturalized in the United States, growing in woods and fields, and flowering in June and July. The flowers of the wild plant are blue; of the cultivated, blue, red, or white. The whole plant contains an acrid principle, more abundant in the seeds. The seeds furnish considerable oil, and a blue pigment is obtained from the flowers, which is rendered permanent by alum. Diluted alcohol is its best solvent. The root, as well as the leaves (*herba*), flowers (*flores*), and seeds (*semen consolidæ*, *consolidæ regalis*, and *consolidæ calcatrippæ*), have at various times been used in medicine. As "*Delphinium*," the seeds were official in the *U. S. P.* of 1870. The seeds of the D. Consolida contain volatile oil, fixed oil, gum, resin, gallic acid, etc. (T. C. Hopkins, *Amer. Jour. Pharm.*, 1839, pp. 1–8), and an alkaloid, *calcatripine*. This resinous body, soluble in alcohol, chloroform, and ether, was isolated from the dried herb by E. Masing, in 1883. It exists in small amount (0.02 per cent), and, under the influence of chemical agents, readily decomposes. W. Wicke (*Amer. Jour. Pharm.*, 1855, p. 152), obtained *aconitic acid* ($C_6H_6O_6$) from D. Consolida. The flowers of D. Consolida are considered diuretic, emmenagogue, and vermifuge. They were formerly used as a local application to *wounds*, and the decoction was recommended as efficient in some *ophthalmic affections*. The seeds possess similar properties with those of the D. Staphisagria, but less energetic. A tincture of them has been recommended in *calculus*, as a vermifuge, and to destroy *lice* in the hair. It has also been found useful in *spasmodic asthma* and *dropsy*. It is made by adding 2 ounces of the seed to a quart of diluted alcohol, of which 10 drops may be given 3 times a day, gradually increasing the quantity until the system is influenced by it. The root possesses similar virtues, but is seldom employed. A drachm or 2 of the flowers of D. Consolida, placed in 1 pint of hot water, and slowly simmered down to ½ pint, then strained and sweetened, is said to be an excellent remedy for *cholera morbus*, to be administered in teacupful doses, at short intervals, until relief is obtained. As an antiemetic in the *vomiting of autumnal fevers* and other diseases, this plant is highly extolled, calming the stomach speedily, and giving a delightful relief; it is used in infusion, made similar to the above, by adding ½ ounce of the leaves and flowers to ½ pint of boiling water. The dose is a wineglassful, to be repeated every ½ hour or oftener, if necessary. This plant undoubtedly deserves further investigation. The seeds of the D. Consolida, in tincture, have been found to possess similar properties to the D. Staphisagria, but in a lesser degree. An infusion of the flowers has been found useful in *dysentery*.

Delphinium Ajacis, Linné, of south Europe, and the indigenous species, *Delphinium azureum*, Michaux, of central United States, and *Delphinium exaltatum*, Aiton, of the middle states, seem to possess properties similar to those of *Delphinium Consolida*.

Aquilegia vulgaris, Columbine.—A well-known perennial, native of Europe, all parts of which are medicinal. It has antiscorbutic, diuretic, and diaphoretic properties, and was formerly employed in *scurvy* and *jaundice*. It undoubtedly possesses active properties. Linnæus states that children have been killed by overdoses of the plant. According to Jorissen (*Jahresb. der Pharm.*, 1885, p. 16), the plant, upon distillation with water, yields hydrocyanic acid.

STATICE.—MARSH ROSEMARY.

The root of *Statice caroliniana*, Walter (*Statice Limonium*, Linné, var. *caroliniana*, Gray).

Nat. Ord.—Plumbaginaceæ.

COMMON NAMES: *Marsh rosemary*, *Inkroot*, *Sea-lavender.*

Botanical Source.—*Statice caroliniana* is a perennial maritime plant, indigenous, having a large, fleshy, fusiform, or branched, brownish-red root, from which arises, annually, a scape and leaves. The leaves are radical, petiolate, cuneiform, or narrow obovate, smooth, veinless, obtuse, mucronated, level and flat on the margin. The scapes are round, smooth, slightly scaly, flexuose, terminated by a panicle of numerous branches, which bear the flowers on the upper side only. Flowers pale bluish-purple, alternate, erect, mostly in pairs, but appearing singly in consequence of one expanding before the other. The peduncles are short, forked, and concealed by several sheathing scales. Calyx funnel-shaped, scarious and pink at the edge, 5-angled, the angles ciliate, ending in long acute teeth, with sometimes, not always, minute intermediate teeth. Petals 5, spatulate, obtuse, and longer than the calyx. Stamens 5, inserted in the claws of the petals; anthers heart-shaped. The ovary is superior, small, obovate, with 5 ascending styles, shorter than the stamens. Fruit an oblong, utricle, 1-seeded, and inclosed in the calyx (L.).

History and Description.—The resemblance which this plant bears to the foreign *Statice Limonium* is such as to have induced many botanists to rank it as a variety. They will be found to differ, however, in the American species having smaller flowers, and flat, somewhat wedge-shaped leaves, while the leaves of the

S. Limonium are oblong and wavy at the margins. Probably these slight differences are sufficient to require a distinct position, and the position given it by Gray (var. *caroliniana*) is sufficiently warranted to give it the name *Statice Limonium*, var. *caroliniana*. Marsh rosemary is common in the salt-marshes on the Atlantic shore of the United States, bearing flowers from August to October. The part used is the root, which is rather large and heavy, inodorous, but having a saltish, amarous, and strongly astringent taste. Alcohol or water takes up its properties, especially when hot or boiling.

Chemical Composition.—Mr. E. Parrish, who analyzed it, found it to consist of about 12 per cent of tannic acid, volatile oil, resin, gum, albumen, caoutchouc, extractive, coloring matter, woody fiber, and several salts (*Amer. Jour. Pharm.*, 1842, p. 116).

Action, Medical Uses, and Dosage.—Marsh rosemary is a strong astringent, and has long been used, in the form of infusion or decoction, as a domestic remedy in *diarrhœa, chronic dysentery*, etc. It is not indicated in the acute stages of these affections, but will be found very efficient as an astringent and tonic, after the active symptoms have subsided. It also relieves irritation of the mucous membranes. It is an efficient remedy in *atonic dyspepsia, pulmonary hemorrhage, chronic laryngitis, bronchorrhœa*, and other *catarrhal disorders*, with profuse secretion. The decoction is very useful as a gargle or wash in *ulcerations of the mouth and throat, scarlatina anginosa*, etc. Externally, the powdered root may be applied to *old ulcers*, or made into an ointment, as a soothing application for *piles*. The decoction is likewise very useful as an injection in *chronic gonorrhœa, gleet, leucorrhœa, prolapsus ani and uteri*, and in some *ophthalmic affections*. It may be used in all cases where astringents are indicated. A tincture of the fresh root (℥viii to alcohol, 98 per cent, Oj) may be given in doses of from 1 to 20 drops. The decoction (℥i to aqua Oj), in doses of from ½ to 1 fluid ounce.

Related Species.—*Statice Limonium*, Linné (see above), of Europe, is possessed of the same powers, but in a less degree. The infusion may be given in doses of from ½ to 2 fluid ounces, every 2, 3, or 4 hours.

Statice mucronata, Linné.—Morocco. Natives employ the root, called *safrifa*, as a nervine.

Statice latifolia, Smith.—Russia and Spain. Root employed in tanning leather. Has properties similar to Marsh rosemary.

Statice speciosa, Linné.—Siberia. Used like Marsh rosemary.

Statice braziliensis, Buaycura, Baycuru, Biacura, or *Guaycura*.—Brazil. Contains tannin (12.15 per cent), volatile oil (trace), acrid, sharp resin, and an alkaloid, *baycurine*, crystallizing in white, feathery needles, isolated by F. A. Dalpe, in 1884 (*Amer. Jour. Pharm.*, 1884, p. 361). Baycura is used in Brazil as an astringent and discutient for *glandular and other enlargements*.

Plumbago europæa, Leadwort, Dentellaria.—A European, herbaceous perennial, the root of which yielded Dulong an acrid, yellow, crystallizable body, *plumbagin*. The plant, and especially the root, when chewed, is extremely acrid, and acts as a decided sialagogue. *Toothache* is said to be relieved by masticating the root, and a decoction of the latter, in olive oil, has been lauded as a remedy for *scabies* and *old ulcers*. Some claim that this plant is almost inert; others that it is destructive topically, and, internally, a dangerous emetic, producing severe gastro-intestinal complications. These differences are probably due to the condition in which the plant is used. According to Sauvage-Delacroix, a young woman rubbed with the root, stated that she felt as if she had been flayed alive (Hogg).

Armeria vulgaris (*Nat. Ord.*—Plumbaginacæ), *Maiden pink*.—Europe. This is reputed a good diuretic.

STELLARIA.—CHICKWEED.

The plant *Stellaria media*, Smith (*Alsine media*, Linné).

Nat. Ord.—Caryophyllaceæ.

Common Names: *Chickweed, Star chickweed.*

Botanical Source.—This plant is the *Alsine media* of Linnæus. It is an annual or biennial weed, 6 to 15 inches in length, with prostrate, branched, brittle, round, jointed, and leafy stems, distinguished by the alternate, lateral, hairy lines, extending from joint to joint. The leaves are ovate, ovate-cordate, and glabrous; the lower on hairy petioles. Flowers small, white, in forked cymes; petals 2-parted, shorter than the calyx. Stamens varying, 3, 5, or 10 (W.—G.).

History.—This is a common plant throughout the United States, growing in fields and around dwellings, in moist, shady places, probably introduced from

Europe. It flowers from the beginning of spring to the end of autumn. The seeds are eaten by poultry and birds. The whole herb is used, when recent.

Action, Medical Uses, and Dosage.—Chickweed appears to be a cooling demulcent. I have seen the fresh leaves bruised and applied as a poultice to indolent, intractable *ulcers* on the leg, of many years' standing, with the most decided and immediately beneficial results; to be changed 2 or 3 times a day. In *acute ophthalmia*, the bruised leaves will likewise be found a valuable application. An ointment, made by bruising the recent leaves in fresh lard, may be used as a cooling application to *erysipelatous and other forms of ulceration*, as well as in many forms of *cutaneous disease* (J. King). A tincture of Stellaria media has been extolled in some quarters as a remedy for *rheumatic pains* of a fugitive and shifting character.

STICTA.—STICTA.

The lichen, *Sticta Pulmonaria*, Linné (*Lobaria Pulmonaria*, *Pulmonaria reticulata*, *Lichen pulmonarius*).

Nat. Ord.—Lichenes.

COMMON NAMES: *Lungwort lichen*, *Lungmoss*, *Tree lungwort*, *Oak lungwort*.

Botanical Source and History.—This lichen grows upon tree trunks, and is leafy, laciniated, smooth, and obtuse; green on the upper surface, pitted, and somewhat reticulated. On the under surface it is downy. The shields are mostly marginal. The whole lichen is somewhat coriaceous and cartilaginous. This lichen is found upon the trunks of large trees and upon rocks in England and in this country, especially in New England, New York, Pennsylvania, and the Carolinas, being found mostly in mountainous districts. The *Homœopathic Pharmacopœia* directs a tincture of that growing upon *Acer saccharinum*, or Sugar maple. The drug used is imported from Europe, none of consequence being collected in this country. Sticta makes a dark-brown colored tincture. According to Knop and Schnedermann (1847), the bitter principle contained in this lichen is *stictic acid*, allied to cetraric acid from Iceland moss.

Action, Medical Uses, and Dosage.—Sticta is a remedy for *pain* and *cough*. It acts upon the base of the brain and the vagus, and parts supplied by that nerve, relieving irritation. When its specific indications are followed it proves a very important remedy, and it is one that is frequently neglected. "Pain in shoulders, back of the neck, and extending to the occiput," were the indications long ago pointed out by Prof. Scudder with whom the remedy was a favorite. Atonic troubles are those in which it does the best work. With the above-named guides to its selection it will be found useful to reduce elevated temperature, due to irritation, and when pain and cough are due to irritation of the vagus they are controlled by it. "Cough, associated with pain in the shoulders or in the extrinsic respiratory muscles," is also relieved by sticta. The sticta pulse is soft but has a peculiar wiry thrill. With such a pulse it will have a good effect in disturbed heart-action. Sticta is a remedy for *rheumatism*, when in the shoulders or chest walls, or in the smaller joints, being in all cases associated with cervical and occipital pain. It is a good remedy for *muscular pain* in the regions mentioned when accompanying *catarrhal fever* and *epidemic influenza*. By far the most general employment of sticta is in *irritative coughs* whether acute or chronic. With the cough there are, besides the cervical and occipital pain, dull pains in the chest, increased upon taking a deep breath, and a sense of soreness like that from a bruise or muscular over-exertion. When such irritation and cough is present it will sometimes check *chills*, *hectic fever*, and *night-sweats* in confirmed *phthisis* (Scudder). Prof. Webster confines its action in cough to the upper tracheal region. The sticta cough is wheezing, rasping, dry, and persistent, and comes on mostly, according to Webster, during the dusty months of July and August. He finds it particularly valuable in *hay fever* and *summer influenza* with the point of irritation in the upper part of the trachea. Others have found it of special value in the irritating, persistent, and exhaustive cough of *phthisis*, *bronchitis*, *laryngitis*, and in *whooping-cough*, *croupal cough*, and *catarrhal asthma*. Ellingwood speaks of its value in sharp hacking cough, especially that occurring in the early part of the year and in wheezing, tight cough, with sharp quick pain in the respiratory tract. Sticta is also useful in chronic *nasal catarrh* with reflex irritation, and stands conspicuous as a remedy for *la grippe*, with free nasal discharge of hot, watery mucus, subsequently becoming thick, yellow, greenish, or bloody. Sticta has cured *sick headache* when the characteristic indications were present, and Dr. Scudder used it with success in *scarlet fever*, with occipital pain. The dose of specific sticta is from a fraction of a drop to 10 drops; of the powder (seldom employed), 1 to 10 grains.

Specific Indications and Uses.—"Pain in the shoulders, back of neck, and extending to the occiput." Soreness and dull pain in chest or extrinsic respiratory muscles, increasing by a deep breath; irritation of base of brain and parts supplied by the pneumogastric nerve; irritative cough; cough persistent, dry, rasping, wheezing, or short, hacking, with quick darting pains in chest-walls; rheumatism involving the muscles and smaller joints; hay-fever with headache; catarrhal disorders with frontal tension, sneezing, coryza, and conjunctivitis.

STILLINGIA (U. S. P.)—STILLINGIA.

The root of *Stillingia sylvatica*, Linné (*Sapium sylvaticum*, Torrey).

Nat. Ord.—Euphorbiaceæ.

Common Names: *Queen's delight, Queen's root, Silver leaf, Yaw root.*

Illustration: Bentley and Trimen, *Med. Plants*, 241.

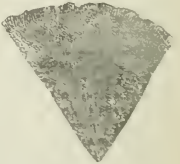
Botanical Source.—This plant was named in honor of Dr. Benjamin Stillingfleet. It is a perennial herb, with a glabrous somewhat angled stem, which, upon being broken, gives out a milky sap, and which attains the height of 2 to 4 feet. The leaves are sessile, lance-oblong, tapering at the base, serrulate, and somewhat leathery. The flowers are yellow, on a terminal spike; the male flowers with a hemispherical involucre, many-flowered or wanting, perianth tubular, erose, florets scarcely longer than the bracteal scales; stamens 2 or 3, and exserted. Female flowers with an inferior, 1-flowered calyx; style 3-cleft; capsule 3-grained (Eaton—Wi.).

Fig. 235.

Stillingia sylvatica.

History and Description.—This plant is found growing in sandy soils from Maryland to the Gulf of Mexico, and in Mississippi and Louisiana, flowering from April to July. A whitish acrid juice exudes from the plant when cut or broken. It is much more active in its recent state, than when dried, and loses much of its medicinal virtue by age. The root is the part used. As officially described, it is "about 30 Cm. (12 inches) long and nearly 5 Cm. (2 inches) thick, subcylindrical, slightly branched, compact, wrinkled, tough, grayish-brown, breaking with a fibrous fracture, showing a thick bark and porous wood, the inner bark and medullary rays having numerous yellowish-brown resin-cells; odor peculiar and unpleasant; taste bitter, acrid, and pungent"—(*U. S. P.*). Alcohol or water extracts its virtues, but its best solvent is diluted alcohol.

Fig. 236.



Section of Stillingia.

Chemical Composition.—The root of Stillingia sylvatica contains tannin (11.6 per cent), gum, starch, volatile oil (3.25 per cent) of a strong, disagreeable odor, an acrid oil soluble in ether, an acid resin, and leaves (5 per cent) of ash (see Wm. Bichy, *Amer. Jour. Pharm.*, 1885, p. 528, and J. H. Harmanson, *ibid.*, 1882, p. 386). According to Bichy, an alkaloid, *stillingine*, is present, but this is doubted by E. G. Eberhardt (Lilly's *Bulletin*, No. 17, Nov., 1891). For so-called oil of stillingia, see *Related Species and Derivatives.*)

Action, Medical Uses, and Dosage.—In large doses, stillingia vomits and purges, producing in many instances a peculiar, disagreeable burning sensation in the stomach, or some portion of the alimentary canal, accompanied with more or less prostration of the system. In less doses it is an alterative, exerting an influence over the secretory and lymphatic functions, which is unsurpassed by few, if any other of the known alteratives. It must, however, be fresh or recent material to be of any therapeutic value, and undoubtedly many of the failures to obtain good results in the use of stillingia are due to the fact that preparations from old and worthless material have been employed. It is an American remedy of much importance and value, and is extensively used in all the various forms of *primary* and *secondary syphilitic affections*, in which it appears to have a most decided action; also in *scrofulous*, *hepatic* and *cutaneous affections*, in which its administration is followed by the most successful results (J. King). In regard to its effects upon *syphilis* there appears to be much discordance of opinion among physicians, and this is probably due to the fact that in earlier years it was undoubtedly much overrated, that poor preparations have been employed and that the special conditions favoring its action have not been properly observed. When the specific indications for the drug have been followed the results have been fully as good as have been obtained from any of the antisyphilitics. The cases for its exhibition in syphilitic and other affections are these in which the tissues are feeble and are tardily removed and renewed; the mucous membranes are predominantly affected and the skin secondarily; and the mucous surfaces are tumid, red, and glistening, and secretion is scanty. With these indications it has been very successfully used in *syphilitic* and *strumous diseases*, and *chronic inflammations with low deposits*. It has been found very beneficial in *chronic laryngeal* and *bronchial affections*, and in *leucorrhœa*. Small pieces of the recent root, chewed occasionally through the day, have effectually and permanently cured *laryngitis* and *bronchitis*. In fact stillingia is one of the most important of laryngeal remedies, not only relieving irritation of that important organ, but proving beneficial in irritative disorders of the fauces, trachea, and bronchiæ. It is, therefore, an important *cough* remedy, and we have observed the irritative *winter-cough* of years' standing promptly cured with small doses of specific stillingia. A strumous diathesis adds to its adaptability to *chronic coughs*. This remedy exerts some influence upon the periosteal structures and is applicable to the periosteal pains in old cases of syphilis with tendency to periosteal destruction and the formation of nodes and exostoses, as of the tibia, head, and face. It is likewise said to favorably influence the persistent pains of *chronic periosteal rheumatism*. Stillingia is a very important remedy, and by improving the lymphatic functions aids in good blood-making and nutrition, and may be taken without harm for a continued period. It is very important, however, that the proper preparations be used. As before stated the root, when long kept, has its active properties impaired; as a rule, syrups and decoctions are of less value than the alcoholic preparations of the fresh drug, as the properties are but imperfectly extracted by water. The stronger alcoholic preparations (as a strong tincture), the fluid extract (which may be given with aromatics, as oil of anise or caraway), and especially specific stillingia, are far preferable to other forms of administration (see *Stillingia Liniment*). The oil is entirely too acrid for internal use, unless it be well incorporated with some mucilaginous or saccharine substance. But as an external stimulating application, the oil will be found very valuable in many instances. One drop of it placed upon the tongue, and repeated 3 or 4 times a day, is reputed to have proved successful in cases of severe *croup*. Stillingia liniment, both externally and internally, is an excellent remedy in various forms of croup. Dose of the tincture from ½ fluid drachm to 1 fluid drachm; of the decoction, 1 or 2 fluid ounces; of specific stillingia, 1 to 20 drops.

Specific Indications and Uses.—Feeble tissues, with tardy removal of broken-down material, and slow renewal of the parts; mucous membranes, tumid, red, and glistening, with scanty secretion; skin affections, with irritation and ichorous discharge; laryngeal irritation, with paroxysmal, hoarse, croupous cough; irritation of the superior pharynx just behind the fauces, with cough; winter-cough of irritation; periosteal pain and tendency to form nodes; an important remedy in struma and syphilitic affections.

Related Species and Derivatives.—*Stillingia sebifera*, Michaux (*Sapium sebifera*, Roxburgh; *Croton sebifera*, Linné; *Excæcaria sebifera*, Müller). A Chinese tree, also cultivated in the tropics. The seeds are imbedded in a vegetable fat known as *Chinese tallow*, which is obtained by expressing the bruised fruits previously freed from the kernels. It is solid, without odor, fuses at 44.5° C. (112° F.) and contains a small portion of stearin, but is made up mostly of palmitin. An oil is also yielded by the seeds (see *Pharm. Jour. Trans.*, Vol. XXI, 1891, p. 943).

Oil of Stillingia is a concentrated alcoholic preparation made by percolating the powdered root with full strength alcohol and evaporating the percolate to a creamy consistence. It has a dark-red color, a slight odor, the taste of the drug, and leaves an acrid sensation in the throat and fauces which is persistent in effect. This preparation is prone to gelatinize and precipitate. Often it changes to a brown mush and should then be thrown away as useless. Stillingia yields a colorless fixed oil to proper solvents, which, however, does not carry the medicinal value of the drug. (For remarks by Prof. King and Wm. Saunders concerning this and other similar preparations, see previous editions of this *Dispensatory*.)

STRAMONIUM.—STRAMONIUM.

The seeds and leaves of *Datura Stramonium*, Linné.

Nat. Ord.—Solanaceæ.

Common Names: *Thorn-apple*, *Jamestown-weed*, *Jimpson* or *Jimson-weed*, *Stinkweed*, *Apple of Peru*, etc.

Illustration: Bentley and Trimen, *Med. Plants*, 192.

Fig. 237.

Datura Stramonium.

Botanical Source.—This plant is a bushy, smooth, fetid, annual plant, 2 or 3 feet in height, and in rich soil even more. The root is rather large, of a whitish color, giving off many fibers. The stem is much branched, forked, spreading, leafy, and of a yellowish-green color. The leaves are from the forks of the stem, large, ovate, smooth, unequal at the base, variously and acutely sinuated and toothed, veiny, dark-green above, and paler beneath. The flowers are large, axillary, erect, white, and about 3 inches long. Corolla funnel-shaped, regular, angular, plaited, with 5 mucronate lobes. Calyx oblong, 5-angled, 5-toothed, dropping off from its base by a circular, horizontal incision, which remains permanently at the base of the ovary. Stamens 5; anthers erect and oblong; style filiform; stigma thick, obtuse, and bilobed. Ovary free, oval, hairy, and 4-celled. The fruit is a large, dry, prickly capsule, ovate, half 4-celled, with 4 valves, and numerous black, reniform seeds, attached to a longitudinal receptacle, which occupies the center of each cell (L.).

Datura Tatula, or *Purple stramonium*, differs from the above, in having its stem purplish, or dark-red, and with minute green punctations, and its flowers of a dull deep-purple at the angles, and purple stripes inside.

Fig. 238.

Capsule and seed of Datura Stramonium.

History and Description.—Stramonium is a well-known poisonous weed, growing in all parts of the United States, along roadsides, waste grounds, etc., and flowering from July to September. Its native country is unknown. It is found growing in Asia, Europe, Canada, Mexico, and Peru. The whole plant has an unpleasant, fetid, narcotic odor, which diminishes upon drying. Almost every part of the plant is possessed of medicinal properties, but the officinal parts are the leaves and seeds. The leaves should be gathered when the flowers are full blown, and carefully dried in the shade. They have a rank odor when fresh, especially when bruised, which is lost on drying, and a mawkish, amarous, nauseous taste. They impart their properties to water, alcohol, and the fixed oils. Water distilled from them slightly possesses their odor, but does not contain their active properties. The seeds, when bruised, emit the peculiar heavy odor of the herb. They should be gathered when ripe. Spirit, water, and fixed oils take up their active properties Stramonium leaves and seeds are thus officially described:

I. STRAMONII FOLIA (*U. S. P.*), *Stramonium leaves.*—"About 15 Cm. (6 inches) long, petiolate, dark-green, smooth, ovate, pointed, unequal, especially at the base, coarsely and sinuately toothed; thin, brittle, and nearly inodorous; taste unpleasant, bitter, and nauseous"—(*U. S. P.*). (See comparison of microscopical structure of stramonium, belladonna, and henbane leaves, by J. O. Schlotterbeck and A. Van Zwaluwenburg, in *Proc. Amer. Pharm. Assoc.*, 1897, p. 202.)

II. STRAMONII SEMEN (*U. S. P.*), *Stramonium seed.*—"About 4 Mm. ($\frac{1}{6}$ inch) long, reniform, flattened, pitted, and wrinkled; testa dull brownish-black, hard, inclosing a cylindrical, curved embryo, imbedded in a whitish, oily perisperm; of an unpleasant odor when bruised, and of an oily and bitter taste"—(*U. S. P.*).

Chemical Composition.—The seeds of Datura Stramonium contain the alkaloid *daturine*, said to be combined with malic acid (Brandes, 1821). It was first obtained pure and crystallized by Geiger and Hesse, in 1833, who also found it to occur in the leaves and the herb. It is now known to be a mixture of several alkaloids. Von Planta (1850) pronounced daturine to be identical with *atropine*, the principal belladonna alkaloid. Ladenburg (*Amer. Jour. Pharm.*, 1880, p. 368) differentiated daturine into atropine and *hyoscyamine*, the latter alkaloid predominating. E. Schmidt, however, contended that atropine predominates (*ibid.*, 1884, p. 440). It is accepted that *hyoscyamine* is the principal datura alkaloid; other alkaloidal constituents being *atropine* and *hyoscine*. (For the chemistry of these alkaloids, see *Atropina*, *Hyoscyamus*, and *Belladonna*.) The seeds of Datura Stramonium contain fatty oil (25 per cent), from which a new fatty acid, *daturic acid* ($C_{17}H_{34}O_2$), was isolated by Gérard (*Amer. Jour. Pharm.*, 1890, p. 493). It stands intermediate between palmitic and stearic acids. *Stramonin* is an indifferent, crystallizable, tasteless body, obtained from the seeds by Trommsdorff. As to the quantity of total alkaloids in various parts of the plant, Dr. A. R. L. Dohme (*ibid.*, 1893, p. 482) concludes that the stems contain more alkaloid (0.3 to 0.4 per cent, volumetrically) than even the seeds (0.25 to 0.29 per cent), and the latter more alkaloid than the leaves (0.21 to 0.23 per cent, and 0.27 per cent for green leaves), etc. Herb gathered in July and August contained more alkaloid than that collected in June (*ibid.*, 1894, p. 503, from *Proc. Amer. Pharm. Assoc.*). J. B. Nagelvoort (1897) finds the flowers of *Datura alba*, Linné, to contain a notable quantity of total alkaloids.

Action, Medical Uses, and Dosage.—In large doses, stramonium is an energetic, narcotic poison, producing dryness of the throat, thirst, nausea, giddiness, nervous agitation, dilatation of the pupil, obscurity of vision, headache, disturbance of the cerebral functions, perspiration, occasional relaxation of the bowels, and, in some cases diuresis (P.). When about to prove fatal, maniacal delirium, loss of voice, dryness of throat, etc., are usually present. In fact, the physiological action of stramonium is practically the same as that of belladonna, though it is thought to influence the sympathetic more strongly, to occasion irregular heart-action, and induce greater delirium. Full doses of it are said to increase the sexual appetite and power. Daturine, though chemically similar to atropine, produces a more profound effect, both as a mydriatic and in other ways, and is more liable to produce depression, heart failure, and unconsciousness. (For further consideration of the effects of stramonium and daturine, see *Belladonna* and *Atropinæ Sulphas*.)

Daturine is seldom employed in medicine. It is a very energetic poison, $\frac{1}{8}$ grain having killed a sparrow in 3 hours, and nearly proved fatal to a cat, when applied to the eye. Very minute quantities applied to the eye occasion protracted and excessive dilatation of the pupil. In cases of poisoning by stramonium and its alkaloid, the best mode of obtaining relief is to evacuate the stomach by emetics or the stomach-pump, after which vinegar and water may be used, with mucilaginous drinks, at a later period, and strong coffee, tea, and other stimulating drinks, if there is much prostration. The physiological antidote is opium (or morphine) its employment being guided by the degree of pupillary contraction produced. Electricity and pilocarpine may also be useful. According to Garrod, caustic alkalies, but not their carbonates, destroy the active principle of stramonium

Datura fatuosa is employed in India by a brotherhood of thieves and murderers—the *Daturiahs*, successors of the *Thugs*, or *Phansigars*, who formerly waylaid and strangled their victims. The powdered seeds are mixed with flour and given with food.

In medicinal doses, stramonium acts as an anodyne antispasmodic, without causing constipation, and will prove serviceable in cases where opium can not be given. It does not readily produce sleep, but if sleep follows, it is generally due to the alleviation of pain or nervous irritability produced by the drug. Belladonna has proved serviceable in *gastritis* and *enteritis*, and may likewise be used to allay *neuralgic pains*. It is very remarkable that a plant so closely allied to belladonna in physiological action, should be so different in some of its therapeutical effects, and particularly in regard to pain. For deep-seated pain, as of *neuralgia*, etc., it is far less effective than belladonna, but for *superficial neuralgia*, when locally applied, it is more effective than that drug. It well illustrates the fallacy of prescribing remedies for certain effects, because of known physiological action of a drug—the therapeutical effects often being widely at variance. Again, it is more effective in *mental disorders* than is belladonna. Besides, while daturine, in some respects, exceeds atropine in power, in many respects it does not in the least accomplish the therapeutical results of the latter. Stramonium, in combination with quinine, forms an invaluable preparation which has been found beneficial in *intermittent fever*, *periodic pains*, *headache*, *dysmenorrhœa*, *delirium tremens*, etc. It is said that the seeds exert an influence to prevent abortion.

While less effective than belladonna for the relief of pain, it may be employed in *neuralgic dysmenorrhœa*, with nervous irritation, *tic-douloureux*, *spasmodic intestinal pain*, *sciatica*, *rheumatism*, and *syphilitic pain*. It is a minor remedy for some forms of *epilepsy*. It has been lauded for *vertigo* and *headache*, from disordered conditions of the stomach produced by hyperacidity, and is also endorsed for *muscular tremblings* of the hands of functional or reflex origin, and associated with great restlessness. When *gastric headache* is accompanied with marked nervous erethism and unsteadiness, its action is specific.

Stramonium is a remedy of value in troubles resulting from *cerebral irritation*, in abdominal derangements, when due to irritation of the sympathetic. It has long borne a reputation as a remedy for *acute delirium*, and in *acute mania*, the patient being violent, boisterous, angry, and possessed of a destructive tendency. Such delirium may occur as a grave symptom in inflammatory and febrile diseases, particularly in *zymotic diseases*. The dose here ranges from a fraction of a drop to 4 drops of specific stramonium. In regard to its action in maniacal excitement and other nervous disorders, Dr. Scudder (*Spec. Med.*, p. 251) says: "It may be given in acute diseases when the patient is *furiously delirious;* in *delirium tremens*, when the patient is enraged and inclined to injure those present, destroy furniture, or harm himself; in *violent mania;* in *epilepsy*, associated with or followed by maniacal excitement. In chronic disease, it is enough that the patient feels inclined to violent outbursts of passion, and has difficulty in restraining himself." It is often a remedy of value in *hysterical mania*, with convulsions, and alternate laughing and weeping, and for *globus hystericus*. With these conditions, there is usually headache, flushed face, and sexual irritation (Locke). Prof. Locke speaks of it as a good remedy in some forms of *paralysis* following convulsions, strong injections, or shock, or due to suppressed eruptions. Bloating and redness of the face indicate it. For *retrocession of the eruptions* in the *exanthemata*, it is of considerable value, though less efficient than belladonna. As an antidote to the *opium habit*, stramonium may be given as follows: ℞ Specific stramonium, ℥ss; tincture of cardamom, ℥iijss. Mix. Sig. Begin with 10-drop doses and increase as may be necessary (Locke). Stramonium is indicated in *cough*, with constriction and difficult deglutition and impaired innervation. It gives temporary relief in purely *spasmodic asthma*, but usually fails when dyspnœa or asthmatic breathing are due to pulmonary or cardiac diseases. As a remedy for asthma, it was introduced into England, in 1802, by General Gent, who brought the custom from India, where the smoking of datura, under the name *gharbhah* ("forgetfulness of home"), was common. It soon became very fashionable for individuals having difficult breathing to smoke gharbhah. For spasmodic asthma, the remedy may be given internally, and the following may be smoked or burned so as to be inhaled:

R Powdered stramonium leaves, ℥i; powdered anise seeds, powdered potassium nitrate, āā ℥ss. Mix without trituration. Sig. Burn a thimbleful of this powder under a conical vessel, as a funnel, and inhale the fumes. Or equal amounts of sage and stramonium leaves may be smoked in a pipe until slight nausea is induced (Locke). It is useful in severe paroxysms of *whooping-cough*, with hemorrhage from the mouth and nose, and in *hæmoptysis*, brought on by fits of coughing, or by spasm. It is a better cough remedy than opium, as it does not arrest the secretions. Stramonium has been extolled for its effects in *milk-sickness*. In plethoric habits, and in patients with determination to the head, the larger doses of stramonium must be administered with caution, keeping the excretory organs, as the skin, kidneys, and bowels, in an active condition during its employment.

Externally, a poultice of the fresh leaves, bruised, or the dried leaves in hot water, will be found an excellent application over the bowels, in severe forms of *gastritis*, *enteritis*, *peritonitis*, *acute rheumatism*, *painful bladder affections*, *pleurisy*, etc. "I have in many instances applied the leaves to the perineum, in cases of *retention of urine* from enlarged prostate, where it was impossible to introduce a catheter, and, after having allowed them to remain for about $\frac{1}{2}$ hour, have been enabled to pass the catheter with ease and facility, and thus afford relief to the patient. I have met with similar good results in *spasmodic urethral stricture*" (J. King). It will also be found beneficial as a local medication to all species of *painful ulcers*, *acute ophthalmia*, taking care not to produce too great mydriasis, *swelled breasts*, *orchitis*, *parotitis*, and other *glandular inflammations*, *vulvar inflammation*, *inflammatory rheumatism*, and *irritable hemorrhoidal tumors*. An ointment of it is very valuable in many of the above diseases, but it should be prepared carefully without too great heat, from fresh leaves and stems, if possible. In cases where the leaves can not be obtained, a plaster of the alcoholic extract or inspissated juice may be applied over the affected parts, or the extract may be rendered thin by heating it in diluted alcohol, and then forming into a poultice with meal or moistened bread and applied. The ointment is exceedingly efficient in *cutaneous hypertrophy around the anus*, attended with great itching, and sometimes with sero-purulent secretion. Dose of the powdered leaves or seeds, from $\frac{1}{10}$ to 5 grains; of the extract, which is the best form of administration, from $\frac{1}{20}$ to 2 grains; of the tincture, for which the seeds, bruised, are preferable, from a fraction of a drop to 30 drops; specific stramonium, $\frac{1}{30}$ to 10 minims.

Specific Indications and Uses.—Delirium, furious, enraged, and destructive; continuous talking; restless, can not rest in any position, seems to be fearful; pain, especially when superficial and localized; spasm, with pain; cerebral irritation; bloating and redness of face; purely spasmodic asthma; convulsive cough.

STRONTII BROMIDUM (U. S. P.)—STRONTIUM BROMIDE.

FORMULA: $SrBr_2+6H_2O$. MOLECULAR WEIGHT: 354.58.

"Strontium bromide should be kept in glass-stoppered vials"—(*U. S. P.*).

Preparation.—Neutralize pure strontium carbonate (freed from calcium or barium) with hydrobromic acid, having always an excess of the strontium salt. Filter and evaporate the transparent solution until the salt begins to crystallize. Allow to cool, separate the crystals and dry them carefully, avoiding a high temperature lest efflorescence should occur.

Description and Tests.—This compound is official in the *U. S. P.* (1890) for the first time. As demanded by that authority it is in "colorless, transparent, hexagonal crystals, odorless, and having a bitter, saline taste. Very deliquescent"—(*U. S. P.*). Mr. Carl E. Smith (*Pharm. Review*, 1896, p. 268) points out that the salt when free from calcium, does not deliquesce, even in a humid atmosphere, although it absorbs some moisture. Hence, deliquescence is an indication of calcium being present. "Soluble in 1.05 parts of water at 15° C. (59° F.), and in 0.5 part of boiling water. It is readily soluble in alcohol, and is precipitated from this solution upon the addition of an equal volume of ether, in which it is insoluble. When heated, the crystals at first melt, and then lose all their water (30.4 per cent). The anhydrous salt fuses at 630° C. (1166° F.). To a non-luminous flame the salt communicates an intense, red color. The aqueous solution is neutral to litmus paper. With calcium sulphate T.S. the aqueous solution (1 in 20) slowly forms a white precipitate of strontium sulphate, insoluble in diluted acids; the same reaction occurs more quickly with diluted sulphuric acid, potassium sulphate T.S., and other soluble sulphates. With potassium chromate T.S. it forms a yellow precipitate of strontium chromate, soluble in acetic acid. With ammonium carbonate T.S., or sodium carbonate T.S., it forms a white precipitate of strontium carbonate, soluble, with effervescence, in acetic acid. If a few drops of chloroform be added to 5 Cc. of the solution, then 1 Cc. of chlorine water, and the mixture shaken, the liberated bromine will dissolve in the chloroform, communicating to it a yellow or brownish-yellow color. The aqueous solution (1 in 20) should not be affected by hydrogen sulphide T.S. either before or after acidulation with a drop of hydrochloric acid (absence of arsenic, lead, copper, etc.); nor by ammonium sulphide T.S. (absence of iron, aluminum, etc.). It should form no precipitate with potassium dichromate T.S. (absence of barium)"—(*U. S. P.*). Mr. Carl E. Smith (*loc. cit.*) ascertained that about 0.25 per cent of barium salt escapes notice by this test. "If a few drops of starch T.S. be mixed with 5 Cc. of the aqueous solution, and then 1 or 2 drops of chlorine water added, no blue color should appear (absence of iodine). If 0.3 Gm. of strontium bromide, rendered anhydrous by thorough drying before being weighed, be dissolved in 10 Cc. of water, and 3 drops of potassium dichromate T.S. be added, it should require not more than 24.6 Cc. of decinormal silver nitrate V.S. to produce a permanent red color (corresponding to at least 98 per cent of the pure salt)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—The action of this agent is undoubtedly largely due to the bromine it contains, and closely resembles that of the corresponding potassium salt for which it is proposed as a substitute. It is, however, less irritating to the stomach and bowels, much less liable to produce pronounced somnolence, and not so likely to provoke a rash and other effects of bromism. It has been successfully employed in *epilepsy*, in which it is better borne than the potassium salt, in gastric dilatation with gaseous accumulations, *gastric catarrh*, and the *nervous disorders of the stomach* to which the potassium compound is adapted but not well tolerated. According to Sée, it has a marked control over the amount of sugar excreted in *diabetes mellitus*, is a remedy against *lactic* and *acetic fermentations* and the gases arising from decomposition. The dose, as proposed by Sée, is from 120 to 180 grains per day. (See also *Strontii Lactas.*)

Strontium and Its Salts.—Strontium (Symbol: Sr. Atomic Weight: 87.2) is one of the rarer elements, and was first obtained by Davy, in 1808, by means of electrolysis. It received its name from having been produced from a mineral (*strontianite*) found in the neighborhood of Strontian, in Argyllshire, England. Strontium occurs in nature chiefly as strontium sulphate ($Sr.SO_4$) (*celestine*), and strontium carbonate ($SrCO_3$) (*strontianite*). Large deposits of the latter mineral are found in Westphalia, Germany, and both minerals occur in Pennsylvania and New York; celestine on Put-in-Bay Island, Lake Erie, etc. The ashes of bladder-wrack (*Fucus vesiculosus*) and the waters of some mineral springs contain it in the form of sulphate and chloride. Occasionally it is found as an accessory constituent of minerals and some soils, from which it finds its way into the sap of plants (see Prof. Trimble, on the occurrence of strontium in species of Castanopsis from Singapore, *Amer. Jour. Pharm.*, 1897, p. 296; also see L. F. Kebler and C. H. LaWall, on the presence of strontium in opium, *ibid.*, p. 244).

Strontium is a yellow metal harder than lead, malleable, and has a specific gravity of 2.5. It melts at a red heat, readily oxidizes in the air, and if heated burns with a brilliant light. The flame of strontium and that of its compounds is of a beautiful crimson hue. The nitrate is much employed in the making of *red fire* for pyrotechnic display and signal lights. Strontium readily decomposes water, and like sodium or potassium, must be kept under petroleum. Strontium has become of great technical importance also in the recovery of sugar from the molasses (see *Saccharum*). The introduction of the salts of strontium into medicine, in 1890, is due to Dr. J. V. Laborde (*Amer. Jour. Pharm.*, 1891, pp. 129 and 352), who also demonstrated the innocuousness of strontium salts, though Vulpian is said to have previously (1885) advocated their use. (For the preparation of pure strontium salts, see *Western Druggist*, 1892, p. 383).

Strontium Hydroxide ($Sr[OH]_2$).—This compound may be prepared pure, according to H. B. Dunham (1893), by the following method: Convert strontium nitrate into an oxide by heating the former for 20 minutes in a capsule by direct fire. Slake the product with an excess of water, allow the solid portion to settle, and decant the clear solution. Repeat the last part of the operation, and by this means the more easily soluble (1 in 20) barium hydroxide will be removed. To free it from calcium compounds dissolve the base in 2.4 parts of boiling water and set aside to crystallize. Transparent prismatic crystals of the composition $Sr(OH)_2 + 8H_2O$ result, soluble in 60 parts of cold water. This substance has been recommended by Dunham as a substitute for the carbonate in the preparation of the iodide, bromide, and lactate of strontium, because it is much more easily prepared pure than the carbonate.

STRONTII IODIDUM (U. S. P.)—STRONTIUM IODIDE.

FORMULA: SrI_2+6H_2O. MOLECULAR WEIGHT: 448.12.

"Strontium iodide should be kept in dark amber-colored, glass-stoppered vials"—(*U. S. P.*).

Preparation.—Strontium iodide is prepared by neutralization of freshly-made hydriodic acid with pure strontium carbonate. Filter out the excess of strontium salt, evaporate the clear solution, and allow it to crystallize by cooling. Hydroxide of strontium may be substituted for the carbonate, and it may also be used in preparing the bromide, for, according to Dunham (1893), it may be more easily obtained in a pure state than the carbonate.

Description and Tests.—This compound is also one of the new official salts, and should conform to the following requirements: "Colorless, transparent, hexagonal plates, odorless, and having a bitterish, saline taste. Deliquescent, and colored yellow by exposure to air and light. Soluble in 0.6 part of water at 15° C. (59° F.), and in 0.27 part of boiling water. Also soluble in alcohol, and slightly in ether. When cautiously heated, the crystals melt and gradually lose their water (24.05 per cent), becoming anhydrous. At a red heat, it is decomposed, losing iodine, and leaving a residue of strontium oxide. To a non-luminous flame it communicates an intense red color. The aqueous solution is neutral, or very slightly acid, to litmus paper. With calcium sulphate T.S. it slowly forms a white precipitate of strontium sulphate, insoluble in diluted acids; the same reaction occurs more quickly with diluted sulphuric acid, potassium sulphate T.S., or other soluble sulphates. With potassium chromate T.S. it forms a yellow precipitate of strontium chromate, soluble in acetic acid. With ammonium carbonate T.S. or sodium carbonate T.S., it forms a white precipitate of strontium carbonate, soluble, with effervescence, in acetic acid. If a few drops of starch T.S. be added to 5 Cc. of the solution, and then 1 Cc. of chlorine water, a bluish-black color will appear. The aqueous solution (1 in 20) should not be affected by hydrogen sulphide T.S., either before or after acidulation with a drop of hydrochloric acid (absence of arsenic, lead, copper, etc.); nor by ammonium sulphide T.S. (absence of iron, aluminum, etc.). No turbidity should be produced in the aqueous solution by potassium dichromate T.S. (absence of barium). If 0.3 Gm. of strontium iodide, rendered anhydrous by thorough drying before being weighed, be dissolved in 10 Cc. of water and 3 drops of potassium dichromate T.S. be added, it should require not more than 18 Cc. of decinormal silver nitrate V.S., to produce a permanent red color (corresponding to at least 98 per cent of the pure salt)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This salt, which contains nearly 57 per cent of iodine, has been proposed as a substitute for potassium iodide. It lacks depressing properties and does not irritate the gastro intestinal tract. The dose is from 2 to 20 grains, well diluted with water. (See also *Strontii Lactas.*)

STRONTII LACTAS (U. S. P.)—STRONTIUM LACTATE.

FORMULA: $Sr(C_3H_5O_3)_2+3H_2O$. MOLECULAR WEIGHT: 318.76.

Preparation.—Strontium lactate is prepared by dissolving carbonate of strontium in an aqueous solution of lactic acid, using heat, if necessary, to accomplish solution. Filter, and evaporate to dryness, employing a moderately low temperature. It may likewise be prepared by neutralizing lactic acid with strontium hydroxide, and evaporating the solution to dryness.

Description and Tests.—Officially described, strontium lactate is in the form of "a white, granular powder, or crystalline nodules, odorless, and having a slightly bitter, saline taste. Permanent in the air. Soluble in about 4 parts of water at 15° C. (59° F.), and in less than 0.5 part of boiling water. The solution saturated at a boiling heat remains liquid for many hours, even after being cooled to 0° C. (32° F.). Soluble in alcohol. When heated to 110° C. (230° F.), the salt loses its water (16.9 per cent). At a higher temperature, it first fuses, then is decomposed, giving off inflammable vapors, and leaves a residue of strontium carbonate and carbon, which, on the addition of hydrochloric acid, effervesces and communicates an intense, red color to a non-luminous flame. The aqueous solution (1 in 20) is slightly acid to litmus paper. With calcium sulphate T.S., the solution slowly forms a white precipitate of strontium sulphate, insoluble in diluted acids. The same reaction occurs more quickly with diluted sulphuric acid, potassium sulphate T.S., or other soluble sulphates. With potassium chromate T.S., it forms a yellow precipitate of strontium chromate, soluble in acetic acid. With ammonium carbonate T.S., or sodium carbonate T.S., it forms a white precipitate of strontium carbonate, soluble, with effervescence, in acetic acid. If to 5 Cc. of the solution (1 in 20) 1 Cc. of sulphuric acid be added, then 1 Cc. of decinormal permanganate V.S., the red color will rapidly disappear, while the mixture will effervesce and give off the odor of aldehyde. If 1 Gm. of the salt be dissolved in 19 Cc. of water, it should form a perfectly clear, colorless solution, leaving no insoluble residue (absence of carbonate, oxalate, etc.). The aqueous solution should not be affected by hydrogen sulphide T.S., either before or after acidulation with a drop of hydrochloric acid (absence of arsenic, lead, etc.); nor by ammonium sulphide T.S. (absence of iron, aluminum, etc.). No turbidity should be produced in the solution by potassium dichromate T.S. (absence of barium)"—(*U. S. P.*). (Regarding the sensitiveness of this test, see under *Strontii Bromidum*.) "If 0.5 Cc. of silver nitrate T.S. be added to 5 Cc. of the aqueous solution (1 in 20), not more than a slight opalescence should be perceptible (limit of chloride, etc.). If 0.5 Gm. of the salt be placed upon a watch-glass, and 1 Cc. of sulphuric acid be carefully poured upon it, no effervescence should occur (absence of carbonate, oxalate, etc.); nor should any penetrating odor be perceptible, even after gentle heating (absence of butyrate, propionate, etc.); nor should the acid assume, within 10 minutes, a deeper color than a pale straw-yellow (limit of readily carbonizable, organic impurities). If 1.33 Gm. of the salt, rendered anhydrous, before being weighed, by careful drying at 110° C. (230° F.), be ignited, until most of the carbon has diappeared, and then dissolved in 10 Cc. of water, it should require, for complete neutralization, not less than 9.9 Cc. of normal sulphuric acid (corresponding to at least 98.6 per cent of the pure salt), methyl orange being used as indicator"—(*U. S. P.*). Prof. Charles O. Curtman (*Pharm. Rundschau*, 1893, p. 32) found commercial specimens to be mostly or almost nearly anhydrous.

Action, Medical Uses, and Dosage.—Dr. J. V. Laborde (Chief of the Physiological Laboratory of the Faculty of Medicine of Paris), in 1890, was the first to demonstrate the harmlessness of the salts of strontium. Besides this, he observed that assimilation and nutrition were promoted by them, and that obstinate and painful *dyspepsia* was relieved by their use. Germain Sée confirmed the claims of Laborde, and regarded the pure salts as preferable to the alkaline carbonates in gastric disorders. The lactate of strontium, particularly, bids fair to become a valuable remedy in disorders of the assimilative and nutritive functions. Already good results have been obtained from its exhibition in *gastric debility*, *indigestion*, and *general depravity of the nutritive processes*. In *chronic kidney affections*, it seems to have produced remarkable results. Laborde regarded it, as well as the other salts of strontium, as diuretic, but in the case of the lactate such a property is denied by Constantin Paul. However, most clinicians agree that it favorably influences various forms of *nephritis* and *albuminuria*, diminishing the amount of albumin excreted, though diuresis be not necessarily increased. This is thought to be due to the conjoint action upon the digestive tract, and to a special action upon the renal tissues. The parenchymatous and epithelial varieties of nephritis are best treated with it, according to Paul, who states that even intense fever does not prevent its beneficial action. It is thought to be particularly indicated in the *parenchymatous nephritis of rheumatic and gouty individuals*, and the *albuminuria* preceding and following child-birth. Not only is the amount of albumen lessened or checked, but the general health of the patient becomes markedly improved. In some cases, the albumen reappears in the urine if the salt be withdrawn, and will disappear again upon resumption of the treatment. It has been suggested in the *post-scarlatinal* or *glomerular form of nephritis*. The interstitial variety of *nephritis* receives the least benefit from its use. As the elimination of nitrogenous material and diminution of the urates take place when this salt is administered, it is asserted to have proved useful in *gout* and *rheumatism*. It is also said to be a cardiac sedative and to have a good influence in *disease of the heart-muscle* and *valves*. In regard to dosage, there is some discordance, See maintaining that the dose should be from 120 to 160 grains a day, while Malbec puts the daily quantity at 30 to 150 grains. Probably the best method is to administer from 10 to 20 grains of the salt every 3 or 4 hours.

STROPHANTHUS (U. S. P.)—STROPHANTHUS.

"The seed of *Strophanthus hispidus*, De Candolle, deprived of its long awn"—(*U. S. P.*).

Nat. Ord.—Apocynaceæ.

ILLUSTRATION: Köhler's *Medizinal Pflanzen*.

Botanical Source and History.—The genus Strophanthus which produces this drug, is chiefly of African origin, and consists, at present, of more than 25 species. (Regarding the geographical distribution of the various species in Africa, see E. M. Holmes, *Pharm. Jour. Trans.*, Vol. XXIII, 1892–93, pp. 868 and 927.) Plants of this genus have usually woody stems, emitting a milky juice when wounded, and are generally twining vines, which climb the highest trees. The seed of commerce is probably collected from various species indiscriminately, which have been classified and differentiated by Pax, Planchon, Hartwich, Holmes, Blondel, and others. The medicinally valuable strophanthus seeds are yielded chiefly by two species—*S. hispidus* and *S. Kombé*. Both are official in the *German Pharmacopœia*, only the former in the *U. S. P.*, and the latter in the *Br. Pharm.*

Strophanthus hispidus, De Candolle, was one of four species described by De Candolle as early as 1802, and is the species to which this drug was first ascribed. Its habitat is Senegambia and Guinea, and other parts of western Africa. The stem is a twining, milky shrub, with opposite hirsute leaves (hence the name *hispidus*, Latin for bristly, hairy). The flowers are borne in terminal, many-flowered, dense cymes. The calyx consists of 5 hairy, green sepals about the length of the corolla tube. The corolla is white, with a short, funnel-shaped tube, yellowish within, and furnished with 10 small, nectariferous glands. The segments of the corolla are very long, tapering, slender, hairy without, having a length sometimes of 8 inches, and are the conspicuous part of the flower, giving the plant its generic name (from *strophos*, Greek for twisted cord). The stamens are 5, with sagittate anthers and slender filaments. The pistil consists of 2 distinct carpels, each of which, if fertilized, ripens into a long pod, filled with numerous seed. The seed, each bearing a slender style, terminating in a plumose pappus, consisting of long, fine hairs, is the part used in medicine, after being deprived of their awns.

Strophanthus Kombé, Oliver, is a similar plant, native, however, of eastern Africa, and was differentiated from *S. hispidus* by Oliver, in 1885. It has the same hirsute leaves, but they are more coriaceous. The sepals are shorter than the corolla tube, and cymes are fewer flowered than the *S. hispidus*. Some botanists contend that *S. Kombé* is merely a variety of *S. hispidus*.

Although, as before stated, the genus Strophanthus was established as far back as the year 1802, it was not until the early 60's that the drug came to the general notice of Europeans as being one of the several arrow-poisons (*e. g.*, *inée* or *onaye*, in Senegambia, from *S. hispidus*, and *S. Kombé*, on the east coast, from *S. Kombé*) used among the African native tribes. (Regarding details on arrow-poisons, see article on Strophanthus, by J. U. Lloyd, in *Western Druggist*, 1897, p. 403, from which most of the subject herein presented is derived.) In this connection, the following observation, regarding arrow-poisons among the American Indians, may be of interest: "In some of my western work I have found among the Indians that the poisoning of their arrows, while mixed up a great deal with useless ceremonials, and often, no doubt, nearly useless plant extracts, has a basis in some sort of poison, probably ptomaine, or something of that character, derived from rotten meat. This was the case among the Klamath and Modoc Indians" (Frederick V. Coville, botanist to United States Government, in a private letter to Prof. Lloyd).

The powerful cardiac properties of the drug were recognized by Sharpey (1862), Pelikan (1865), Fraser (1871), but not until about 1885 did strophanthus gain a foothold in medical practice. As the demand for strophanthus began to increase, substitution by allied, though often inert, species became frequent. It was, therefore, recommended that the seeds be purchased in the follicles, and that chemical tests for the active principle, *strophanthin*, be applied to the seeds (see *Chemical Composition*). (Regarding substitution of the seeds by *Kickxia Africana*, Bentham, see E. M. Holmes, *Pharm, Jour. Trans.*, Vol. XVII, 1886–87, p. 903; and P. Siedler, *Ber. d. Deutsch. Pharm. Ges.*, 1898, pp. 222–228.)

Description.—The *U. S. P.* describes strophanthus thus: "About 15 Mm. ($\frac{3}{5}$ inch) long and 4 or 5 Mm. ($\frac{1}{6}$ to $\frac{1}{5}$ inch) broad, oblong-lanceolate, flattened and obtusely edged, grayish-green, covered with appressed, silky hairs, one side with a ridge extending into the attenuated, pointed end; kernel white and oily, consisting of a straight embryo, having 2 thin cotyledons, and surrounded by a thin layer of perisperm, nearly inodorous; taste very bitter. A decoction, prepared with 1 part of the seed and 10 parts of water, has a brownish color, and is not changed in appearance on the addition of iodine T.S., ferric chloride T.S., or potassium mercuric iodide T.S."—(*U. S. P.*).

Chemical Composition.—In 1877, the name *strophanthin* was given by Hardy and Gallois (*Jour. Pharm. Chim.*, Vol. XXV, p. 177) to a crystalline but non-glucosidal substance obtained from the seed of *Strophanthus hispidus* by extracting the latter with alcohol acidulated with hydrochloric acid. Thus it might have been strophanthidin (see below), but it is described as being soluble in cold, more soluble in warm water. Prof. T. R. Fraser, of Edinburgh, isolated from the same source amorphous, glucosidal *strophanthin* capable of being hydrolyzed with diluted acids (slowly in the cold, more rapidly by heat) into sugar and *strophanthidin*, a crystallizable body (*Pharm. Jour. Trans.*, Vol. XX, 1889–90, pp. 328–335). In addition to strophanthin, Prof. H. Thoms (*Berichte der Deutsch. Chem. Ges.*, 1898, p. 271) found the seeds of this species to contain the bases *choline* and *trigonelline*, the latter being the characteristic alkaloid of fenugreek. An alkaloid (*ineïne*) was previously indicated by Hardy and Gallois (*loc. cit.*) in the awns of the seeds; the observation could not be subsequently verified. As to the seeds of *Strophanthus Kombé*, Catillon (1880) affirmed the existence of two glucosids, one being *strophanthin*, the other nitrogen-bearing and splitting with acids into sugar and a distinct alkaloid. Arnaud in 1888 gave strophanthin from Kombé seeds the formula $C_{31}H_{48}O_{12}$, and concludes that it is *methyl-ouabain* (see *Related Principles*, p. 1849).

Strophanthin of Fraser, is a very bitter, amorphous, nitrogen-free glucosid, freely soluble in water and alcohol, insoluble in pure ether or chloroform (A.W. Gerrard, 1887). It is also insoluble in a concentrated solution of ammonium sulphate (H. Thoms, 1898). Strophanthin produces with concentrated sulphuric acid a bright-green color which is permanent for some time. The seeds containing strophanthin (occurring in the endosperm and sometimes also in the cotyledons) give the same reaction, hence may be readily distinguished from seeds devoid of this active principle (see *e. g.*, Hartwich, *Archiv der Pharm.*, 1892, p. 411). *Strophanthidin* is crystallizable, insoluble in ether, "very slightly soluble in cold water" (Fraser), soluble in alcohol, moderately soluble in chloroform and amyl alcohol. According to F. Feist (*Berichte der Deutsch. Chem. Ges.*, 1898, p. 534), it yields by oxidation, among other products, benzoic acid. It is stated that strophanthin from *S. hispidus* is amorphous, that from *S. Kombé* crystallizable.

Kombic acid is a peculiar acid obtained by Fraser from Kombe seeds. Its aqueous solution is precipitated by lead acetate. To assay tincture of strophanthus for strophanthin, Mr. Barclay proposes to convert this active principle by hydrolysis into the more positive *strophanthidin*. (See two interesting papers on this subject in *Pharm. Jour. Trans.*, Vol. III, 1896, p. 463, and Vol. VII, 1898, p. 655.)

Action, Medical Uses, and Dosage.—Externally applied, strophanthus preparations appear to exert no special effects unless applied with hydrous wool fat, when the effects of the drug are said to be apparent. The seeds, however, applied to the cornea produce prolonged anæsthesia (Steinbach). Three or 4 drops of a solution of strophanthin (1 in 1000) applied to the cornea also produce total anæsthesia, including sensibility to heat and cold (difference from cocaine), these sensations being the last to yield and the first to revive after its application. A disagreeable irritation of the conjunctiva has been produced by this use of strophanthin; it has no effect on intraocular pressure or upon vision-accommodation. Strophanthus is a muscle poison. When taken internally its action is primarily upon the voluntary muscles, increasing their contractility, and if the dose be poisonous it causes tetanic paralysis, the muscles being unable to regain their former normal flexibility. Under its toxic influence the muscles first become enfeebled, then somewhat rigid, fibrillary twitchings, which are spontaneous, non-rhythmical and increasing contractions, somewhat similar to those of chorea, are observed, and finally the muscles become pallid, non-contractile and hard. It is these effects that render strophanthus an efficient arrow-poison, the muscular paralysis produced rendering the animal an easy prey to its pursuer. When the muscles are in extreme paralysis lactic acid has been observed to replace the normal alkaline condition. Strophanthus muscular paralysis consists chiefly in diminishing the ability of the muscles to relax, and then in destroying this capability, producing a condition difficult to distinguish from *rigor mortis*.

Strophanthus does not appear to affect either the spinal cord or to act upon its nerve trunks. Its specific action upon the heart is due to direct contact (through the blood) with the muscular fibres of that organ and not to any effect upon the cardiac nerves. A large dose so increases contractility that a more perfect, energetic, and prolonged systole is the result, and the capability of the muscle to relax is lost, or so diminished that diastole can not take place; after death the ventricle is so completely contracted as to almost efface the cavity, the heart passing from life directly into *rigor mortis*. According to some it may cease either in systole or diastole. The caliber of the blood vessels is but little influenced by strophanthus; it is strongly diuretic in so far as lack of secretion depends upon low blood pressure, *i. e.*, it increases diuresis in so far as increased blood pressure produces an increased urinary product. It is also thought by some to act specially upon the renal secreting structures. When one is in good physiological condition it is said to have little or no diuretic action; but in diseased conditions, with low blood pressure, it is asserted to excel digitalis in diuretic power.

If strophanthus be given in large doses it produces gastro-intestinal irritation with vomiting and diarrhœa. Small doses, however, act as a bitter tonic, improve the appetite, augment gastric action, and promote digestion. In proper doses it strengthens the heart-muscle, slows cardiac action, increases the interval between beats, reduces the pulse-rate, and powerfully increases arterial tension, not by any effect (to any extent at least) upon the vessels, but by strengthening the heart-muscle, giving increased power. Whether or not the drug is cumulative is still an unsettled question, though it probably is not cumulative unless given too freely in over-lapping doses. The action of strophanthus upon the heart is probably greater than that of any other drug, and its active principle is of far greater potency than the digitalis derivatives.

Strophanthus is a remedy for *weak heart* from debility of the cardiac muscle, with lack of proper contractile power, as shown by a rapid, weak pulse, and very low blood pressure. The disordered action of the heart is due to lack of tonicity and not from weak walls due to depositions of fat, in which case the drug must be used with extreme circumspection, though in small doses it has been recommended by some as a remedy for *cardiac fatty degeneration*, as it has also in *atheroma of the arteries* in the aged. It is a remedy for *præcordial pain* and for *cardiac dyspnœa*. It has been strongly endorsed in heart affections with *disorders of compensation*. Strophanthus is a remedy for valvular heart disease only so far as there is *muscular insufficiency*, where the compensatory increase of muscular action is not sufficient to offset the valvular insufficiency. "It has been reported useful in cases of *mitral regurgitation with dilatation; mitral stenosis with regurgitation; regurgitation with œdema*, *anasarca*, *dyspnœa*, etc.; *mitral insufficiency with palpitation*, *præcordial pain*, *cyanosis*, *dyspnœa*, etc." (*Annual of Eclectic Med. and Surg.*, Vol. I, 1890, p. 25). Dr. S. Schiller (*ibid.*, p. 40), a keen observer, says: "When the balance in the circulation has become impaired, as a result of insufficiency of the valves of the heart from organic disease with a general dropsical condition, strophanthus, although affording temporary relief in some cases, has failed in every case in my hands to reestablish the compensation. The result was the same whether the mitral, the tricuspid, or the semilunar valves were most involved. These are the cases of heart disease in which digitalis is *the* remedy. However, evidence is strong to show that when the muscular insufficiency can be corrected in these cases then the remedy will do good service. Dr. Schiller looks upon the drug as a remedy for what is ordinarily termed *functional heart disease*, when not sympathetic. The heart-action is rapid or abnormally slow, or the rhythm is bad, a condition common in school children at puberty when forced to overstudy. Strophanthus is well endorsed as a remedy for the *irritable heart* of tobacco smokers, masturbators, and those addicted to the use of alcoholics and narcotics.

Acute endocarditis and the *reflex palpitation* of neurasthenic, hysterical, and chlorotic subjects have been signally benefited by strophanthus, while it appears to give better cardiac power during or after *typhoid* and other *adynamic fevers*, when heart failure threatens. It should be remembered as a remedy for *threatened cardiac failure* in any disease. Full doses should be given for the relief of *angina pectoris*, and the remedy should be continued for a period after the attack. It is less efficient, because slower in action, than amyl nitrite or nitroglycerin, but may be given for more permanent effects after the evanescent action of these agents has passed off. In *pulmonary congestion* and in *acute bronchitis* or *acute pneumonia* it may be employed when there is deficient heart-action.

Strophanthus has been praised for prompt results in *cardiac asthma* and *bronchial asthma*, with œdema; in *whooping-cough* it has many advocates; it assists the action of iron salts in *pernicious anemia* and is credited with the cure of *traumatic tetanus*. *Goitre* is asserted to have been cured with it, and large doses (8 to 25 drops several times a day) have been said to cure a large proportion of cases of *exophthalmic goitre*, with irregular cardiac action. Dr. S. Schiller reports great relief to the heart symptoms in two cases of exophthalmic goitre, with disappearance of the bronchocele in one case (*Annual of Eclectic Med. and Surg.*, Vol. I, p. 40). Strophanthus has also been lauded as a remedy for *chronic nephritis*, with *albuminuria*, in *anasarca*, and in *ascites* from hepatic cirrhosis. It is of little value in œdema and other forms of dropsy or kidney affections unless dependent upon cardiac disorders. Dr. W. E. Bloyer (*Ec. Med. Jour.*, 1897, p. 51) reports a case of anasarca in which 5-drop doses, every 2 hours, produced an enormous flow of urine and thin alvine discharges, completely draining the tissues in less than 12 hours. Finally, strophanthus is given credit for the cure of a large number of cases of *Asiatic cholera*, and it has been asserted useful in *urticaria* and *psoriasis*.

This agent does not take the place of digitalis, each having its own field of action. It may, however, follow the use of other heart tonics, and particularly those evanescent in action, as amyl nitrite and nitroglycerin. As it does not affect the caliber of the vessels it may be used in preference to digitalis when it is not desirable to add extra work to the heart. It is well borne by the aged and by children. Wilcox (see *Ec. Med. Jour.*, 1897, p. 394) sums up the advantages of strophanthus over digitalis as follows: "Greater rapidity, modifying pulse-rate within an hour; absence of vaso-constrictor effects; greater diuretic power; no disturbance of digestion; absence of cumulation; greater value in children; great safety in the aged." He further summarizes its uses as follows: "All cases in which we wish to establish compensation; all cases of arterial degeneration in which a remedy which causes more energetic cardiac contraction is required; all cases of cardiac disease where diuresis is necessary; all cases of weak or irritable hearts; all cases of cardiac disease in childhood or old age." These we would qualify by adding *when the heart-muscle is at fault*.

Strophanthus should be avoided or very cautiously used in advanced muscular degeneration, in pronounced mechanical defects of the heart, and in fully and over-compensated hearts. There is great variation in strength in various batches of tincture of strophanthus owing to lack of uniformity in the crude drug employed. The dose of tincture of strophanthus is from 1 to 10 drops; of specific strophanthus, $\frac{1}{2}$ to 10 minims; of strophanthin, $\frac{1}{500}$ to $\frac{1}{60}$ grain. All of which should be cautiously administered.

Specific Indications and Uses.—Weak heart, due to muscular debility; muscular insufficiency; rapid pulse, with low blood pressure; cardiac pain, with dyspnœa.

Related Principles and Preparations.—UKAMBIN. If not identical with Kombe arrow poison, this substance is at least closely related. The active crystalline principle belongs to the digitalis group, and produces death by arresting cardiac action.

Exuja or Echugin.—Said to be derived from *Adenium Boehmianum* (*Nat. Ord.* Leguminosæ), and employed as an arrow-poison by southwest African Ovambos. Its active principles were found to be a glucosid whose physiological effects were much like those produced by strophanthin, and a resinous substance (*echugon*). The glucosid *echugin* ($C_5H_8O_2$) forms small, satiny, colorless plates insoluble in ether but easily dissolved by water and alcohol. It constitutes about 10 per cent of exuja, which is an odorless, very bitter, blackish-brown crumbly mass.

Hippo and Vakamba.—The Sakayes and Somangs of Africa employ these two arrow-poisons. They induce emesis and tetanic convulsions and paralyze both heart and lungs simultaneously. The action of vakamba, however, is less tetanic, though the effects upon the muscle are observed sooner than with hippo (Laborde).

Ouabaio.—A poison said to be derived from *Carissa Schimperi*, A. De Candolle (*Acokanthera Schimperi* [DeC.], Bentham and Hooker; *A. Ouabaio*, Cathelineau). Arnaud (1888) obtained therefrom an active principle *ouabain* ($C_{30}H_{46}O_{12}$) a very poisonous, amorphous glucosid which he also obtained from *Strophanthus glaber* to the extent of nearly 5 per cent (*Pharm. Jour. Trans.*, Vol. XIX, 1888–89, pp. 162 and 606). It resembles strophanthin chemically, and is intensely deadly, $\frac{1}{65}$ grain reputed to have been fatal. Locally it is reputed tenfold more powerful than cocaine as a local anæsthetic. It kills by its action upon the lungs and heart. It has been proposed as a remedy for *whooping-cough* ($\frac{1}{500}$ grain), but is evidently too dangerous a poison to be employed in such a malady.

Onobaio.—This arrow-poison is used by the inhabitants of Obok, situated on the Gulf of Aden. It occurs in small, brown resinous balls. Small doses of it arrest pulmonary action; but large doses promptly arrest the action of both heart and lungs.

Dajaksh.—The Borneo arrow-poison paralyzes the heart (Braidwood).

Incassa Poison.—An ordeal bark of Africa said to be a violent heart-poison (Liebreich). (For other arrow and ordeal poisons, see under *Nux Vomica.*)

STRYCHNINA (U. S. P.)—STRYCHNINE.

Formula: $C_{21}H_{22}N_2O_2$. **Molecular Weight**: 333.31.

"An alkaloid obtained from Nux vomica, and also obtainable from other plants of the natural order *Loganiaceæ*"—(*U. S. P.*).

Synonym: *Strychnia.*

History and Preparation.—Strychnine was discovered by Pelletier and Caventou (1818) in St. Ignatius beans (see *Ignatia*), and, subsequently, also in nux vomica and other species of Strychnos, always accompanied by the alkaloid *brucine.* The latter is more soluble in boiling water and diluted alcohol than strychnine, and brucine nitrate is more soluble in water than strychnine nitrate. These differences permit separation of both alkaloids. Strychnine is obtained almost exclusively from the seeds of nux vomica. A practical difficulty consists in the toughness of the seeds. These are previously exposed to heat, then powdered; or the seeds are softened by prolonged boiling with diluted sulphuric acid (Merck). The process of the *British Pharmacopœia* (1885) consists in extracting the powdered seeds by prolonged digestion with diluted alcohol, distilling off the alcohol, precipitating *igasuric acid* with lead acetate, evaporating the filtrate, and adding aqua ammoniæ to slight excess, drying the precipitate, and extracting it with alcohol. Upon evaporation of the solvent, the bulk of strychnine crystallizes first; it is obtained pure by recrystallization. (For a summary of other methods, see Husemann and Hilger, *Pflanzenstoffe*, 1884. p. 1284.)

Description.—The *U. S. P.* thus describes strychnine: "Colorless, transparent, octohedral, or prismatic crystals, or a white, crystalline powder, odorless, and having an intensely bitter taste, perceptible even in highly dilute (1 in 700,000) solution. Permanent in the air. Soluble, at 15° C. (59° F.), in 6700 parts of water, and in 110 parts of alcohol; in 2500 parts of boiling water, and in 12 parts of boiling alcohol. Also soluble in 7 parts of chloroform, but almost insoluble in ether"—(*U. S. P.*). It is also insoluble in caustic alkalies, moderately soluble in fixed and volatile oils and creosote, in amyl alcohol (181 parts), benzol (164 parts), and glycerin (300 parts) (compare the solubilities of *brucine*, under *Nux Vomica*). "When heated to 268° C. (514.4° F.), strychnine melts. Upon ignition, it is consumed, leaving no residue. Strychnine has an alkaline reaction upon litmus paper"—(*U. S. P.*). With acids, it forms crystallizable salts of an intensely bitter taste. Chemically, strychnine is a derivative of the base quinoline ($C_6H_4{:}C_3H_3N$), and is still under investigation. (For the quantitative separation of strychnine and brucine, see *Nux Vomica.*) Another method recommended by Gordin and Prescott (*Amer. Jour. Pharm.*, 1899, p. 18), is that of Dunstan and Short (*ibid.*, 1883, p. 579), which consists in precipitating strychnine with potassium ferrocyanide from solution slightly acidulated with sulphuric acid. Brucine is precipitated only in concentrated solution.

The solutions of strychnine in diluted acids are precipitated by all alkaloidal reagents. Mercuric chloride occasions a white precipitate, composed of plumose tufts and acicular, radiating crystals. Platinum chloride and gold chloride produce pale-yellow crystals. Picric acid will occasion a pale-yellow precipitate of very delicate needles, arranged in tufts or in radii. Potassium iodide produces a rich amber-yellow or reddish-brown precipitate, composed of minute prisms. Chloride of iron, perchloric acid, iodine, tannic acid, potassium chromate and bichromate, ammonia water, potassa, soda, and potassium and sodium carbonates, each, produce a precipitate; hence, all of these reagents are incompatible with salts of strychnine. This alkaloid enters into a crystallizable compound with iodoform (*Amer. Jour. Pharm.*, 1882, p. 119). It also combines with chloroform, but not unless the solution is heated, in a sealed tube, to 120° C. (248° F.), and higher (P. F. Trowbridge, *Archiv der Pharm.*, 1899, p. 624) Strychnine resists putrefactive influences exceedingly well. Dr. Riekher (*Neues Jahrbuch der Pharm.*, Vol. XXIX, 1868, p. 1) was able to determine its presence in the heart, lung, and liver of a steer, after the specimens had been kept for 11 years in loosely-covered jars, under the roof of a house. (Also see G. Welborn, *Proc. Amer. Pharm. Assoc.*, 1893, p. 865.)

Tests.—The most characteristic test for strychnine is the violet-blue color, produced with strong sulphuric acid and oxidizing agents. With cold sulphuric acid alone, pure strychnine produces a colorless solution. The *U. S. P.* gives the following directions for the color test, and for the limit of brucine: "If a minute quantity of strychnine be dissolved in about 0.5 Cc. of concentrated sulphuric acid on a white porcelain surface, and a small crystal of potassium dichromate slowly drawn across the liquid with a glass rod, there will be produced at first, momentarily, a blue color, which quickly changes to purplish-blue, then gradually to violet, purplish-red, and cherry-red, and finally to orange or yellow. On dissolving 0.02 Gm. of strychnine in 2 Cc. of nitric acid (specific gravity 1.300), in a small test-tube, the acid should not turn more than faintly yellow (limit of *brucine*)"—(*U. S. P.*). (Regarding the latter test, see brucine, under *Nux Vomica.*) The blue coloration in the strychnine test is also obtained by other oxidizers, *e.g.*, dioxide of manganese (MnO_2), of lead (PbO_2), potassium permanganate, etc., and the reaction is exceedingly delicate, being obtainable with $\frac{1}{100}$ milligramme of alkaloid, provided brucine is absent. The presence of large quantities of brucine interferes with the reaction (see Flückiger-Nagelvoort, *Reactions*, Detroit, 1893; and H. Beckurts, *Archiv der Pharm.*, 1892, p. 551; also see Dr. T. G. Wormley's work on the *Micro-Chemistry of Poisons*, 1885, pp. 542–612).

Action, Medical Uses, and Dosage.—(See *Strychninæ Sulphas* and *Nux Vomica.*)

Salts of Strychnine.—STRYCHNINÆ CITRAS, *Citrate of strychnine*, may be made by dissolving, with a gentle heat, in a sufficient quantity of distilled water, 192 parts of dried citric acid, and then adding 346 parts of pure strychnine. By gentle evaporation the citrate may be obtained in crystals. The above proportions correspond to an acid salt ($C_6H_8O_7.C_{21}H_{22}N_2O_2$). The dose is from $\frac{1}{16}$ to $\frac{1}{20}$ grain, to be given cautiously till the desired effect is produced.

STRYCHNINÆ TARTRAS, *Tartrate of strychnine*, may be obtained by dissolving in a sufficient quantity of distilled water, 156 parts of tartaric acid, and then adding 346 parts of strychnine, and evaporating as above. It is also an acid salt, and has the formula $C_4H_6O_6.C_{21}H_{22}N_2O_2+3H_2O$ (Arppe). The dose is the same as for the citrate.

STRYCHNINÆ ACETAS, *Strychnine acetate.*—This solution forms crystals, which, when evaporated in solution, lose a portion of their acid. It does not easily crystallize. Soluble in chloroform (about 15 parts) and in water (96 parts).

STRYCHNINÆ HYDRIODAS, *Strychnine hydriodate* ($C_{21}H_{22}N_2O_2.HI$).—To solution of a salt of strychnine add solution of potassium iodide. Collect the precipitate, dissolve it in alcohol, and allow to crystallize. It forms very bitter, 4-angled needles, or white scales; dissolves but sparingly in water at ordinary temperatures, but dissolves quite readily in alcohol. The salt holds 72.2 per cent of the alkaloid.

STRYCHNINÆ HYDROCHLORAS, *Strychnine hydrochlorate* ($2[C_{21}H_{22}N_2O_2.HCl]3H_2O$).—Dissolve strychnine in warm diluted hydrochloric acid, and allow to cool. Silky, acicular crystals, containing 84 per cent of the alkaloid. Soluble in cold water (50 parts); loses its water of crystallization quite readily.

Strychninæ Nitras, *Strychnine nitrate* ($C_{21}H_{22}N_2O_2.HNO_3$).—Dissolve strychnine in warm diluted nitric acid, and allow to cool. Extremely bitter, colorless needles are formed, which contain 84 per cent of strychnine. It dissolves in cold water (90 parts), boiling water (3 parts), cold alcohol (70 parts), boiling alcohol (5 parts), and glycerin (26 parts); somewhat soluble in fixed oils and absolute alcohol, not soluble in ether and carbon disulphide. This agent is official in the *Ger. Pharm.* It has been largely used in the treatment of the *alcohol habit.*

Strychninæ Hydrobromas, *Strychnine hydrobromate* ($C_{21}H_{21}N_2O_2.HBr$).—This salt contains 80.4 per cent of the base. It crystallizes in prismatic needles, easily soluble in diluted alcohol, but sparingly in strong alcohol. Water (32 parts) effects its solution. According to Bullock, it is prepared by the interaction of strychnine sulphate and potassium bromide in diluted alcoholic solution whereby potassium sulphate forms an insoluble precipitate. The reaction is as follows: $(C_{21}H_{22}N_2O_2)_2.H_2SO_4+2KBr \quad K_2SO_4+2C_{21}H_{22}N_2O_2.HBr$.

Strychninæ Phosphas, *Strychnine phosphate* ($\frac{1}{100}$ to $\frac{1}{16}$ grain), has been advised in *pregnancy,* when the patient is exhausted or anemic (see Ellingwood's *Mat. Med. and Therap.*, pp. 169 and 170). Prepared by dissolving strychnine in phosphoric acid.

Strychninæ Arsenias, *Strychnine arseniate,* may be given, in doses of $\frac{1}{200}$ to $\frac{1}{80}$ grain, in *debility* and prostration of the aged, or those suffering from the effects of severe disease. It possesses, in an increased proportion, the antimalarial effects of strychnine. Prepared by dissolving strychnine in aqueous arsenic acid (AsO_4H_3).

STRYCHNINÆ SULPHAS (U. S. P.)—STRYCHNINE SULPHATE.

Formula: $(C_{21}H_{22}N_2O_2)_2H_2SO_4+5H_2O$. Molecular Weight: 854.24.

Synonym: *Strychniæ sulphas* (*U. S. P.*, 1870).

"Strychnine sulphate should be kept in well-stoppered vials"—(*U. S. P.*).

Preparation.—To diluted, warm sulphuric acid, add a slight excess of pure powdered strychnine. Filter, and allow to crystallize. Rhombic, neutral, prismatic crystals, containing 5 molecules of water, are deposited upon cooling the saturated, hot solution. By dissolving the neutral sulphate in diluted sulphuric acid, long, thin needles of the acid salt ($C_{21}H_{22}N_2O_2.H_2SO_4$) are formed upon evaporation. Reversedly, the neutral salt may be obtained from the acid salt, by dividing a solution of the latter into two equal parts, precipitating one-half by aqua ammoniæ, and adding this precipitate to the other half (Rammelsberg, *Amer. Jour. Pharm.*, 1881, p. 627; also see M. W. Coleman, *ibid.*, 1883, p. 113).

Description.—The *U. S. P.* describes the neutral salt as occurring in "colorless or white prismatic crystals, odorless, and having an intensely bitter taste, perceptible even in highly dilute (1 in 700,000) solution. Efflorescent in dry air. Soluble, at 15° C. (59° F.), in 50 parts of water, and in 109 parts of alcohol; in 2 parts of boiling water, and in 8.5 parts of boiling alcohol. Almost insoluble in ether. When heated at 100° C. (212° F.), the salt slowly loses its water of crystallization (10.51 per cent); more rapidly when heated to 110° C. (230° F.). When quickly heated to 200° C. (392° F.), the salt fuses. Upon ignition, it is consumed, leaving no residue"—(*U. S. P.*).

Tests.—"On adding potassium or sodium hydrate T.S. to an aqueous solution of the salt, a white precipitate is thrown down, which is insoluble in an excess of the alkali, and which should conform to the reactions and tests of strychnine (see *Strychnina*). Barium chloride T.S., added to the aqueous solution, throws down a white precipitate, insoluble in hydrochloric acid. On dissolving 0.05 Gm. of strychnine sulphate in 2 Cc. of nitric acid (specific gravity 1.300), in a small test-tube, the acid should not turn more than faintly yellow (limit of brucine)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Nux vomica and strychnine (see also *Nux Vomica*) act chiefly, if not solely, by stimulating the spinal cord and medulla oblongata, and without affecting the functions of the brain. The terminal nerves and nerve trunks are little, if at all, affected by strychnine, except in very large doses. Even then, its influence is not thought to be marked. The slightest observable effects from small doses are twitches of the muscles of the arms and legs, occurring especially during sleep, accompanied with restlessness, some anxiety, acceleration of the pulse, and generally slight perspiration. Sometimes the action of the bowels is increased, and the discharge of urine is either augmented or discharged more frequently; it likewise promotes the venereal appetite. Large doses occasion very violent starting of the muscles; even a tendency to lockjaw, succeeded by stiffness, weariness, pain or rending in the limbs. In their highest degree, these effects amount to violent tetanic spasms, occurring in frequent fits.

with brief intervals of repose, acute sensibility, and dreadful alarm. If the spasms continue, opisthotonos ensues. The risus sardonicus is observed in strychnine poisoning. The convulsions may be so violent as to throw the victim off a bed. Through whatever form or structure strychnine is introduced into the body, it exerts this action more or less, operating with an energy proportioned to the activity of absorption where it is applied. It is supposed to be a cumulative poison like mercury or digitalis, nor does its activity diminish under the influence of habit, as with opium. M. Duclos states that, under the influence of positive electricity, the symptom of poisoning by strychnine increase, while they lessen or cease altogether when negative electricity is applied. The long-continued use of strychnine, in excessive amounts, tends to impair the digestive organs, and while small amounts favor diuresis, large quantities impair that function by producing spasm of the bladder muscles. Strychnine is eliminated in part by the kidneys, and may also impair the contractile power of the sphincter vesicæ. When strychnine kills, it usually does so by causing spasm of the respiratory muscles, producing asphyxia. As some patients are powerfully affected by the smallest doses of this agent, too much caution can not be employed in its administration. Thirty grains of powdered nux vomica (equal to about 1 seed, or $\frac{1}{3}$ grain of strychnine), in 2 doses, proved fatal, while death followed the administration of 3 grains of the alcoholic extract; $\frac{1}{16}$ grain of strychnine proved fatal to a small child in 4 hours, while $\frac{1}{2}$ grain has killed an adult. Toxic symptoms are often produced by so small a dose as $\frac{1}{12}$ grain. Poisoning by nux vomica is slower than by strychnine. The usual length of time in which the latter proves fatal is 2 hours, though death has resulted in 15 minutes, and has been delayed 6 hours. If the patient survives longer than 6 hours, he is likely to recover. There are no characteristic internal post-mortem appearances, though, as a rule, there is congestion of the meninges, and the blood throughout the body is black and liquid. The body stiffens after death, and may be arched, with incurvated toes. Rigidity of the body has been known to persist for months.

In poisoning by strychnine or nux vomica, the patient must be kept absolutely quiet, no noises should be permitted, nor should even a draught of air be permitted to strike the body. Apomorphine, hypodermatically, or other emetics, by mouth, should be given to induce vomiting, while lard, sweet oil, milk, charcoal, or tannin, may be given with a view of enveloping the poison or retarding its absorption. The spasms should be controlled with chloroform. Chloral and potassium bromide have also been asserted to be effectual, as have also atropine, tobacco, and nicotine. Physostigma is also useful, but must be carefully employed, lest exhaustion follow its use. This may, however, be guarded against by the use of stimulants. Artificial respiration may be performed, the forcible action required being less likely to produce spasms than light and superficial contact with the skin.

"I would observe here that, 13 years ago, a favorite Newfoundland bitch, with 3 pups about 2 months old, were poisoned by some evil-minded person, by strychnine placed on meat. One of the pups died in the convulsed condition common to the influence of strychnine; the others were attacked with spasmodic twitchings, which continued to increase. From some cause the bitch vomited up her meat, a portion of which was eaten by 2 chickens, about 6 or 8 weeks old. To the bitch and the remaining 2 pups, I gave about a gill of sweet oil to each, followed by about 4 grains of camphor to the mother, and 2 grains to the pups, in some bread. They recovered and were doing well. Of the chickens, one was apparently dying, lying on the ground, wings outspread, mouth open, and with frequent spasmodic jerks; the other trembled and spasmodically staggered around like an intoxicated person. To each of these I gave about a grain of camphor in butter, and fastened them up, and in an hour they had fully recovered. I mention these facts that further inquiries may be made as regards the antidotal power of camphor in poisoning by strychnine. To determine whether strychnine was the poison administered, the meat vomited by the dogs was carefully examined, and strychnine found present. Both dogs and chickens were actively purged. Since the above occurrence, tannin oil, freely given, and camphor, have been found excellent antidotes to strychnine, also the tinctures of iodine, and bromine, and chlorine" (J. King).

Dr. John Bartlett strongly recommends a solution of common salt as an antidote to strychnine poisoning, from the invariable success attending its use with poisoned dogs (*Amer. Drug. Cir.*, Vol. XI, 1868). Folker, in the *Lancet*, July, 1867, relates an instance where a healthy man had taken over 2 grains of strychnine, who was saved by the use of chloroform, internally and externally, aided by repeated small doses of tincture of aconite. In *Amer. Med. Record*, 1867, is a case related where a young man, residing at Chardon, Ohio, who had poisoned himself with 3 grains of crystallized strychnine, was saved by the internal use of camphor, and inhalations of chloroform, continued for several hours. *The Medical Times and Gazette*, May, 1868, also relates a case where a little girl, 4 years of age, had taken strychnine by mistake, and was saved by being kept under the anæsthetic influence of chloroform for a couple of hours. The *Med. and Surg. Reporter of Philadelphia*, 1867, relates a case where 3½ grains of strychnine had been swallowed, and, in 24 hours, the person was saved by the administration, every 5, 10, and 15 minutes, of ½-teaspoonful doses of tincture of Cannabis indica. J. Rosenthal, from the results of experiments upon animals, and having observed that artificial respiration caused the convulsions, arising from the influence of strychnine, to cease, and even saved the animals from dying, is strongly inclined to believe that, if any method can be devised by which artificial respiration can be maintained for a long time, all persons poisoned by strychnine can be saved, if too long a time has not been allowed to elapse from its ingestion. This method, if practicable, is reasonable, as strychnine kills by spasmodically arresting respiration.

Strychnine increases the quantity of the blood in the spinal cord, and, hence, is not useful when there is congestion of the cord; it localizes its action entirely upon the sensitive nerves; it is injurious in epilepsy and paralysis, arising from lesions of the encephalon, or congestion of the spinal cord; it is useless in paralysis agitans; but, in small doses, is useful in slight *paralysis*, due to white softening of the spinal cord, and in all cases of functional derangement from want of nervous power. It should be employed in *paraplegia*, without irritation or without increase of the vital properties of the spinal cord, as in cases of *reflex paraplegia*, and white or non-inflammatory softening of the cord. It should be avoided in paralysis with symptoms of congestion, myelitis, or spinal meningitis. It is more useful in *paraplegia* than *hemiplegia*.

Nux vomica is preferred in many gastro-intestinal affections, while strychnine is more generally employed in troubles affecting the nervous system, bladder, heart, and reproductive organs; and the action of the former is chiefly owing to the strychnine it contains. Yet their action differs but slightly, and most largely in degree. The uses of strychnine are those enumerated under *Nux Vomica* (which see). There are some conditions, however, in which strychnine is to be preferred, chiefly on account of its prompt action. Some that are mentioned under *Nux Vomica* are here repeated, and other conditions added.

Strychnine may be administered subcutaneously, and is therefore, of great value in threatened *heart failure*, to prevent *surgical shock*, and in *dyspnœa*, to sustain the breathing function when it seems to be dependent most largely upon the influence of the will, as in *low fevers* and *pneumonia*. This action is particularly marked in *typhoid* and *asthenic types of disease*, with impaired spinal innervation, and imperfect or feeble respiration. Strychnine, hypodermatically, may be used with great advantage in *atonic diarrhœa*, *cholera morbus*, and *Asiatic cholera*. One-fifth grain, in divided doses, is of marked utility in the cold stage of *congestive intermittents*, and in *ague*, with atony of the stomach and impaired innervation. Strychnine is preferred over nux vomica in *impotence*, from exhaustion or weakness, in *urinal incontinence* of the young and the aged, and in *urinal retention* from atony. Strychnine enters largely into the treatment of *dipsomania*, the sulphate or nitrate being preferred. The latter is said to be effectual in preventing *surgical shock*. It is antidotal to *chloral*, *morphine*, or *opium* (early stage of poisoning), and in *asphyxia* from gas or water, or in *chloroform narcosis*. The semi-paralytic state, produced by excess of bromides or lead, is somewhat relieved by it. Strychnine is of marked value in many nervous affections. Occasionally, it gives good results in *tetanus* and *epilepsy*, and, in *chorea*, it first aggravates, and then frequently cures. *Œsophageal spasm* and *hay-fever* are sometimes controlled by it. It has relieved *writer's cramp*. The forms of *paralysis* benefited by strychnine are those functional in character, and often reflex from excesses and rheumatism, neuralgia, concussion of the cord, hysteria, etc. In *post-diphtheritic paralysis*, it is one of our best agents. It relieves *obstinate facial neuralgia*, when atony is a marked feature.

Strychnine is also useful in *hemiplegia*, *paraplegia*, *partial paralysis of particular joints or muscles*, and of the *bladder*. The paralyzed muscles are always first affected if they are thrown into spasms at all. If the remedy is to succeed, improvement begins speedily. It must not be used in recent cases of paralysis, or while general reaction prevails; neither when signs exist either of local irritation in the brain or spinal cord, or of determination of blood to the head. It has been likewise used in various forms of *neuralgia*, *amenorrhœa*, *dysentery*, *rheumatism*, *syphilitic osteocopa*, and *obstinate constipation*. "In the treatment of *gleet*, *urethral stricture*, and *recent enlargement of the prostate*, I have found it a superior remedy, used internally and locally. In *dyspepsia*, when there is a want of appetite, constipation, and a sensation of epigastric weight after eating, I have found the combination of 1 grain of the alcoholic extract of nux vomica, well triturated with 40 grains of the oleoresin of ptelea, and divided into 20 pills, an excellent remedy. Likewise in dyspepsia connected with *impotence*, caused by masturbation or venereal disease; the dose is 1 pill, repeated 3 times a day" (John King). Strychnine will also be found advantageous in many *uterine diseases*, *prolapsus uteri*, etc. Prof. A. J. Howe found the following powder to produce an anodyne influence in cases of *cancer of the uterus*, and other severe diseases, attended with extreme pain: Take of sulphate of morphine, 5 grains; sulphate of quinine, 10 grains; strychnine, 1 grain; liquorice powder, 20 grains; mix thoroughly together, and divide into 20 powders, 1 of which may be taken every 4 or 6 hours, according to the urgency of the symptoms. Dr. Alexander Fleming recommended the following solution of strychnine, for internal use, as being much safer and more efficient than the galenical preparations of nux vomica: "Take of strychnine, 4 grains; distilled water, 10 fluid drachms; dissolve the strychnine thoroughly with the aid of a few drops of diluted hydrochloric acid, and then add alcohol, a sufficient quantity to make the whole measure 20 fluid drachms. This is of uniform strength, passes readily into the circulation, and the dose can be apportioned with accuracy. The commencing dose is 10 minims, and contains $\frac{1}{30}$ grain of strychnine. It should be given on an empty stomach, and diluted with water, to insure its prompt and easy absorption. As a tonic, the dose is 5 minims, 2 or 3 times a day." He also stated that "strychnine should never be given in pill form, because it is hard of solution in the weak acids of the stomach, and several pills may remain unchanged and accumulate there or in the bowels. A change in the secretions may then dissolve and transport them simultaneously into the blood, and give rise to alarming tetanic symptoms. This is commonly the correct explanation of the so-called cumulative action of strychnine—the sudden solution and absorption of hard pills accumulated in the stomach or bowels." The dose of strychnine is from $\frac{1}{30}$ to $\frac{1}{10}$ grain, 2 or 3 times a day. It may be rendered more soluble in alcohol or water, by the addition of a few drops of an acid, as acetic, hydrochloric, nitric, or sulphuric.

Specific Indications and Uses.—(See *Nux Vomica.*) Functional forms of paralysis, due to excesses; atony.

Related Alkaloid.—BRUCINE exerts an influence upon the system very similar to that occasioned by strychnine, but is less energetic. Its dose is from $\frac{1}{8}$ to $\frac{1}{2}$ grain, 3 or 4 times a day. In the administration of brucine and strychnine, or any of their salts, great caution must be observed, and the patient carefully watched during their use. According to Prof. Brown-Sequard, strychnine and brucine have similar effects. Local anæsthesia is reported from the use of a 5 per cent solution of brucine upon mucous membranes, but not upon the skin.

STYRAX (U. S. P.)—STORAX.

"A balsam prepared from the inner bark of *Liquidambar orientalis*, Miller"—(*U. S. P.*) (*Liquidambar imberbe*, Aiton).

Nat. Ord.—Hamamelaceæ.

COMMON NAMES AND SYNONYMS: *Liquid storax*, *Balsamum storacis*, *Prepared storax*, *Styrax præparatus* (*Br.*).

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 107.

Botanical Source.—This tree is a native of Asia Minor, in the extreme southwest of which country it is gregarious, forming forests of trees of from 20 to 60 feet high. The leaves are bright-green, perfectly smooth even at the axils of the veins on the under side, shining above, pale beneath, palmate, with serrated, obscurely trilobed divisions. The aments or catkins are of distinct sexes, monœcious, having a common 4-leaved deciduous involucre; males conical; anthers numerous and subsessile; females globose, composed of small scales which surround the ovary, grow together, and gradually enlarge; calyx urceolate, 1-leafed, 2-flowered; styles 2, subulate; capsules 2, oblong, 1-celled, many-seeded (L.—Jus.).

History and Preparation.—Mr. Daniel Hanbury, in 1857, ascertained that the original storax, derived from *Styrax officinale*, had disappeared from commerce, and that the liquid storax then in the market was collected in the southwestern part of Asia Minor, from *Liquidambar orientalis*, or *Oriental sweet-gum tree* (see *Amer. Jour. Pharm.*, 1857, p. 249, and 1863, p. 436). The district opposite the islands of Samos and Rhodus is now known to be the only place on the globe where liquid storax is collected on a commercial scale. This is done, according to Mr. H. Massopust (1896), by removing strips of the whole bark lengthwise, by means of a sharp instrument, laying bare the wood. One-fourth of the total bark is removed in one season, which lasts from July to September, during which time the tree is in its sap. The bark is made into bundles and softened by throwing them into kettles with boiling water, and is then pressed out in bags made of goat's hair or in baskets. The balsam is then put into barrels, together with about one-fourth its weight of water. This is intended to keep the balsam soft and prevent loss of its aroma. Before the storax is put on the market, the water is poured off, and the balsam is kneaded with a stick so as to remove "the last drop of water." On storax so treated, the seller allows 16 per cent of tare. It is also made up in tin cans which are put into boxes (Prof. J. Mœller, *Zeitschr. des Allg. Oesterr. Apotheker-Vereins*, 1896, p. 19). It is shipped to Constantinople, Smyrna, and Bombay, and reaches the western commerce by way of Trieste.

The residual bark from which storax is removed by pressure, is also an object of commerce under the name of *Cortex thymiamati*. It has a strong odor of storax, and is used at Trieste in the preparation of *Storax calamitus*, which is a mixture of ground cortex thymiamati (3 parts) with liquid storax (1 part) and some olibanum (J. Mœller, *loc. cit.*), the purpose being to bring storax into a more easily manageable form. Exposed to the air for some time, it becomes covered with a whitish efflorescence consisting of *styracin* (see page 1856). Much of the commercial storax calamitus however, is merely "an odoriferous sawdust." (See an interesting article on storax, in *Pharm. Era*, Vol. VIII, 1892, p. 135.)

Description and Tests.—The official storax must conform to the following requirements: "A semiliquid, gray, sticky, opaque mass, depositing, on standing, a heavier, dark-brown stratum; transparent in thin layers, and having an agreeable odor and a balsamic taste. Insoluble in water, but completely soluble (with the exception of accidental impurities) in an equal weight of warm alcohol. If the alcoholic solution, which has an acid reaction, be cooled, filtered, and evaporated, it should leave not less than 70 per cent of the original weight of the balsam, in the form of a brown, semiliquid residue, almost completely soluble in ether and in carbon disulphide, but insoluble in benzin"—(*U. S. P.*). This evidently refers to cold benzin, as some constituents of storax are soluble in boiling benzin (see *Chemical Composition*). "When heated on a water-bath, storax becomes more fluid, and if it be then agitated with warm benzin, the supernatant liquid, on being decanted and allowed to cool, will be colorless, and will deposit white crystals of cinnamic acid and cinnamic ethers"—(*U. S. P.*).

Storax is heavier than water. It is sometimes adulterated with mineral matters, resin, turpentine, etc. If large quantities of resins are present, the balsam hardens in cold weather; genuine storax has at all seasons more or less the consistency of honey (J. Mœller, *loc. cit.*). An important aid in detecting the presence of turpentine and other resins in storax consists in determining the acid number, the saponification and iodine numbers, and other data (see for example, F. Evers, *Jahresb. der Pharm.*, 1896, p. 116; and K. Dieterich, *ibid.*, 1897, p. 11). The *British Pharmacopœia* and the *German Pharmacopœia* direct that storax be purified by alcohol previous to its being used medicinally.

Chemical Composition.—The chief constituents of storax are certain esters of cinnamic acid, together with free *cinnamic acid*. These esters are crystallizable *styracin* (*cinnamyl-cinnamate*, $C_6H_5CH:CH.COOC_9H_9$, derived from *cinnamyl-alcohol* C_9H_9OH, or $C_6H_5CH:CHCH_2OH$); oily *phenyl-propylcinnamate* ($C_6H_5CH:CH.COOCH_2CH_2CH_2C_6H_5$), *ethyl cinnamate* ($C_6H_5CH:CH.COOC_2H_5$), and the *cinnamate of* the trivalent alcohol *storesin* ($C_{36}H_{55}[OH]_3$), a substance existing in storax also uncombined and in the form of a sodium compound. It constitutes altogether about one-half of the weight of storax (W. von Miller, *Liebig's Annalen*, 1877, and *Amer. Jour. Pharm.*, 1878, p. 455; also compare *Liquidambar*). Other constituents of storax are water (from about 20 to 25 per cent), the hydrocarbon *styrol*, resin, caoutchouc, *ethyl-vanillin*, traces of benzoic acid, etc.

W. von Miller, in separating these constituents, proceeded as follows: Storax was wrapped in a linen bag and heated in the vapors of distilling water. The distillate contained volatile *styrol* (*styrolene*, *cinnamene*, *phenyl-ethylene*, C_8H_8, or $C_6H_5.CH:CH_2$). The residual storax passed through the cloth, leaving caoutchouc and resin. The storax was next extracted with 3 times its quantity of diluted caustic soda solution (of about 5 per cent NaOH). This dissolved part of the *storesin* and all of the free cinnamic acid. The former was precipitated from the solution by carbonic acid gas, then the latter by hydrochloric acid. The residual storax was extracted with cold alcohol, the solvent distilled off, and the residue treated with hot petroleum-ether, which dissolved *styracin* and the other esters, leaving the remainder of *storesin* undissolved.

Cinnamic acid ($C_6H_5CH:CH.COOH$) is the common constituent of several balsams, *e. g.*, balsam of Peru, tolu, storax, etc., and is formed in old oil of cinnamon by oxidation of cinnamic aldehyde (Dumas and Péligot, 1834). It has also been obtained synthetically from benzaldehyde (bitter almond oil) by Perkin. Storax usually yields between 6 and 12 per cent of the acid, but Loewe obtained as much as 23 per cent. It forms shining, odorless crystals of an aromatic, somewhat acrid taste, soluble in hot water, alcohol, and ether. Oxidizers convert it into benzaldehyde and benzoic acid. Its cinnamyl-ester is *styracin;* its benzyl-ester is *cinnameïn* (see *Balsam of Peru*).

Action, Medical Uses, and Dosage.—Storax is a stimulant, acting more especially upon mucous tissues, as do nearly all balsams. It has been found beneficial as an expectorant in *cough*, *chronic catarrh*, *asthma*, *bronchitis*, and other *pulmonary affections;* also in *gonorrhœa*, *leucorrhœa*, and *gleet*, in which it is as efficient, and more pleasant than copaiba. In fact the uses of storax are very similar to those of the latter balsam. Combined with tallow or lard, it forms a valuable application in many forms of *cutaneous disease*, especially those common to children, as *ringworm*, *tinea*, *ringworm of the scalp*, *scabies*, etc. It forms a good application for *ulcerations*, the result of freezing the fingers or toes. It is much used, on account of its fragrance, for compounding ointments and pills, and is an excellent addition to opium in the form of pill, when it is necessary to conceal the taste and smell of this narcotic; 3 or 4 grains of storax may be combined with 1 grain of opium for this purpose. The dose of storax is from 10 to 20 grains, gradually increased.

Related Species and Preparations.—*Styrax officinale*, Linné, is a small tree growing from 12 to 20 feet or more in height, with the branches alternate and round, having its bark smooth, and the young shoots downy. This plant inhabits the Levant, Palestine, Syria, and is common all over Greece; it is cultivated in several parts of Europe, but at the present day produces no balsam. It formerly yielded true storax, an article no longer in commerce (see *Pharmacographia*).

Liquidambar Formosana, Hance.—Formosa and southern China. Yields "a dry, terebinthinous resin of agreeable fragrance when heated" (*Pharmacographia*). The Chinese use it

Altingia Excelsa, Noronha (*Liquidambar Altingiana*, Blume).—The *rasamala* of Java and Malaysia. Yields a fragrant resin (see *Pharmacographia*).

Symplocos racemosa, Roxburgh (*Nat. Ord.* Stryraceæ), *Lotur bark*.—India. Contains 3 alkaloids, *loturine*, *colloturine*, *loturidine* (Hesse). In dilute acid solutions all show deep violet-blue fluorescence. In India this bark enters into numerous preparations for *bowel disorders*, and a decoction is used to give "firmness to spongy and bleeding gums." It is also used in *menorrhagia*, and as a mordant in dyeing red (Dymock, *Mat. Med. of Western India*).

Mackenzie's Syrup.—A preparation known as Mackenzie's syrup, and which has obtained considerable celebrity in some sections of the country, as a remedy in *consumption*, *coughs*, *laryngitis*, etc., is made as follows: Take of colombo root and horehound, each, 2 ounces; boneset, 1 ounce; pleurisy root, 4 ounces; water, 2 gallons. Boil until one-half of the water has evaporated; subject the articles to another boiling in fresh water, add the two decoctions together, strain and evaporate to 6 quarts. To this add sugar, 5 pounds; Canada balsam, 1 pound; liquid storax, ½ pound; wheat bran, 2 pints; subject to a gentle heat for 2 hours; add beeswax, 1 pound, and let it stand for 24 hours to cool; strain, add 1 pint of yeast, let the mixture stand for 6 days, and put it into well-corked bottles. The dose is 1 or 2 tablespoonfuls, 3 times a day. The sugar aud the balsams are undoubtedly the active agents of this heterogeneous compound.

SUCCI.—JUICES.

Preparation and History.—This class of preparations is official in the *British Pharmacopœia*. Prepared juices were introduced by Squire, in 1830. In 1870, they were made official in the *U. S. P.*, from which they have been dismissed, and, in their stead, the tinctures of recent herbs (TINCTURÆ HERBARUM RECENTIUM) substituted. Succi are prepared by expressing the juice from crushed, fresh plants, and adding thereto 25 per cent of alcohol. Owing to differences in strength, due to methods of cultivation, climate, soil, etc., they must necessarily be of doubtful value so far as uniformity of quality is concerned (compare Farr and Wright, *Chem. and Drug.*, 1896, Vol. XLIX, p. 219).

SUCCUS BELLADONNÆ.—JUICE OF BELLADONNA.

Preparation.—"Bruise the fresh leaves and young branches of Atropa Belladonna, Linne; press out the juice; to every 3 volumes of juice add 1 of alcohol (90 per cent); set aside for 7 days; filter"—(*Br. Pharm.*, 1898).

Action, Medical Uses, and Dosage.—(See *Belladonna.*) Dose, 1 to 15 minims.

SUCCUS CONII.—JUICE OF HEMLOCK.

Preparation.—"Bruise the fresh leaves and young branches of Conium maculatum, Linne; press out the juice; to every 3 volumes of juice add 1 of alcohol (90 per cent); set aside for 7 days; filter"—(*Br. Pharm.*, 1898).

Action, Medical Uses, and Dosage.—(See *Conium.*) Dose, ½ to 2 fluid drachms.

SUCCUS HYOSCYAMI.—JUICE OF HENBANE.

Preparation.—"Bruise the fresh leaves, flowering tops, and young branches of Hyoscyamus niger, Linné; press out the juice; to every 3 volumes of juice add 1 of alcohol (90 per cent); set aside for 7 days; filter"—(*Br. Pharm.*, 1898).

Action, Medical Uses, and Dosage.—(See *Hyoscyamus.*) Dose, ½ to 1 fluid drachm.

SUCCUS LIMONIS.—LEMON JUICE.

"The freshly expressed juice of the ripe fruit of Citrus medica, Linné, var. B. Limonum, Hooker filius"—(*Br. Pharm.*, 1898).

Description and Tests.—"A slightly turbid, yellowish liquid, with a sharply acid taste. Specific gravity 1.030 to 1.040. One fluid ounce contains 30 to 40 grains (or 100 cubic centimeters contain 7 to 9 grammes) of citric acid. When lemon juice is evaporated to dryness, and the residue is incinerated, it should yield not more than 3 per cent of ash; 110 minims (or 100 cubic centimeters) of lemon juice are neutralized by about 11½ grains (or 11.4 grammes) of potassium bicarbonate, by about 9½ grains (or 9.5 grammes) of sodium bicarbonate, and by about 16½ grains (or 16.5 grammes) of sodium carbonate"—(*Br. Pharm.*).

SUCCUS LIMONIS CUM PEPSINO (N. F.)—LIME JUICE AND PEPSIN.

Preparation.—"Pepsin (*U. S. P.*), thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; water, one hundred and seventy-five cubic centimeters (175 Cc.) [5 fl℥, 440 ♏]; glycerin, one hundred and seventy-five cubic centimeters (175 Cc.) [5 fl℥, 440 ♏]; alcohol, ninety cubic centimeters (90 Cc.) [3 fl℥, 21 ♏]; purified talcum (F. 395), fifteen grammes (15 Gm.) [232 grs.]; lime juice, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the pepsin in the water, mixed with about five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of lime juice. Then add the glycerin and alcohol, and, lastly enough lime juice to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Incorporate the purified talcum with the liquid, let it stand a few days in a cold place, if convenient, occasionally agitating, then filter through a wetted filter, and finally pass enough lime juice through the filter to restore the original volume. Each fluid drachm represents 2 grains of pepsin (*U. S. P.*)"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—Uses, those of *Pepsin*. Dose, 1 to 2 fluid drachms.

SUCCUS SCOPARII.—JUICE OF BROOM.

Preparation.—"Bruise fresh broom tops; press out the juice; to every 3 volumes of juice add 1 of alcohol (90 per cent); set aside for 7 days; filter"—(*Br. Pharm.*, 1898).

Action, Medical Uses, and Dosage.—(See *Scoparius.*) Dose, 1 to 2 fluid drachms.

SUCCUS TARAXACI.—JUICE OF TARAXACUM.

SYNONYM: *Juice of dandelion.*

Preparation.—"Bruise fresh taraxacum root; press out the juice; to every 3 volumes of juice add 1 of alcohol (90 per cent); set aside for 7 days; filter"—(*Br. Pharm.*, 1898).

Action, Medical Uses, and Dosage.—(See *Taraxacum.*) Dose, 1 to 2 fluid drachms.

SULPHONAL.—SULPHONAL.

FORMULA: $(CH_3)_2C(SO_2C_2H_5)_2$, or $C_7H_{16}S_2O_4$. MOLECULAR WEIGHT: 227.59.

SYNONYM: *Diethylsulphon-dimethylmethane.*

History and Preparation.—Sulphonal is a copyrighted name of a preparation now official in the *German Pharmacopœia* and the *British Pharmacopœia*, 1898. It was first prepared by E. Baumann, in 1886, and is obtained by the action of *mercaptane* ($C_2H_5.SH$) upon acetone ($CH_3.CO.CH_3$), and oxidizing the resulting *mercaptol* with potassium permanganate. The following equations will illustrate the reactions: $CH_3COCH_3+2C_2H_5SH=(CH_3)_2:C:(SC_2H_5)_2$ (mercaptol), and $(CH_3)_2:C:(SC_2H_5)_2+O_4=(CH_3)_2:C:(SO_2C_2H_5)_2$. (For another method, which avoids the employment of the ill-smelling mercaptane, see *Amer. Jour. Pharm.*, 1889, p. 178.)

Description and Tests.—Sulphonal occurs in almost tasteless, odorless, and colorless prismatic crystals, neutral to test-paper. At 125.5° C. (258° F.) it fuses. It is easily soluble in boiling alcohol (2 parts), and dissolves in ether (135 parts), cold water (450 parts, *Br.*; 500 parts, *P. G.*), in boiling water (15 parts), and in cold alcohol (50 parts, *Br.*; 65 parts, *P. G.*). "When ignited with free access of air, it burns away without leaving a residue, and with evolution of sulphur dioxide gas. It is very permanent toward bromine, chlorine, strong alkalies, and acids. The unpleasant, characteristic odor of mercaptane (C_2H_5SH) is evolved when 0.1 gramme of sulphonal is heated, in a test-tube, with powdered charcoal"—(*Ger. Pharm.*). "If a mixture of sulphonal with an equal weight of potassium cyanide be heated, the odor of mercaptane is evolved, and when to the solution of the product, in water, excess of hydrochloric acid and a few drops of a solution of perchloride of iron are added, a reddish color is developed"—(*Br. Pharm.*). The red coloration is that of ferric rhodanide, and indicates the sulphur of sulphonal. The *British Pharmacopœia* further states that "it evolves hydrogen sulphide when gradually warmed with dried sodium acetate. It should yield no characteristic reaction with the tests for chlorides or sulphates"—(*Br. Pharm.*). The *German Pharmacopœia* prescribes that no odor should be developed when dissolving 1 part of sulphonal in 50 parts of boiling water. It also directs that 10 Cc. of a 2 per cent hot, aqueous solution of sulphonal should not at once decolorize 1 drop of solution of potassium permanganate. The presence of unoxidized mercaptol would be indicated by the reduction.

Action, Medical Uses, and Dosage.—Sulphonal is hypnotic, but is said not to be analgesic. Single doses, unless large, do not, as a rule, produce serious effects, but the continued use of the drug may produce any or several of the following results: Nausea, vomiting, mental excitation, languor, headache, gastric pain, vertigo, nervous depression, exhaustion, diarrhœa, and incoordination of muscular movements, particularly staggering gait. Even small doses will, occasionally, produce ill-effects. An ounce has produced death from respiratory paralysis, preceded by stupor, elevated temperature, slow heart-action and respiration, anuria, and complete general anæsthesia (Knagg's *Br. Med. Jour.*, 1890). Death has also resulted after taking 30 grains, but the victim was a nervous wreck. Ptosis, sphincter paralysis, erythematous, rubeolous, and scarlatinous eruptions, and arrest of renal action have also been observed (see case of chronic poisoning from sulphonal in *Amer. Homœopathist*, 1897, p. 419). During its administration the kidneys should be carefully watched, and the bowels should not be allowed to become constipated. It produces, in overdoses, deep wine-colored urine, staining garments with which it may come in contact. When the urine begins to darken in color or become smoky, the agent should be at once discontinued. The duration of sleep produced by sulphonal varies, and can not be prejudged with certainty. As a rule, sleep is slowly produced and quite prolonged. After awakening, mental and physical dullness and sluggishness are often marked. Pain especially retards its action greatly. Those who have used it in *heart affections*, for which it has been advised, declare it a dangerous agent under such circumstances. It has been used with a measure of success in *chorea*, *diabetes*, and *night-sweats*. Its chief use is as a hypnotic, being adapted to *insomnia*, due to mental worry or excitement. It gives sleep to those worrying over spermatorrhœa, gonorrhœa, and similar nervous conditions. It has been most largely used to secure sleep in *insanity* and *delirium tremens*. In *mania*, with general nervous irritation and great excitement, it has produced calm and refreshing sleep. It is better adapted, however, to mild forms of mania. Dr. Locke advises it as a safe remedy (1 or 2-grain doses) in the *restlessness of dentition*, to ward off spasms and to produce sleep. Manley (*Ann. of Ec. Med. and Surg.*, Vol. I, p. 45) speaks highly of sulphonal, having employed it chiefly for the *insomnia of the aged*, and in nervous excitement of drunkards but short of delirium tremens. He had observed no bad effects from the drug. Prof. Locke speaks of it as a good hypnotic in the *insomnia of typhoid fever*, giving 10-grain doses; here it does not seem to impair the nervous system. While it does not stop *cough*, it often gives sleep when cough produces wakefulness. In *rheumatism* and *erysipelas*, if the pain be not too great, it may be employed to give sleep; if pain is great, it will do no good. The patient in whom sleep is produced by sulphonal, should not be awakened lest headache or giddiness be produced, but should be allowed to awaken naturally (Locke). The dose of sulphonal for a child is from 1 to 3 grains; for an adult, 5 to 20 grains. It acts slowly, and, therefore, should be given 1 or 2 hours before bedtime. It should be given in powder, in milk, hot water, beef tea, or soup. It should not be given in tablet form.

Related Compounds.—TETRONAL, *Diethylsulphon-diethylmethane* ($[C_2H_5]_2C[SO_2C_2H_5]_2$). This compound is prepared exactly like sulphonal, except that *diethylketone* ($C_2H_5COC_2H_5$) is employed in the place of dimethylketone (acetone). Tetronal, sulphonal, and trional are analogous, all belonging to the group known as disulphones. Tetronal occurs in shining laminæ or plates, easily soluble in ether and alcohol, and in cold (450 parts) and hot water, forming a solution which is tasteless, and neutral to litmus paper. The melting point is 85° C. (187° F.), which is its distinctive feature, since it gives the same reactions as sulphonal and trional. Tetronal is employed in *insomnia*, due to functional or structural nervous diseases, and particularly for the *sleeplessness of insanity*. Dose, 8 to 30 grains.

TRIONAL, *Diethylsulphon-methylethylmethane* ($CH_3.C_2H_5.C[SO_2C_2H_5]_2$).—This body is prepared like sulphonal, except that, instead of acetone, methylethylketone is employed. It forms plate-like crystals, which are colorless and odorless. At 70° C. (158° F.) they fuse, (see *Tetronal*). Easily soluble in alcohol and ether; less soluble in cold water (1 in 300), and quite readily soluble in water. Action and medical uses identical with those of tetronal. Dose, 8 to 30 grains.

SULPHUR LOTUM (U. S. P.)—WASHED SULPHUR.

Symbol: S. Atomic Weight: 31.98.

Preparation.—Take of "sublimed sulphur, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; ammonia water, ten cubic centimeters (10 Cc.) [163 ♏]; water, a sufficient quantity. Pass the sublimed sulphur through a No. 30 sieve, mix it thoroughly with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of water, add ten cubic centimeters (10 Cc.) [163 ♏] of ammonia water, and digest for 3 days, agitating occasionally. Then add one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of water, transfer the mixture to a muslin strainer, and wash the sulphur with water until the washings cease to impart a blue color to red litmus paper. Then allow it to drain, press the residue strongly, dry it rapidly at a moderate heat, and pass it through a No. 30 sieve"—(*U. S. P.*).

Owing to the method of obtaining sulphur by sublimation, the product is apt to be contaminated with sulphuric acid, and volatile foreign bodies, especially small quantities of arsenic, consequently a little ammonia is added to the wash-water to neutralize and remove the acidity as well as dissolve the arsenic.

Description and Tests.—The *U. S. P.* describes washed sulphur as "a fine yellow powder, without odor or taste. Insoluble in water; slightly soluble in absolute alcohol; more readily soluble in benzin, benzol, oil of turpentine, and many other oils; also in ether, in chloroform, and in boiling aqueous solutions of alkaline hydrates. Carbon disulphide promptly dissolves a portion of it, but leaves a residue of insoluble sulphur, which may be dissolved by a boiling solution of an alkaline hydrate. When heated to 115° C. (239° F.), washed sulphur melts, and at a higher temperature volatilizes, or, if air be admitted, burns to sulphur dioxide, which is identified by its characteristic odor, and by its blackening a strip of paper moistened with mercurous nitrate T.S. held in the gas"—(*U. S. P.*). In this reaction, the sulphurous acid reduces the mercurous salt to metallic mercury. "The amount of residue left after volatilizing or igniting a weighed portion of it should not exceed 0.1 per cent. If 0.5 Gm. of washed sulphur be boiled with 10 Cc. of sodium hydrate T.S., it should be completely dissolved, leaving no residue (absence of earthy or metallic impurities). If 0.5 Gm. of washed sulphur be digested for several hours with 10 Cc. of ammonia water, the clear filtrate should not be colored yellow, nor be rendered turbid, by acidulation with hydrochloric acid, even after the addition of an equal volume of hydrogen sulphide T.S. (absence of arsenic). If 5 Cc. of water be agitated with 2 Gm. of washed sulphur, the liquid should not change the color of blue or red litmus paper (absence of acid, and of ammonia). If 0.5 Gm. of washed sulphur be boiled with a solution of 0.5 Gm. of potassium cyanide in 5 Cc. of water, and, after filtration, the clear liquid be acidulated with hydrochloric acid, it should not assume a reddish color, even after standing for an hour (absence of *selenium*)"—(*U. S. P.*). The reddish color is that of selenium, produced by the decomposition of potassium selenocyanide (KCNSe) by the acid.

Action, Medical Uses, and Dosage.—(See *Sulphur Sublimatum.*) Dose, a fraction of a grain to 4 drachms, according to whether an alterative or laxative effect is desired.

SULPHUR PRÆCIPITATUM (U. S. P.)—PRECIPITATED SULPHUR.

Symbol: S. Atomic Weight: 31.98.

Synonyms: *Lac sulphuris, Milk of sulphur, Magisterium sulphuris.*

Preparation.—"Sublimed sulphur, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs]; lime, fifty grammes (50 Gm.) [1 oz. av., 332 grs.]; hydrochloric acid, water, each, a sufficient quantity. Slake the lime, and mix it uniformly with five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of water. Add the sublimed sulphur, previously sifted, and, after thorough mixing, add one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of water, and boil the mixture during 1 hour, stirring constantly, and replacing the water lost by evaporation. Then cover the vessel, and permit the contents to cool and to become clear by subsidence. Carefully draw off the clear solution, and filter the remainder. To the united liquids add gradually, and with constant stirring, hydrochloric acid, previously diluted with an equal volume of water, until the liquid is nearly neutralized, still retaining, however, an alkaline reaction and a yellow color. Collect the precipitate on a strainer, and wash it, until the washings are tasteless and cease to give an acid reaction with litmus paper. Then dry the product rapidly, at a moderate heat, and keep it in well-stoppered bottles"—(*U. S. P.*). In this process, a solution of calcium thiosulphate and calcium pentasulphide is formed, as follows: $3CaO+S_{12}=CaS_2O_3+2CaS_5$. The pentasulphide causes the deep-yellow color of the solution. Upon adding hydrochloric acid, the pentasulphide is decomposed as follows: $2CaS_5+2HCl=CaCl_2+Ca(SH)_2+S_8$, or $2CaS_5+4HCl=2CaCl_2+2H_2S+S_8$. An excess of hydrochloric acid must be avoided, and the precipitate of sulphur must be quickly separated from the supernatant liquid, in order to prevent its contamination with coarser sulphur which forms upon standing by secondary reactions, viz., decomposition of calcium thiosulphate by the acid, producing sulphur and sulphur dioxide: $CaS_2O_3+2HCl=CaCl_2+S+SO_2$. Again, the sulphur dioxide may react with some dissolved hydrogen sulphide, as follows: $SO_2+2H_2S=S_3+{}_2H_2O$. If the addition of hydrochloric acid is carried to acidity of the liquid, the precipitated sulphur is liable to be contaminated with ill-smelling, oily hydrogen polysulphides (*e. g.*, H_2S_2 and H_2S_3), and with arsenic sulphide which is formed by the following reaction: $(AsS_4)_2Ca_3$ (soluble calcium sulpharseniate) $+6HCl=As_2S_5+3CaCl_2+3H_2S$. The foregoing is in part the explanation of the reaction as given by B. Hirsch and A. Schneider in their *Commentar zum Arzneibuch für das Deutsche Reich*, Göttingen, 1895.

Description and Tests.—"A fine, amorphous powder, of a pale-yellow color, without odor or taste. Insoluble in water; very slightly soluble in absolute alcohol; readily soluble in carbon disulphide; also in benzin, benzol, oil of turpentine, and many other oils; also in ether, chloroform, and in boiling, aqueous solutions of alkaline hydrates. At 115° C. (239° F.) precipitated sulphur melts, and at a higher temperature its volatilizes, or, if air be admitted, burns to sulphur dioxide, leaving no residue. If 0.5 Gm. of precipitated sulphur be boiled with 10 Cc. of sodium hydrate T.S., it should be completely dissolved leaving no residue (absence of earthy or metallic impurities). If 1 Gm. of precipitated sulphur be digested for several hours with 10 Cc. of ammonia water, a portion of the clear filtrate should not leave any residue on evaporation; nor should another portion be colored yellow, or rendered turbid, by acidulation with hydrochloric acid, even after the addition of an equal volume of hydrogen sulphide T.S. (absence of arsenic). If 5 Cc. of water be agitated with 2 Gm. of precipitated sulphur, the liquid should not change the color of blue or red litmus paper (absence of acid or alkali); nor should it leave any residue on evaporation (absence of soluble impurities). If 0.5 Gm. of precipitated sulphur be boiled with a solution of 0.5 Gm. of potassium cyanide in 5 Cc. of water, and, after filtration, the clear liquid be acidulated with hydrochloric acid, it should not assume a reddish color, even after standing for an hour (absence of selenium)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—(See *Sulphur Sublimatum.*) Dose, a fraction of a grain to 3 drachms, according to whether an alterative or laxative effect is desired. Sometimes preferred for ointments on account of the smoothness of the product produced.

SULPHUR SUBLIMATUM (U. S. P.)—SUBLIMED SULPHUR.

SYMBOL: S. ATOMIC WEIGHT: 31.98.

SYNONYMS: *Sulphur*, *Sublimed sulphur*, *Flowers of sulphur*, *Flores sulphuris*, *Brimstone*.

Source and Preparation.—Sulphur, as such, is abundant in volcanic districts, especially in Sicily, where it is often found crystallized (*virgin sulphur*). It mostly occurs intermixed with gypsum, limestone, and clay. Combined sulphur widely occurs in the organic world, being an essential constituent of albumen, of wool, horn, hair, etc., and of certain volatile oils, viz.: those of mustard, garlic, onion, asafetida, etc. Among the minerals, sulphur is much distributed in the form of *sulphates*, as gypsum, heavy-spar, epsom salts, etc., or of *sulphides*, as iron pyrites (FeS_2), copper and iron pyrites ($CuFeS_2$), galena (PbS), cinnabar (HgS), black antimony (Sb_2S_3), and zinc blende (ZnS), etc. In the form of hydrogen sulphide, it gives the sulphur mineral waters their peculiar character. In the United States, sulphur deposits occur in Utah, Nevada, California, and other states. In Sicily, *crude sulphur* is obtained by fusion, *i. e.*, heating the ore, with limited access of air, in kilns (*calcaroni*) having a slanting bottom. The melted sulphur collects in a pit in front of the kiln. It is then purified by distillation from iron retorts, the vapors of sulphur being collected in large brick chambers, where they condense on the walls to a fine, impalpable powder called *flowers of sulphur*, or *sublimed sulphur*. When the temperature is allowed to rise, the powder melts again, and collects at the bottom of the chamber. It is drawn off and poured into cylindrical wooden molds, wherein it is allowed to harden, assuming the well-known form termed *roll* or *stick sulphur*. Roll sulphur, obtained in this manner, is called *refined sulphur* or *brimstone*. *Horse brimstone* (*sulphur vivum*, *black sulphur*) was, at one time, used in veterinary practice, and was an impure and variable preparation (see L. F. Kebler, *Amer. Jour. Pharm.*, 1894, pp. 242 and 559). Some sulphur of commerce is derived from the distillation of pyrites minerals.

Description and Tests.—The refined sulphur of commerce is a hard, brittle substance, of greenish-yellow color, and having a faint, peculiar taste and odor. It is unchanged in the atmosphere, is a non-conductor of electricity, and becomes negatively electric when rubbed. Its specific gravity is about 2.00. When heated, sulphur melts at about 115° C. (239° F.), forming a thin liquid of light-red color. At a temperature between 200° and 250° C. (392° and 482° F.), it becomes dark-red and viscid, and at 330° C. (626° F.), it becomes thin again. At 440° C. (824° F.), sulphur volatilizes. Sulphur is known in several *allotropic modifications*, viz.: as (1) rhombic or octohedral sulphur, (2) monoclinic or prismatic sulphur, (3) amorphous or plastic sulphur. The first is the form in which sulphur crystallizes from carbon disulphide and other solvents; the second is obtained when melted sulphur crystallizes slowly; it is gradually converted into the rhombic form. The third modification is formed when melted sulphur, heated above 330° C. (626° F.), is poured in a thin stream into cold water. In this state it is plastic and capable of receiving and retaining delicate impressions of seals, coins, etc. It has a brown color, but is gradually converted into the yellow rhombic modification. The two crystallizable modifications are soluble in carbon disulphide; the amorphous is but partially soluble.

Sulphur forms principally two oxides, viz.: (1) gaseous sulphur dioxide (SO_2), the anhydride of sulphurous acid (see *Acidum Sulphurosum*), and (2) solid sulphur trioxide (SO_3), the anhydride of sulphuric acid (see *Acidum Sulphuricum*).

Sublimed sulphur should conform to the following pharmacopœial requirements: "A fine, yellow powder, having a slight, characteristic odor, and a faintly acid taste"—(*U. S. P.*). The taste is due to the presence of some sulphuric acid that is formed during sublimation. To remove this acid is one of the objects of purifying this sulphur by washing it with diluted ammonia water (see *Sulphur Lotum*). "Insoluble in water; slightly soluble in absolute alcohol; more readily soluble in benzin, benzol, oil of turpentine, and many other oils; also in ether, in chloroform, and in boiling, aqueous solutions of alkaline hydrates"—(*U. S. P.*). The solution contains alkali sulphide and thiosulphate, *e. g.*, $6KOH+8S=2K_2S_3+S_2O_3K_2+3H_2O$. "Carbon disulphide promptly dissolves a portion of it, but leaves a residue of crystalline sulphur, which may be dissolved by a boiling solution of an alkaline hydrate. At 115° C. (239° F.) it melts, and at a higher temperature it volatilizes, or, if air be admitted, burns to sulphur dioxide, characterized by its odor, and by its blackening a strip of paper moistened with mercurous nitrate T.S. held in the gas. When agitated with water, the latter gives an acid reaction with litmus paper. The amount of residue left after volatilizing or burning a weighed portion of it should not exceed 0.5 per cent"—(*U. S. P.*).

The presence of sulphur in any compound may be readily shown by mixing the powdered substance with pure, calcined sodium carbonate, and heating the mixture on charcoal before the blowpipe until it is fused, transferring the bead on a silver coin, and moistening with water. If sulphur is present, a black spot of silver sulphide is formed at once. In organic substances, the presence of sulphur may be ascertained either by oxidizing the sulphur to sulphuric acid, by means of nitric acid or aqua regia, and testing with barium chloride, or by fusing the mass with a small quantity of metallic sodium, which forms sodium sulphide, cautiously dissolving the fused mass in water, and observing the characteristic violet-blue coloration of the sulphide by adding solution of nitroprusside of sodium.

Action, Medical Uses, and Dosage.—Sulphur, in its various forms, is an ancient and very important medicine. In small doses, it is a very efficient alterative, and influences the skin to some extent; no sensible phenomena are produced by doses of 1 to 6 grains of sulphur, but given in doses of a drachm, it excites intestinal action and occasions small, soft, pasty evacuations, which, however, are never watery. One serious objection to its use is that it renders the stools, and even the insensible perspiration, insupportably fetid; which arises from its being converted within the body into sulphuretted hydrogen. If the sulphur contains acid, its operation will be attended with more or less griping. It is probable that sulphur is rendered soluble, and, therefore, absorbable by the sodium compounds of the bile. In doses of from 10 to 20 grains, repeated every hour, it stimulates the circulation, increases temperature, and finally induces sweating. If long administered, the skin and breath exhale the disagreeable odor of sulphur dioxide, the perspiration stains yellow, and silver articles, coming in contact with the exhalations, are tarnished, a coating of silver sulphide being formed. Sulphur, when administered, may be detected in the urine, and if in sufficient quantity may act as a laxative upon the nursing infant of a woman who has taken it. Poisonous effects have been observed from sulphur when given in large amounts. Two ounces taken in a day, in 2 doses, occasioned headache, fever, pupillary contraction, semiconsciousness, cold, clammy perspiration, hematuria, vomiting, and purging of bloody stools, with much griping pain. Two-drachm doses, several times a day, have occasioned some of these symptoms and left an irritable condition of the stomach, persisting for many years. Even a 10 per cent ointment of sulphur, applied to the scalp, has caused serious trouble. As a rule, however, quite large doses of sulphur have been given for some length of time without any unpleasant results. Undoubtedly, many of the above-named effects were produced by the ordinary impurities of the sulphur, and, as a rule, it is these impurities which make sulphur so valuable as an external remedy, but for internal purposes, with few exceptions, washed sulphur should be used. Sulphur should not be given when there is active inflammation or severe febrile manifestations.

One of the old and important uses of sulphur was as a laxative. It is also used in *diseases of the bladder*, and in *pregnancy* as a mild cathartic, either alone, combined with cream of tartar, or with some other saline purgative. It is given alone in from ½ to 2-drachm doses, in milk or molasses; or 30 grains of sulphur combined with 2 drachms of bitartrate of potassium. For *hemorrhoids*, it is an exceedingly efficient agent. When there is severe lumbar pain, constipation, and the evacuations are hard, tenesmic, and more or less bloody, and the rectum protrudes, give ½ drachm of sulphur in milk, and repeat the dose every 2 or 3 days. Sulphur, however, is chiefly employed in Eclectic practice as an alterative and reconstructive agent. In the majority of instances the 1 x trituration is to be preferred. Thus it frequently does excellent service in the *anemic conditions* of scrofulous individuals suffering from female disorders, and may be given with iron when the latter alone is generally ineffectual. It not unfrequently happens that the natural supply of sulphur is insufficient for the perfect elaboration of the protein tissues, and, without doubt, the beneficial action of onions, eggs, mustard, and like substances is largely due to their furnishing sulphur when the system is greatly in need of it. The cases requiring sulphur have a blanched appearance of the skin, the iris and the hair fade in color, and in the middle-aged there is an early tendency to gray hairs; the feces and urine are pale, and the latter contains cystine. If the mucous surfaces are bathed in a mucous flow, and there are itching and burning, the indications are stronger. If the secretions are fetid or cadaverous, and there is evident tendency to decomposition of the fluids and tissues, sulphur is indicated, and, in small doses, will greatly change the condition of disease of which these symptoms are a part. If the bile be imperfectly elaborated so that it fails to exert its antiseptic effects upon the contents of the stomach, sulphur will greatly assist in rectifying the trouble. As a rule, most scrofulous conditions are benefited by sulphur. Use it in *leucorrhœa*, *conjunctivitis*, with red, swollen lids, *mucous diarrhœa*, and *ulcerations*, all depending upon a *scrofulous diathesis*. Take of the 1 x trituration about 10 or 15 grains, night and morning. The same course should be pursued in chronic diseases where the usual alterative acts but slowly or imperfectly; here substitute a month's treatment with sulphur. In *skin affections*, it is an aid to local treatment in affections simulating *itch*, in *herpetic eruptions*, *scald head*, *psoriasis*, and alone in *morph*, and *successive crops of boils*. For that form of irritation behind the ears, and at the angles of the mouth and wings of the nose in scrofulous children, sulphur should form the internal treatment, and salicylic acid and borax the local (Locke). Sulphur is of value in *neuralgia*, *muscular cramps*, and *headaches* due to fullness of blood in the cerebrum, accompanied with vertigo and ringing in the ears.

Sulphur is an efficient remedy in *chronic rheumatism*, giving internally 5-grain doses, and wrapping the affected part in a flannel bandage freely sprinkled with powdered sulphur. In these cases the pain is darting and tearing, and of a scrofulous or syphilitic origin. The scrofulous conditions of females present a good field for the application of alterative doses of sulphur. Thus it is useful in *sore nipples*, *sexual frigidity*, and in that form of *amenorrhœa* where the patient is anemic and a semileucorrhœal flow takes the place of normal menstruation. It is valuable in the *dyspepsia* of strumous origin, with gastric heaviness after meals, bad taste, heartburn, constipation, or tenesmic diarrhœa with offensive stools. It is a remedy for *incontinence of urine*, associated with piles, or cystic irritation, and in *catarrhal conditions of the bladder*. Sulphur is occasionally of value in *paralytic states*, and, as a remedy for *cough*, it fills a very important place. The cough is obstinate and accompanied by loud rattling of mucus within the chest, and expectoration is abundant, yellowish or greenish, and occasionally very offensive. Thus it mitigates the *cough of phthisis*, and is sometimes sufficient to effect a cure in *humid asthma*, *chronic nasal catarrh*, *chronic bronchitis*, and *chronic pertussis*, all with profuse secretion. Dr. Guibourt, of Paris, used sulphur with considerable success in the treatment of *lead colic*, and Dr. Laugantiers, by administering teaspoonful doses every hour of a mixture of 1 teaspoonful of sulphur in 4 fluid ounces of water, found it beneficial in the treatment of *croup*. An insufflation of sulphur is thought to be of service in *diphtheria*, to hasten the removal of the membranes, and it is frequently employed in other *ulcerative forms of sore throat*.

Externally, sulphur is used in various cutaneous diseases of the vesicular, scaly, or papular kind. Sulphur-baths are likewise found beneficial in *scrofula*, *chronic paralysis*, *chronic rheumatism*, *scabies*, and all kinds of *scaly cutaneous disorders;* the sulphurous acid gas, developed by sprinkling sulphur upon a hot iron or other vessel, is applied to the body, the head being protected. The effects occasioned are warmth, redness, and prickling of the integuments, followed by considerable sweating and excitement of the circulation. If the gas should be inhaled, it will prove powerfully irritating to the glottis, and altogether irrespirable, even when diluted with atmospheric air. As this procedure is sometimes apt to irritate the skin considerably, it is not so frequently employed as formerly. Sulphur, locally, is often beneficial in *ecthyma*, *comedones*, *sycosis*, *impetigo*, and *psoriasis*. The effects of sulphur, and of sulphurous acid in cutaneous diseases and rheumatism may be obtained by using the sulphide of potassium in the form of bath, say 2 or 3 ounces to 100 pounds of water.

Sulphur is a specific for *scabies*, and it is for this purpose that it has been most used externally. There are many methods employed, and all of them have for their purpose the destruction of the insect, which is accomplished by sulphur, or, as some contend, by the sulphurous acid formed in the usual sulphur applications. The following ointment is as efficient as any, having first thoroughly and freely washed the parts with soap and water: ℞ Sulphur. ℥i; potassium carbonate, ʒii; lard, ℥iv. Mix. Anoint the parts from 2 to 4 times a day (Locke). Prof. Webster recommends the following: ℞ Lanolin, ℔j; oil of tar, fl℥j; specific veratrum, fl℥i; sublimed sulphur, q.s. Mix. Ft. Unguent. Apply 3 successive nights, omit 3 nights, then apply again in the same order, preceded by a thorough bath each time. This is also recommended as a good application for *psoriasis* and *eczema;* eczematous affections are also well treated locally with sulphur (1 part) and starch (2 or 3 parts) (Locke). Prof. Locke recommends the following hair tonic, provided the hair bulbs are not dead: ℞ Washed sulphur, ʒi; oil of bergamot, gtt. x. Triturate; add glycerin, flʒij, and rose-water, fl℥xij. Apply with a soft sponge once a day.

Prof. Ellingwood (*Mat. Med. and Therap.*, p. 628) speaks favorably of sulphur used alternately with potassium nitrate in stubborn *acne*. His method is to apply (after thorough washing with sulphur or tar soap, rinsing with hot water, and carefully drying with a soft cloth) a lotion of 1 drachm of precipitated sulphur in the morning, and a lotion of 1 drachm of potassium nitrate in the evening, in either case not drying the parts, but allowing them to dry by evaporation. From this procedure he has obtained remarkable results in cases which have resisted other treatment for years. He advises against sulphur *ointments* in this affection on account of the mechanical obstruction produced. The dose of sulphur, as a laxative, is about 1 drachm; as an alterative, ½ grain, or the 1 x trituration, in 5-grain doses.

Specific Indications and Uses.—Hemorrhoids, with severe lumbar pain, constipation, and hard, tenesmic stools, which are sometimes bloody, and the rectum protrudes; scrofula; anemia of scrofula where iron is ineffectual; skin blanched, iris and hair fade, feces and urine pale; cystine in urine; mucorrhœa, with itching and burning; tendency to decomposition of fluids and solids, with fetid secretions; scrofulous ophthalmia, with red, swollen eyes; headache, with cerebral fullness; rheumatic darting or tearing pain; localized pain like the sticking of a pin; cough obstinate, with profuse expectoration; dyspepsia, with gastric weight, heartburn; constipation or offensive, tenesmic diarrhœa; skin affections, simulating itch. Externally, scabies; scaly, vesicular, and papular eruptions; sores at the angles of the mouth, and around the ears and nose.

Related Preparation.—Balsam of Sulphur, *Oleum lini sulphuratum*, *Oleum sulphuratum*, *Sulphurated oil*. Sulphur is partially soluble in hot olive oil, and will be deposited crystalline from a saturated oily solution upon cooling. The oil, however, is partially decomposed, the result being a viscid, acid, reddish-brown liquid of a very offensive odor. The Edinburgh College directed sublimed sulphur (1 part) and olive oil (8 parts), to be boiled together over a slow fire with constant stirring, the process to be conducted in an iron pot large enough to hold three times the amount above directed. The pot should be provided with a cover, to use in case the rising vapors should inflame. This preparation was once used, in doses of 5 to 30 drops, in such respiratory affections as *consumption* and *catarrh*. Owing to its acrid properties, it was abandoned as an internal agent. Locally, it is a stimulant to *foul ulcerations*.

SULPHURIS IODIDUM (U. S. P.)—SULPHUR IODIDE.

Synonym: *Sulfur iodatum*.

Preparation.—"Washed sulphur, twenty grammes (20 Gm.) [309 grs.]; iodine, eighty grammes (80 Gm.) [2 ozs. av., 360 grs.]. Mix the sulphur and iodine thoroughly by trituration; introduce the mixture into a flask, close the orifice loosely, and, by means of a water-bath, gradually, and with occasional agitation, apply a heat not exceeding 60° C. (140° F.), until the ingredients combine and become of a uniformly dark color throughout. Then increase the heat to the boiling point of the water, so as to fuse the mass. Should any iodine have sublimed and condensed on the glass, incline the flask so as to combine the iodine with the fused mass, and then pour the latter out upon a porcelain plate or other suitable cold surface. After cooling, break the product into pieces of suitable size, and keep them in a glass-stoppered bottle, in a cool place"—(*U. S. P.*).

Description.—When united, as directed above, in atomic proportion, iodine and sulphur form what is commonly regarded as *sulphur subiodide* (S_2I_2), or, as sometimes called, *iodine disulphide* (I_2S_2). The *U. S. P.* thus describes it: "Brittle masses of a crystalline fracture, and a grayish-black, metallic lustre, having the odor of iodine, and a somewhat acrid taste. Almost insoluble in water; soluble in about 60 parts of glycerin; very soluble in carbon disulphide. Alcohol and ether dissolve out the iodine, leaving the sulphur"—(*U. S. P.*). The iodine is also removed by cold solutions of potassium iodide, by caustic potash, and volatile oils. "Continued boiling with water vaporizes all the iodine, leaving about 20 per cent of sulphur as residue. On exposing sulphur iodide to the air, it gradually loses iodine. On heating it, some iodine sublimes at first; at a somewhat higher temperature, a sublimate is formed, containing both iodine and sulphur. At a still higher temperature, the whole is volatilized, leaving only a trace of residue"—(*U. S. P.*). (Also see investigation on the iodides of sulphur, by Prof. H. McLeod, in *Amer. Jour. Pharm.*, 1892, p. 573.)

Action, Medical Uses, and Dosage.—Internally, in doses of from 1 to 6 grains per day, sulphur iodide has been found useful in *scrofulous* and various *cutaneous affections*. It may be given in pill form. Externally, in form of ointment, *Unguentum Sulphuris Iodidi*, 1 part to 8, 12, or 16 parts of lard or cocoanut fat, it has been very efficient in certain chronic cutaneous diseases, as *lupus*, *acne*, *herpes*, *eczema*, *tinea capitis*, etc. If the ointment be strong with the salt, caustic effects may be produced.

SUMBUL (U. S. P.)—SUMBUL.

"The root of *Ferula Sumbul* (Kauffmann) Hooker filius"—(*U. S. P.*) (*Euryangium Sumbul*, Kauffmann; *Sumbulus moschatus*, Reinsch).

Nat. Ord.—Umbelliferæ.

Common Names: *Sumbul*, *Musk-root*, *Jatamansi*.

Illustrations: *Botanical Mag.*, Pl. 6196; Bentley and Trimen, *Med. Plants*, 131.

Botanical Source.—The plant that produces the sumbul-root of commerce, is an herbaceous perennial, with an erect, milk-bearing stem, and is a native of central Asia. The leaves are mostly radical, large, and ternately decompound, with the ultimate segments narrow and toothed. The upper stem leaves are reduced merely to the sheathing bases of the petioles. The flowers are small, yellow, and disposed in compound umbels. The terminal umbels are perfect, the lateral, only staminate. They have 5 stamens, 5 petals, and a 2-carpeled pistil. The fruit consists of 2 dry, seed-like carpels, compressed laterally, and each carpel having 3 dorsal ribs, and 2 narrow lateral wings.

History.—For thirty years after sumbul (musk-root) had become an article of commerce, nothing was known concerning its botanical source. In 1869, Kauffmann, from plants collected in Russian Turkestan, and grown in the Moscow Botanic Garden, established it in a new genus, *Euryangium*, closely related to Ferula, and differing chiefly in the broader vittæ (*Treasury of Botany*). The plant has since, however, been ascribed to *Ferula* by Petournikoff, and by Hooker filius, after an examination of the ripe fruit sent from Russia.

Description.—*Ferula Sumbul*, or *Musk-root* of commerce, reaches our market through Russia. Some specimens are under cultivation in England (see E. M. Holmes, *Amer. Jour. Pharm.*, 1897, p. 314, from *Pharm. Jour.*). Sumbul-root of commerce occurs in pieces or sections, often branched, and from ½ inch to 4 inches in thickness, the diameter of the root ranging from ½ inch to 3 inches. It is brown externally, the bark, in some instances, scaling off in tough, paper-like pieces, resembling birch bark, and again adhering closely to the root. The lower part of the stem is frequently attached to the root, and usually, in such cases, it is broken into a fibrous mass. The cut parts of the roots are covered with a dirty resinous layer, which exuded while fresh. A fresh section of the root shows a very porous, spongy texture; in many cases the fibrous substances being saturated with resinous matter, especially near the bark. There is much difference in the color, some pieces being almost white internally; these we find to contain a comparatively small proportion of resin, and to be of light weight, when compared with the specimens of a brown color. This latter quality of the root is to be preferred, although it is customary, we believe, to select the former. Choice sumbul has a strong odor of musk, is resinous internally, and is aromatic and bitter to the taste. Its medicinal principles seem to be mostly extracted by strong alcohol, the addition of even a small amount of water being objectionable. An inferior sumbul, having only a faint musky odor, is derived from *Ferula suaveolens*, Aitchison (see E. M. Holmes, *loc. cit.*). As demanded by the *U. S. P.*, sumbul is "in transverse segments, varying in diameter from about 2 to 7 Cm. (⅘ to 2⅘ inches), and in length from 15 to 30 Mm. (⅗ to 1⅕ inches); light, spongy, annulate or longitudinally wrinkled; bark thin, brown, more or less bristly fibrous; the interior whitish, with numerous brownish-yellow resin dots and irregular, easily separated fibres; odor strong, musk-like; taste bitter and balsamic"—(*U. S. P.*).

Chemical Composition.—An examination of sumbul was made about 1843, by Reinsch, who found it to contain wax and a balsam; both are extracted from the root by ether. The balsam has a faint, musky odor, strengthened by soaking in water; it dissolves in sulphuric acid, with the production of a blue color. When the root has been previously extracted by ether, alcohol dissolves from it an aromatic resin and a bitter substance, the latter being soluble in water. P. H. Utech (*Amer. Jour. Pharm.*, 1893, p. 465) obtained 6.1 per cent of an aromatic resin, bitter, insoluble in water, soluble in chloroform, ether, carbon disulphide, benzol, etc., almost insoluble in aqueous ammonia. The root also contains about 0.3 per cent of a volatile oil of a musk-like odor. Reinsch and Ricker (1848) obtained about 0.3 per cent of pure *angelic* acid from the root, but according to E. Schmidt (*Archiv der Pharm.*, 1886, p. 529) it does not preexist in the root, but is a decomposition product of the balsam obtainable by means of petroleum-ether. This solvent yielded to J. H. Hahn 17.25 per cent of fixed oil (*Amer. Jour. Pharm.*, 1896, p. 395).

Action, Medical Uses, and Dosage.—Sumbul is a stimulant and tonic to the nervous system; it has been recommended in *low typhus fevers* (to allay intestinal irritation), in *gastric spasm*, *hysteria*, *delirium tremens*, *diarrhœa*, *dysentery*, *leucorrhœa*, *gleet*, *chlorosis*, *asthma*, *chronic bronchitis*, and other maladies accompanied with an asthenic condition. In *nervous diseases* of a low, depressing character, it has been found very useful. Dr. Murawieff, a Russian physician, considers the balsamic resin as the active part, and has proposed its use, in the form of pills or tincture, in *pulmonary diseases*. The drug is seldom used in this country, but it certainly deserves further investigation. It was introduced (1835) as a remedy for *cholera*, but proved useless in that scourge. It is prepared in the form of fluid extract, the dose of which is from 10 to 60 minims, every 2, 3, or 4 hours; a tincture (dried root, ℥viii to alcohol, 98 per cent, Oj) may be administered in doses of 1 to 30 drops.

Pharmaceutical Preparation.—TONO-SUMBUL CORDIAL. This preparation is a specialty of Wm. R. Warner & Co., of Philadelphia. It is composed of sumbul, phosphate of iron, cinchona, acid phosphates, aromatics, and sherry wine. Tonic and cordial.

SUPPOSITORIA.—SUPPOSITORIES.

History.—Suppositories are globular, conical, cylindrical, or club-shaped solid bodies designed for introduction into the urethra, rectum, or vagina, in order to effect a therapeutical influence upon the adjacent parts or upon the general system. In a few instances they are prepared of articles not readily liquefying at the animal temperature, but, generally, they should be slowly fusible. The quantity of the active medicinal agent in each suppository, should, as a general rule, be about 3 times its dose for internal administration; however, with certain articles, or for certain results, more or less of this quantity will occasionally be required, according to the circumstances. Heretofore, when suppositories have been ordered by the physician, they were prepared by pouring the partially cooled mass, of which they were composed, into paper cones, the paper not being removed until the suppository became thoroughly hardened. The only advantage this method possesses is the readiness with which the cones may be made, and of any size required. The objections to it are the length of time required to finish the suppository, and the uncertainty of having the external surface clear, regular, and polished. In the preparation of suppositories, two things are especially required: (1) A composition which will permit the active ingredients to be so regularly diffused that each suppository will contain an equal quantity of the medicinal agent; the composition when cold must be firm, smooth, not liable to crack or split, must not adhere to the mold, and must be readily fusible at the temperature of the body. (2) A mold which, with as little extra manipulation as possible, will give smooth suppositories, of uniform size, shape, and weight, which will permit of their being made with as little loss of time as possible, and from which the suppository can be promptly removed.

For the first purpose, cacao butter (*Oleum Theobromatis*) is generally preferred by pharmacists, being used alone, especially when employed in cold seasons; or, in warm seasons, with the addition of $\frac{1}{5}$ or $\frac{1}{8}$ of wax or spermaceti. Spermaceti is usually preferred to wax, on account of its congealing with greater rapidity. Bullock and Crenshaw preferred, during warm weather, the addition of from $\frac{1}{16}$ to the $\frac{1}{20}$ of paraffin. Dr. W. B. Chapman, of Cincinnati, who at one time made a specialty of suppositories, preferred $\frac{1}{8}$ of Japan wax. The amount of these articles to be added, will depend entirely upon the season and the temperature, as well as upon the latitude; thus, in summer, more of the hardening body will be required. The quantity will necessarily have to be determined by experiment, in different latitudes. In this latitude $\frac{1}{4}$ of spermaceti is added during the hot summer months, and $\frac{1}{6}$ during the winter; or $\frac{1}{8}$ of Japan wax in winter, and $\frac{1}{6}$ or $\frac{1}{4}$ in summer. Curd soap was directed in some formulæ of the *British Pharmacopœia*, 1885. But it must be remembered that there are certain medicinal agents that contribute to the hardening of the cacao butter, as, most dry vegetable or mineral powders, especially iodides of lead and of cadmium, carbonate of lead, oxide of zinc, etc., in which instances no hardening aid is required. On the other hand creosote, chloral hydrate, camphor, carbolic acid, and the essential oils modify the consistence of cacao butter so that together they liquefy at a heat lower than the ordinary fusing point of the butter.

Various instruments have been proposed for making suppositories, and the reader is referred to *Amer. Jour. Pharm.*, 1852, p. 211; 1861, pp. 5 and 202; 1867, p. 121; 1868, pp. 52 and 223; 1869, p. 53; to *Proc. Amer. Pharm. Assoc.*, 1865, p. 65; 1866, p. 155; 1867, p. 167; 1868, p. 111; and to Caspari's, Coblentz's and other well-known works on pharmacy. Three sizes are to be preferred, two for the rectum, of 15 or 20 grains, each, for children, the other of 30 or 40 grains, each, for adults; likewise, one for the vagina, of about 120 grains, each. The weight of the suppositories will, of course, depend upon that of the medicinal agent added to the cacao butter—hence, there will always be a variation in weight of a few grains in the different kinds of suppositories. The ordinary weight of the *U. S. P.* and *Br. Pharm.* is 15 grains. Three varieties of molds have been used: (1) Individual hard-metal, cone-shaped molds; (2) separable solid blocks, hinged or otherwise, having several depressions, so that when apposed they form molds; (3) compression molds, for forming suppositories without the intervention of heat.

Upon the suggestion of Mr. H. S. Wellcome, of London, suppositories are now largely made of which the end to be inserted is formed largest—that is, tapering—bulb-shaped. This insures its retention by the sphincter muscles, much trouble having sometimes been experienced in retaining the ordinary conical suppository. When suppositories are prepared in advance by the pharmacist, they should always be kept in a cool place, and when passed over the counter, the person who receives them should be cautioned against placing the box or bottle containing them in the pocket, or in or near any place of too high a temperature; directions should likewise be given to keep them in a cool place until they are wanted for use, and then to handle them quickly.

Suppositories which contain a cavity from the base to a point near the apex, into which the active ingredient is placed, and the aperture then closed at base, have been recommended by some parties, but such are entirely unfit for use, as the medicinal substance, not being equally diffused throughout, instead of acting gradually and for a length of time, does not act at all until the material of which the suppository is made becomes liquefied, and then it acts suddenly and powerfully, perhaps irritating the parts to a considerable extent, and effecting more injury than benefit.

Preparation.—Dr. Chapman's process is as follows: (1) Melt the cacao butter and Japan wax together, and then thoroughly incorporate the medicinal articles with it, either by rubbing them together in a mortar, or by first triturating the medicinal extract, powder, or tincture, etc., with part of the melted butter upon a warm slab, adding, if necessary, as little as possible of alcohol, oil, glycerin, or water, etc., sufficient quantity to aid in obtaining a thorough incorporation of the materials; and, when well incorporated, triturate this with the remainder of the melted liquid in a mortar, continuing the trituration until the mass becomes quite thick, not, however, so thick as to prevent it from flowing readily into the molds. (2) The metallic block, before the melted mass is poured into the molds, must previously be set upon a lump of ice, and rest there until it has reached the dew point, as manifested by the thin layer of moisture upon its external surface (sometimes called sweating), then, and not till then, the mixture must be poured into the molds, as cool as may be without interfering with its flowing, and allowed to remain in until all the suppositories are hard and movable in the molds. (3) When the suppositories are sufficiently congealed, which requires 2 or 3 minutes, very seldom exceeding 5, pressure with the ball of the thumb upon each suppository, will cause it to move in the mold, at the same time imparting a snapping or cracking sensation; then the block may be turned upside down, and the suppositories will fall out. If the suppositories are allowed to remain in the mold for too long a time, they are liable to split or crack.

The following method is that directed by the *U. S. P.*: "Take of the medicinal ingredient, the prescribed quantity; oil of theobroma, a sufficient quantity. Having weighed out the medicinal ingredient or ingredients, and the quantity of oil of theobroma required, according to the kind of suppository to be prepared (see below), mix the medicinal portion (previously brought to a proper consistence, if necessary) with a small quantity of the oil of theobroma, by rubbing them together, and add the mixture to the remainder of the oil of theobroma, previously melted and cooled to the temperature of 35° C. (95° F.). Then mix thoroughly, without applying more heat, and immediately pour the mixture into suitable molds. The molds must be kept cold by being placed on ice, or by immersion in ice-cold water, before the melted mass is poured in. In the absence of suitable molds, suppositories may be formed by allowing the mixture, prepared as above, to cool, care being taken to keep the ingredients well mixed, and dividing the mass into parts, of a definite weight each, of the proper shape. Unless otherwise specified, suppositories should have the following weights and shapes, corresponding to their several uses: Rectal suppositories should be cone-shaped, and of a weight of about one gramme (1 Gm.) [15.5 grs.]. Urethral suppositories should be pencil-shaped, and of a weight of about one gramme (1 Gm.) [15.5 grs.]. Vaginal suppositories should be globular, and of a weight of about three grammes (3 Gm.) [about 46 grs.]"—(*U. S. P.*). A cold process has been followed in which the ingredients, finely divided, are mixed in a mortar or on a slab, and compressed by hand, spatula, or other compressing instrument.

Formulas.—The following suppositories were official in the *U. S. P.*, 1870:

Suppositoria	Medicinal Ingredients	Mix first with Cacao Butter	Subsequently mix with Cacao Butter
Acidi Carbolici	Carbolic acid, grains xij	Grains lx	Grains cviii
Acidi Tannici	Tannin, grains lx	Grains lx	Grains lx
Aloes	Purified aloes (powdered), grains lx	Grains lx	Grains lx
Asafœtidæ	Tincture asafetida, 1 fluid ounce; spontaneously evaporated	Grains lx	Grains lxxx
Belladonnæ	Alcoholic extract of belladonna, grains vj; water, q. s.	Grains lx	Grains cxiv
Morphiæ	Morphine sulphate, grains vj	Grains lx	Grains cxiv
Opii	Extract of opium, grains xij; water, q. s.	Grains lx	Grains cviij
Plumbi	Acetate of lead, grains xxxvj	Grains lx	Grains lxxxiv
Plumbi et Opii	Acetate of lead, grains xxxvj; extract of opium, grains vj; water, q. s.	Grains lx	Grains lxxx

Make of each formula twelve (12) suppositories. The following was official in the *British Pharmacopœia*, 1885:

Suppositoria Hydrargyri (*Mercurial suppositories*).—Mercurial ointment, 60 grains; oil of theobroma, 120 grains. Mix with sufficient heat, and make into 15-grain suppositories. Each suppository contains 5 grains of ointment of mercury. The following suppositories are official in the *British Pharmacopœia*, 1898:

Suppositoria Acidi Carbolici (*Phenol suppositories*).—Each containing 1 grain of phenol.

Suppositoria Acidi Tannici (*Tannic acid suppositories*).—Each containing 3 grains of tannic acid.

Suppositoria Belladonnæ (*Belladonna suppositories*).—Each containing approximately $\frac{1}{60}$ grain (0.001 gramme) of the alkaloids of belladonna root.

Suppositoria Glycerini (*Glycerin suppositories*).—Each containing 70 per cent of glycerin.

Suppositoria Iodoformi (*Iodoform suppositories*).—Each containing 3 grains (0.2 gramme) of iodoform.

Suppositoria Morphinæ (*Morphine suppositories*).—Each containing ¼ grain (0.017 gramme) of morphine hydrochloride.

Suppositoria Plumbi Composita (*Compound lead suppositories*).—Each containing 3 grains (0.2 gramme) of lead acetate, and 1 grain (0.067 gramme) of opium.

SUPPOSITORIA GLYCERINI (U. S. P.)—SUPPOSITORIES OF GLYCERIN.

Preparation.—"Glycerin, sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; sodium carbonate, three grammes (3 Gm.) [46 grs.]; stearic acid, five grammes (5 Gm.) [77 grs.]. To make 10 rectal suppositories. Dissolve the sodium carbonate in the glycerin in a capsule on a water-bath; then add the stearic acid, and heat carefully until this is dissolved, and the escape of carbonic acid gas has ceased. Then pour the melted mass into suitable molds, remove the suppositories when they are cold, and wrap each in tin-foil. These suppositories should be freshly prepared when required"—(*U. S. P.*). The *U. S. P.* suppository contains 90 per cent of glycerin. The hygroscopic nature of glycerin renders it necessary to cover the suppository in some manner, as by paraffin or tin-foil, which latter is recommended in the formula. The official suppository weighs about 102 grains.

Action and Medical Uses.—These suppositories, by the irritating presence of the glycerin, provoke rectal action, causing an alvine evacuation. They are useful in some cases of *constipation* depending upon atony of the lower bowel. They should not be used continuously.

SYMPHYTUM.—COMFREY.

The root of *Symphytum officinale*, Linné.

Nat. Ord.—Boraginaceæ.

Common Name and Synonyms: *Comfrey; Radix symphyti, Radix consolidæ majoris.*

Botanical Source.—Comfrey has an oblong, fleshy, perennial root, black externally, and a pilose, herbaceous stem, 3 or 4 feet high, branching above, and winged by the decurrent bases of the pointed, wavy, rough-edged leaves. The lower leaves and radical are ovate-lanceolate, tapering into a petiole; the upper and floral, lanceolate. Flowers white or of a rose color, and borne in terminal, revolute racemes. Calyx 5-parted, with lanceolate, acuminate sepals; the corolla tubular-campanulate; the limb with 5 recurved teeth. Stamens 5, included; anthers elongated. Style filiform. Nutlets smooth, ovate, fixed by a large excavated (perforate) base. The whole plant is rough with dense hairs (W.—G.).

History, Description, and Chemical Composition.—Comfrey is a native of Europe, but naturalized in this country, growing on low lands and moist places, flowering all summer. The root is medicinal; when fresh it is glabrous, fusiform, branching, 10 or 12 inches in length, by 1 in diameter, and very mucilaginous. The dried root, as found in commerce, is in pieces varying from 1 to 4 or 5 inches long, black, and corrugated externally, dark-whitish and corneous internally, nearly odorless, viscid, and slightly astringent. It contains some tannic acid, a trace of starch, some sugar, and a large amount of mucilage, which is readily extracted by water. *Asparagine* in small amount was obtained from it by Henry and Plisson in 1829.

Action, Medical Uses, and Dosage.—This plant is demulcent and slightly astringent. With other mucilaginous agents, it is considered inert or of but little medical importance by many writers; but this is an erroneous view, the result of deficient investigation. All mucilaginous agents exert an influence on mucous tissues, hence the cure, by their internal use, of many pulmonary and other affections in which these tissues have been chiefly implicated. Physicians must not expect a serious disease to yield to remedies which act on mucous membranes only; and to determine the true value of a medicinal agent, they must first ascertain the true character of the affection, as well as of the tissues involved. Again, mucilaginous agents are always beneficial in *scrofulous* and *anemic habits*. Comfrey root is very useful in *diarrhœa*, *dysentery*, *bronchial irritation*, *coughs*, *hæmoptysis*, other *pulmonary affections*, *leucorrhœa*, and *female debility;* these being principally mucous affections. It is also of some value in *passive hemorrhages* from the bowels, kidneys, or womb. It may be boiled in water, wine, or made into a syrup, and taken in doses of from 1 to 4 fluid ounces of the preparation 2 or 3 times a day. A tincture of the recent root (℥viii to alcohol, 98 per cent, Oj) has been recommended in from 1 to 10-drop doses. Externally, the fresh root, bruised, forms an excellent application to *bruises, ruptures, fresh wounds, sore breasts, ulcers, white swellings*, etc.

SYRUPI.—SYRUPS.

Syrups are liquid medicines, of a viscid consistence. They are solutions of sugar alone, or sugar mixed with honey and dissolved in water, wine, vinegar, or diluted acetic acid. Simple syrup is a solution of sugar in water, and forms the basis of many medicated syrups.

Medicated syrups are those in which one or more medicinal agents enter into the solution, and are commonly prepared by incorporating sugar with vegetable, aqueous or spirituous solutions, expressed juices, etc. When the active principles of the ingredients are dissipated or decomposed by boiling water, or where they are not readily taken up by water, they are frequently dissolved by alcohol, specific gravity 0.935, the alcohol being retained or evaporated subsequently, as may be required; sometimes a tincture of the medicinal agent or agents is added to simple syrup. The stability of a syrup depends on its composition and consistence, the temperature, and the amount of exposure to the air. As many syrups are used in chronic diseases during the absence of febrile or active inflammatory symptoms, the addition of an alcoholic tincture is not then objectionable, unless it be in large proportion; but syrups prepared for febrile or inflammatory difficulties should be entirely free from any spirituous liquor whatever.

If the sugar be in too small amount the syrup will ferment; if in too large amount the sugar will crystallize. The heat employed should be adapted to the character of the active principle; if it be volatile or easily decomposed a gentle heat is required. If it be not injured by heat, concentration may be conducted with a brisk fire, and effected as rapidly as possible. After the syrup has cooled, if a pellicle forms upon its surface, it has been concentrated too much. "Various means have been devised for the preservation of syrups; a little sulphate of potassium, chlorate of potassium, bisulphite of calcium, or sugar of milk, has been recommended for this purpose. One fluid drachm of Hoffman's Anodyne to the pint of syrup will effectually check a tendency to fermentation. The maintenance of a syrup in a regular degree of temperature, say 55° to 60° C. (131° to 140° F.), will tend very much to lessen its liability to ferment. As a general rule, syrups intended to be kept should be bottled while hot, securely corked and sealed, and after cooling should be shaken, that the moisture condensed on the cork may be mixed with the syrup, and not form a diluted layer at the surface" (Mohr and Redwood).

Salicylic acid has of late years been employed to preserve syrups, but if prepared by the cold process to be hereafter mentioned no preservative is required.

Nearly all the compounds that have been proposed for syrups, such as the *Eclectic Alterative, Scrofulous, Stillingia*, and *Pulmonary Syrups*, comprise substances whose medicinal principles are imperfectly soluble in water. The process laid down under the formula for *Compound Syrup of Aralia* (which see) is applicable to this class.

In all these preparations, the principle should be adopted of confining the boiling and evaporation to the weaker portion of the solution, so that those delicate principles which are evaporated or decomposed by heat may be submitted to its action as little as possible.

Owing to the fact that syrups which have been boiled for a long time, and syrups which contain acids, are liable to have a part of their sugar changed to inverted sugar, the cold process of Orynski (1871) has attracted considerable attention, it having been observed that such syrups are less liable to ferment, and that alkaline solutions of copper are more slowly affected by them than when heat has been employed. This process, as employed later by Hunstock, consists in placing the sugar into a cylindrical cone-shaped percolator, in the lower end (neck) of which has been introduced a piece of moistened sponge or cotton, packed neither too tight nor too loose, a cork being inserted into the lower orifice of the vessel. The menstruum, prepared as directed by the official process, is now poured upon the sugar, and the whole is set aside until a portion of the sugar has dissolved and the mass has settled to half its original bulk. The cork is then removed and the syrup allowed to pass drop by drop. Should the liquid fail to dissolve all the sugar, pour upon the final remainder a portion of the filtrate, which will usually complete the solution. This process is especially adapted for syrups made of plants holding volatile principles, or for those whose ingredients are likely to be injured by heat.

Syrups in which vinous fermentation has begun, which may be known by the frothiness due to escaping carbon dioxide and by the vinous odor, may, unless the fermentation has passed beyond the incipient stage, or unless their virtues depend partly or wholly upon volatile principles, be restored by boiling and straining them. Almond and acacia syrups excepted, alteration of non-volatile active constituents seldom takes place at such a stage of decomposition. Glycerin has been proposed as a menstruum for syrups which, when made of sugar, readily decompose. In some cases sugar is used as a preservative on account of its quality of preventing chemical changes. Thus syrup of iodide of iron and Vallett's iron mass both contain sugar for this quality. Syrups, both simple and compound, once constituted an important part of the Eclectic physicians' remedies. But they have been discarded almost wholly, the burden of sugar being of no use in disease and often harmful. In Eclecticism syrups are practically obsolete; yet we give in the pages to follow the formulæ of those peculiar to our school.

SYRUPUS (U. S. P.)—SYRUP.

SYNONYMS: *Syrupus simplex*, *Simple syrup*, *Syrupus albus*, *Syrupus sacchari*.

Preparation.—"Take of sugar, in coarse powder, eight hundred and fifty grammes (850 Gm.) [1 lb. av., 13 ozs., 430 grs.]; distilled water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the sugar, with the aid of heat, in four hundred and fifty cubic centimeters (450 Cc.) [15 fl℥, 104 ♏] of distilled water, raise the temperature to the boiling point, strain the liquid, and pass enough distilled water through the strainer to make the product, when cold, measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly. Syrup may also be prepared in the following manner: Press down into the neck of a percolator or funnel of suitable size a tapering piece of coarse, well-cleaned sponge, not too tightly, and in such a manner that the whole sponge shall be within the neck of the percolator, its upper end being about half an inch below its commencement. Place the sugar in the apparatus, make its surface level without shaking or jarring, then carefully pour on four hundred and fifty cubic centimeters (450 Cc.) [15 fl℥, 104 ♏] of distilled water, and regulate the flow of the liquid, if necessary, so that it will pass out in rapid drops. Return the first portions of the percolate, until it runs through clear, and, when all the liquid has passed, follow it by distilled water, added in portions, so that all the sugar may be dissolved, and the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly. Syrup thus prepared has a specific gravity of about 1.317"—(*U. S. P.*).

Description.—Simple syrup, when properly made, is sweet, nearly odorless, transparent, and colorless, of the consistence of thin molasses. Refined sugar should always be used.

Action and Medical Uses.—Simple syrup is nutritious and demulcent. It is employed in various mixtures, pills, medicated syrups, and extemporaneous prescriptions. Locally, it is applied to *abrasions*, *burns*, and *scalds*.

Soda Water Syrups.—The following formulæ and directions for the preparation of soda water syrups, etc., are reproduced from *Elixirs*, by J. U. Lloyd.

Simple syrup made according to the *U. S. P.*, is too thick for use as a soda syrup. It is difficult to mix it with the carbonated water, and it sticks to the glass. For a simple soda syrup, the following formula has stood the test of years:

SIMPLE SYRUP (*Soda syrup*).—Pure white sugar, 35 pounds (av.); distilled water, 20 pints. Pour the water into a kettle, add the sugar, and bring the mixture to a boil, stirring constantly. Then remove from the fire and strain while hot. This syrup will neither crystallize in cold, nor ferment in warm weather. However, the addition of certain vegetable extractives will cause any simple syrup to ferment. Either rock-candy syrup (a purified, uncrystallizable syrup resulting from the manufacture of rock-candy), or simple syrup, made according to the foregoing formula, may be used in the formulæ that follow when "syrup" is commended.

Syrup of Almond or Peach.—Flavoring extract of almond (peach), ½ fluid ounce; syrup, 15½ fluid ounces. Mix them together.

Chocolate Syrup.—Flavoring extract of chocolate, 4 fluid ounces; syrup, 12 fluid ounces. Mix them together. This syrup is brown and unsightly.

Syrup of Coffee. Flavoring extract of coffee, 4 fluid ounces; syrup, 12 fluid ounces. Mix them together.

Syrup of Coffee.—Coffee (Java), 8 ounces (av.); sugar, 20 ounces (av.); boiling water, a sufficient amount. Percolate the coffee with hot water until 10 fluid ounces of percolate are obtained, and in the percolate dissolve the sugar.

Syrup of Ginger.—Flavoring extract of ginger, 1 fluid ounce; syrup, 32 fluid ounces. Mix them together. This syrup is likely to be unsightly from the presence of finely divided resin. It is also too peppery for some persons, and must be made with less ginger than is called for by our formula. The formula that follows is milder, and yields a transparent product.

Syrup of Ginger.—Soluble extract of ginger, 2 fluid ounces; syrup, 30 fluid ounces. Mix them together.

Syrup of Lemon.—Syrup, 1 pint; flavoring extract of lemon, 2 fluid drachms; citric acid, 1 drachm; curcuma color, water, frothing liquid, of each, a sufficient amount. Dissolve the powdered citric acid in ½ fluid ounce of water, add to the syrup, and then add the extract, frothing liquid, and enough curcuma color to bring to a lemon color. By referring to our remarks concerning lemon extract, the operator will find that the quality of syrup of lemon depends upon the quality of the lemon extract employed in making it. Since we give several formulæ, choice thereof is readily made.

Syrup of Nectarine.—Flavoring extract of nectarine, 1 fluid ounce; syrup, 15 fluid ounces. Mix them together.

Syrup of Orange.—Syrup, 1 pint; flavoring extract of orange, 2 fluid drachms; citric acid, 1 drachm; curcuma color, water, frothing liquid, of each, a sufficient amount. Dissolve the powdered citric acid in ½ fluid ounce of water, add to the syrup, and then add the extract, frothing liquid, and enough curcuma color, modified by a small amount of cochineal color, to bring to an orange-yellow color. By referring to our remarks concerning orange extract, the operator will find that the quality of syrup of orange depends upon the quality of the orange extract employed in making it. Since we give several formulæ, choice thereof is readily made.

Syrup of Blood Orange.—Syrup of blood or red orange is not distinguished from the foregoing excepting by its color. To make it, color the syrup of orange with cochineal color until it is of a rich-red color.

Syrup of Pineapple.—Syrup, 1 pint; flavoring extract of pineapple, 1 fluid drachm; curcuma color, frothing liquid, of each, a sufficient amount. Mix the simple syrup and the extract of pineapple, color the liquid appropriately with tincture of curcuma, and then add the frothing liquid.

Syrup of Raspberry.—Flavoring extract of raspberry, 2 fluid drachms; simple syrup, 1 pint; cochineal color, frothing liquid, of each, a sufficient amount. Mix the extract with the syrup, color with an appropriate amount of cochineal color, and add the frothing liquid, if desirable.

Syrup of Rose.—Flavoring extract of rose, 1 fluid ounce; syrup, 1 pint. Mix them together and color red with cochineal color.

Syrup of Sarsaparilla.—Flavoring extract of sarsaparilla, 1 fluid ounce; syrup, 1 pint. Mix them together and color dark-brown with caramel.

Syrup of Strawberry.—Flavoring extract of strawberry, 2 fluid drachms; simple syrup, 1 pint cochineal color, frothing liquid, of each, a sufficient amount. Mix the extract with the syrup, color with an appropriate amount of cochineal color, and add the frothing liquid, if desirable.

Syrup of Vanilla.—Syrup, 1 pint; flavoring extract of vanilla, 2 fluid drachms; caramel, cochineal color, frothing liquid, of each, a sufficient amount. Mix the extract and the syrup, then add caramel and cochineal color enough to give a clear red-brown, and finally add the frothing liquid. By referring to our remarks on flavoring extract of vanilla, it will be seen that the quality of syrup of vanilla depends on the quality of the extract employed in making it. The operator may, therefore, select as his judgment dictates, but our experience is to the effect that the extract made of prime long vanilla is best suited to build up a business and retain it. In like manner, other soda syrups may be extemporaneously prepared by mixing together flavoring extracts and syrup. It is unnecessary for us to consume space with details that will suggest themselves to every druggist.

Cream Syrups. These syrups have long been favorites, and when made of pure, fresh milk are delicious. In former times, they were made with much care and replenished daily. Now we learn that condensed milk is often substituted for fresh milk, and simple syrup is mixed therewith. The formulæ that follow are such as were used thirty years ago, and, in our judgment, have no superiors.

Cream Syrup (Orange Cream).—Milk, 1 quart; sugar, 2½ pounds. Dissolve the sugar in the milk by the aid of a gentle heat, stirring constantly; strain, and when cool, add 4 fluid drachms of flavoring extract of orange and enough curcuma color to bring to a rich cream color. This syrup must be freshly made each day.

Nectar Syrup (Nectar Cream).—Milk, 1 quart; sugar, $2\frac{1}{2}$ pounds. Dissolve the sugar in the milk by the aid of a gentle heat, stirring constantly; strain, and when cool, add 4 fluid drachms of flavoring extract of best vanilla (or nectar) and enough cochineal color to bring to a deep pink. This syrup must be freshly made every day.

Fruit Syrups.—In recent years fruit juices have largely replaced some of the artificial flavors of former times. These juices are manufactured in large amounts by experienced men, and druggists usually find it better to purchase them than to attempt their manipulation. They produce delicious syrups, and, in our opinion, are very much to be preferred to most of the ordinary imitation syrups that are made of artificial ethers. Full directions for making syrups accompany them, and we need not, therefore, consider these substances in detail. While we do not recommend an attempt at manufacturing these juices generally in a small way, we believe it often judicious for the apothecary to make syrups direct from some of the juicy fruits when they are plentiful and in season. The following are suggested if the respective fruit is abundant and cheap; if not, it is better to purchase fruit juices on the market and make the syrup therefrom.

Blackberry (Fruit) Syrup.—Heat ripe blackberries to the boiling point and express the juice. To 4 pints of juice add 6 pounds of sugar, dissolve by heat, and bottle securely while hot. It must be kept in a cool, dark location.

Raspberry (Fruit) Syrup.—Heat ripe berries to the boiling point and express the juice. To 4 pints of juice add 6 pounds of sugar, dissolve by heat, and bottle securely while hot. It must be kept in a cool, dark location.

Strawberry (Fruit) Syrup.—Heat ripe berries to the boiling point and express the juice. To 4 pints of juice add 6 pounds of sugar, dissolve by heat, and bottle securely while hot. It must be kept in a cool, dark location.

Cherry (Fruit) Syrup.—Heat ripe fruit to the boiling point and express the juice. To 4 pints of juice add 6 pounds of sugar, dissolve by heat, and bottle securely while hot. It must be kept in a cool, dark location.

Grape (Fruit) Syrup.—Heat ripe fruit to the boiling point and express the juice. To 4 pints of juice add 6 pounds of sugar, dissolve by heat, and bottle securely while hot. It must be kept in a cool, dark location.

Pineapple (Fruit) Syrup.—Wash and then slice the pineapples thinly, without removing the peel; then mix therewith 1 pound of sugar for each pound of fruit, and occasionally stir the mixture for 2 or 3 days, then squeeze the syrup therefrom and bottle it.

Quince (Fruit) Syrup.—Quarter and seed the quinces without removing the peel. Slice thinly, and mix therewith 1 pound of sugar for each pound of fruit, and occasionally stir the mixture for 2 or 3 days, then add some water if too thick, and squeeze the syrup therefrom and bottle it. Most persons peel such fruits as pineapple and quince, and thereby lose the rich aroma which mostly resides in the peel. Quince especially becomes insipid if peeled. Other fruit syrups can be made of juicy fruits by similar methods.

"Tonic" Syrups.—We can not too strongly condemn the indiscriminate use of nervines in the form of beverages. Perhaps there may be an excuse for the affixing of a name only to a fanciful, harmless syrup, the name reminding one of a remedy, and yet it seems as though the use or imaginary use of medicines should be left to the discretion of physicians.

Such "tonics," even as solution of phosphate of calcium in acid water, so fashionable in some instances at present, may better be left to the discretion of physician prescribers who understand the systemic condition of the "debilitated." It seems to us as though much injury may result in the continued drinking of phosphoric acid and other medicines by persons who do not need such substances, and who simply imagine that they should "take a tonic."

The same remarks apply to "iron tonics" and "calisaya tonics," and other similar syrups; and while "syrup of beef extract" may do no harm, it seems to us enough out of place as a beverage to give even a man in health the horrors and a dislike for beef tea in its proper place. We may, with our views of this matter expressed, be pardoned for omitting formulæ for such compounds.

The following frothing liquids and colors are employed in the above formulæ:

Frothing Liquids.—In some cases it is desirable that a syrup should froth considerably. Judgment, however, must be employed in adding the frothing liquid, as well as drawing the carbonated water into the syrup, for some syrups are naturally inclined to foam too much. Among our formulæ we occasionally direct the use of a frother, and the operator can select from the following that which best suits his taste:

The white of 1 egg added to a quart of the syrup specified.

One ounce of mucilage of acacia added to a quart of the syrup.

Two drachms of tincture of soap bark (quillaya) added to a quart of the syrup.

The first and second of these have been in use for a long time; the last is a comparatively recent addition. That the first and second are both harmless is evident, and we have as yet heard no complaints concerning tincture of quillaya.

Tincture of Soap Bark (Quillaya). Take of ground or powdered quillaya, 4 ounces; alcohol, water of each a sufficient amount. Moisten the quillaya with a mixture of alcohol, 2 ounces; water, 14 ounces; and having allowed the moistened powder to stand 1 hour to expand, pack it loosely in a percolator. Cover with menstruum, and when it appears at the exit of the percolator cork the exit and allow the mixture to macerate from 12 to 24 hours. Then continue the percolation until 1 pint of tincture be obtained.

This tincture is of an opalescent color and is likely to precipitate by age; it should be kept in a cool locality. It can be made clear by increasing the proportion of alcohol in the menstruum, but this increase of alcohol is at the expense of the frothing power of the product. The larger the amount of alcohol the less its comparative value as a froth producer. One ounce of the foregoing tincture is sufficient for a gallon of syrup.

Colors.—Throughout this work *Elixirs*, by J. U. Lloyd various substances for coloring are occasionally commended. They are, or should be, harmless, and are necessary adjuncts, for the public taste must be catered to in the way of bringing certain syrups to resemble the colors of the fruits that they are designed to imitate. It is important that these colors should be innocuous, and luckily the shades desired can be easily obtained. At the present time, beautiful, concentrated red, yellow, green, and other colors, can be purchased of dealers in essential oils, and are warranted free from any poison or objectionable impurity, and may be substituted for those we commend. The colors we direct may be made as follows (natural fruit syrups do not demand artificial colors):

Solution of Cochineal (*Carmine*).—This preparation has been used some years by the writer in preference to any "tincture" of cochineal. The fat in cochineal causes such preparations to putrefy in warm weather; and to extract the fat, by means of ether, from the powdered cochineal, previous to tincturing it, is expensive and tedious. The term "tincture of cochineal" is scarcely appropriate as applied to the aqueous solutions made of cochineal, cream of tartar, and alum, and, as the object is simply to secure a coloring matter, the term might, with equal propriety, be applied to our solution of carmine, made as follows: Carmine, No. 40, 60 grains; distilled water, glycerin, of each, 4 ounces; ammonia water, a sufficient quantity. Powder the carmine and triturate with the water, gradually adding ammonia water until the carmine disappears, and a dark-red liquid, free from insoluble matter, remains. To this add the glycerin and mix. Should this solution ever become murky, a little ammonia water will restore its transparency. Solution of carmine is necessarily alkaline, and can not be employed to color acid liquids. For all neutral or alkaline solutions it is admirable, and for soda water syrups is far preferable to aniline red.

Curcuma (*Turmeric*) (Yellow).—Macerate 4 ounces of good curcuma in a pint of alcohol, shaking occasionally for 7 days, then filter.

Caramel (*Burnt sugar*) (Brown).—In a capacious iron kettle, over a direct fire, melt a pound of sugar, and increase the temperature until empyreumatic vapors have been freely driven off, and the residue has acquired a deep-black color. Then remove from the fire, allow to partially cool, and gradually and cautiously stir 2 pints of hot water into it. This operation must be performed in the open air or over a good flue, for the vapors are very irritating when inhaled. Caution must also be employed in pouring the water into the hot mass, for, if it be very hot, the material will be thrown violently from the kettle by the sudden expansion of steam. If caramel is only wanted in small amount, it is best to purchase it.

SYRUPUS ACACIÆ (U. S. P.)—SYRUP OF ACACIA.

Synonyms: *Syrup of gum Arabic*, *Syrupus gummosus*.

Preparation.—"Mucilage of acacia, recently prepared, twenty-five cubic centimeters (25 Cc.) [406 ♏]; syrup, seventy-five cubic centimeters (75 Cc.) [2 flʒ, 257 ♏]; to make one hundred cubic centimeters (100 Cc.) [3 flʒ, 183 ♏). Mix them. This syrup should be freshly prepared when required"—(*U. S. P.*).

Mucilage of acacia is easily and very quickly decomposed, and the formula of the *U. S. P.* (1870) is, by some, regarded as preferable to the preceding. It is made practically as follows: Dissolve 2 troy ounces of gum Arabic (in pieces) in 8 fluid ounces of water, without heat, add 14 ounces of coarsely-powdered refined sugar, and, by aid of gentle heat, dissolve it, and then strain the product. Momentarily heating the preparation to 100° C. (212° F.) is thought advisable by some.

Action and Medical Uses.—Demulcent for *catarrhal disorders of the throat*, and as a *fever drink*. It may be used as a medium for suspending powders when about to be swallowed.

SYRUPUS ACIDI CITRICI (U. S. P.)—SYRUP OF CITRIC ACID.

Preparation.—"Citric acid, ten grammes (10 Gm.) [154 grs.]; water, ten cubic centimeters (10 Cc.) [162 ♏]; spirit of lemon, ten cubic centimeters (10 Cc.) [162 ♏]; syrup, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 flʒ, 391 ♏]. Dissolve the citric acid in the water, and mix the solution with five hundred cubic centimeters (500 Cc.) [16 flʒ, 435 ♏] of syrup. Then add the spirit of lemon, and, lastly, enough syrup to make the product measure one thousand cubic centimeters (1000 Cc.) [33 flʒ, 391 ♏]. Mix thoroughly"—(*U. S. P.*).

This syrup is prepared with less trouble than lemon syrup direct from the fruit, and can be preserved much better, but its taste is less agreeable.

Action, Medical Uses, and Dosage.—This syrup, added to water or to carbonic acid water, forms an agreeable cooling beverage for persons laboring under *febrile complaints*, and in certain states of the system requiring acids. From 1 fluid drachm to ½ fluid ounce may be added to ½ pint of the fluid in which it is to be taken.

SYRUPUS ACIDI HYDRIODICI (U. S. P.)—SYRUP OF HYDRIODIC ACID.

"A syrupy liquid containing about 1 per cent, by weight, of absolute hydrochloric acid ($HI=127.53$), or about 1.3 Gm. in 100 Cc."—(*U. S. P.*).

Preparation.—"Potassium iodide, thirteen grammes (13 Gm.) [201 grs.]; potassium hypophosphite, one gramme (1 Gm.) [15.5 grs.]; tartaric acid, twelve grammes (12 Gm.) [185 grs.]; water, fifteen cubic centimeters (15 Cc.) [243 ♏]; diluted alcohol, syrup, each, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Dissolve the two potassium salts in the water, and the tartaric acid in twenty-five cubic centimeters (25 Cc.) [406 ♏] of diluted alcohol. Mix the two solutions in a vial, shake it thoroughly, and place it in ice-water for half an hour, occasionally shaking. Then filter the mixture through a small, rapidly-acting, white filter, and carefully wash the vial, and filter with diluted alcohol, until the filtrate ceases to produce more than a faint cloudiness when a drop or two is allowed to fall in silver nitrate test-solution. Reduce the filtrate, by evaporation in a tared capsule, on a water-bath, to fifty grammes (50 Gm.) [1 oz. av., 334 grs.], and mix it, when cold, with enough syrup to make the product weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]"—(*U. S. P.*).

Hydriodic acid, in aqueous solution, is unstable, and, as sugar tends to preserve the acid, this syrup has been made official. The process is practically that of the *National Formulary* (1st ed.). The potassium hypophosphite, reacting with the tartaric acid, causes a small quantity of hypophosphorous acid to be liberated, which preserves the product from decomposition. Mr. George M. Beringer (*Amer. Jour. Pharm.*, 1894, p. 20) points out that the above quantity of tartaric acid is below the theoretical amount required for the decomposition of the iodide and the hypophosphite, and should be at least 13.19 grammes.

Description and Tests.—"A transparent, colorless, or not more than a pale straw-colored liquid, odorless, and having a sweet and acidulous taste. Specific gravity about 1.313 at 15° C. (59° F.). If a small portion of the syrup be mixed with a little starch T.S., and a few drops of chlorine water then added, the liquid will acquire a deep-blue color. Not more than a faint bluish tint should be produced in the syrup by starch T.S. alone (limit of free iodine). The addition of silver nitrate T.S. to a small portion of the syrup produces a pale-yellow precipitate, nearly insoluble in ammonia water. If 32 (31.88) Gm. of the syrup be exactly neutralized by ammonia water, and then mixed with 2 drops of potassium chromate T.S., it should require about 25 Cc. of decinormal silver nitrate V.S. to produce a permanent red tint (corresponding to about 1 per cent of absolute hydriodic acid)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Uses, same as for *Acidum Hydriodicum*. Dose, ½ to 1 fluid drachm, largely diluted with water.

SYRUPUS ACTÆÆ COMPOSITUS (N. F.)—COMPOUND SYRUP OF ACTÆA.

SYNONYMS: *Syrupus cimicifugæ compositus*, *Compound syrup of cimicifuga* (or *Black cohosh*).

Preparation.—"Fluid extract of cimicifuga (*U. S. P.*), forty cubic centimeters (40 Cc.) [1 fl℥, 169 ♏]; fluid extract of glycyrrhiza (*U. S. P.*), twenty cubic centimeters (20 Cc.) [325 ♏]; fluid extract of senega (*U. S. P.*), twenty cubic centimeters (20 Cc.) [325 ♏]; fluid extract of ipecac (*U. S. P.*), ten cubic centimeters (10 Cc.) [162 ♏]; wild cherry, in moderately fine powder, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; purified talcum (F. 395), fifteen grammes (15 Gm.) [232 grs.]; sugar, six hundred and fifty grammes (650 Gm.) [1 lb. av., 6 ozs., 406 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the wild cherry with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of water, and allow it to macerate during 1 hour. Then add to it the fluid extracts and talcum, and stir or agitate the mixture frequently and thoroughly during about 15 minutes. Transfer to a wetted filter, and, when the liquid ceases to drop from the funnel, wash the contents of the filter with water to obtain five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of filtrate. In this dissolve the sugar by agitation, and add enough water, previously passed through the filter, to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*Nat. Form.*).

Through an oversight of the National Formulary committee, this preparation is made to bear the title *Syrupus Actææ Compositus*, which error was corrected in the *errata* of the first edition of that work, whereby the above title was made a synonym. In the second revision, however, the change seems not to have been made. *Syrupus Cimicifugæ Compositus* is the name to be preferred.

Action, Medical Uses, and Dosage.—This preparation is evidently intended for *pulmonic complaints*. The dose should be from ½ to 1 fluid drachm.

SYRUPUS ÆTHERIS.—SYRUP OF ETHER.

Preparation.—Take of refined sugar, 18 ounces; distilled water, 1 pint; alcohol (of 90 per cent), 13 fluid drachms; pure ether, 5 fluid drachms. Introduce all the articles into a close-stoppered flask, agitate together, until the sugar is dissolved, and keep in the flask well closed. This process furnishes a syrup of a fixed composition, not disturbed by variations of temperature, and holding a sufficient amount of ether in solution, which is not readily lost by evaporation.

Action, Medical Uses, and Dosage.—This syrup will be found an agreeable form of administering ether in all cases where its internal use is indicated. The dose is from ½ to 2 or 3 teaspoonfuls.

SYRUPUS ALLII (U. S. P.)—SYRUP OF GARLIC.

Preparation.—"Fresh garlic, sliced and bruised, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; sugar, eight hundred grammes (800 Gm.) [1 lb. av., 12 ozs., 96 grs.]; diluted acetic acid, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Macerate the garlic with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of diluted acetic acid during 4 days, and express the liquid, avoiding the use of metallic utensils. Then mix the residue with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] more of diluted acetic acid, and again express. Mix the expressed liquids, and filter. Pour the filtrate upon the sugar, contained in a suitable vessel, and stir or agitate until the sugar is dissolved. Lastly, add enough diluted acetic acid to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and mix thoroughly. Keep the syrup in well-stoppered, completely filled bottles, in a cool place. *Syrup of Garlic* may also be prepared in the following manner: Prepare a percolator or funnel in the manner described under syrup (see *Syrupus*). Pour the filtrate obtained as directed in the preceding formula upon the sugar, return the first portions of the percolate, until it runs through clear, and, when all the liquid has passed, follow it by diluted acetic acid, until the product measures one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly"—(*U. S. P.*). This produces a syrup which is more or less opalescent.

Action, Medical Uses, and Dosage.—This syrup is useful in *cough* and *chronic catarrhal affections of infants*, acting also as a mild stimulant to the nerves; to a child under 1 year old, 1 fluid drachm may be given for a dose. The active principle of garlic is more readily taken up by vinegar than water. A syrup of onions is often prepared extemporaneously for coughs, by slicing 1 or 2 onions, and laying the slices upon each other with sugar between. This is set by the fire in a saucer or glass vessel, and kept there until the juice of the onion and the sugar have, by the aid of the heat, formed a syrup in the vessel. It may be given freely.

SYRUPUS ALTHÆÆ (U. S. P.)—SYRUP OF ALTHÆA.

SYNONYM: *Syrup of marshmallow.*

Preparation.—"Althæa, cut into small pieces, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; alcohol, thirty cubic centimeters (30 Cc.) [1 fl℥, 7 ♏]; glycerin, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; sugar, seven hundred grammes (700 Gm.) [1 lb. av., 8 ozs., 303 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [32 fl℥, 391 ♏]. Wash the althæa with cold water, then macerate it with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of water, previously mixed with the alcohol, during 1 hour, stirring frequently, and strain without expressing the residue. In the strained liquid dissolve the sugar by agitation, without heat, add the glycerin and enough water to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly. Keep the syrup in well-stoppered, completely filled bottles, in a cool place"—(*U. S. P.*). This produces a syrup having an agreeable, but faint odor, and a yellowish color. Like syrup of acacia, it is extremely liable to ferment. The glycerin and alcohol present probably retard this change to some extent.

Action, Medical Uses, and Dosage.—Like those of *Syrup of Acacia.*

SYRUPUS AMYGDALÆ (U. S. P.)—SYRUP OF ALMOND.

SYNONYM: *Syrupus emulsivus.*

Preparation.—"Sweet almond, one hundred and forty grammes (140 Gm.) [4 ozs. av., 411 grs.]; bitter almond, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; sugar, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; orange-flower water, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; water, one hundred and thirty cubic centimeters (130 Cc.) [4 fl℥, 190 ♏]; syrup, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Rub the almonds, previously blanched, in a mortar, with one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.] of the sugar and thirty cubic centimeters (30 Cc.) [1 fl℥, 7 ♏] of water to a smooth paste. Mix this well with the orange-flower water and two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of syrup, and strain with strong expression. To the residue add one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of water, and express again. In the strained liquid dissolve the remainder of the sugar, without heat, adding enough syrup to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Keep the syrup in well-stoppered, completely filled bottles, in a cool place"—(*U. S. P.*).

Action and Medical Uses.—A feebly sedative preparation, used considerably in admixture with diuretics and expectorants in *irritable conditions of the renal and broncho-pulmonic tracts.*

SYRUPUS ARALIÆ COMPOSITUS.—COMPOUND SYRUP OF ARALIA.

Preparation.—Take of the roots of small spikenard, yellow dock, burdock, and ground guaiacum-wood, each, 10 troy ounces; bark of the root of sassafras, of southern prickly ash, elder flowers, blue flag root, each, 8 troy ounces. First grind and mix the articles together, moisten with diluted alcohol and place in a percolator, cover with the same menstruum, and macerate for 2 days. Then gradually add diluted alcohol until 2 pints of percolate have been obtained, which retain and set aside. Continue the percolation until the drug is exhausted and distill or evaporate the alcohol from it. Mix the solutions, add

12 pounds (av.) of refined sugar and water enough to make 16 pints of syrup, using a gentle heat to effect solution of the sugar. Each pint will contain the virtues of 4 ounces of the ingredients. It may be flavored with essence of wintergreen, sassafras, or prickly ash berries, etc.

"In the early editions of this work this preparation was termed Compound Syrup of Sarsaparilla (*Syrupus Sarsaparillæ Compositus*). On account of the difficulty met with among druggists in filling orders for compound syrup of sarsaparilla, when it is not indicated to them what syrup of this name is required (as there are several), I have deemed it best to change the name, that no such difficulty may occur hereafter. This article has also been termed *Alterative syrup*, but it is much superior to the compound formerly known by this name. In the present case I have substituted the roots of *Aralia nudicaulis* for the Honduras sarsaparilla of the former formula, as it is considered by physicians to be the more active agent; those, however, who prefer the Honduras sarsaparilla, will, of course, retain it in their preparation of this syrup" (J. King).

Action, Medical Uses, and Dosage.—"This forms a valuable syrup, which may be used in all cases where an alterative is indicated; in *chronic hepatitis, rheumatism, syphilis, scrofula, cutaneous diseases, ulcers, white swellings, rickets, necrosis*, and every taint of the system. Some physicians add an ounce of the iodide of potassium to every pint of syrup. The dose is from a teaspoonful to a tablespoonful, 3 or 4 times a day, in about a gill of water" (J. King).

SYRUPUS ASAFŒTIDA.—SYRUP OF ASAFETIDA.

Preparation.—Take of asafetida, 1 ounce; boiling water, 1 pint; sugar, 2 pounds. Triturate the asafetida in a mortar with a portion of the boiling water until a uniform paste is formed, then gradually add the remainder of the water, strain, and add the sugar, dissolving it with a gentle heat (R. Petty, *Amer. Jour. Pharm.*, Vol. XXIV, p. 319).

Description.—Good asafetida contains a portion of volatile oil, which would be dissipated were much heat employed in the solution of the sugar. Boiling water instead of cold is employed to take up more of the gum-resin which is permanently dissolved or suspended by the aid of sugar. This syrup is nearly white when first made, but gradually assumes a pinkish tinge; it is quite permanent, keeping for several months without any material change, and has the advantage of being entirely free from alcohol, which is often objectionable with asafetida mixtures.

Action, Medical Uses, and Dosage.—This is an excellent form for the administration of asafetida, being prompt in its action, and not so stimulating as the tincture. The dose is 1 or 2 tablespoonfuls, repeated 3 or 4 times a day. If used in enema, 2 to 4 fluid ounces may be injected into the rectum at one time. Other antispasmodics may be combined with it, as fluid extracts of black cohosh, blue cohosh, ladies'-slipper root, scullcap, valerian, etc., according to indications.

SYRUPUS ASARI COMPOSITUS (N. F.)—COMPOUND SYRUP OF ASARUM.

SYNONYM: *Compound syrup of Canada snakeroot.*

Preparation.—"Asarum, root, in moderately coarse (No. 40) powder, sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; alcohol, one hundred and eighty-five cubic centimeters (185 Cc.) [6 fl℥, 123 ♏︎]; cochineal, in fine powder, one and one-half grammes (1.5 Gm.) [23 grs.]; potassium carbonate, two and one-half grammes (2.5 Gm.) [39 grs.]; wine of ipecac (*U. S. P.*) thirty cubic centimeters (30 Cc.) [1 fl℥. 7 ♏︎]; sugar, seven hundred grammes (700 Gm.) [1 lb. av., 8 ozs., 303 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏︎]. Mix the asarum intimately with the cochineal and potassium carbonate, previously triturated together. Moisten the powder with a sufficient quantity of a menstruum prepared by mixing the alcohol with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of water, and allow it to macerate in a covered vessel for 24 hours. Then transfer it to a small percolator, and pour on the remainder of the menstruum. Allow the percolation to proceed slowly, and then follow up the menstruum by water, until five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of percolate are obtained. To this add the wine of ipecac, and afterward the sugar, and dissolve the latter by agitation. Finally, add enough water, previously passed through the percolator, to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents about 3½ grains of asarum"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—This agent combines the expectorant qualities of asarum and ipecacuanha. The dose is about 1 fluid drachm.

SYRUPUS AURANTII (U. S. P.)—SYRUP OF ORANGE.

SYNONYM: *Syrup of orange peel.*

Preparation.—"Sweet orange peel, taken from the fresh fruit, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; precipitated calcium phosphate, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; sugar, seven hundred grammes (700 Gm.) [1 lb. av., 8 ozs., 303 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Introduce the sweet orange peel (which should be as free as possible from the white, inner layer, and cut into small shreds) into a flask, and add eighty cubic centimeters (80 Cc.) [2 fl℥, 339 ♏] of alcohol. Stopper the flask loosely with a notched cork, and apply the heat of a water-bath until the alcohol boils, and maintain it boiling during 5 minutes. Then stopper the flask well, and set it aside to cool. Filter off the liquid, and wash the filter and contents with alcohol until the filtrate measures one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Mix the precipitated calcium phosphate in a mortar, with one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.] of sugar, and add the tincture with constant trituration. To the resulting, pasty mass add three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water, triturating constantly, transfer the whole to a filter, and return the first portions of the filtrate, if necessary, until it runs through clear. In the filtrate dissolve the remainder of the sugar, and add enough water, through the filter, to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly"—(*U. S. P.*).

Pharmaceutical Uses.—This syrup is agreeable in flavor and odor, and has a yellowish color. The volatile oil of the fresh, sweet orange peel, together with coloring matter, is dissolved by the alcohol. It is an excellent flavoring substance for mixtures.

SYRUPUS AURANTII FLORUM (U. S. P.)—SYRUP OF ORANGE FLOWERS.

SYNONYM: *Syrupus aurantii floris.*

Preparation.—"Sugar, eight hundred and fifty grammes (850 Gm.) [1 lb. av., 13 ozs., 430 grs.]; orange-flower water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the sugar in four hundred and fifty cubic centimeters (450 Cc.) [15 fl℥, 104 ♏] of orange-flower water by agitation, without heat, add enough orange-flower water to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and mix thoroughly. Syrup of orange flowers may also be prepared in the following manner: Prepare a percolator or funnel in the manner described under syrup (see *Syrupus*). Pour four hundred and fifty cubic centimeters (450 Cc.) [15 fl℥, 104 ♏] of orange-flower water upon the sugar, return the first portions of the percolate until it runs through clear, and, when all the liquid has passed, follow it by orange-flower water, until the product measures one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly"—(*U. S. P.*).

Action and Medical Uses.—A very slight sedative effect is produced by this syrup upon those delicate individuals whose nervous system is easily excited. Its chief use, however, is in flavoring other medicines.

SYRUPUS CALCII LACTOPHOSPHATIS (U. S. P.)—SYRUP OF CALCIUM LACTOPHOSPHATE.

Preparation.—"Precipitated calcium carbonate, twenty-five grammes (25 Gm.) [386 grs.]; lactic acid, sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏]; phosphoric acid, thirty-six cubic centimeters (36 Cc.) [1 fl℥, 104 ♏]; orange-flower water, twenty-five cubic centimeters (25 Cc.) [406 ♏]; sugar, seven hundred grammes (700 Gm.) [1 lb. av., 8 ozs., 303 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. To the lactic acid, mixed with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of water, and contained in a capacious mortar, gradually add the calcium carbonate, in portions, until it is dissolved. Then add the phosphoric acid, and triturate until the precipitate at first formed is dissolved. Add one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏] of water, and filter, rinsing the mortar with seventy-five cubic centimeters (75 Cc.) [2 fl℥, 257 ♏] of water, and passing the rinsings through the filter. To the mixed filtrates add the orange-flower water, and, having added the sugar, dissolve it by agitation, without heat, and strain. Lastly, pass enough water through the strainer to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and mix thoroughly"—(*U. S. P.*). This formula is regarded as a great improvement over the official process of 1880. Diluted lactic acid readily dissolves calcium carbonate, and, by adding phosphoric acid, calcium phosphate is formed, and this is maintained in solution by the presence of lactic acid and the uncombined phosphoric acid. Should precipitation be likely to occur, a very small quantity of hydrochloric acid will prevent such a change.

Action, Medical Uses, and Dosage.—This agent is used as a reconstructive in cases of general and nervous debility. It was a favorite remedy with Prof. A. J. Howe, M. D., as a vehicle for Fowler's solution, to be used in *incipient phthisis*. The dose ranges from 1 to 4 fluid drachms.

Related Preparations.—SYRUPUS CALCII LACTOPHOSPHATIS CUM FERRO (N. F.), *Syrup of calcium lactophosphate with iron, Syrup of lactophosphate of lime with iron.* "Lactate of iron, eight and one-half grammes (8.5 Gm.) [131 grs.]; potassium citrate, eight and one-half grammes (8.5 Gm.) [131 grs.]; water, sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏]; syrup of calcium lactophosphate (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the lactate of iron and potassium citrate in the water with the aid of heat, and add enough syrup of calcium lactophosphate to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm contains ½ grain of lactate of iron and about ¼ grain of calcium lactate (or about ⅜ grain of so-called calcium lactophosphate)"—(*Nat. Form.*).

SYRUPUS CALCII HYPOPHOSPHITIS (N. F.), *Syrup of calcium hypophosphite, Syrup of hypophosphite of lime.*—"Calcium hypophosphite, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; citric acid, one and one-half grammes (1.5 Gm.) [23 grs.]; sugar, seven hundred and seventy-five grammes (775 Gm.) [1 lb. av., 11 ozs., 148 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the calcium hypophosphite and the citric acid in five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of water, filter the solution, add the sugar to the filtrate, and pass enough water through the filter to make the product, after the sugar has been dissolved by agitation, measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm contains 2 grains of calcium hypophosphite"—(*Nat. Form.*). Or, dissolve hypophosphite of calcium, 1 ounce, in water, 9½ fluid ounces; filter, add white sugar, 12 ounces; dissolve by aid of heat, and add fluid extract of vanilla, ½ fluid ounce. The dose varies from a teaspoonful to a tablespoonful 3 times a day. A teaspoonful is equivalent to 3½ grains of the calcium salt.

SYRUPUS CALCII ET SODII HYPOPHOSPHITUM (N. F.), *Syrup of calcium and sodium hypophosphites, Syrup of hypophosphite of lime and soda.*—"Calcium hypophosphite, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; sodium hypophosphite, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; citric acid, one and one-half grammes (1.5 Gm.) [23 grs.]; sugar, seven hundred and seventy-five grammes (775 Gm.) (1 lb. av., 11 ozs., 148 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the two hypophosphites and the citric acid in five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of water, filter the solution, add the sugar to the filtrate, and pass enough water through the filter to make the product, after the sugar has been dissolved by agitation, measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm contains 2 grains, each, of calcium hypophosphite and sodium hypophosphite"—(*Nat. Form.*).

SYRUPUS CALCII CHLORHYDROPHOSPHATIS (N. F.), *Syrup of calcium chlorhydrophosphate, Syrup of chlorhydrophosphate of lime.*—"Precipitated calcium phosphate, seventeen and one-half grammes (17.5 Gm.) [270 grs.]; spirit of lemon (*U. S. P.*), twenty cubic centimeters (20 Cc.)

[325 ♏]; hydrochloric acid (*U. S. P.*), water, syrup (*U. S. P.*), of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the precipitated calcium phosphate with thirty cubic centimeters (30 Cc.) [487 ♏] of water, and dissolve it with the aid of hydrochloric acid, avoiding an excess. Then add the spirit of lemon, filter the liquid, and wash the filter with a mixture of thirty cubic centimeters (30 Cc.) [487 ♏], each, of water and syrup. Lastly, add enough syrup to the filtrate, to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm contains 1 grain of calcium phosphate"—(*Nat. Form.*).

SYRUPUS CALCIS (U. S. P.)—SYRUP OF LIME.

SYNONYMS: *Saccharated solution of lime, Syrupus calcariæ, Liquor calcis saccharatus.*

Preparation.—"Lime, sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.]; sugar, four hundred grammes (400 Gm.) [14 ozs. av., 48 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the lime and sugar thoroughly in a mortar, so as to form a homogeneous powder; then add the mixture to five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of boiling water, contained in a bright copper or tinned iron vessel, boil for 5 minutes, constantly stirring, and then strain. Dilute the strained liquid with an equal volume of water, and filter through white paper. Then evaporate the filtrate, in a tared capsule, to seven hundred grammes (700 Gm.) [1 lb. av., 8 ozs., 303 grs.], allow it to cool, add to it enough water to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and mix thoroughly. Keep the syrup in well-stoppered bottles"—(*U. S. P.*).

Description.—In the presence of sugar, water will dissolve a much greater amount of lime than when employed alone, in consequence of the saccharates formed being more soluble than lime itself. This syrup is likely to vary in the quantity of lime present, and no limit is fixed in the official formula for the amount to be contained in the finished product. Syrup of lime is thin, viscid, transparent, and colorless, has a bitter, pronounced alkaline, almost caustic, and sweetish taste, and is strongly alkaline in reaction. It should be preserved in well-closed bottles, for, when exposed to the air, it absorbs carbonic acid gas. It should be well diluted before being administered.

Action, Medical Uses, and Dosage.—This syrup has been proposed as an antidote for *poisoning by oxalic acid*, *carbolic acid*, etc., and is useful in all cases requiring lime-water, but not preferable to the latter. The dose is about ½ to 1 fluid drachm, well diluted with water.

Related Preparation.—SYRUPUS CALCII IODIDI (N. F.), *Syrup of calcium iodide.* "Iodine, seventy-six grammes (76 Gm.) [2 ozs. av., 298 grs.]; iron wire, fine, bright, and finely cut, twenty-eight grammes (28 Gm.) [432 grs.]; precipitated calcium carbonate, thirty-four grammes (34 Gm.) [1 oz. av., 87 grs.]; sugar, seven hundred grammes (700 Gm.) [1 lb. av., 8 ozs., 303 grs.]; distilled water, syrup (*U. S. P.*), of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the iron wire with fifty-seven grammes (57 Gm). [2 ozs. av., 5 grs.] of the iodine, and one hundred and eighty-five cubic centimeters (185 Cc.) [6 fl℥, 123 ♏] of distilled water, and apply a gentle heat, until the iodine is combined, and the liquid has acquired a greenish color. Filter the liquid through a small filter into a flask containing the remainder of the iodine, wash the filter with sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏] of distilled water, and heat the solution gently, taking care that no iodine is lost by evaporation. Heat two hundred and fifty cubic centimeters (250 Cc. [8 fl℥, 218 ♏] of distilled water in a capacious capsule to boiling, and add to it small alternate portions, first of the precipitated calcium carbonate, and then of the solution of iodide of iron, in small portions at a time, stirring briskly and waiting until the violence of the reaction moderates before adding a fresh portion. From time to time, add a little distilled water, to replace that lost by evaporation. When all the iron solution has been added, continue heating the mixture until it is quietly boiling, then filter it through a wetted filter, and wash the latter with enough distilled water to make the product, when cold, measure five hundred cubic centimeters (500 Cc. [16 fl℥, 435 ♏]. In this dissolve the sugar by agitation, then make up the volume with syrup to one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and strain, if necessary. Each fluid drachm contains about 5 grains of calcium iodide"—(*Nat. Form.*).

SYRUPUS CEANOTHI COMPOSITUS.—COMPOUND SYRUP OF RED-ROOT.

Preparation.—Take of the tops and leaves of Ceanothus americanus, of the bark of the root of Ceanothus americanus, and herb of Lactuca elongata, each, 16 troy ounces; root of Cimicifuga racemosa, 4 troy ounces; root of Asclepias tuberosa and Asarum canadense, each, 2 troy ounces; lobelia herb, and root of Sanguinaria canadensis, each, 1 troy ounce. Proceed as with Compound Syrup of Aralia, making 2 gallons of the finished syrup. This preparation is an improvement on the formula of its introducer, Dr. James Cooper.

Action, Medical Uses, and Dosage.—This syrup has been found very valuable in *coughs, pulmonary and hepatic affections.* The dose is from 1 fluid drachm to ½ fluid ounce, 3 or 4 times a day. In smaller doses, frequently repeated, it forms an excellent expectorant.

SYRUPUS CHLORAL.—SYRUP OF CHLORAL.

Preparation.—"Take of hydrate of chloral, 80 grains; distilled water, 1½ fluid drachms; syrup, a sufficiency. Dissolve the hydrate of chloral in the water, and add the syrup until the mixed product measures 1 fluid ounce. The specific gravity should be about 1.320"—(*Br. Pharm.*, 1885).

Action, Medical Uses, and Dosage.—The uses of this syrup, which is also official in the *British Pharmacopœia*, 1898; are those of chloral hydrate (which see). Each fluid drachm contains 10 grains of chloral hydrate, and the dose is from ½ to 2 fluid drachms.

SYRUPUS CHONDRI COMPOSITUS (N. F.)—COMPOUND SYRUP OF CHONDRUS.

Synonym: *Compound syrup of Irish moss.*

Preparation.—"Irish moss, one gramme (1 Gm.) [15.5 grs.]; fluid extract of ipecac (*U. S. P.*), one cubic centimeter (1 Cc.) [16 ♏]; fluid extract of squill (*U. S. P.*), sixteen cubic centimeters (16 Cc.) [260 ♏]; fluid extract of senega (*U. S. P.*), sixteen cubic centimeters (16 Cc.) [260 ♏]; camphorated tincture of opium (*U. S. P.*), twenty-eight cubic centimeters (28 Cc.) [454 ♏]; purified talcum (F. 395), fifteen grammes (15 Gm.) [232 grs.]; sugar, six hundred and fifty grammes (650 Gm.) [1 lb. av., 6 ozs., 406 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Macerate the Irish moss in sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏] of water until it is softened, then heat it on a boiling water-bath for 15 minutes, strain it through flannel, without pressure, and wash the flannel and contents with sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏] of hot water. Mix the fluid extracts and tincture with the purified talcum and three hundred and twenty-five cubic centimeters (325 Cc.) [10 fl℥, 475 ♏] of water, shake the mixture frequently and thoroughly during half an hour, and then filter it through a wetted filter, returning the first portions of the filtrate until it runs through clear. Mix the mucilage of Irish moss with the filtrate, then add the sugar, and pass enough water through the filter to make the product, after the sugar has been dissolved by agitation, measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—This agent is demulcent and expectorant. The dose is from ½ to 1 fluid drachm.

SYRUPUS CINNAMOMI (N. F.)—SYRUP OF CINNAMON.

Preparation.—"Cinnamon (cassia), in moderately coarse powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; alcohol, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; sugar, seven hundred grammes (700 Gm.) [1 lb. av., 8 ozs., 303 grs.]; cinnamon water (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the alcohol with four hundred and fifty cubic centimeters (450 Cc.) [15 fl℥, 104 ♏] of cinnamon water, moisten the cinnamon with a sufficient quantity of this menstruum and allow it to macerate for about 2 hours. Then transfer it to a small percolator, and percolate, in the usual manner, using first the remainder of the menstruum above directed, and afterward cinnamon water. Collect the first five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of the percolate separately, and dissolve in it the sugar. Then collect an additional quantity of percolate, and add it to the syrup, so as to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. *Note.*—This preparation is practically identical with that official in the *German Pharmacopœia*"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—This syrup is a warm aromatic stomachic, carminative, and astringent. It is chiefly used as an adjuvant to other less pleasant medicines, especially in the treatment of *diarrhœa*, *dysentery*, *hemorrhages*, and where astringents are indicated. It may be given in doses of 1 or 2 fluid drachms.

SYRUPUS COCHLEARIÆ COMPOSITUS.—COMPOUND SYRUP OF HORSERADISH.

Preparation.—Take of the recent root of horseradish, grated, 2 ounces; boneset, leaves and tops, 1 ounce; Canada snakeroot, ½ ounce; boiling water, diluted acetic acid, of each, a sufficient quantity; refined sugar, 2 pounds (av.) Infuse the boneset and Canada snakeroot in ½ pint of the boiling water, and express with strong pressure, adding boiling water to the mass until ½ pint of infusion is obtained; then add the sugar. Add the horseradish to diluted acetic acid, ½ pint; let it stand for 2 days, and then express, adding diluted acetic acid to the mass until ½ pint of the acetous solution is obtained. Add this to the above syrup, and agitate until all the sugar is dissolved.

Action, Medical Uses, and Dosage.—This forms an efficient preparation for *obstinate colds*, *catarrhs*, *hoarseness*, and *chronic irritation of the throat and fauces*. The dose is from 1 to 4 fluid drachms, every 2 or 3 hours. The following compound, known as *Cough* or *Vegetable Elixir*, has been found a most beneficial agent in *chronic pulmonary affections*, *cough*, etc. To 1 gallon of good cider vinegar, add ½ pound each, of balsam of tolu and gum Arabic, dissolve by heat, and add of refined sugar 6 pounds; when all is dissolved, remove from the fire, and add of tincture of opium, 18 fluid ounces. The dose of this is a teaspoonful 3, 4, or 5 times a day, or whenever the cough is severe. Sometimes molasses or honey may be substituted for the sugar.

SYRUPUS COFFEÆ (N. F.)—SYRUP OF COFFEE.

Preparation.—"Coffee, roasted, two hundred and fifty grammes (250 Gm.) [8 ozs. av., 358 grs.]; sugar, seven hundred and fifty grammes (750 Gm.) [1 lb. av., 10 ozs., 199 grs.]; water, a sufficient quantity. Introduce the coffee, reduced to a moderately coarse powder, into a suitable vessel; pour upon it five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of boiling water, then cover it well, and boil for 5 minutes. Allow it to become cold, keeping the vessel well covered; strain off the liquid and pass enough water through the strainer to make the strained liquid, when cold, measure five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]. In this dissolve the sugar, by agitation, without heat, and strain through muslin. *Note.*—It is recommended that a mixture of equal parts of the commercial varieties of coffee, known as 'Java' and 'Mocha,' be employed for this purpose. The coffee may also be exhausted by percolation, but special arrangements are then necessary to maintain the menstruum at the proper temperature"—(*Nat. Form.*).

Uses.—Two tablespoonfuls of this syrup, to a cup of boiling water or milk, will make a cup of good coffee. It is much used in soda water and mineral waters, in which it may be less concentrated, and be diluted with simple syrup (*Amer. Jour. Pharm.*, Vol. XXVIII, p. 372).

SYRUPUS CORYDALIS COMPOSITUS.—COMPOUND SYRUP OF TURKEY-CORN.

Preparation.—Take of the root of turkey-corn, coarsely bruised, 32 troy ounces; the leaves of twin-leaf, blue flag root, each, 16 troy ounces; sheep-laurel leaves, 8 troy ounces. Mix the articles together, and prepare a syrup after the manner of making Compound Syrup of Aralia, using the same proportion of sugar to the finished product. It may also be flavored with some agreeable aromatic essence, as sassafras, wintergreen, prickly ash berries, etc.

Action, Medical Uses, and Dosage.—This is a valuable alterative syrup, and is used with much success in *syphilis, scrofula, liver affections*, and *rheumatism*. Iodide of potassium may be added to it, in the same manner as usually pursued with the compound syrup of stillingia, to which this is by no means second. The dose is 1 fluid drachm, 3 or 4 times a day, in ½ gill of water (J. King).

Related Syrup.—Some sixty years since, a half-breed Indian called Ben Smith, in the state of New York, made a syrup, which gained considerable reputation as a remedy in *syphilitic diseases*, and which sold rapidly for $3.00 per bottle; the following is the formula for its preparation: Take of Indian hemp (*Apocyn. cann.*), Virginia sarsaparilla, inner bark of white pine, each, 1 pound; mezereon, 4 ounces; sheep-laurel, ½ pound; water, 4 gallons; sugar, 8 pounds. Place the plants in the water, boil for a few minutes, and then gradually evaporate, until about 2 gallons of decoction are left, then strain, and add the sugar. To each quart bottle of this syrup he added 40 drops of nitric acid, and 20 grains of tartar emetic dissolved in a sufficient quantity of spirits. The dose was a wineglassful 3 times a day. I have never been able to ascertain the true botanical character of the Virginia sarsaparilla. This syrup has been found as efficient in syphilis, when prepared without the tartar emetic (J. King).

SYRUPUS ERIODICTYI AROMATICUS (N. F.)—AROMATIC SYRUP OF ERIODICTYON.

SYNONYMS: *Aromatic syrup of yerba santa, Syrupus corrigens.*

Preparation.—"Fluid extract of eriodictyon (*U. S. P.*), thirty-two cubic centimeters (32 Cc.) [1 fl℥, 39 ♏]; solution of potassa (*U. S. P.*), twenty-five cubic centimeters (25 Cc.) [406 ♏]; compound tincture of cardamom (*U. S. P.*), sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; oil of sassafras, one-half cubic centimeter (0.5 Cc.) [8 ♏]; oil of lemon, one-half cubic centimeter (0.5 Cc.) [8 ♏]; oil of cloves, one cubic centimeter (1 Cc.) [16 ♏]; alcohol, thirty-two cubic centimeters (32 Cc.) [1 fl℥, 39 ♏]; sugar, eight hundred grammes (800 Gm.) [1 lb. av., 12 ozs., 96 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the fluid extract of eriodictyon and solution of potassa, then add one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of water previously mixed with the compound tincture of cardamom, and afterward add the oils dissolved in the alcohol. Shake the mixture thoroughly, then filter it, and pour enough water through the filter to obtain three hundred and seventy-five cubic centimeters (375 Cc.) [12 fl℥, 327 ♏] of filtrate. Pour this upon the sugar contained in a bottle, and dissolve it by placing the bottle in hot water, frequently agitating. Lastly, cool the product and add enough water, passed through the filter previously used, to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. *Note.*—This preparation is chiefly intended as a vehicle, for disguising the taste of quinine or of other bitter substances"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—For uses, see *Eriodictyon*. Largely used as a disguising vehicle for bitter substances. Dose, 1 fluid drachm.

SYRUPUS FERRI IODIDI (U. S. P.)—SYRUP OF FERROUS IODIDE.

SYNONYM: *Syrup of iodide of iron.*

"A syrupy liquid containing about 10 per cent, by weight, of ferrous iodide (FeI_2=308.94), or about 13.4 Gm. in 100 Cc."—(*U. S. P.*).

Preparation.—"Iron, in the form of fine bright wire, and cut into small pieces, twenty-five grammes (25 Gm.) [386 grs.]; iodine, eighty-three grammes (83 Gm.) [2 ozs. av., 406 grs.]; syrup, distilled water, each, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.] Introduce the iron into a flask of thin glass, having a capacity of about five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏], add to it one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏] of distilled water, and afterward the iodine. Shake the mixture occasionally, checking the reaction, if necessary, by the affusion of cold water, and, when the solution has acquired a greenish color, and has lost the odor of iodine, heat it to boiling. Then filter it through a strong, double, rapidly-acting filter placed in a funnel, the point of which dips below the surface of six hundred grammes (600 Gm.) [1 lb. av., 5 ozs., 72 grs.] of syrup contained in a tared vessel. When the liquid has run through, wash the flask and filter with a mixture of twenty-five cubic centimeters (25 Cc.) [406 ♏] each, of syrup and distilled water, previously raised to near 100° C. (212° F.), then withdraw the funnel, add enough syrup to make the product weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.], and mix thoroughly. Keep the syrup in small, well-stoppered and completely filled bottles"—(*U. S. P.*).

By this process the solution of iodide of iron is preserved to a great extent from decomposition by the addition of saccharine matter. The aqueous solution is exceedingly subject to decomposition by exposure to air and light, the ferrous salt passing into basic ferric salt with liberation of iodine. To obviate this tendency to oxidation, M. Frederking, of Riga, and Prof. Procter, of Philadelphia, proposed the addition of saccharine matter, which they found to exert a protective action, and which fact has since been amply confirmed. Hence, the sugar is added to protect the solution of iodide of iron.

Upon standing for a length of time, or if exposed to the action of diffused light or air, syrup of iodide of iron gradually undergoes decomposition, and becomes more or less colored a rusty red. To overcome this difficulty, various means have been suggested and tried. It has been found that placing the well-filled bottle directly in the sunlight will prevent such decomposition, and even it the preparation has already become dark in color such treatment will restore it to its natural hue, though it is probable that the preparation is somewhat changed, some ferric iodate probably being formed in it. Prof. J. F. Judge recommended hypophosphorous acid to decolorize such a changed syrup. Dr. E. R. Squibb has found from 15 to 20 minims of a solution of 15 to 20 grains of hyposulphite of sodium in a fluid ounce of water, to restore the color of syrup of iodide of iron, when the color had not become darker than brown sherry wine. Syrup thus restored is not so apt to change again (*Amer. Jour. Pharm.*, 1868, p. 99). Prof. F. F. Mayer had previously recommended the same for preserving aqueous solutions of iodide of iron (*Proc. Amer. Pharm. Assoc.*, 1859, p. 371). Mr. Thomas B. Groves recommended phosphoric acid for the preservation of syrup of iodide of iron; he adds diluted phosphoric acid, ½ fluid ounce to each 31 fluid ounces of the syrup. The syrup must be completely cooled before the acid is added (*Amer. Jour. Pharm.*, 1868, p. 265).

Description and Tests.—Syrup of iodide of iron is a pale yellowish-green, clear fluid, destitute of any precipitate. If the addition of starch changes it to a blue color, it holds free iodine. Sulphuric acid added to it changes it to a brown color, with evolution of vapors of a violet color on the application of heat. The *U. S. P.* describes it as "a transparent, pale-green liquid, having a sweet, strongly ferruginous taste, and a neutral reaction. Specific gravity about 1.353 at 15° C. (59° F.). On adding a few drops of potassium ferricyanide T.S. to a small portion of the syrup, a blue precipitate will be produced. If mixed with a little starch T.S., and afterward with a few drops of chlorine water, the syrup will acquire a deep-blue color. This color should not be produced in the syrup by starch T.S. alone (absence of free iodine). If 1.55 Gm. (1.5447 Gm.) of the syrup and 10 Cc. of water be introduced into a flask, and the liquid mixed, successively, with 11 Cc. of decinormal silver nitrate V.S., and 5 Cc., each, of diluted nitric acid and ferric ammonium sulphate T.S., it should not require more than about 1 Cc. of decinormal potassium sulphocyanate V.S. to produce a reddish-brown tint which persists after shaking (corresponding to about 10 per cent of ferrous iodide)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—The medicinal properties are the same as mentioned under the head of *Saccharated Iodide of Iron;* the dose is from 10 to 40 drops, 3 times a day. It should be well diluted with water, and care should be taken not to allow it to act on the teeth, by washing the mouth immediately after taking a dose.

Related Syrups.—Syrupus Ferri Bromidi (*U. S. P.*, 1880). *Syrup of bromide of iron*, was at one time in some little demand, and may be made by filtering the solution of bromide of iron (as prepared under *Ferri Bromidum*), into 16 fluid ounces of simple syrup, and, after washing ne paper and excess of iron and liberated carbon with a little distilled water, adding enough simple syrup to the mixture to make the whole measure 20 fluid ounces. Several and varying proportions have been suggested for this preparation, but the strength we have adopted seems to be the best, as it produces a syrup similar to the official syrup of iodide of iron, bromine being substituted for iodine. Syrup of bromide of iron has a greenish color when recent, somewhat resembling, in appearance, that of syrup of iodide of iron, and, like this preparation, it decomposes by age. Each fluid ounce contains about 65 grains of bromide of iron.

The following is the process of the *National Formulary:*

Syrupus Ferri Bromidi (N. F.), *Syrup of bromide of iron* (*U. S. P.*, 1880).—A syrupy liquid containing 10 per cent of ferrous bromide ($FeBr_2$=215.4). "Iron, in the form of fine wire, and cut into small pieces, thirty grammes (30 Gm.) [1 oz. av., 25 grs.]; bromine, seventy-five grammes (75 Gm.) [2 ozs. av., 282 grs.]; sugar, in coarse powder, six hundred grammes (600 Gm.) [1 lb. av., 5 ozs., 72 grs.]; distilled water, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Introduce the iron into a flask of thin glass of suitable capacity, add to it two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.] of distilled water, and afterward the bromine. Shake the mixture occasionally, until the reaction ceases and the solution has acquired a green color and has lost the odor of bromine. Place the sugar in a porcelain capsule and filter the solution of bromide of iron into the sugar. Rinse the flask and iron wire with ninety grammes (90 Gm.) [3 ozs. av., 76 grs.] of distilled water and pass the washings through the filter into the sugar. Stir the mixture with a porcelain or wooden spatula, heat it to the boiling point on a sand-bath, and, having strained the syrup through linen into a tared bottle, add enough distilled water to make the product weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Lastly, shake the bottle and transfer its contents to small vials, which should be completely filled, securely corked, and kept in a place accessible to daylight"— *Nat. Form.*).

Syrupus Ferri Citro-iodidi (N. F.), *Syrup of citro-iodide of iron, Tasteless syrup of iodide of iron.*—"Iodine, fifty-nine grammes (59 Gm.) [2 ozs. av., 36 grs.]; iron wire, fine, bright, and finely cut, twenty-eight and one-half grammes (28.5 Gm.) [1 oz. av.]; potassium citrate, eighty-eight grammes (88 Gm.) [3 ozs. av., 46 grs.]; sugar, six hundred and fifty grammes (650 Gm.) [1 lb. av., 6 ozs., 406 grs.]; distilled water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the iron with one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏] of distilled water in a flask, add forty-five grammes (45 Gm.) [1 oz. av., 257 grs.] of the iodine, apply a gentle heat and set aside until the iodine is combined and the solution has acquired a green color. Then heat the contents of the flask to boiling, filter the liquid, and wash the filter with thirty cubic centimeters (30 Cc.) [487 ♏] of warm distilled water. Add to the filtrate the remaining fourteen grammes (14 Gm.) [216 grs.] of iodine, and, as soon as solution has been effected, mix with the potassium citrate previously dissolved in one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of distilled water, and agitate the liquid until it has assumed a green color. Pour this upon the sugar contained in a bottle, agitate until solution has been effected, and when the liquid is cold, add enough distilled water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm contains an amount of iron, corresponding to about 3.6 grains of ferric iodide. *Note.*—The official *Syrupus Ferri Iodidi* contains about 8 grains of *ferrous iodide* (protiodide of iron) in each fluid drachm. The above preparation contains the iron in the *ferric* condition"—(*Nat. Form.*).

SYRUPUS FERRI PHOSPHATIS.—SYRUP OF PHOSPHATE OF IRON.

Preparation.—"Take of granulated sulphate of iron, 224 grains; phosphate of sodium, 200 grains; bicarbonate of sodium, 56 grains; concentrated phosphoric acid, 1¼ fluid ounces; refined sugar, 8 ounces (av.); distilled water, 8 fluid ounces; dissolve the sulphate of iron in about 4 ounces of boiling water, and the phosphate of sodium in a similar quantity of cold water; mix the solutions, then add the bicarbonate of sodium, dissolved in a little water, and, after careful stirring, transfer the precipitate to a calico filter, and wash it with distilled water, till the filtrate ceases to be affected by chloride of barium. Mix the residue on the filter, in a mortar, with the phosphoric acid. As soon as the precipitate is dissolved, filter the solution, add water and the sugar, and dissolve without heat. The product should measure exactly 12 fluid ounces; any water which may be necessary beyond that introduced with the precipitate or with the sugar, being added to form the stated bulk. Its specific gravity is about 1.305. It contains the equivalent of about 1 grain of anhydrous phosphate of iron ($Fe_3[PO_4]_2$) in 1 fluid drachm"—(*Br. Pharm.*, 1885). The *British Pharmacopœia* (1898) prepares a compound of the same strength by dissolving iron, in the form of wire, in warm diluted phosphoric acid, and filtering the solution into syrup.

In the first process, where sodium phosphate and ferrous sulphate react upon each other, tribasic ferrous phosphate and sodium sulphate result with formation of free sulphuric acid. This is almost wholly neutralized by the presence of the bicarbonate of sodium, otherwise the acid would hold the ferrous phosphate in solution. The reaction is as follows: $2PO_4HNa_2+3FeSO_4=(PO_4)_2Fe_3+H_2SO_4+2Na_2SO_4$. The precipitated ferrous phosphate is washed, and, during the process, changes from white to blue, through partial oxidation, forming ferroso-ferric phosphate. Such a change is also liable to take place when the syrup is exposed to air, even though the sugar is intended to prevent such a change. The precipitate above mentioned is dissolved in the phosphoric acid, and then made into a syrup. A sherry color sometimes ensues in the finished product, and is due to caramel (Groves), and, at the same time, an insoluble phosphate is deposited, which may be filtered out.

Action, Medical Uses, and Dosage.—This syrup is employed where a chalybeate and nerve tonic combined is required. The dose is 1 fluid drachm.

Other Iron Syrups.—Syrupus Ferri Saccharati Solubilis (N. F.), *Syrup of soluble saccharated iron, Syrupus ferri oxydati solubilis* (*Ger. Pharm.*), *Syrup of saccharated oxide of iron, Syrup of soluble oxide of iron.* I. "Solution of chloride of iron (*U. S. P.*), eighty grammes (80 Gm.) [2 ozs. av., 360 grs.]; soda (*U. S. P.*), thirty-two and one-half grammes (32.5 Gm.) [1 oz. av., 64 grs.]; solution of soda (*U. S. P.*), a sufficient quantity; sugar, three hundred grammes (300 Gm.) [10 ozs. av., 255 grs.]; distilled water, syrup (*U. S. P.*), of each, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Dissolve the soda in two hundred and ten cubic centimeters (210 Cc.) [7 fl℥, 49 ♏] of water, add this solution to the solution of chloride of iron previously mixed with seventy grammes (70 Gm.) [2 ozs. av., 205 grs.] of syrup, and set the mixture aside, during 24 hours, in a dark place. Then pour the clear liquid slowly into sixteen hundred cubic centimeters (1600 Cc.) [54 fl℥, 49 ♏] of boiling distilled water, continue the boiling for a few minutes, and then set the mixture aside during 1 day, in a dark place, so that it may become clear by settling. Withdraw the supernatant liquid by means of a siphon, then wash the residue again with sixteen hundred cubic centimeters (1600 Cc.) [54 fl℥, 49 ♏] of boiling distilled water, by decantation. Transfer the magma to a wetted strainer, and wash it with hot distilled water until this runs off colorless, but so that the mass on the strainer still retains a moderately strong alkaline reaction. Then allow the excess of liquid to drain off, transfer the moist magma to a tared porcelain capsule, add the sugar, and heat it on a water-bath, with exclusion of daylight, during 2 hours, replacing from time to time any water lost by evaporation, and adding, if necessary, solution of soda, drop by drop, until the magma is entirely dissolved. Lastly, add enough syrup to make the product weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.], and transfer the product to bottles, which should be completely filled, and stored in a cool and dark place. One hundred grains, or about 75 minims, of this syrup represent approximately 1 grain of metallic iron. *Note.*—The above process is based upon that of the *German Pharmacopœia* (1st ed.). The formula given by the second edition of this work presupposes the keeping in stock of a dry 'Ferrum Oxydatum Saccharatum Solubile' (Saccharated Oxide of Iron), representing 3 per cent of metallic iron. When this is available, the Syrup of Soluble Saccharated Iron may also be prepared by the following formula: II. Saccharated oxide of iron, syrup, water, each, equal parts. Dissolve the saccharated oxide of iron in the mixed liquids"—(*Nat. Form.*).

Syrupus Phosphatum Compositus (N. F.), *Compound syrup of phosphates, Chemical food.*—"Precipitated calcium carbonate, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; soluble ferric phosphate (*U. S. P.*), seventeen and one-half grammes (17.5 Gm.) [270 grs.]; ammonium phosphate, seventeen and one-half grammes (17.5 Gm.) [270 grs.]; potassium bicarbonate, four grammes (4 Gm.) [62 grs.]; sodium bicarbonate, four grammes (4 Gm.) [62 grs.]; citric acid, sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; glycerin, sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; phosphoric acid (50 per cent), one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; orange-flower water, one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; tincture of cudbear (F. 418), sixteen cubic centimeters (16 Cc.) [260 ♏]; sugar, five hundred and twenty-five grammes (525 Gm.) [1 lb. av., 2 ozs., 227 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the precipitated calcium carbonate with the potassium and sodium bicarbonates, the citric acid, glycerin, and orange-flower water, and gradually add the phosphoric acid, stirring until solution has been effected. Dissolve the ferric phosphate and the ammonium phosphate in two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of hot water, cool, and add the solution to that previously prepared. Filter the whole through a pellet of absorbent cotton placed in the neck of a funnel, and receive the filtrate in a graduated bottle containing the sugar. Agitate until the latter is dissolved, then add the tincture of cudbear, and lastly, enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm contains about 2 grains of calcium phosphate, 1 grain, each, of the phosphates of iron and of ammonium, and smaller quantities of potassium and sodium phosphates. *Note.*—Phosphoric acid (50 per cent) may be made by adding seventy grammes (70 Gm.) [2 ozs. av., 205 grs.] of distilled water to one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.] of phosphoric acid (*U. S. P.*), which contains 85 per cent, by weight, of absolute orthophosphoric acid (H_3PO_4)"—(*Nat. Form.*).

Syrupus Ferri et Mangani Iodidi (N. F.), *Syrup of iodide of iron and manganese.*—"Iodine, eighty-one and one-half grammes (81.5 Gm.) [2 ozs. av., 383 grs.]; iron wire, fine, bright, and finely cut, twenty-six and one-half grammes (26.5 Gm.) [409 grs.]; manganese sulphate, twenty-six and one-half grammes (26.5 Gm.) [409 grs.]; potassium iodide, thirty-one and one-half grammes (31.5 Gm.) [486 grs.]; sugar, seven hundred and seventy-five grammes (775 Gm.) [1 lb. av., 11 ozs., 148 grs.]; distilled water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the iron with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of distilled water in a flask, add the iodine, and prepare a solution of ferrous iodide, in the usual manner, aiding the process, if necessary, by heating the contents of the flask, at first gently, and finally to boiling. Filter the liquid, through a small filter, directly upon the sugar, contained in a suitable bottle. Dissolve the manganese sulphate in one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏] of distilled water, and the potassium iodide in one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏] of diluted alcohol, mix the two solutions, and filter into the same bottle which contains the sugar and the iron solution. Wash the filter with thirty cubic centimeters (30 Cc.) [487 ♏] of cold distilled water, receiving the washings in the same bottle. Agitate until the sugar is dissolved, and, if necessary, strain. Finally, make up the volume with distilled water to one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm contains about 6 grains of iodide of iron (ferrous) and 3 grains of manganese iodide" (*Nat. Form.*).

Syrupus Ferri Arsenatis (N. F.), *Syrup of arsenate of iron.* "Sodium arsenate (*U. S. P.*), dried to a constant weight at a heat not exceeding 149° C. (300° F.), forty centigrammes (0.40 Gm.) [6 grs.]; citrate of iron (*U. S. P.*), thirty-five centigrammes (0.35 Gm.) [5.5 grs.]; water, thirty cubic centimeters (30 Cc.) [487 ♏]; syrup (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the sodium arsenate and citrate of iron in the water, contained in a test-tube, by the aid of heat. Then mix the solution with enough syrup to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm contains about $\frac{1}{30}$ grain of arsenate of iron (ferric). *Note.*—Care should be taken to select perfectly formed crystals of sodium arsenate, which must then be dried completely at 100° Cc. (212° F.), and the quantity required for the above formula must be weighed from the *dried* salt. It is advisable to dry a fresh quantity of the salt each time the above syrup is to be prepared"—(*Nat. Form.*).

SYRUPUS FERRI PYROPHOSPHATIS.—SYRUP OF PYROPHOSPHATE OF IRON.

Preparation.—Take of soluble pyrophosphate of iron, in scales, 150 grains; distilled water, 4 fluid drachms; syrup, 37 fluid ounces. Dissolve the pyrophosphate of iron in the distilled water, filter, and mix the solution with the syrup. One to 2 fluid drachms of the tincture of some aromatic oil should be added to it. There are other formulas for this syrup.

Action, Medical Uses, and Dosage.—This forms a pleasant preparation for the administration of this salt of iron, in all cases where it is indicated (see *Ferri Pyrophosphas*). One fluid drachm contains 2 grains of the pyrophosphate. Its dose is from 1 to 3 teaspoonfuls, repeated 2 or 3 times a day. When required, it may be added to many other tonic and alterative syrups.

Related Preparation.—Syrupus Ferri Lactophosphatis (N. F.), *Syrup of lactophosphate of iron.* "Lactate of iron, seventeen and one-half grammes (17.5 Gm.) [270 grs.]; phosphoric acid (85 per cent, *U. S. P.*), a sufficient quantity; water, thirty cubic centimeters (30 Cc.) [487 ♏]; syrup (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the lactate of iron in the water with the aid of a sufficient quantity of phosphoric acid, avoiding excess, and add enough syrup to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm contains 1 grain of lactate of iron, or about 1½ grains of so-called lactophosphate of iron"—(*Nat. Form.*).

SYRUPUS FERRI PROTOCHLORIDI (N. F.)—SYRUP OF PROTOCHLORIDE OF IRON.

Synonyms: *Syrup of ferrous chloride.*

Preparation.—"Solution of protochloride of iron (F. 222), fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; glycerin, one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; orange-flower water, one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; syrup (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the solution of protochloride of iron with the glycerin and orange-flower water, and add enough syrup to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm contains about 1 grain of protochloride of iron (ferrous chloride)"—(*Nat. Form.*).

This syrup is a solution of ferrous chloride protected from oxidation by means of sugar. Notwithstanding, this precaution, it loses its pale-green hue upon standing, and changes to a deeper color. Small quantities only should be prepared, and be kept securely stoppered in small, well-filled vials.

Action, Medical Uses, and Dosage.—This syrup is used for the general purposes of the chalybeates. Dose, ½ to 1 fluid drachm.

SYRUPUS FERRI, QUININÆ, ET STRYCHNINÆ PHOSPHATUM (U.S.P.)

SYRUP OF THE PHOSPHATES OF IRON, QUININE, AND STRYCHNINE.

SYNONYMS: *Syrupus ferri phosphorici cum chinino et strychnino, Syrupus Eastoni, Easton's syrup, Aitkin's syrup, Syrup of the triple phosphates, Syrup of the three phosphates.*

Preparation.—"Soluble ferric phosphate, twenty grammes (20 Gm.) [309 grs.]; quinine sulphate, thirty grammes (30 Gm.) [463 grs.]; strychnine, two-tenths of a gramme (0.2 Gm.) [3 grs.]; phosphoric acid, forty-eight cubic centimeters (48 Cc.) [1 fl℥, 299 ♏]; glycerin, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; water, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; syrup, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Heat the soluble ferric phosphate with the water, in a porcelain capsule, until it is dissolved. Then add the phosphoric acid, the quinine sulphate, and the strychnine, and stir, until solution is effected. Filter the liquid into the glycerin, contained in a graduated bottle, add enough syrup to make up the volume to one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and mix thoroughly. Lastly, strain, if necessary"—(*U. S. P.*).

This syrup can be readily prepared by the foregoing process. Instead of the freshly precipitated ferrous phosphate formerly used, the above scaled salt, known as sodio-ferric citro-phosphate, is now employed. The phosphoric acid and glycerin are added to preserve the solution from precipitation. Each fluid drachm holds about $\frac{1}{85}$ grain of strychnine, 1⅛ grain of the iron compound, and 1⅔ grain of sulphate of quinine. The syrup slightly deepens in color with age.

Action, Medical Uses, and Dosage.—This preparation is very similar to the Compound Tonic Mixture, or *Misturæ Alterantiæ Composita*, mentioned elsewhere, and may be used to fulfil the same indications. The dose ranges from ½ to 1 fluid drachm, well diluted with water.

SYRUPUS GLYCYRRHIZÆ (N. F.)—SYRUP OF GLYCYRRHIZA.

SYNONYM: *Syrup of liquorice.*

Preparation.—"Pure extract of glycyrrhiza (*U. S. P.*), one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; glycerin, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; sugar, six hundred and fifty grammes (650 Gm.) [1 lb. av., 6 ozs., 406 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the pure extract of glycyrrhiza in five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of water, add the sugar, dissolve it by agitation, and strain. Then add the glycerin, and lastly, enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents about 30 grains of glycyrrhiza"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—(See *Glycyrrhiza.*) Dose, ½ to 1 fluid drachm.

SYRUPUS HELIANTHI COMPOSITUS.—COMPOUND SYRUP OF SUNFLOWER SEED.

Preparation.—Take of bruised sunflower seed, 8 troy ounces; sugar, 24 ounces; Holland gin, 2 pints; water, a sufficient quantity. Pour 4 pints of water on the bruised seeds, and bring to a boil, strain, and evaporate the liquid to 24 fluid ounces, in which dissolve the sugar by the aid of heat. Then, when cold, add the Holland gin.

Action, Medical Uses, and Dosage.—Prof. R. S. Newton highly lauds the compound syrup of helianthus in *chronic affections of the lungs, larynx, bronchi*, etc., as an efficient preparation for relieving *cough*, diminishing abnormal mucous secretion, and imparting tone and healthful vigor to the mucous tissues of the air passages. The dose varies from a teaspoonful to a tablespoonful, 3, 4, or more times per day, or whenever cough is severe. Where it is desired to obtain a diuretic effect, ½ ounce, each, of the oils of juniper and of stillingia may be added to the above syrup.

SYRUPUS HYPOPHOSPHITUM (U. S. P.)—SYRUP OF HYPOPHOSPHITES.

SYNONYM: *Syrupus calcii hypophosphitis compositus.*

Preparation.—"Calcium hypophosphite, forty-five grammes (45 Gm.) [1 oz. av., 257 grs.]; potassium hypophosphite, fifteen grammes (15 Gm.) [232 grs.]; sodium hypophosphite, fifteen grammes (15 Gm.) [232 grs.]; diluted hypophosphorus acid, two grammes (2 Gm.) [31 grs.]; sugar, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]; spirit of lemon, five cubic centimeters (5 Cc.) [81 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the hypophosphites with four hundred and fifty cubic centimeters (450 Cc.) [15 fl℥, 104 ♏] of water, until they are dissolved, add the spirit of lemon, and the hypophosphorous acid, and filter the liquid. In the filtrate dissolve the sugar by agitation, without heat, and add enough water, through the filter, to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Strain, if necessary. Syrup of hypophosphites may also be prepared in the following manner: Prepare a percolator or funnel in the manner described under Syrup (see *Syrupus*). Pour the filtrate obtained as directed in the preceding formula upon the sugar, return the first portions of the percolate, until it runs through clear, and, when all the liquid has passed, follow it by water, until the product measures one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly"—(*U. S. P.*).

The hypophosphorous acid is employed in this sweetened solution of the hypophosphites, to complete the solution of the calcium salt, which otherwise does not wholly dissolve. The combined hypophosphites are present to the amount of about 4.3 grains to the fluid drachm, about 2½ grains of which consists of the calcium compound. Heat should be avoided in its preparation.

Action, Medical Uses, and Dosage.—This syrup combines the virtues of the respective hypophosphites employed. Dose, ½ to 1 fluid drachm.

Related Preparations.—SYRUPUS HYPOPHOSPHITUM COMPOSITUS (N. F.), *Compound Syrup of hypophosphites, Compound hypophosphites.* "Calcium hypophosphite, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; potassium hypophosphite, seventeen and one-half grammes (17.5 Gm. [270 grs.]; sodium hypophosphite, seventeen and one-half grammes (17.5 Gm.) [270 grs.]; hypophosphite of iron, two and one-fourth grammes (2.25 Gm.) [35 grs.]; manganese hypophosphite, two and one-fourth grammes (2.25 Gm.) [35 grs.]; potassium citrate, five grammes (5 Gm.) [77 grs.]; citric acid, two grammes (2 Gm.) [31 grs.]; quinine hydrochlorate, one and one-eighth grammes (1.125 Gm.) [17 grs.]; tincture of nux vomica (*U. S. P.*), twenty-two cubic centimeters (22 Cc.) [357 ♏]; sugar, seven hundred and seventy-five grammes (775 Gm.) [1 lb. av., 11 ozs., 148 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc. [33 fl℥, 391 ♏]. Rub the hypophosphites of iron and of manganese with the potassium citrate and citric acid to powder, add sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏] of water, and warm the mixture a few minutes until a clear greenish solution is obtained. Introduce the other hypophosphites and the quinine hydrochlorate, previously triturated together, into a graduated bottle, next add the sugar, the iron and manganese solution first prepared, the tincture of nux vomica, and lastly, enough water to make up the volume, as soon as the sugar is saturated by the liquid, to one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Agitate until solution has been effected, and strain, if necessary. Each fluid drachm contains 2 grains of calcium hypophosphite, 1 grain, each, of potassium and sodium hypophosphites, ⅛ grain, each, of the hypophosphites of iron and of manganese, 1/16 grain of quinine hydrochlorate, and 1¼ minims of tincture of nux vomica. *Note.*—This syrup should not be confounded with the official *Syrupus Hypophosphitum* (syrup of the hypophosphites). It is not intended to be perfectly clear, and should be shaken before using"—(*Nat. Form.*).

SYRUPUS SODII HYPOPHOSPHITIS (N. F.), *Syrup of sodium hypophosphite.*—"Sodium hypophosphite, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; citric acid, one and one-half grammes (1.5 Gm.) [23 grs.]; sugar, seven hundred and seventy-five grammes (775 Gm.) [1 lb. av., 11 ozs., 148 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the sodium hypophosphite and the citric acid in five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of water, and filter the solution. In this dissolve the sugar by agitation, and pass enough water through the filter, to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm contains 2 grains of sodium hypophosphite"—(*Nat. Form.*).

SYRUPUS HYPOPHOSPHITUM CUM FERRO (U. S. P.)—SYRUP OF HYPOPHOSPHITES WITH IRON.

Preparation.—"Ferrous lactate, ten grammes (10 Gm.) [154 grs.]; potassium citrate, ten grammes (10 Gm.) [154 grs.]; syrup of hypophosphites, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Rub the ferrous lactate and potassium citrate with a small quantity of the syrup, gradually added, until they are dissolved. Then strain, and add enough syrup of hypophosphites to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly. This preparation should be freshly made, when wanted"—(*U. S. P.*).

Formerly ferrous hypophosphite was employed in preparing this syrup but was found to be unsatisfactory. Ferrous lactate has now been selected as less liable to precipitate with the other salts, and citrate of potassium is added to further assist in holding the salts in perfect solution. The preparation should be well and carefully preserved to prevent oxidation, which is likely to gradually ensue. Avoid heat in preparing this syrup. Each fluid drachm contains about ¾ grain of ferrous lactate, about 1 grain each of potassium and sodium hypophosphites, and about 2½ grains of calcium hypophosphite.

Action, Medical Uses, and Dosage.—This syrup is representative of the hypophosphites and iron compounds, and employed like them. The dose is from ½ to 1 fluid drachm.

Related Preparation.—SYRUPUS FERRI HYPOPHOSPHITIS (N. F.), *Syrup of hypophosphite of iron.* "Hypophosphite of iron, seventeen and one-half grammes (17.5 Gm.) [270 grs.]; potassium citrate, twenty-five grammes (25 Gm.) [386 grs.]; orange-flower water, sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; syrup (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the hypophosphite of iron, with the aid of the potassium citrate, in the orange-flower water, and add enough syrup to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm contains 1 grain of hypophosphite of iron (ferric)"—(*Nat. Form.*).

SYRUPUS IPECACUANHÆ (U. S. P.)—SYRUP OF IPECAC.

Preparation.—"Fluid extract of ipecac, seventy cubic centimeters (70 Cc.) [2 fl℥, 176 ♏]; acetic acid, ten cubic centimeters (10 Cc.) [162 ♏]; glycerin, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; sugar, seven hundred grammes (700 Gm.) [1 lb. av., 8 oz., 303 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dilute the fluid extract of ipecac with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water to which the acetic acid had previously been added, and mix them thoroughly by shaking. Then filter, and pass enough water through the filter to obtain five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of filtrate. To this liquid add the glycerin, dissolve the sugar in the mixture, and add enough water to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly, and strain, if necessary. Syrup of ipecac may also be prepared in the following manner: Prepare a percolator or funnel in the manner described under syrup (see *Syrupus*). Mix the filtrate obtained as directed in the preceding formula with the glycerin, pour the mixture upon the sugar, return the first portions of the percolate, until it runs through clear, and, when all the liquid has passed, follow it by water, until the product measures one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This syrup is emetic and expectorant; it is used principally among children. As an emetic the dose for an adult is 1 or 2 fluid ounces; for a child 1 or 2 years old, 1 or 2 fluid drachms, to be repeated every 10 or 20 minutes till it operates. When used as an expectorant, an adult may take 1 or 2 fluid drachms; a child, from 5 to 20 minims.

SYRUPUS KRAMERIÆ (U. S. P.)—SYRUP OF KRAMERIA.

SYNONYMS: *Syrup of rhatany*, *Syrupus ratanhæ*.

Preparation.—"Fluid extract of krameria, four hundred and fifty cubic centimeters (450 Cc.) [15 fl℥, 104 ♏]; syrup, five hundred and fifty cubic centimeters (550 Cc.) [18 fl℥, 287 ♏]; to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix them"—(*U. S. P.*). This is a clear syrup, holding 27 minims of the fluid extract of krameria in each fluid drachm.

Action, Medical Uses, and Dosage.—This syrup is usually added to astringent and antacid mixtures, to be administered in the *non-inflammatory diarrhœas* of small children. Dose, ½ to 1 fluid drachm.

SYRUPUS LACTUCARII (U. S. P.)—SYRUP OF LACTUCARIUM.

Preparation.—"Tincture of lactucarium, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; precipitated calcium phosphate, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; sugar, seven hundred and fifty grammes (750 Gm.) [1 lb. av., 10 ozs., 199 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the precipitated calcium phosphate and one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.] of the sugar, in a mortar, with the tincture of lactucarium gradually added, and afterward with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water, added in small portions at a time. Filter the mixture, dissolve the remainder of the sugar in the filtrate, and pass enough water through the filter to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly. Syrup of lactucarium may also be prepared in the following manner: Prepare a percolator or funnel in the manner described under syrup (see *Syrupus*). Pour the filtrate obtained as directed in the preceding formula upon the sugar, return the first portions of the percolate, until it runs through clear, and, when all the liquid has passed, follow it by water, until the product measures one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly"—(*U. S. P.*). This syrup is transparent, the rubber-like constituents of lactucarium having been removed in the process of tincturing. Of lactucarium it contains about 3 grains in each fluid drachm.

Action, Medical Uses, and Dosage.—(For uses, see *Lactucarium*.) Dose, about 1 fluid drachm.

SYRUPUS LIMONIS.—SYRUP OF LEMON.

Preparation.—"Take of fresh lemon peel, 2 ounces (av.); lemon juice, strained, 1 pint (Imp.); refined sugar, 2¼ pounds (av.). Heat the lemon juice to the boiling point, and, having put it into a covered vessel with the lemon peel, let them stand until they are cold, then filter, and dissolve the sugar in the filtered liquid with the aid of heat. The product should weigh 3½ pounds (av.), and its specific gravity be about 1.340"—(*Br. Pharm.*, 1885). The *British Pharmacopœia* (1898) directs the previous maceration of the lemon peel for 7 days in alcohol of 90 per cent, pressing off the tincture and mixing it with the lemon juice and sugar.

Action, Medical Uses, and Dosage.—When diluted with water, this forms an agreeable drink for *febrile affections* when an acid is indicated. Dose, 1 fluid drachm, well diluted.

SYRUPUS LIQUIDAMBAR.—SYRUP OF SWEET-GUM.

Preparation.—Take of sweet-gum bark, in coarse powder, 5 ounces; refined sugar, 2 pounds (av.); water, a sufficient quantity. Moisten the bark thoroughly with water, let it stand for 24 hours in a close vessel, then transfer it to a percolator, and pour water gradually on it until a pint of filtered liquor is obtained. To this add the sugar in a bottle, and agitate occasionally until it is dissolved (Dr. C. W. Wright).

Action, Medical Uses, and Dosage.—This is a pleasant medicine, which is not apt to be ejected from an irritable stomach. It is very useful in *bowel complaints of children*, *diarrhœa*, *chronic cough*, and *chronic mucous affections* generally. The dose for an adult is a fluid ounce, 3 or 4 times a day; and, in diarrhœa, to be repeated after each evacuation from the bowels when they recur too frequently. Probably the sweet-gum, or resinous exudation, dissolved in alcohol, or made into an emulsion, and then added to syrup, would answer the purpose still better.

SYRUPUS LOBELIÆ.—SYRUP OF LOBELIA.

Preparation.—Take of vinegar of lobelia, 1 pint; sugar, 2 pounds. Dissolve with the aid of a gentle heat, and strain while hot.

Action, Medical Uses, and Dosage.—This forms a pleasant expectorant syrup, and although the volatile properties of lobelia are dissipated by heat, this syrup will be found sufficiently active for practical purposes; the long-continued digestion removes the peculiar, disagreeable taste of the lobelia. It will be found very useful in *infantile catarrh*, *pertussis*, *croup*, *pectoral diseases*, to produce emesis, and to bring the system under the relaxing influence of lobelia. The dose is from 1 fluid drachm to ½ fluid ounce (N. T. Isgrigg, M. D.).

SYRUPUS MANNÆ (N. F.)—SYRUP OF MANNA.

Preparation.—"Manna, in flakes, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; sugar, seven hundred and seventy-five grammes (775 Gm.) [1 lb. av., 11 ozs., 148 grs.]; alcohol, sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the manna in four hundred and fifty cubic centimeters (450 Cc.) [15 fl℥, 104 ♏] of hot water, add the alcohol, set the liquid aside for 12 hours in a moderately warm place, and filter. Dissolve the sugar in the filtrate, with the aid of a gentle heat, allow the syrup to cool, and add enough water, passed through the filter previously used, to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. *Note.*—This product is approximately of the same strength as that which is official in the *German Pharmacopœia*"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—(See *Manna.*) Dose, 1 to 2 fluid drachms.

SYRUPUS MARRUBII COMPOSITUS.—COMPOUND SYRUP OF HOARHOUND.

Preparation.—Take of the bark of red-root, roots of elecampane, spikenard, and comfrey, bark of wild cherry, and leaves and tops of hoarhound, each, 16 troy ounces; bloodroot, 8 troy ounces. Grind and mix the articles together. Make a syrup after the process directed for Compound Syrup of Aralia, using the same menstruum and the proportional amount of sugar to produce 24 pints of syrup. Each pint will contain the virtues of 4 ounces of the ingredients. In the earlier Dispensatories, this article was called *Syrupus Araliæ Compositus* (Compound Syrup of Spikenard), but in consequence of the great improvement in the formula, and from the fact that this name has been now bestowed upon another preparation, the name of the article under consideration has been changed to avoid confusion.

Action, Medical Uses, and Dosage.—This is an elegant remedy for *obstinate coughs* of long standing, and *pulmonary affections* generally. It has been called "Pulmonary Balsam," but is superior to the preparation bearing this name in past years. It is often employed advantageously in pulmonary and bronchial difficulties, combined with ¼ part of fluid extract of queen's root. The dose of the syrup is ½ fluid ounce, 3 or 4 times a day.

SYRUPUS MITCHELLÆ COMPOSITUS.—COMPOUND SYRUP OF PARTRIDGEBERRY.

SYNONYM: *Mother's cordial.*

Preparation.—Take of partridgeberry, 16 troy ounces; helonias root, high cranberry bark, blue cohosh root, each, 4 troy ounces. Grind, and mix the articles together; place the whole 1¾ pounds in a convenient vessel, cover them with fourth-proof brandy, and macerate for 3 days. Then transfer the whole to a percolator, and gradually add brandy, until 3 pints of spirituous tincture have been obtained, which reserve. Then continue the percolation with water until the liquid passes tasteless; add to this 2 pounds of refined sugar, and evaporate by a gentle heat to 5 pints; remove from the fire, add the reserved 3 pints of spirituous tincture, and flavor with essence of sassafras. Strictly speaking, this is not a syrup, but a sweetened infusion, yet I place it here, as being nearly in its appropriate class. It is often termed *Mother's cordial*, but is superior to the article to which the name was formerly applied (J. King). This process is not always followed, the brandy being displaced by diluted alcohol.

Action, Medical Uses, and Dosage.—This preparation is a uterine tonic and antispasmodic. It may be used in all cases where the functions of the internal reproductive organs are deranged, as in *amenorrhœa*, *dysmenorrhœa*, *menorrhagia*, *leucorrhœa*, and to overcome the *tendency to habitual abortion*. The dose is from 2 to 4 fluid ounces, 3 times a day. Pregnant women, especially those of a delicate or nervous system, will find it an advantage to take 1 or 2 doses daily, for several weeks previous to parturition, as by the energy it imparts to the uterine nervous system, the labor will be very much facilitated, beside which it frequently removes the cramps to which some are liable during the latter weeks of the utero-gestation. The medicine appears to exert a specific influence on the uterus (J. King).

Related Preparation.—PARTURIENT BALM. A preparation called the "*Parturient Balm*," has also been used and recommended in the above diseases, but I have found it to be of less efficacy; however, as some practitioners employ it, I introduce at this place the formula for its preparation: Take of blue cohosh root, spikenard root, each, 4 pounds (av.); black cohosh root, partridgeberry herb, queen-of-the-meadow root, each, 2 pounds (av.); ladies'-slipper root, comfrey root, each, 1 pound (av.). Proceed to make a syrup according to the directions given for the Compound Syrup of Aralia, making 8 gallons of syrup. The dose of this is from a teaspoonful to a tablespoonful, 3 or 4 times a day (J. King).

SYRUPUS MORI.—SYRUP OF MULBERRIES.

Preparation.—"Take of mulberry juice, 1 pint (Imp.); refined sugar, 2¼ pounds (av.); rectified spirit, 2½ fluid ounces. Heat the mulberry juice to the boiling point, and, when it has cooled, filter it. Dissolve the sugar in the filtered liquid by the aid of heat, and add the spirit. The product should weigh 3 pounds, 6 ounces (av.), and its specific gravity be about 1.330"—(*Br. Pharm.*, 1885).

Raspberry, pineapple, currant, strawberry, blackberry, and other fruit syrups may be made after this method, or by the one followed in making *Syrupus Rubi Idæi*. The object of heating in this instance is to coagulate and separate the albumen present. Only porcelain or enamelled-iron vessels should be used in preparing syrups from acid juices.

Action, Medical Uses, and Dosage.—This syrup is used chiefly to flavor fever drinks and so-called "soda water" (carbonic acid water). The dose, as given in the *British Pharmacopœia*, is 1 fluid drachm.

SYRUPUS MORPHINÆ SULPHATIS (N. F.)—SYRUP OF MORPHINE SULPHATE.

SYNONYMS: *Syrupus morphinæ*, *Syrup of morphine.*

Preparation.—I. "Morphine sulphate, two and two-tenths grammes (2.2 Gm.) [34 grs.]; water, hot, thirty cubic centimeters (30 Cc.) [487 ♏]; syrup (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the morphine sulphate in the hot water, and add enough syrup to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm contains ⅛ grain of morphine sulphate. *Note.*—This preparation is in considerable use in the southern states. It should, however, never be dispensed in prescriptions, unless it is known to be the preparation intended, or unless it is designated as that of the *National Formulary* (N. F.). When *Syrup of Morphine* is prescribed without any such specific designation or knowledge, it is recommended that the corresponding, but weaker preparation of the *French Pharmacopœia* be dispensed. The official title of this is *Sirop de Chlorhydrate de Morphine* (or *Sirop de Morphine*). This may be prepared approximately of the strength required by the *Codex*, as follows: II. Morphine hydrochlorate, seventeen decigrammes (0.7 Gm.) [11 grs.]; water, thirty cubic centimeters (30 Cc.) [487 ♏]; syrup (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the morphine hydrochlorate in the water, and add enough syrup to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm contains about $\frac{1}{25}$ grain of morphine hydrochlorate"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—(See *Morphinæ Sulphas.*) Dose, ½ to 1 fluid drachm.

Related Preparations.—SYRUPUS MORPHINÆ COMPOSITUS (N. F.), *Compound syrup of morphine.* "Fluid extract of ipecac (*U. S. P.*), two cubic centimeters (2 Cc.) [33 ♏]; fluid extract of senega (*U. S. P.*), one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; fluid extract of rhubarb (*U. S. P.*), sixteen cubic centimeters (16 Cc.) [260 ♏]; morphine sulphate, fifty-five centigrammes (0.55 Gm.) [8.5 grs.]; oil of sassafras, one cubic centimeter (1 Cc.) [16 ♏]; syrup (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the morphine sulphate in about sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏] of syrup, then add the fluid extracts and the oil of sassafras, and lastly enough syrup to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the whole thoroughly by shaking. *Note.*—In some sections of the country, this preparation is dispensed when Pectoral Syrup or Jackson's Cough Syrup is demanded or ordered. As the formula differs too much from that originally used by Dr. Jackson, it is recommended that the above preparation be dispensed only when it is designated by the title above given"—(*Nat. Form.*). To the above we will add that it seems to us to have been unwise to have introduced this preparation at all, much less under the name Compound Syrup of Morphine, which title properly belongs to Jackson's Cough Syrup, which is the original Compound Syrup of Morphine.

SYRUPUS PECTORALIS (N. F.), *Pectoral syrup, Jackson's pectoral (or cough) syrup.*—"Morphine hydrochlorate, fifty-five centigrammes (0.55 Gm.) [8.5 grs.]; oil of sassafras, one-half cubic centimeter (0.5 Cc.) [8 ♏]; syrup of acacia (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the morphine hydrochlorate in about sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏] of the syrup, add the oil of sassafras, and enough syrup to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm contains $\frac{1}{32}$ grain of morphine hydrochlorate. *Note.*—The original formula of Dr. Samuel Jackson's cough syrup was as follows: Sassafras pith, 60 grains; acacia, 1 ounce; sugar, 28 ounces (av.); muriate of morphine, 8 grains; water, enough to make 32 fluid ounces. The sassafras pith was afterward uniformly replaced by oil of sassafras, and the other constituents of the syrup have been more or less altered, so that a number of different formulas are in vogue in different sections of the country. It is recommended that the above be followed, if possible, for the sake of uniformity"—(*Nat. Form.*). There must be much confusion in the minds of pharmacists concerning these morphine syrups. Had the *National Formulary* given but one formula for Compound Syrup of Morphine, and made that one also Jackson's Cough Syrup, this could have been avoided. It seems as though the many syrups containing opium (or its chief alkaloid, might be reduced to the advantage of physicians, pharmacists, and the public.

SYRUPUS CODEINÆ (N. F.), *Syrup of codeine.*—"Codeine sulphate, one gramme (1 Gm.) [15.5 grs.]; syrup (*U. S. P.*), one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]. Reduce the codeine sulphate to a fine powder and dissolve it in the syrup, previously warmed. A fluid drachm of this preparation contains about ½ grain of codeine sulphate. *Note.*—The *Syrupus Codeini* of the *French Pharmacopæia*, is a weaker preparation, containing only about ⅛ grain of codeine (alkaloid) in a fluid drachm"—(*Nat. Form.*).

SYRUPUS PAPAVERIS (N. F.)—SYRUP OF POPPY.

Preparation.—I. "Tincture of poppy (F. 416), eight hundred and seventy-five cubic centimeters (875 Cc.) [29 fl℥, 282 ♏]; sugar, seven hundred and seventy-five grammes (775 Gm.) [1 lb. av., 11 ozs., 148 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Evaporate the tincture of poppy on a water-bath, at a gentle heat, until its volume is reduced to four hundred and fifty cubic centimeters (450 Cc.) [15 fl℥, 104 ♏]. In this dissolve the sugar with a gentle heat, strain, and when the syrup is cold, add enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. *Note.*—The product is practically identical with the *Syrupus Papaveris* of the *British Pharmacopœia.* The corresponding preparation of the *German Pharmacopœia* (*Syrupus Papaveris,* or *Syrupus Diacodii*) is much weaker, and may be prepared as follows: ℞. Tincture of poppy (F. 416), one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; syrup (*U. S. P.*), eight hundred and seventy-five cubic centimeters (875 Cc.) [29 fl℥, 282 ♏]. Mix them"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—This syrup is anodyne and narcotic, though capable of doing mischief on account of the uncertain opium strength of the poppy capsules employed in preparing the tincture. The dose for small children is placed at ½ fluid drachm.

Related Preparation.—SYRUPUS IPECACUANHÆ ET OPII (N. F.), *Syrup of ipecac and opium, Syrup of Dover's powder.* "Fluid extract of ipecac (*U. S. P.*), eight and one-half cubic centimeters (8.5 Cc.) [138 ♏]; tincture of deodorized opium (*U. S. P.*), eighty-five cubic centimeters (85 Cc.) [2 fl℥, 420 ♏]; sugar, seven hundred and seventy-five grammes (775 Gm.) [1 lb. av., 11 ozs., 148 grs.]; cinnamon water (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the fluid extract and tincture with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of cinnamon water, and filter the liquid; to this add the sugar and enough cinnamon water to make the product, after the sugar has been dissolved by agitation, measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents 5 grains of Dover's powder, or ½ grain, each, of ipecac and opium. *Note.*—In place of the above directed quantities of fluid extract of ipecac and tincture of deodorized opium, eighty-five cubic centimeters (85 Cc.) [2 fl℥, 320 ♏] of the official *Tinctura Ipecacuanhæ et Opii* may be taken"—(*Nat. Form.*).

This preparation may be used like *Dover's powder.* The dose is from 1 to 2 fluid drachms.

SYRUPUS PHYTOLACCÆ COMPOSITUS.—COMPOUND SYRUP OF POKE.

Preparation.—Take of poke-root and bark of American ivy (*Ampelopsis quinquefolia*), each, coarsely bruised, 16 troy ounces; black cohosh root, coarsely bruised, and sheep laurel leaves, each, 8 troy ounces. Prepare a syrup after the manner of making Compound Syrup of Aralia, using the same menstruum and the same proportion of sugar. Make 12 pints. Flavor with some aromatic essence, as sassafras, wintergreen, etc.

Action, Medical Uses, and Dosage.—This syrup is an excellent alterative and antisyphilitic, and is beneficial in *syphilis, scrofula,* and *rheumatism.* If required, iodide of potassium may be added to it, as in the instance of Compound Syrup of Stillingia. The dose is a teaspoonful, 3 or 4 times a day, in ½ gill of water (J. King).

SYRUPUS PICIS LIQUIDÆ (U. S. P.)—SYRUP OF TAR.

Preparation.—"Tar, seventy-five grammes (75 Gm.) [2 ozs. av., 282 grs.]; water, one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏]; boiling distilled water, four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏]; glycerin, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; sugar, eight hundred grammes (800 Gm.) [1 lb. av., 12 ozs., 96 grs.]; distilled water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the tar intimately with about one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.] of white sand, pour on the water, and stir frequently during twelve hours; then pour off the water and throw it away. Pour the boiling distilled water upon the residue, stir well and frequently during 15 minutes, add the glycerin, and set the vessel aside for 24 hours, occasionally stirring. Decant the clear solution, and filter. Dissolve the sugar in the filtrate with the aid of a gentle heat; allow the liquid to cool, then strain it, and pass enough distilled water through the strainer to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly"—(*U. S. P.*)

The official process very properly directs the washing of the tar which removes the acetic acid and other irritant impurities, and the glycerin is intended to prevent turbidity. The official syrup should have a tarry odor, a yellowish hue, and a somewhat bitterish taste. It is of acid reaction and turns brown when treated with alkalies.

Action, Medical Uses, and Dosage.—This forms a very useful remedy in the treatment of *chronic pulmonary* and *bronchial affections*, and also acts as a diuretic in certain *diseases of the bladder and kidneys*. The dose is from a dessert to a tablespoonful, repeated 3 or 4 times a day.

SYRUPUS PINI STROBI COMPOSITUS (N. F.)—COMPOUND SYRUP OF WHITE PINE.

Preparation.—"White pine bark (Pinus Strobus), seventy-five grammes (75 Gm.) [2 ozs. av., 282 grs.]; wild cherry bark, seventy-five grammes (75 Gm.) [2 ozs. av., 282 grs.]; spikenard root, ten grammes (10 Gm.) [154 grs.]; balm of Gilead buds, ten grammes (10 Gm.) [154 grs.]; sanguinaria root, eight grammes (8 Gm.) [123 grs.]; sassafras bark, seven grammes (7 Gm.) [108 grs.]; morphine sulphate, one-half gramme (0.5 Gm.) [8 grs.]; chloroform, six cubic centimeters (6 Cc.) [97 ♏]; sugar, seven hundred and fifty grammes (750 Gm.) [1 lb. av., 10 ozs., 199 grs.]; alcohol, water, syrup (*U. S. P.*), of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Reduce the vegetable drugs to a moderately coarse (No. 40) powder, moisten the powder with a menstruum composed of 1 volume of alcohol and 3 volumes of water, and macerate for 12 hours. Then percolate with the same menstruum until five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of tincture have been obtained, in which dissolve the sugar and the morphine sulphate; lastly, add the chloroform, and sufficient syrup to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and strain"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—This agent is considerably employed for the general purposes of a "cough syrup." Dose, 1 fluid drachm.

SYRUPUS PRUNI VIRGINIANÆ (U. S. P.)—SYRUP OF WILD CHERRY.

Preparation.—"Wild cherry, in No. 20 powder, one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]; sugar, seven hundred grammes (700 Gm.) [1 lb. av., 8 ozs., 303 grs.]; glycerin, one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the glycerin with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water. Moisten the wild cherry with a sufficient quantity of the liquid, and macerate for 24 hours in a close vessel; then pack it firmly in a cylindrical percolator, and pour on the remainder of the menstruum. When the liquid has disappeared from the surface, follow it by water, until the percolate measures four hundred and fifty cubic centimeters (450 Cc.) [15 fl℥, 104 ♏]. Dissolve the sugar in the percolate by agitation, without heat, strain, and pass enough water through the strainer to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly. Syrup of wild cherry may also be prepared in the following manner: Prepare a percolator or funnel in the manner described under syrup (see *Syrupus*). Pour the percolate obtained as directed in the preceding formula upon the sugar, return the first portions of the percolate, until it runs through clear, and, when all the liquid has passed, follow it by water, until the product measures one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly"—(*U. S. P.*).

Or, take of wild cherry bark, in rather coarse powder, 5 ounces; moisten it thoroughly with a sufficient quantity of water, and then introduce it, rather closely packed, into a percolator, and gradually add water until a pint of percolate has passed. Place this in a well-stopped bottle, add to it sugar, 28 troy ounces, and form a syrup by agitation. The official process is based upon that proposed by Procter and Turnpenny (1842). The glycerin present (proposed by Schnabel, in 1874) not only prevents fermentation, but obviates all danger of precipitation. This syrup has an agreeable taste and a fine brown-red color.

Action, Medical Uses, and Dosage.—This forms a handsome tonic and sedative syrup, which may be used in all cases where wild cherry bark is indicated or desired. It may be given in doses of from 1 fluid drachm to ½ fluid ounce.

SYRUPUS RHAMNI CATHARTICÆ (N. F.)—SYRUP OF RHAMNUS CATHARTICA.

SYNONYMS: *Syrup of buckthorn berries, Syrupus spinæ cervinæ.*

Preparation.—"Syrup, eight hundred grammes (800 Gm.) [1 lb. av., 12 ozs., 96 grs.]; fermented juice of buckthorn berries, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the sugar in four hundred and fifty cubic centimeters (450 Cc.) [15 fl℥, 104 ♏] of the juice, with the aid of a gentle heat. allow the syrup to cool, then add enough of the juice to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and strain, if necessary. *Note.*—This preparation is practically identical with that official in the *German Pharmacopœia.* The species of buckthorn to be used is the *Rhamnus cathartica*, Linne, native of Europe, and naturalized, to some extent, in the United States. If the fresh berries can not be obtained, the imported fermented juice may be used in preparing the syrup"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—Used chiefly as a purgative for children (see *Rhamnus Cathartica*). Dose, 1 fluid drachm.

SYRUPUS RHEI (U. S. P.)—SYRUP OF RHUBARB.

Preparation.—"Fluid extract of rhubarb one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; spirit of cinnamon, 4 cubic centimeters (4 Cc.) [65 ♏]; potassium carbonate, ten grammes (10 Gm.) [154 grs.]; glycerin, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; water, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; syrup, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the spirit of cinnamon with the fluid extract of rhubarb, and add to it the potassium carbonate dissolved in the water. Then add the glycerin, and, lastly, enough syrup to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly"—(*U. S. P.*). This syrup has a dark red-brown color.

Action, Medical Uses, and Dosage.—(See *Rheum.*) Dose, ½ to 1 fluid drachm.

SYRUPUS RHEI AROMATICUS (U. S. P.)—AROMATIC SYRUP OF RHUBARB.

Preparation.—"Aromatic tincture of rhubarb, one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏]; syrup, eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏]; to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix them"—(*U. S. P.*). This preparation is somewhat opaque. and possesses a spicy, bitterish taste, and emits a pleasant aroma.

Action, Medical Uses, and Dosage.—(See *Rheum.*) Dose, ½ to 1 fluid drachm.

SYRUPUS RHEI ET POTASSÆ COMPOSITUS.—COMPOUND SYRUP OF RHUBARB AND POTASSA.

SYNONYM: *Neutralizing cordial.*

Preparation.—Take of best India rhubarb. in coarse powder, and bicarbonate of potassium, each, 16 troy ounces; cinnamon, golden seal, each, 8 troy ounces; refined sugar, 6 pounds (av.); fourth-proof brandy, 2 gallons; oil of peppermint, 2 fluid drachms. Macerate the rhubarb, potassium bicarbonate, cinnamon, and golden seal in the brandy for 2 days, then express the tincture with strong pressure, and add to it the oil of peppermint, previously dissolved in a little alcohol. Break up the cake or compressed residue from the press, and place it in a displacement apparatus, and gradually add warm water, until the strength of the articles is exhausted. Evaporate this solution to 8 pints, and while the liquor is still hot dissolve in it the sugar. Continue the evaporation, if necessary, until when added to the tincture first obtained, it will make 3 gallons, and mix the two solutions together. Strictly speaking, this is not a syrup, but a sweetened tincture (Wm. S. Merrell).

Dr. Hill has kindly furnished me with the formula by which he prepares this syrup, and which many physicians prefer on account of its pleasantness and efficacy. It is as follows: Take of best India rhubarb, in coarse powder, and pure carbonate of potassium, each, 2 ounces; golden seal, cinnamon, each, 1 ounce; refined sugar, 4 pounds; brandy, 1 gallon; oil of peppermint, 20 minims. Macerate the rhubarb, golden seal, and cinnamon in ½ gallon of the brandy for 6 hours with a gentle heat, then transfer the mass to a percolator and displace with the remaining ½ gallon of brandy. The remaining strength, if there be any, can be obtained by adding water until the liquor comes off tasteless. To this add the carbonate of potassium, sugar, and oil of peppermint, this last having been previously rubbed with a sufficient quantity of the sugar to absorb it, and mix the two liquors. The whole of the active properties of the ingredients may be obtained with more certainty by using alcohol (76 per cent) instead of brandy, owing to the great want of uniformity in the quality of the latter (J. King).

The following excellent preparation is recommended by Prof. F. J. Locke, M. D.: Take rhubarb, coarsely ground, peppermint herb, and potassium bicarbonate, of each, 3 ounces; boiling water, 4 pints; diluted alcohol, ½ pint; essence of peppermint, ½ ounce; white sugar, 2 pounds. Pour the boiling water upon the rhubarb, peppermint herb, and potassium bicarbonate, and allow them to macerate for 2 hours in a warm place. Strain, and while still warm add the sugar. After the sugar has dissolved and the liquid is cold, add the diluted alcohol and the essence of peppermint. The dose is from 1 to 4 fluid drachms.

Action, Medical Uses, and Dosage.—This syrup is an agreeable laxative, antacid, and tonic. It is sometimes called *Neutralizing cordial*. It may be used in cases of *obstinate constipation*, *acidity of stomach*, *dyspepsia*, and as a laxative in *pregnancy*, and where *piles* are present. It is one of the principal remedies employed by physicians in *diarrhœa*, *dysentery*, *cholera morbus*, *cholera infantum*, and in the same diseases as the compound powder of rhubarb. Dr. Locke's preparation is exceedingly efficient in *acid and irritative forms of summer diarrhœa* (see *Rheum*). The dose for an adult is a tablespoonful every ½ hour, hour, or 2 hours, according to the urgency of the symptoms; for a child, in proportion to its age.

Related Preparation.—SYRUPUS RHEI ET POTASSII COMPOSITUS (N. F.), *Compound syrup of rhubarb and potassa, Neutralizing cordial*. "Fluid extract of rhubarb (*U. S. P.*), seventeen and one-half cubic centimeters (17.5 Cc.) [284 ♏]; fluid extract of hydrastis (*U. S. P.*), eight and one-half cubic centimeters (8.5 Cc.) [138 ♏]; potassium carbonate, seventeen and one-half grammes (17.5 Gm.) [270 grs.]; tincture of cinnamon (*U. S. P.*), sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; spirit of peppermint (*U. S. P.*), eight cubic centimeters (8 Cc.) [130 ♏]; syrup (*U. S. P.*), two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; diluted alcohol (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the potassium carbonate in the syrup, and add the solution to the fluid extracts, tincture, and spirit, previously mixed with six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of diluted alcohol. Mix well, add enough diluted alcohol to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and filter, if necessary"—(*Nat. Form.*). This preparation is designed to replace the old Eclectic neutralizing cordial, and, in some respects, is as important. It will be observed that alcohol is used instead of brandy.

SYRUPUS RHŒADOS.—SYRUP OF RED POPPY.

Preparation.—"Take of fresh red poppy petals, 13 ounces (av.); refined sugar, 2¼ pounds (av.); distilled water, 1 pint (Imp.), or a sufficiency; rectified spirit, 2½ fluid ounces. Add the petals gradually to the water heated in a water-bath, stirring frequently, and afterward, the vessel being removed, infuse for 12 hours. Then press out the liquor, strain, add the sugar, and dissolve by means of heat. When nearly cold add the spirit, and as much distilled water as may be necessary to make up for loss in the process, so that the product shall weigh 3 pounds 10 ounces (av.). Its specific gravity should be about 1.330"—(*Br. Pharm.*, 1885).

The directions in the *British Pharmacopœia* (1898) practically agree with these. This syrup is prone to ferment, but this is retarded by the addition of the alcohol. It has a handsome red color.

Action, Medical Uses, and Dosage.—The proportion of opium present in this syrup is very uncertain, consequently but little reliance is placed upon it as an opiate. It is chiefly used as a coloring agent for mixtures. The dose is about 1 fluid drachm.

SYRUPUS ROSÆ (U. S. P.)—SYRUP OF ROSE.

Preparation.—"Fluid extract of rose, one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; syrup, eight hundred and seventy-five cubic centimeters (875 Cc.) [29 fl℥, 282 ♏]; to make one thousand cubic centimeters (1000 Cc. [33 fl℥, 391 ♏]. Mix them"—(*U. S. P.*).

Syrup of rose has a beautiful red color, and is often used to color mixtures. It has a pleasant, subastringent taste. One fluid drachm of red rose petals is represented in each fluid ounce of syrup.

Uses.—Employed chiefly as a flavoring and coloring agent. Dose, 1 fluid drachm.

SYRUPUS RUBI (U. S. P.)—SYRUP OF RUBUS.

Preparation.—"Fluid extract of rubus, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; syrup, seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏]; to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix them"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This agent, in doses of from 1 to 2 fluid drachms, is a remedy for mild forms of *non-irritable diarrhœa*.

Related Preparation.—SYRUPUS RUBI AROMATICUS (N. F.), *Aromatic syrup of blackberry.* "Rubus (*U. S. P.*), one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; cinnamon fifteen grammes (15 Gm.) [232 grs.]; nutmeg, fifteen grammes (15 Gm.) [232 grs.]; cloves, eight grammes (8 Gm.) [123 grs.]; allspice, eight grammes (8 Gm.) [123 grs.]; sugar, six hundred and fifty grammes (650 Gm.) [1 lb. av., 6 ozs., 406 grs.]; diluted alcohol (*U. S. P.*), blackberry juice, of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc. [33 fl℥, 391 ♏]. Reduce the rubus (blackberry root) and the aromatics to a moderately coarse (No. 40) powder, and percolate it, in the usual manner, with the diluted alcohol, until two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of percolate are obtained. To this add four hundred and fifty cubic centimeters (450 Cc.) [15 fl℥, 104 ♏] of blackberry juice, and dissolve the sugar in the liquid by agitation. Lastly, add enough blackberry juice to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*Nat. Form.*).

SYRUPUS RUBI IDÆI (U. S. P.)—SYRUP OF RASPBERRY.

Preparation.—"Fresh, ripe raspberries, any convenient quantity; sugar, a sufficient quantity. Reduce the raspberries to a pulp, and let this stand, at a temperature of about 20° C. (68° F.), until a small portion of the filtered juice mixes clear with half its volume of alcohol. Then separate the juice by pressing, set it aside, in a cool place, until the liquid portion has become clear, and filter. To every 40 parts by weight of the filtrate (which should not be allowed to remain, unprotected by sugar, more than 2 hours) add 60 parts of sugar, heat the mixture to boiling, avoiding the use of tin vessels, and strain. Keep the product in well-stoppered bottles, in a cool and dark place"—(*U. S. P.*).

Test.—"On shaking separate portions of syrup of raspberries with ether, chloroform, or amylic alcohol, no color should be imparted to these liquids (absence of foreign coloring matters)"—(*U. S. P.*).

In the preparation of fruit syrups, all being prepared alike, the juice is allowed to ferment so as to free it from pectinous and albuminous constituents, which cause it to become opaque. Raspberries readily ferment, so that the process is generally completed in a short time, or in a day, at the most, if put in a position favorable to fermentative action. The process must, however, be carefully watched lest it proceed to acetous fermentation, which greatly impairs the flavor of the product. Neither should it be allowed to mold. Generally a moderate temperature, about 12° to 15° C. (54° to 59° F.), and checking the fermentation when the juice reaches that stage when it can be easily filtered, as directed by the *French Codex*, will insure a good product.

Medical Uses.—Diluted with water this syrup provides a pleasant drink in *fevers*. The syrup may also be used for flavoring purposes.

Related Preparations.—Other syrups prepared like the above, using fresh ripe fruits, are the following: SYRUPUS FRAGARIÆ, *Strawberry syrup;* SYRUPUS CYDONIÆ, *Quince syrup;* SYRUPUS CERASORUM, *Cherry syrup;* SYRUPUS GRANATI, *Pomegranate syrup*, etc. (See *Syrupus Rhamni* and *Syrupus Mori.*)

AQUA RUBI IDÆI, or *Raspberry water*, is prepared by treating 1 part of press cake (left after clarification of the juice) with 2 parts of water and distilling. It has the odor of the fruit. A pleasant *fever drink*.

AQUA FRAGARIÆ.—Prepared like the preceding. A *fever drink* and cosmetic.

ACETUM RUBI IDÆI.—*Raspberry vinegar* may be prepared either by mixing equal parts of raspberry syrup and vinegar, or by taking of raspberry syrup 1 part, and vinegar 2 parts. Diluted with water it forms an agreeable acidulous drink for *fever* patients. The same method is followed in preparing other fruit vinegars.

SYRUPUS RUMICIS COMPOSITUS.—COMPOUND SYRUP OF YELLOW DOCK.

Preparation—Take of yellow dock root, 32 troy ounces; bark of the root of false bittersweet, 16 troy ounces; bark of American ivy (*Ampelopsis quinquefolia*) and figwort (*Scrophularia marilandica*), each, 8 troy ounces; refined sugar, 16 pounds (av.). Prepare after the manner of making Compound Syrup of Aralia, using the same menstruum and the same proportion of sugar. Make 16 pints of syrup. This syrup is sometimes called *Scrofulous Syrup*, but is superior to the article formerly known by this name.

Action, Medical Uses, and Dosage.—This syrup is alterative and antiscrofulous, and was formerly extensively and successfully used in the treatment of *scrofula*, *scrofulous affections*, and many *cutaneous diseases*. Iodide of potassium is frequently added to it, in the proportion of 1 ounce to 1 pint of syrup. The dose is from 1 to 4 fluid drachms, 3 times a day, in about a gill of water; or when the iodide is added, 1 or 2 fluid drachms, in water.

SYRUPUS SANGUINARIÆ (N. F.)—SYRUP OF SANGUINARIA.

SYNONYM: *Syrup of bloodroot.*

Preparation.—Take of bloodroot, in coarse powder, 8 ounces; acetic acid, 4 fluid ounces; water, 5 pints; refined sugar, 2 troy pounds. Macerate the bloodroot for 3 days in 2 fluid ounces of the acetic acid and a pint of the water, then transfer to a percolator, and displace with the remainder of the acetic acid mixed with the balance of the water. Evaporate, by means of a water-bath, to 18 fluid ounces, add the sugar, and form a syrup. By the above process, carefully conducted, the root will be exhausted, and a syrup of a deep-ruby color obtained, opaque in quantity, but transparent in thin strata, having a strongly acrid and bitterish taste.

The *National Formulary* directs its preparation as follows: "Sanguinaria, in No. 20 powder, two hundred and twenty-five grammes (225 Gm.) [7 ozs. av., 410 grs.]; acetic acid (*U. S. P.*), one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; sugar, eight hundred grammes (800 Gm.) [1 lb. av., 12 ozs., 96 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the acetic acid with three hundred and seventy-five cubic centimeters (375 Cc.) [12 fl℥, 327 ♏] of water, moisten the sanguinaria with a sufficient quantity of this menstruum, and allow it to macerate for 2 hours. Then pack it in a glass percolator, and percolate in the usual manner, first with the remainder of the menstruum previously prepared, and afterward with water, until seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of percolate are obtained, or until the sanguinaria is practically exhausted. Evaporate the percolate, at a moderate heat, to four hundred and fift cubic centimeters (450 Cc.) [15 fl℥, 104 ♏]. In this dissolve the sugar with a gentle heat, if necessary, and add enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents about 13 grains of sanguinaria"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—This syrup may be used in all cases where bloodroot is applicable, in doses of from 10 to 60 drops. An excellent cough mixture is composed of equal parts of syrup of squill, syrup of balsam of tolu, syrup of ipecacuanha, syrup of bloodroot, and paregoric; the dose of which is a teaspoonful whenever the cough is troublesome. Syrups of wild cherry bark, bloodroot, balsam of tolu, and fluid extract of stillingia, combined in equal proportions, have been found very useful in *chronic catarrhal* and *bronchial affections*. Prof. E. S. Wayne prepared a good expectorant by dissolving 1 grain of sulphate of sanguinarine in 1 fluid ounce of simple syrup; the dose is ½ fluid drachm, 3 or 4 times a day. It may be added as a valuable adjuvant to other expectorants.

SYRUPUS SARSAPARILLÆ COMPOSITUS (U. S. P.)—COMPOUND SYRUP OF SARSAPARILLA.

SYNONYM: *Syrupus sudorificus.*

Preparation.—"Fluid extract of sarsaparilla, two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏]; fluid extract of glycyrrhiza, fifteen cubic centimeters (15 Cc.) [243 ♏]; fluid extract of senna, fifteen cubic centimeters (15 Cc.) [243 ♏]; sugar, six hundred and fifty grammes (650 Gm.) [1 lb. av., 6 ozs., 406 grs.]; oil of sassafras, one-tenth cubic centimeter (0.1 Cc.) [1.6 ♏]; oil of anise, one-tenth cubic centimeter (0.1 Cc.) [1.6 ♏]; oil of gaultheria, one-tenth cubic centimeter (0.1 Cc.) [1.6 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Add the oils (equivalent to about 2 drops, each) to the mixed fluid extracts, and shake the liquid thoroughly. Then add enough water to make up the volume to six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏], and mix well. Set the mixture aside for 1 hour, then filter it. Dissolve the sugar in the filtrate with the aid of a gentle heat, allow the liquid to cool, strain, and add enough water, through the strainer, to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly"—(*U. S. P.*).

History.—This syrup differs from that of 1880 in not containing guaiac and rose petals, and in the introduction of aromatic oils. The original preparation (1820) was patterned after the celebrated French preparation, known as *Sirop de Cuisinier*, which was a sweetened infusion of sarsaparilla, senna, pale rose, anise, and borage flowers.

Action, Medical Uses, and Dosage.—A vehicle for potassium iodide, etc. Used, but probably valueless, in *syphilis*. Dose, ½ fluid ounce.

SYRUPUS SCILLÆ (U. S. P.)—SYRUP OF SQUILL.

Preparation.—"Vinegar of squill, four hundred and fifty cubic centimeters (450 Cc.) [15 fl℥, 104 ♏]; sugar, eight hundred grammes (800 Gm.) [1 lb. av., 12 ozs., 96 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Heat the vinegar of squill to the boiling point, in a glass or porcelain vessel, and filter the liquid while it is hot. Dissolve the sugar in the hot filtrate by agitation, without further heating, strain, and, when the strained liquid is cold, add enough water, through the strainer, to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly"—(*U. S. P.*). The object in heating the already prepared vinegar of squill is to coagulate the albuminous substances present, which are subsequently removed by filtration. Avoid metallic vessels in the preparation of this syrup.

Action, Medical Uses, and Dosage.—Syrup of squill is used as an expectorant in *coughs* and *catarrhs*, and as an emetic in affections of the air passages in infants. It is frequently given in combination with tincture of lobelia and other emetic or expectorant agents. A fluid drachm is the usual dose.

SYRUPUS SCILLÆ COMPOSITUS (U. S. P.)—COMPOUND SYRUP OF SQUILL.

SYNONYMS: *Hive syrup*, *Cough syrup*.

Preparation.—"Fluid extract of squill, eighty cubic centimeters (80 Cc.) [2 fl℥, 339 ♏]; fluid extract of senega, eighty cubic centimeters (80 Cc.) [2 fl℥, 339 ♏]; antimony and potassium tartrate, two grammes (2 Gm.) [31 grs.]; precipitated calcium phosphate, ten grammes (10 Gm.) [154 grs.]; sugar, seven hundred and fifty grammes (750 Gm.) [1 lb. av., 10 ozs., 199 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the fluid extracts, evaporate them, in a tared capsule, on a water-bath, to one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; and mix the residue with three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of water. When the mixture is cold, incorporate with it, intimately, the precipitated calcium phosphate, filter, pass enough water through the filter to obtain four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of filtrate, and add to this the antimony and potassium tartrate dissolved in twenty-five cubic centimeters (25 Cc.) [406 ♏] of hot water. Dissolve the sugar in this liquid by agitation, without heat, strain, and add enough water, through the strainer, to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly. Compound syrup of squill may also be prepared in the following manner: Prepare a percolator or funnel in the manner described under syrup (see *Syrupus*). Pour the filtrate obtained as directed in the preceding formula, and mixed with the solution of antimony and potassium tartrate, upon the sugar, return the first portions of the percolate, until it runs through clear, and, when all the liquid has passed, follow it by water, until the product measures one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly"—(*U. S. P.*).

This syrup is regarded as much superior to previous official preparations of the same. It is a substitute for the once famous *Cox's Hive Syrup*, which was a decoction of the drugs sweetened with honey. Undoubtedly, a still better syrup could be obtained if vinegar of squill were substituted for the fluid extract, which is an inferior article. Upon evaporation of the alcoholic portion, a pectinous coagulum separates, and is removed by means of the calcium phosphate. More can be removed by repeated filtration, and the antimony salt should not be added until a perfectly transparent filtrate has been obtained. One-eighth grain of tartar emetic is contained in each fluid drachm.

Action, Medical Uses, and Dosage.—According to the dose, this preparation is diaphoretic, expectorant, emetic, and, in large doses, cathartic. It is of some value in *spasmodic laryngitis*. It should, however, be very carefully used, beginning with from 10 to 20-drop doses, every 10 or 15 minutes, until its relaxant and emetic effects are produced. It is seldom used by Eclectic physicians.

SYRUPUS SENEGÆ (U. S. P.)—SYRUP OF SENEGA.

Preparation.—"Fluid extract of senega, two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏]; ammonia water, five cubic centimeters (5 Cc.) [81 ♏]; sugar seven hundred grammes (700 Gm.) [1 lb. av., 8 ozs., 303 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] Mix the fluid extract of senega with three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water, and with the ammonia water, and set the mixture aside for a few hours. Then filter, and pass enough water through the filter to obtain five hundred and fifty cubic centimeters (550 Cc.) [18 fl℥, 287 ♏]. In the filtrate dissolve the sugar by agitation, without heat, strain, and add enough water, through the strainer, to make the product measure one thousand cubic centimeters (1000 Cc. [33 fl℥, 391 ♏]. Mix thoroughly. Syrup of senega may also be prepared in the following manner: Prepare a percolator or funnel in the manner described under syrup (see *Syrupus*). Pour the filtrate obtained as directed in the preceding formula upon the sugar, return the first portions of the percolate, until it runs through clear, and, when all the liquid has passed, follow it by water, until the product measures one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏︎]. Mix thoroughly"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This forms a stimulating expectorant, which is often very useful in *affections of the chest*, etc. It is frequently combined with syrup of squill, tincture of lobelia, syrup of sanguinaria, etc. Its dose is 1 or 2 fluid drachms.

SYRUPUS SENNÆ (U. S. P.)—SYRUP OF SENNA.

Preparation.—"Senna (Alexandria), bruised, two hundred and fifty grammes (250 Gm.) [8 ozs. av., 358 grs.]; oil of coriander, five cubic centimeters (5 Cc.) [81 ♏︎]; alcohol, one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏︎]; sugar, seven hundred grammes (700 Gm.) [1 lb. av., 8 ozs., 303 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏︎]. To the senna add seven hundred cubic centimeters (700 Cc.) [23 fl℥, 321 ♏︎] of boiling water, and digest, at a temperature not exceeding 60° C. (140° F), during 24 hours. Then express the liquid, and pass enough water through the residue to obtain six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏︎] of liquid. Strain this, and, when it is cold, mix it with the alcohol in which the oil of coriander had previously been dissolved. Set it aside until the precipitate has subsided, then pour off the clear liquid, filter the remainder, and pass enough water through the filter to obtain five hundred and fifty cubic centimeters (550 Cc.) [18 fl℥, 287 ♏︎]. In the filtrate dissolve the sugar by agitation, without heat, strain, and add enough water, through the strainer, to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏︎]. Mix thoroughly"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—A mild purgative. Dose, 1 to 4 fluid drachms.

Related Syrups.—The *Nat. Form.* provides for the following forms of syrup of senna:

SYRUPUS SENNÆ AROMATICUS (N. F.), *Aromatic syrup of senna.*—"Senna, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; jalap, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; rhubarb, seventeen and one-half grammes (17.5 Gm.) [270 grs.]; cinnamon, four grammes (4 Gm.) [62 grs.]; cloves, four grammes (4 Gm.) [62 grs.]; nutmeg, two grammes (2 Gm.) [31 grs.]; oil of lemon, one and one-half cubic centimeters (1.5 Cc.) [24 ♏︎]; sugar, seven hundred and fifty grammes (750 Gm.) [1 lb. av., 10 ozs., 199 grs.]; diluted alcohol (*U.S.P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏︎]. Reduce the drugs to a moderately fine (No. 50) powder, add to it the oil of lemon, and percolate it, in the usual manner, with diluted alcohol. Remove the first five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏︎] of the percolate, and dissolve in this the sugar, with the aid of a gentle heat, if necessary, but avoiding loss of alcohol by evaporation. Allow the solution to cool, collect a further portion of percolate, and add it to the syrup, so as to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏︎]. Each fluid drachm represents 7½ grains of senna, 3 grains of jalap, and 1 grain of rhubarb, with aromatics"—(*Nat. Form.*).

SYRUPUS SENNÆ COMPOSITUS (N. F.), *Compound syrup of senna.*—"Fluid extract of senna (*U. S. P.*), one hundred and thirty-five cubic centimeters (135 Cc.) [4 fl℥, 271 ♏︎]; fluid extract of rhubarb (*U. S. P.*), thirty-five cubic centimeters (35 Cc.) [1 fl℥, 88 ♏︎]; fluid extract of frangula (*U. S. P.*), thirty-five cubic centimeters (35 Cc.) [1 fl℥, 88 ♏︎]; oil of gaultheria, four cubic centimeters (4 Cc.) [65 ♏︎]; alcohol, sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏︎]; syrup (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏︎]. Dissolve the oil of gaultheria in the alcohol, and add this to the mixed fluid extracts. Then add enough syrup to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏︎], and mix by agitation. Each fluid drachm represents 8 grains of senna, 2 grains of rhubarb, and 2 grains of frangula"—(*Nat. Form.*).

SYRUPUS STILLINGIÆ.—SYRUP OF QUEEN'S ROOT.

Preparation.—Take of queen's root, 48 troy ounces; prickly ash berries, 24 troy ounces; refined sugar, 18 pounds (av.). Prepare a syrup after the manner directed for making Compound Syrup of Aralia, using the same menstruum and the same proportion of sugar. Make 18 pints of syrup.

Action, Medical Uses, and Dosage.—This has been found highly beneficial in *bronchial* and *laryngeal affections*, also in obstinate cases of *rheumatism*, and wherever a stimulating alterative is required. The dose is from 1 fluid drachm to ½ fluid ounce, 3, 4, or 5 times a day, according to the urgency of the symptoms. It should be taken in water.

SYRUPUS STILLINGIÆ COMPOSITUS.—COMPOUND SYRUP OF QUEEN'S ROOT.

Preparation.—Take of queen's root, and root of turkey corn, each, 32 troy ounces; blue flag root, elder flowers, and pipsissewa leaves, each, 16 troy ounces; coriander and prickly ash berries, each, 8 troy ounces. Prepare a syrup after the manner of making Compound Syrup of Aralia, using the same menstruum and the same proportion of sugar. Make 32 pints of syrup. This syrup is the old Eclectic preparation that gave the reputation to this compound and served as a basis for the present formula in the *U. S. P.*

Action, Medical Uses, and Dosage.—This is a most powerful and effective alterative, and is extensively used by many practitioners in *syphilitic*, *scrofulous*, *osseous*, *mercurial*, *hepatic*, and *glandular diseases*, or in cases where an alterative is indicated. It is most commonly given with an ounce of iodide of potassium added to each pint of the syrup. The dose is 1 fluid drachm, 3 or 4 times a day, in ½ gill of water; but where the iodide is omitted, the dose is from 1 fluid drachm to 1 fluid ounce, 3 or 4 times a day, also in water.

Related Preparation.—SYRUPUS STILLINGIÆ COMPOSITUS (N. F.), *Compound syrup of stillingia.* "Compound fluid extract of stillingia (F. 176), two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; purified talcum (F. 395), fifteen grammes (15 Gm.) [232 grs.]; sugar, seven hundred grammes (700 Gm.) [1 lb. av., 8 ozs., 303 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the compound fluid extract of stillingia with the purified talcum, and afterward with two hundred and seventy-five cubic centimeters (275 Cc.) [9 fl℥, 143 ♏] of water, and shake them together thoroughly. Then pour the mixture upon a wetted filter, add the sugar to the filtrate, and pass enough water through the filter to make the product, after the sugar has been dissolved by agitation, measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents 15 minims of compound fluid extract of stillingia (see F. 176)"—*Nat. Form.*).

SYRUPUS TOLUTANUS (U. S. P.)—SYRUP OF TOLU.

Preparation.—"Balsam of tolu, ten grammes (10 Gm.) [154 grs.]; precipitated calcium phosphate, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; sugar, eight hundred and fifty grammes (850 Gm.) [1 lb. av., 13 ozs., 430 grs.]; alcohol, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the balsam of tolu in the alcohol, in a small flask or bottle, with the aid of a gentle heat. Mix the precipitated calcium phosphate with one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.] of the sugar, in a mortar, thoroughly incorporate with it the solution of the balsam, and set the mortar aside, in a moderately warm place, until the alcohol has evaporated. Then triturate the residue well with five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of water, gradually added, and filter the mixture through a wetted filter, returning the first portions of the filtrate until it runs through clear. To the filtrate, heated to a temperature of about 60° C. (140° F.), add the remainder of the sugar, and dissolve it by agitation. Then allow the syrup to cool, strain it, and pass enough water through the filter and strainer to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly. Syrup of tolu may also be made in the following manner: Prepare a percolator or funnel in the manner described under syrup (see *Syrupus*). Pour the filtrate obtained as directed in the preceding formula upon the sugar, return the first portions of the percolate, until it runs through clear, and, when all the liquid has passed, follow it by water, until the product measures one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly"—(*U. S. P.*).

Or, take of balsam of tolu, carbonate of magnesium, each, ½ ounce; alcohol, 1 fluid ounce; refined sugar, 2½ pounds; water, a sufficient quantity. Triturate the balsam of tolu and carbonate of magnesium together, with 1 ounce of the sugar, gradually adding the alcohol, and then water enough to make the whole measure 12 fluid ounces. Filter, add water enough to make 1 pint of filtrate, to which add the rest of the sugar, and dissolve by a very gentle heat. If required, strain the syrup, while hot, through a damp cotton-flannel bag (Prof. Procter). This forms a beautiful, clear syrup, free from turbidity, possessing a decided taste of the balsam, with most of its medicinal virtues.

A more decided flavor and fragrance would be insured if the alcohol were not driven off as directed in the official process. In that case the amount of sugar should be correspondingly decreased. The alcohol would better impart the properties of tolu to the syrup than water, which takes up but very little of the resin, oils, etc., upon which the drug depends for its aroma and flavor.

Action, Medical Uses, and Dosage.—This syrup is used in *coughs*, and to give a pleasant taste to medicines. The dose is from ½ fluid drachm to 2, or even 4 fluid drachms.

SYRUPUS ZINGIBERIS (U. S. P.)—SYRUP OF GINGER.

Preparation.—"Fluid extract of ginger, thirty cubic centimeters (30 Cc). [487 ♏]; precipitated calcium phosphate, fifteen grammes (15 Gm.) [232 grs.]; sugar, eight hundred and fifty grammes (850 Gm.) [1 lb. av., 13 ozs., 430 grs.]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the fluid extract of ginger with the precipitated calcium phosphate, and expose the mixture in a warm place until the alcohol has evaporated. Then triturate the residue with four hundred and fifty cubic centimeters (450 Cc.) [15 fl℥, 104 ♏] of water, and filter. In the filtrate dissolve the sugar by agitation, without heat, strain, and pass enough water through the filter to make the product measure one thousand cubic centimeters (1000 Cc. [33 fl℥, 391 ♏]. Mix thoroughly. Syrup of ginger may also be prepared in the following manner: Prepare a percolator or funnel in the manner described under syrup (see *Syrupus*). Pour the filtrate obtained as directed in the preceding formula upon the sugar, return the first portions of the percolate, until it runs through clear, and, when all the liquid has passed, follow it by water, until the product measures one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix thoroughly"—(*U. S. P.*).

"Take of strong tincture of ginger, 6 fluid drachms; syrup, sufficient to produce 20 fluid ounces (Imp.). Mix with agitation"—(*Br. Pharm.*, 1885). This produces a milky syrup.

Take of Jamaica ginger, in a uniform coarse powder, 4 ounces; water, deodorized alcohol, each, a sufficient quantity; carbonate of magnesium, 1 ounce; refined sugar, 20 pounds. Pack the ginger in a percolator, and slowly pour on it the alcohol, until 8 fluid ounces of tincture have passed; evaporate this spontaneously, or at 48.8° C. (120° F.), until it is reduced to 3 fluid ounces. Triturate it with the carbonate of magnesium and 2 ounces of the sugar, gradually adding 2 pints of water. Filter, and add enough water to make 8 pints of filtrate, to which add the rest of the sugar, in a covered vessel, and dissolve by a very gentle heat. If necessary, strain the syrup, while hot, through a damp cotton-flannel bag (Prof. Procter). This forms a beautiful, clear syrup, free from turbidity, possessing a decided taste of the ginger, with most of its medicinal virtues. That made by the official process is yellowish, and has the strong pungency and characteristic odor of ginger.

Action, Medical Uses, and Dosage.—Syrup of ginger is used as a remedy in *atonic bowel complaints of children*, and as a stimulating aromatic addition to various medicinal preparations. The dose is from ½ fluid drachm to 2, 3, or 4 fluid drachms.

TABACUM (U. S. P.)—TOBACCO.

"The commercial, dried leaves of *Nicotiana Tabacum*, Linné"—(*U. S. P.*).

Nat. Ord.—Solanaceæ.

Common Name and Synonym: *Leaf tobacco; Tabaci folia.*

Illustration: Bentley and Trimen, *Med. Plants*, 191.

Botanical Source.—This is an annual herb, with a long, fibrous root, and an erect, round, hairy, viscid stem, branched toward the top, and from 4 to 6 feet in height. The alternate leaves are sessile, ovate or lanceolate, acuminate, decurrent, viscid, pale green, 1 or 2 feet long, and 6 or 8 inches broad. The under surface of the tobacco leaf is marked by a prominent, thick midrib, sending off, at acute angles, lateral veins, which terminate near the margin of the leaf in a curved manner. The flowers are rose-colored, and produced in panicles at the ends of the stems and branches. The bracts are linear and acute. The calyx is urceolate, hairy, glutinous, half as long as the corolla, and ends in 5 acute segments. Corolla funnel-shaped, swelling toward the top, the border dull-red, expanding, with 5 acute, crimped lobes. Stamens 5; filaments inclined to one side, with oblong anthers. Ovary ovate; style long and slender; stigma capitate and cloven. Capsule ovate, invested with the calyx, 2-celled, 2-valved, but opening crosswise at top, and loculicidal. The seeds are very numerous, small, somewhat reniform, and attached to a fleshy receptacle (L.—W.—R.).

ig. 239.

Nicotiana Tabacum.

History.—Tobacco is a native of the warmer parts of America, and was first exported to England, in 1586, by Sir Walter Raleigh. According to the authors of the *Pharmacographia*, it was carried to Europe by the Spaniards on their return from discovering America (1492), and employed for its medicinal effects. At present, it is raised in many parts of the world, and especially in the middle states of this country. The strongest and more commonly used tobacco is raised in Virginia, but the Cuban or Havana leaf is preferred by smokers. The plant flowers in July. In cultivating tobacco the seeds are thickly sown in beds of prepared soil; the young plants are reset in the last month of spring, into fields, where they are placed in rows at distances of 2, 3, or 4 feet apart, and, in order to obviate the flowering and consequent formation of seed, the tops are removed from time to time. Close vigilance is required until the plant is ready for harvest, which is generally in the last summer month, when the matured plants are cut off just above their roots, hung up in bundles under sheds to dry, after which the leaves are removed from the stalks and packed in hogsheads or boxes for the market. There are several varieties of this plant, all of which appear to possess analogous virtues. Soil and the peculiar method adopted in raising this plant, as well as the various methods of curing the leaf, will influence the quality of the final product. (For a detailed account of the production and treatment of the more important tobacco grades of commerce, see L. Janke, *Forschungsberichte über Lebensmittel*, 1897, pp. 58–69.)

Description.—Commercial tobacco is usually of a dark-brown or orange-brown color, though its shades differ, of a powerful, heavy, disagreeable odor, and a peculiar, bitter, sickening taste, followed by a very disagreeable sense of acridity in the fauces. The dark leaves are much stronger and more powerful in their action than the light-colored. The *U. S. P.* describes dried tobacco leaves as follows: "Up to 50 Cm. (20 inches) long, oval or ovate-lanceolate, acute, entire, brown, friable, glandular-hairy, of a heavy, peculiar odor, and a nauseous, bitter, and acrid taste"—(*U. S. P.*). Water or alcohol extract the virtues of dried tobacco leaves. Continued boiling materially impairs their activity.

Chemical Composition.—The aroma of dried tobacco leaves is due to a small quantity of *tobacco camphor* or *nicotianin* (Vauquelin, 1809; Hermbstädt, 1823). It is volatile with steam, forms white, scaly crystals, is of neutral reaction, little soluble in water, soluble in alcohol and ether. The toxic properties of tobacco leaves are due to the alkaloid *nicotine*, discovered by Posselt and Reimann, in 1828, yet the quality of tobacco for smoking purposes does not depend on the quantity of nicotine present. The latter varies in the different grades of leaf from 0.4 to as high as 8 per cent. Smoking tobacco contains less (about 0.4 to 1.3 per cent), owing to partial volatilization of nicotine in the curing process. The alkaloid exists in the leaves combined with malic and citric acids, of which 10 to 14 per cent is present in dried leaves. These acids are supposed to be chiefly combined with potassium. The dried leaves yield a large amount of ash (18 to 27 per cent). Potassium nitrate is among the mineral constituents, occurring especially in the midrib, and may amount to as much as 10 per cent (Flückiger, *Pharmacognosie des Pflanzenreichs*, 3d ed., 1891, p. 715). Other constituents of the fresh leaves are albuminous matters (25 per cent), gum, (5 per cent), resin (4 to 6 per cent), tannic acid, sugar (*tabacose*, Attfield, 1884), wax, calcium oxalate, etc. The poisonous constituents of tobacco smoke are small amounts of carbon monoxide, hydrogen sulphide, and hydrogen cyanide, somewhat larger quantities of *picoline bases* (methyl pyridines), and considerable amounts of nicotine (R. Kissling, see *Amer. Jour. Pharm.*, 1882, pp. 492 and 628; and H. Thoms, *Berichte d. Deutsch. Pharm. Ges.*, 1900, p. 19).

NICOTINE (*Nicotia*, $C_{10}H_{14}N_2$), when freshly distilled, is a colorless, mobile liquid, of an intense, peculiar odor, differing from the accustomed tobacco odor, and an acrid, burning taste. It is very poisonous. Exposed to air and light, it turns dark, and partly resinifies. It is slowly volatilized at ordinary temperature, and can be distilled with the vapors of boiling water. Heated by itself, it boils, with decomposition, at about 240° C. (464° F.), but does not decompose in an atmosphere of hydrogen. It begins to distill at a much lower temperature (146° C., or 294.8° F.). It is miscible with water, alcohol, ether, chloroform, and fatty oils, the solutions being strongly alkaline. Nicotine is heavier than water, and forms salts with acids, which do not easily crystallize. It is a pyridine derivative, forming, upon oxidation, *nicotinic acid* (*beta-pyridine-carbonic acid*) ($C_5H_4N.COOH$). (Also see A. Pinner's researches, *Archiv der Pharm.*, 1893, p. 378, and 1895, p. 572.) Nicotine may be obtained by adding to a concentrated tobacco extract, solution of caustic soda or lime, distilling with steam, extracting the distillate with ether, and carefully evaporating the solvent. (For another method, that of Schloesing, see this *Dispensatory*, preceding edition.) R. Kissling (*Fresenius' Zeitschrift f. Analyt. Chem.*, 1882, pp. 64–90) assays tobacco by agitating 20 grammes, in powder form, with alcoholic caustic soda, exhausting the mixture with ether, carefully distilling off the greater part of the solvent, adding diluted caustic soda to the residue, distilling off the nicotine with steam, and titrating each 100 Cc. of the distillate with volumetric sulphuric acid solution, using rosolic acid for indicator. (For other methods, see *Archiv der Pharm.*, 1893, p. 658; and *Jour. Amer. Chem. Soc. Proc.*, 1899, p. 32.)

Action, Medical Uses, and Dosage.—Tobacco and, in a greater degree, its alkaloid, nicotine, exhibit powerful acro-narcotic properties. Applied to the nose, it occasions sneezing and increased mucous flow. Internally, in small amounts, they produce acrid heat in the throat, gastric warmth, nausea, and sometimes purging. Salivation and diuresis are increased. They allay general unrest and quiet mental inquietude, and give to the patient a sense of languid repose. Larger doses, however, produce a hot, acrid, and raw feeling in the throat and fauces, extreme nausea, vomiting, diarrhœa, and great prostration of muscular and nervous power. Muscular relaxation, with trembling of the extremities, is marked; great anxiety, mental confusion, feeble pulse, pale countenance, and marked depression of heart-action, are prominent among the effects. The body is bathed in cold sweat, the breathing oppressed and laborious, there is photophobia and impaired hearing, the limbs are helpless, and faintness, followed by unconsciousness, may supervene. These effects may occur from the use of tobacco in any form, whether internally or externally applied. Those accustomed to the disgusting habit of chewing or smoking tobacco, become so tolerant of the effects of the weed as not to become affected, or but slightly so, in the manner described. Even in these there is, however, more or less nervous impairment, which becomes manifest when the weed is withdrawn for a day or more. The pernicious habit of cigarette smoking, now under the ban of the law, in regard to minors, in many localities, has done incalculable harm—a rapid pulse, irritable heart (tobacco heart), disordered innervation, nervous prostration, general debility, emaciation, dyspepsia, and a train of other evils, being the result of intemperance in the use of this plant. Toxic (tobacco) amblyopia is frequently produced by the excessive use of tobacco. In chronic tobacco poisoning, there may be epithelial cancer of the mouth, tongue, or lips, or other destructive ulcers of the mouth, follicular pharyngitis, bronchorrhœa, feeble and rapid cardiac action, color-blindness, etc.

Nicotine acts chiefly upon the sympathetic and spinal nervous systems, and, when it kills, does so by paralysis of the heart, or respiratory paralysis (asphyxia). In point of toxic power, nicotine is asserted to be second only to prussic acid. A single drop has killed a rabbit in 3½ minutes (Taylor). Among celebrated murders, that of a brother killed with nicotine, by Count and Countess Bocarmé (*Ann. d'Hyg.*, 1851), is a matter of historical record. A child of 3 years was killed from blowing bubbles from an old pipe which had not been used for a year, but had been washed previous to being used by the child. The symptoms were those of narcotic poisoning (Taylor, *Med. Jurisp.*, p. 204). In poisoning by tobacco, the use of stimulants may be resorted to. Among these may be mentioned strychnine, whiskey, and ether, subcutaneously; aromatic spirit of ammonia, tannin and iodides (chemical antagonists), camphor, digitalis, strophanthus, internally; and external heat.

Tobacco infusion is more apt to affect the heart, and its smoke to act on the nervous system—the former being followed by great feebleness of the pulse, fluttering of the heart, faintness, alarm, etc., while the latter occasions nausea and vomiting, followed by drowsiness. Medicinally, it is a sedative, emetic, diuretic, expectorant, discutient, antispasmodic, errhine, antiseptic, and sialagogue. Tobacco should be seldom employed internally, as we have other agents much safer and fully as effectual to meet every desired indication. However, a tincture of the fresh plant has been advised as a sedative in *respiratory disorders of children*, and a water (*Aqua Nicotianæ Tabacum Spirituosæ Rademacheri;* see Scudder's *Spec. Med.*, p. 187, for formula) has been advised in the *brain complications of fevers*, in both wandering and fixed *acute rheumatism*, in *brain and spinal cord affections*, and in *cholera morbus* and *Asiatic cholera*. The alkaloid nicotine, and, in some instances, tobacco, have been most potent in the relief of *tetanus*. The larger doses may be employed—from ½ to 1 drop of nicotine, hypodermatically. For other purposes only the small doses hereinafter advised should be given.

Tobacco is seldom used as an emetic, except in cases where, from extreme insensibility of the stomach, ordinary emetics will not operate. The smoke injected into the rectum, or the leaf itself, in the shape of a suppository, and introduced into the rectum, or an enema of tobacco, has been beneficial in *strangulated hernia*, *obstinate constipation from spasm of the bowels*, in *retention of urine from spasmodic urethral stricture*, *hysterical convulsions*, *worms*, and in *spasms caused by lead;* likewise in *spasmodic croup*, *spasmodic asthma*, and *constipation*, with inflammation of peritoneum, to produce evacuations of the bowels, moderating reaction, and dispelling tympanites. To use the infusion of smoke, blow the smoke into milk or water and inject. *Hiccough* has been relieved by swallowing tobacco smoke. In *spasmodic croup* and *spasm of the rima glottidis*, a plaster made of Scotch snuff and lard, and applied to the throat and chest, has proved very effectual; or a cataplasm of the leaves may be employed. Inhalation of tobacco smoke sometimes relieves a tickling, irritable *cough*, produced by irritation or other nervous action in the larynx or trachea; *spasmodic laryngitis* has also been similarly relieved. An ointment of tobacco has been found valuable in several forms of *cutaneous disease*, as *scabies*, *urticaria*, etc. *Fresh cuts* may be treated with tobacco moistened from time to time with alcohol. The leaves, in combination with belladonna or stramonium leaves, will be found an excellent application to old, obstinate *ulcers*, *painful tumors*, and for spasmodic affections. A reputed cure for *piles*, is the application and maintenance there, for 3 or 4 hours, of a wet leaf to the parts. The inspissated juice has cured *facial neuralgia*, being rubbed along the track of the affected nerve. Topically, the leaves or an infusion, applied by means of a compress, allay pain in *rheumatism*, *gout*, *orchitis*, *epididymitis*, *buboes*, and other *glandular inflammations*, *scirrhous and scrofulous tumors*, *phimosis*, *paraphimosis*, *boils*, *painful hemorrhoids*, and *erysipelatous inflammations*. An enema of tobacco has given relief in *dysentery*, but extreme caution should be observed in its use. An ointment (tobacco, 1 drachm, to lard, 1 ounce), has been advised to relax *rigid os uteri* during *parturition*. *Rectal ascarides* and *lumbricoid worms* have been expelled by the inflation of the rectum with tobacco smoke, or by injection of the infusion. It has also been used to destroy *maggots* in the nose and ear. In using tobacco at all, great caution should always be observed, and if it produce great depression (as it is apt to do very suddenly), or too lasting a sedative effect, stimulants, as ammonia or brandy, should be administered. The quantity for an injection ought not to exceed 20 grains at first; if this fails, cautiously increase it, for even $\frac{1}{2}$ drachm has often proved fatal. If the injection does not come away in 5 minutes, it should be assisted by throwing up a large quantity of warm water. A wine of tobacco may be used in from 1 to 20-drop doses. Nicotine is too dangerous for general use. The beginning dose should not exceed $\frac{1}{100}$ grain, although as high as 1 grain has been recommended. The dose of tobacco, as an emetic, is 5 grains.

Related Species and Preparation.—Other species of Nicotiana have been cultivated for their leaves. Some which figured as distinct species, are now regarded as varieties of *Nicotiana Tabacum*. Among these are *N. petiolata*, Agardh; *N. fruticosa*, Linné; *N. macrophylla*, Lehman, etc. The species said to be cultivated in Cuba, yielding Havana leaf, is the *Nicotiana repanda*, Willdenow, though Vidal denies this, stating that only N. Tabacum is there grown. *Shiras* or *Persian tobacco* is reputed the product of *N. persica*, Linné. That known as *tumbaki* (of Turkish and Persian tobacco) has in the past been attributed to *N. rustica* and *N. persica*, but is now said to be the product of *N. Tabacum* (*Kew Bulletin*, 1891). *Latakia tobacco*, formerly said to be the product of *N. rustica*, is now held to be the flowering heads and capsules of *N. Tabacum* flavored by being exposed to the smoke of *Pinus halipensis*, Aiton (Dyer).

Dynamyne.—This name was given by Lloyd Brothers to a preparation which contains the alkaloids of tobacco. It is a green-colored, hydro-alcoholic liquid, and is designed for external use only. The name was selected at the request of the late Prof. A. J. Howe, M. D., who desired a characteristic term for a preparation he prescribed extensively and valued highly. Dynamyne, when well diluted with water, is destructive to many plant insects, but does not appear to materially affect the plants to which it is applied. Owing to its toxic nature, care should be exercised in handling or inhaling it. Dynamyne is an agent of great value, and is fast becoming established as a remedy to relieve *pain*, both deep-seated and superficial. A solution of 1 to 4 fluid drachms of dynamyne in 1 pint of water, may be applied to *localized inflammations*, to relieve the *pains of neuralgia, rheumatism, felons, abscesses, pleurodynia*, etc., and many other conditions in which the local effects of tobacco, in a more pronounced degree, are desired. It should not be administered internally.

TAMARINDUS (U. S. P.)—TAMARIND.

"The preserved pulp of the fruit of *Tamarindus indica*, Linné"—(*U. S. P.*) (*Tamarindus officinalis*, Hooker).

Nat. Ord.—Leguminosæ.

Common Names: *Tamarind*, *Tamarind pulp*.

Illustration: Bentley and Trimen, *Med. Plants*, 92.

Botanical Source.—This is a large tree with many spreading branches, a stout, straight trunk, and a rough, ash-gray bark, usually attaining the height of 30 or 40 feet. The leaves are alternate and abruptly pinnated; the leaflets in 12 to 15 pairs, opposite, subsessile, small, obtuse, entire, smooth on both sides, tapering a little, of a greenish-yellow color, and about 6 lines long by 2 broad; the inferior pair are larger. The petioles are from 4 to 6 inches long, and channelled; the stipules small and deciduous. In a cold, damp atmosphere, and also after sunset the leaflets close themselves. The flowers are yellow, veined with red, and in terminal and lateral racemes. Bracts obovate, colored, 1-flowered, and deciduous. Corolla somewhat papilionaceous, erect, unilateral, the length of the calyx, and 3-cleft. Segments ovate, acute, concave. Calyx 4-leaved, cruciate, expanding, tubular at base and deciduous; limb bilabiate and reflexed; upper lip tri-partite; lower broad and 2-toothed. The vexillum, or middle petal, is oblong, and its margins involute and curled; wings oval and margins curled. Keel 2 short, subulate processes under the stamens. Stamens 10, 7 very short and sterile, the others longer, monadelphous, bearing incumbent anthers. Ovary stalked, linear, with the subulate style much incurved; stigma obtuse. The legume is oblong, pendulous, nearly linear, generally curved, somewhat compressed, filled with a firm, acid pulp, covered with a hard, scabrous bark, which never separates into valves; under the bark run 3 fibers, one down the upper concave margin, and the other two at equal distances from the inferior or convex edge. The seeds number from 6 to 12, are somewhat trapeziform, compressed, covered with a smooth, hard, brown shell, and inserted into the convex side of the pericarp (L.—W. I.).

History and Description.—The tamarind tree inhabits both the East and West Indies and Africa. The pods of the West Indian tree are shorter than the other, and fewer seeded. The part used is the fruit, which, when recent, has a pleasant acid taste. They are generally brought to this country as a kind of preserve, made by removing the epicarp, arranging the fruit in layers in a cask, and filling the interstices with syrup at 100° C. (212° F.). As met with in this country, they are reddish-brown, have a sweet and agreeably acid taste, and consist of acid-syrup, seeds, *endocarp* and fibers; the acidity of the syrup is due to its admixture with the sarcocarp or pulp. This is the method pursued in the West Indies. The Egyptians compress them into cakes and dry them in the sun, while, in India, they are compressed into masses, sugar being added in some instances. The East Indian variety is not so sweet as the official drug from the West Indies, is of a darker color and much tougher. The Egyptian grade occurs in black-brown cakes, circular and flattish, and often are moldy. These two varieties are not in American markets. The seeds should be solid and corneous, not soft and expanded, the fibers should be tough, and the whole appearance of the mass should be fresh and syrupy, not dried up from loss or lack of syrup, and without a moldy odor. Sometimes, from being prepared in copper vessels, they may prove dangerous from containing copper, which should not be present.

As required by the official standard, tamarind should be "a reddish-brown, sweet, subacid, pulpy mass, containing strong, somewhat branching fibers, and polished, brown, flattish-quadrangular seeds, each enclosed in a tough membrane; taste sweet and refreshingly acidulous. A piece of bright iron, left for 30 minutes in contact with the pulp previously somewhat diluted with water, should not exhibit any reddish deposit of copper"—(*U. S. P.*).

Chemical Composition.—The constituents of tamarind pulp are sugar (about 12.5 per cent), tartaric, citric, and malic acids, and potassium bitartrate, pectin, gum, etc. (Vauquelin). K. Müller (1882), examining nine specimens, found about 1.5 per cent of seeds, and in an exceptional case 38 per cent of seeds present and from 22 to 32 per cent of water; the moist pulp freed from the seeds contained potassium bitartrate (4.66 to 6.01 per cent), tartaric acid (5.29 to 8.68 per cent) and citric acid (0.64 to 3.95 per cent). The presence of formic, acetic, and butyric acids is probably due to slight fermentation.

Action, Medical Uses, and Dosage.—Tamarind pulp is used to allay thirst, and is nutritive and refrigerant; in large quantity, laxative. On this account it forms a useful and agreeable drink in *febrile* and *inflammatory diseases;* and with persons recovering from sickness, to keep their bowels regular, it may form a portion of their diet. A convenient cooling laxative is TAMARIND-WHEY, made by boiling 1 ounce of the pulp in 1 pint of milk, and straining the product. Combined with senna, or resinous cathartics, it is said to diminish their cathartic operation (P.). Dose, from 1 drachm to 2 ounces. A decoction of tamarind flowers is reputed almost a specific for *hemorrhoids.*

Specific Indications and Uses.—(The flowers.) Hemorrhoids, with persistent burning and itching about the anus, and accompanied with constipation.

TANACETUM (U. S. P.)—TANSY.

"The leaves and tops of *Tanacetum vulgare,* Linne"—(*U. S. P.*) (*Chrysanthemum Tanacetum,* Karsch).

Nat. Ord.—Compositæ.

COMMON NAME: *Tansy.*

Botanical Source.—Tansy has a perennial, moderately creeping root, and an erect, herbaceous, somewhat 6-sided, leafy, solid, striated, smooth stem, 1 to 3 feet in height, branched above into a handsome corymb of flowers. The leaves are smoothish, dark-green, and doubly and deeply pinnatifid; the segments oblong-lanceolate, pinnatifid, and incisely serrate; the margined petiole cut-toothed. The flowers are golden-yellow, in dense, terminal, many-headed, fastigiate corymbs; disk florets 5-cleft and perfect; ray florets few, trifid, and pistillate. Scales of the involucre scarious at the apex, small, obtuse, and imbricated. Pappus short, equal, membranous, and 5-lobed; the achenia with a quadrangular, entire crown. There is a variety called *Double tansy* (*Tanacetum crispum*), with crisped and dense leaves (L.—W.—G.).

History and Description. Tansy is indigenous to Europe, but has been introduced into this country. It is cultivated by many, and also grows spontaneously in old grounds, along roads, etc., flowering in the latter part of summer. The whole plant is medicinal. It has an unpleasant, aromatic odor, and a strong, rather pungent and bitter taste, which properties it partly owes to a yellow or greenish volatile oil. The medicinal virtues of the plant are extracted by alcohol, ether, chloroform, and by water in infusion. Drying impairs much of its activity. The *U. S. P.* describes tansy as follows: "Leaves about 15 Cm. (6 inches) long; bipinnatifid, the segments oblong, obtuse, serrate or incised, smooth, dark-green, and glandular; flower-heads corymbose, with an imbricated involucre, a convex, naked receptacle, and numerous yellow, tubular florets; odor strongly aromatic; taste pungent and bitter"—(*U. S. P.*). Though well known to the ancients, it is not known when tansy came into medical use. According to an Egyptian legend, its properties were discovered by the deity Isis.

Fig. 240.

Tanacetum vulgare.

Chemical Composition.—The principal constituent of the herb is the volatile oil, or *oil of tansy* (see *Oleum Tanaceti*). In addition, a bitter, amorphous principle, *tanacetin* ($C_{11}H_{16}O_4$), is present (Leroy, 1845; Leppig, 1882), occurring chiefly in the flowers. It is soluble in water and alcohol, insoluble in ether, although Roder states (*Archiv der Pharm.*, Vol. XCVII, 1846, p. 109) that it is very little soluble in water. The herb also contains tannic acid, resin, malic acid (probably the *tanacetic acid* of Peschier), tartaric, citric, and oxalic acids, etc.

Action, Medical Uses, and Dosage.—Oil of tansy is a poisonous agent, killing by coma and asphyxiation. The effects are different according to the amount taken. The symptoms may be chiefly gastro-intestinal, or they may be spent mainly upon the nervous system. Thus vomiting and purging, with colicky pains were present in one case, the patient dying in collapse, but the mind remained clear to the last. In other cases there have been increased frequency of the pulse, pupillary dilatation, insensibility, convulsions, with frothing at the mouth, and, occasionally, death is preceded by paralysis of motion, swallowing, and respiration. Doses above 15 or 20 drops are highly dangerous.

Tansy is tonic, emmenagogue, and diaphoretic. In small doses, the cold infusion will be found useful in convalescence from exhausting diseases, in *dyspepsia*, with troublesome *flatulence*, *hysteria*, *jaundice*, and *worms*. A warm infusion is diaphoretic and emmenagogue, and has been found beneficial in *intermittent fever*, *suppressed menstruation*, *tardy labor-pains*, and as a preventive for the paroxysms of *gout*. The seeds are reputed the most efficient for *worms*. The oil is likewise used as an anthelmintic, and as an abortive, but for the last purpose it is highly dangerous and generally ineffectual. Tansy is much employed in the form of fomentation to *swellings* and *tumors*, *local inflammations*, etc., and applied to the bowels in *amenorrhœa*, and *painful dysmenorrhœa*. The vinous infusion is said to be beneficial in *strangury*, and other *urinary obstructions*, and in *debility of the kidneys*. By means of a spray or inhalation, a solution of a strong tincture (1 to 4 or 10) is valuable in *diphtheria*, *acute inflammations of the throat*, and in *epidemic catarrh* (Scudder). The dose of the powder is from 30 to 60 grains, every 3 or 4 hours; of the infusion, from 1 to 4 fluid ounces; of the tincture of fresh tansy (℥viii to alcohol, 76 per cent, Oj), 1 to 30 drops; of the oil, from 2 to 10 drops. A very pleasant compound tincture may be made by adding tansy, 2 ounces; swamp milkweed, 1 ounce; unicorn root and prickly ash berries, of each, ½ ounce; to 2 pints of diluted alcohol. Let them macerate for 14 days, and filter. This is useful as a vermifuge and tonic, and may be given to a child 2 or 3 years old, in doses of a teaspoonful, 3 or 4 times a day, in sweetened water.

Related Species.—*Tanacetum Balsamita*, Linné (*Balsamita suaveolens*, Persoon; *Pyrethrum Tanacetum*, De Candolle). This south European perennial is known as the *Costmary*. Its taste is bitter, and its odor strongly aromatic. It is official in the *French Codex*, and is employed for the same purposes as tansy.

Tanacetum umbelliferum, *Sweet pellitory*.—India. Contains an organic pigment, acid, wax, fat, glucose, inulin, and a small quantity of *pyrethrin* (compare *Pyrethrum*) (D. Hooper, *Pharm. Jour. Trans.*, Vol. XXI, p. 143).

TARAXACUM (U. S. P.)—TARAXACUM.

"The root of *Taraxacum officinale*, Weber, gathered in autumn"—(*U. S. P.*) (*Leontodon Taraxacum*, Linné; *Taraxacum Dens-leonis*, Desfontaines; *Taraxacum vulgare*, Schrank).

Nat. Ord.—Compositæ.

Common Names and Synonym: *Dandelion, Dandelion root; Taroxaci radix.*

Illustration: Bentley and Trimen, *Med. Plants*, 159.

Botanical Source.—This plant is an herb with a perennial, tap-shaped, very milky root, with a dull-brownish epidermis. The leaves are radical, numerous, spreading, of a bright, shining green, quite smooth, tapering downward, sessile, pinnatifid, with runcinate, sharp, unequally toothed lobes. The scape or flower-stem is longer than the leaves, erect, round, smooth, brittle, naked, hollow, 5 or 6 inches in height, and bears a single, yellow head. The flowers are of a uniform golden-yellow, in round heads, 1½ inches in diameter, expanding in the morning and fine weather only. Involucre double; external scales small, closely pressed, and spreading or reflexed; internal ones in one row, erect, and linear; all frequently callous-horned at the apex. Florets numerous, strap-shaped, equal, and 5-toothed. Stamens with hair-like filaments. Receptacle naked, convex, and dotted. Ovary obovate; style slender and cylindrical; stigmas 2, revolute. Achenia oblong, ribbed, roughened on the ribs, apex prolonged into a very slender, thread-like beak, bearing the pappus of copious, soft, and white capillary bristles. After blossoming the inner involucre closes for a time, the slender beak elongates and raises up the pappus while the fruit is forming, the whole involucre is then reflexed, exposing to the wind the naked fruits, with the pappus displayed in an open globular head, nearly 2 inches in diameter (L.—G.—W.).

History and Description.—This plant is a native of Greece, but is now found growing abundantly in Europe and this country, in fields, gardens, and along roadsides, flowering from April to November. There are some other species recognized by botanists, that appear to possess the same medicinal powers. The young leaves are frequently used as a salad or greens. The whole plant, when broken or wounded, exudes a white, bitter juice, the sensible qualities of which are said to be greater during period of inflorescence. The root only is the official part, and should be collected while the plant is in flower, or preferably in autumn. When recent, it is from 3 to 5 inches or more in length, from 3 to 9 lines in diameter, tap-shaped, fleshy, dull-yellow or brownish externally, white internally, inodorous, and bitter. As found dried in pharmacy, it is considerably diminished in size, having lost more than half its weight, and corrugated lengthwise. As required by the *U. S. P.*, it is slightly conical, about 30 Cm. (12 inches) long, and 1 or 2 Cm. (⅖ to ⅘ inch) thick above, crowned with several short, thickish heads, somewhat branched, dark-brown, longitudinally wrinkled, when dry breaking with a short fracture, showing a yellowish, porous central axis, surrounded by a thick, white bark, containing numerous milk-vessels, arranged in concentric circles; inodorous, bitter. It should be free from the root of *Cichorium Intybus*, Linné (*Nat. Ord.*—Compositæ), which closely resembles it, but is usually paler, and has the milk-vessels in radiating lines"—(*U. S. P.*). Dandelion root should preferably be used in the recent state. Drying, as well as long boiling, impairs its virtues. Alcohol or boiling water extracts its properties.

Chemical Composition.—Taraxacum root contains *inulin*, the quantities of which vary considerably with the season. Dragendorff (1870) found 24 per cent in root collected in October, and only 1.74 per cent in root collected in March, shortly before blooming, at which season the milky juice is abundant. The root also contains variable quantities of reducing sugar (17 per cent in March), and *lævulin* (18.7 per cent). (See constituents at various seasons, by L. E. Sayre, in *Proc. Amer. Pharm. Assoc.*, 1893, p. 82; also paper, by Charles Symes, in *Pharm. Jour. Trans.*, Vol. X, 1872, p. 361.) Other constituents of taraxacum root are a resin, soluble in chloroform and ether, insoluble in alcohol; a resin soluble in alcohol; *taraxacerin* of Kromayer (1861), a white waxy substance, crystallizing in cauliflower-like formations, and *taraxacin* (Polex, 1839), a bitter, amorphous principle, which, in concentrated solutions, forms precipitates with a number of alkaloidal reagents. Kromayer obtained these two principles from the inspissated milky juice of the root (*leontodonium*) by treating it with hot water. This leaves *taraxacerin* undissolved, which may then be obtained pure by recrystallization from hot alcohol. Prof. Sayre (*Proc. Amer. Pharm. Assoc.*, 1897, p. 223) assigns to it the formula $C_9H_{15}O$. The aqueous extract of leontodonium contains the bitter principle: this is abstracted by charcoal, and the latter boiled out with alcohol. The latter is distilled off, the residue dissolved in water, precipitated by means of basic lead acetate, the lead removed from the filtrate by hydrogen sulphide, and the solution evaporated to dryness, and an acrid resin removed by ether. The residue is bitter *taraxacin*. (For a bibliography of taraxacum, see L. E. Sayre, *Proc. Amer. Pharm. Assoc.*, 1876, p. 165.) A. van Zwaluwenburg and M. Gomberg (*Proc. Amer. Pharm. Assoc.*, 1899, p. 305) also observed the presence of minute quantities of a substance giving alkaloidal reactions; however, the authors doubt its alkaloidal nature. Other constituents of taraxacum root, at least of partly fermented extracts, are calcium lactate and *mannite*. The leaves and stems, according to Marmé (1864), contain the sugar *inosite*. The incinerated root leaves 5 to 7 per cent of ash.

Action, Medical Uses, and Dosage.—Dandelion root, when dried, possesses but little medicinal virtue; when recent, it is a stomachic and tonic, with slightly diuretic and aperient actions. It has long been supposed to exert an influence upon the biliary organs, removing *torpor* and *engorgement of the liver* as well as of the spleen. It is also reputed beneficial in *dropsies*, owing to want of action of the abdominal organs, in *uterine obstructions*, *chronic diseases of the skin*, and *impairment of the digestive functions*. It should not be used by those whose digestive organs are weak, as it is apt to occasion dyspepsia, flatulence, pain, and diarrhœa. The addition of cream of tartar to its decoction will render it more diuretic and laxative. Prof. King states that, as far as his experience with this article had gone, he thought its virtues had been overrated. Nevertheless, it is a slow, but efficient agent when properly prepared for use. The existence of an irritable condition of the stomach or bowels, or acute inflammation, contraindicate its employment. Dose of the decoction, 1 to 2 fluid ounces; of the extract, from 5 to 30 grains; of a strong tincture of the fresh root (℥viii to alcohol, 76 per cent, Oj), from 1 to 30 drops.

Specific Indications and Uses.—Loss of appetite, weak digestion, hepatic torpor, and constipation.

TAXUS.—YEW.

The leaves and fruit of *Taxus baccata*, Linné.

Nat. Ord.—Coniferæ.

COMMON NAME: *Yew tree.*

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 253.

Botanical Source and History.—The common yew is a large evergreen tree, native throughout Europe, and very commonly planted as an ornamental tree in church yards, cemeteries, etc., especially in England. It is of very slow growth, and has a hard, close-grained wood that is much used by cabinet-makers. The branches are long and horizontal, the lowest ones proceeding from the trunk at only a few feet from the ground. The bark is of a dark-brown color, and does not split longitudinally, like the bark of most trees, but scales off in thin plates. The flowers appear in early spring, and the male and female are borne on separate trees. The male are in axillary aments, and consist, each, of a thickened axis, having anther-bearing bracts on the upper half, surrounded at the base by imbricated scales. The female flowers are, each, a single sessile, naked, ovule, without either style or stigma, surrounded at the base by a circular disk, which becomes fleshy in the fruit. The fruit is a single oval seed, covered, excepting at the apex, by a thick, fleshy, red cup, and resembles an abortive acorn surrounded by its cup. The cups of the yew fruit are sweetish, though unpleasant to the taste, often, however, being eaten by children. The leaves are very numerous, linear, about ½ inch long, and $\frac{1}{12}$ inch wide, sharp, dark-green above, lighter beneath, alternate, and are curved outwardly and upwardly.

Fig. 241.

Taxus baccata.

An American variety (var. *Canadensis*, Gray) of the *Taxus baccata*, is a small shrub, found growing in shady, moist places in Canada and the northern parts of the United States.

History.—Excepting the pulp of the fruit, all parts of the yew tree are poisonous. Pliny, Dioscorides, and other ancient writers, mention the poisonous properties of the leaves and seed, and it has been recorded that wine, preserved in casks made of its wood, has occasioned the death of those who drank it. Strabon states that the Gauls used the juice of the leaves as a poison for their arrows. More recent observations have confirmed the statements as to its toxic character; and we frequently read of animals and birds that have been poisoned by the leaves and berries. It is likewise stated that the exhalation emanating from the tree may occasion vertigo, lethargy, and a kind of drunkenness, and that even death may ensue to those who carelessly sleep beneath its branches. Prof. Redwood read a paper before the Pharmaceutical Society of Great Britain (1877), citing the fatal result from drinking a decoction of the leaves.

Chemical Composition.—The poisonons principle of yew resides in an alkaloid *taxine*, first isolated from the leaves by H. Lucas (*Archiv der Pharm.*, 1856, Vol. CXXXV, p. 145), and later from the leaves and fruits by Marmé (*Amer. Jour. Pharm.*, 1876, p. 353), and by A. Hilger and Fr. Brande (*ibid.*, 1890, p. 297). According to Marmé, it is a white crystalline powder, little soluble in water, soluble in ether, alcohol, chloroform, etc.; insoluble in petroleum-ether. It melts at 80° C. (176° F.), and produces a red color with concentrated sulphuric acid. Amato and Caparelli (*ibid.*, 1881, p. 56) obtained from the leaves a probably similar alkaloid, volatile oil, and a non-nitrogenous, crystalline substance, which they called *milouin*.

Action, Medical Uses, and Dosage.—The symptoms occasioned by the juice or extract of the leaves, vary according to the quantity that has been taken. In large doses, there is pallor, vertigo, spasm, and symptoms of collapse, with gastric and enteric irritation, enfeebled and deranged cardiac action, coma, and death. Not unfrequently, very large doses are followed by a prompt diminution of the vital forces, or by positive syncope, in either case speedily terminating in death, without any of the severe symptoms of irritation being manifested. Post-mortem investigations have found some indications of inflammation of the stomach and bowels, of active renal congestion, and of diminished heart-power, with a greater or lesser deprivation of the coagulable quality of the blood. It has been used in the attempt to produce abortion, but always fruitlessly, and in some instances has proved a fatal experiment. In cases of poisoning by the ingestion of this article, it should be promptly removed from the stomach by emesis, after which milk or other bland drinks may be administered, at the same time sustaining the strength, if necessary, by the prudent exhibition of stimulants. The red berries are not injurious. Percy, in former times, prepared a jelly and a syrup from them, which he used in *cough*, *chronic bronchitis*, and to relieve the *pain in calculous nephritis*. The leaves have likewise been recommended in certain maladies, which it is unnecessary to name, as we have no satisfactory evidence of their efficacy. The leaves have been given in doses of 1 to 5 grains; or the infusion may be given corresponding in dosage.

TELA ARANEÆ.—SPIDER'S WEB.

The freshly spun web, free from dust, of the *Tegenaria domestica*, or common house-spider, or as often employed in this country, the web of *Tegenaria medicinalis*.

COMMON NAMES: *Spider's web*, *Cobweb*.

Source, History, and Preparation. The medicinal species of spider, from which the web is obtained, are the *Tegenaria medicinalis* and *Tegenaria domestica*, belonging to the division *Homoganglíata*, class *Arachnida*. The former are found in angles of walls, corners of fences, old houses, barns, etc., where they weave a large, angular, nearly horizontal web, at the upper part of which is a tube in which they keep themselves perfectly at rest, until the web has ensnared a fly or other prey. The field spider's web is said to be of no account, medicinally, while that of the house spider is considered very useful. It is the web of the latter that is preferred by the Homœopaths who introduced spider-web into practice, and who employ it in a trituration. The common house-spider is brownish or blackish in color, and is found in dark places in cellars, dwellings, barns, etc. In Eclectic practice the tincture of the web has been preferred to the trituration. It may be prepared as follows: Cover 2 ounces of clean recently spun web with 1 pint of strong alcohol, and allow it to macerate 10 days. Filter. This remedy was introduced into Eclectic practice as a cure for intermittent fever. There are various opinions among physicians, as to the *modus operandi* of cobweb, some attributing it entirely to the control of the imagination, while others view it in a different light, and entertain favorable opinions of it as a powerful therapeutical agent.

Action, Medical Uses, and Dosage.—Febrifuge, sedative, and antispasmodic. Said to have been found useful in the cure of *intermittents* when all other agents have failed; also recommended in several nervous affections, to relieve pain, lessen spasmodic action, and cause sleep, without any deleterious narcotic influences. Dr. Robert Jackson used it in the *delirium*, *pains*, *spasms*, and *subsultus*, common in *continued fevers*, in dry, nervous *coughs*, *hiccough*, etc. It has also been reputed efficient in *hysteria*, *periodical headache*, *chorea*, *asthma*, *morbid wakefulness* and *restlessness*, and *muscular spasms*. For a series of cases in which this drug acted efficiently, see report of Dr. Pierce, *Ec. Med. Jour.*, Nov., 1886. Of it he writes: "Its specific indications are: Masked periodical diseases in hectic broken-down patients; in all diseases that come up suddenly with cool, clammy skin and perspiration, and cool extremities; in nocturnal orgasm in either sex; numbness of the extremities when sitting still or lying down. It relieves spasms of arterioles, and stimulates capillary circulation. It relieves hyperæsthesia of the cerebro-spinal nerves and the great sympathetic, that depends upon debility. It is the greatest heart stimulant in the materia medica, and lobelia is only second to it." The dose is 5 or 6 grains, rolled up in the form of a pill, and repeated 3 or 4 times a day; or, preferably, specific Tela araneæ in doses of from 1 to 10 drops. The web has been applied to fresh *wounds* to check *hemorrhage*, and used as a plug to the nostrils in cases of long-continued and obstinate *epistaxis*. The small silver-headed spider, given in a dough pill, is said to be a prompt and efficient cure for *ague*.

TEPHROSIA.—HOARY PEA.

The root of *Tephrosia virginiana*, Persoon (*Galega virginiana*, Linné).

Nat. Ord.—Leguminosæ.

COMMON NAMES: *Turkey pea*, *Devil's shoestring*, *Goat's rue*, *Hoary pea*, and *Cat gut*.

ILLUSTRATION: Meehan's *Native Flowers and Ferns*, Vol. I, Plate 81.

Botanical Source.—This plant is indigenous, with a perennial root, and a simple, erect, villous stem, 1 to 2 feet high. Its leaves are unequally pinnate; the leaflets numerous, 15 to 29, crowded, linear-oblong, acuminate, straight-veined, the odd one oblong-obcordate—they are about 1 inch in length by 2 or 3 lines in breadth; petiolules about 1 line long. Stipules subulate, $\frac{1}{3}$ of an inch long, and deciduous. The flowers are large, yellowish-white, marked with red-purple, and borne in a dense, terminal, subsessile raceme. The calyx is very villous, with 5, nearly equal, subulate teeth. The banner is roundish, usually silky outside, and white; the keels obtuse, rose-colored, cohering with the red wings. Legume flat, linear, falcate, villous, and many-seeded (W.—G.).

Closely allied to this is the *Tephrosia onobrychoides*, Nuttall. Pilose with somewhat rusty hairs. Stem stout, erect, flexuous, more or less branched, and about 2 feet high. Leaflets 13 to 17, nearly smooth above, silky-hirsute beneath, cuneate-oblong, obtuse or retuse, and mucronate at the end, 1 inch or more long, one-fourth as wide; stipules free, subulate. The raceme is very long (1 or 2 feet), terminal, nearly opposite the leaves, and many-flowered; the flowers being small, red, and white. Calyx villose-hispid, teeth triangular, the lowest subulate, exceeding the others. Legume 2 inches long, slightly falcate, and 8 to 12-seeded (W.).

History and Description.—Each of the above plants is known in the south by the common name of *Devil's shoestring*. Several varieties of the plant are found growing in dry sandy soils from Canada to Florida, and from Illinois and Missouri to Texas, all of which, probably, possess similar medicinal powers. The two plants above described are the ones more commonly used. They flower in June and July. The root is of a light-drab color, from $1\frac{1}{2}$ to 2 feet or more in length, and varying in thickness from $\frac{1}{8}$ to $\frac{3}{8}$ of an inch; it is crooked, not much branched, gradually tapering, with a very few scattering fibers. Internally its color is whitish-yellow. The root is hard, breaks with a short cottony fracture, as may be seen by examining the fractured end with a pocket lens, has a faint spicy odor, and a spicy, faintly sweetish and slightly astringent taste, succeeded by a moderate degree of pungency. It yields its virtues to water or alcohol. It has not been chemically examined (see *Galega*).

Action, Medical Uses, and Dosage.—The root of this plant alone, or in combination with other agents, has been reputed a very efficient remedy in *syphilis;* many southern practitioners have spoken of it to me in the highest terms as an antisyphilitic. The decoction is also much used as a vermifuge, and is said to be as efficient and powerful as spigelia. According to Dr. B. O. Jones, the plant is a mild, stimulating tonic, having a slight action on the bowels, and the secretive organs generally, and applicable in the treatment of many diseases, especially in a certain stage of *typhoid fever*, where there is little use of active medicine. He recommends the following compound fluid extract of tephrosia: Take of Tephrosia virginiana (the plant), 8 ounces; Rumex acutus (dock), 2 ounces; water, 4 quarts. Place the plants in the water, and boil until reduced to 1 quart. Strain, and when intended to be kept, mix with an equal bulk of brandy or diluted alcohol, and half its weight of sugar, macerate for several days, and strain through muslin. The dose is from $\frac{1}{2}$ to 1 fluid ounce, 2, 3, or 4 times a day (*Amer. Jour. Pharm.*, Vol. XXVIII, p. 218) (J. King).

Related Species.—*Tephrosia Appolinea*, De Candolle (*Galega Appolinea*, Delile). Native of Egypt, south Europe. Leaves of this species have been observed as an adulterant of senna, and are sometimes substituted for the latter. Leaflets contain indigo (Hogg).

Tephrosia purpurea, Persoon.—India. Root laxative and tonic (Dymock). *T. spinosa*, Persoon, has similar properties. Both are quite extensively used in India for *dyspepsia* and *chronic diarrhœa.*

Tephrosia Colonila and *T. tinctoria.*—Orient. Contain indigo.

Tephrosia toxicaria.—Africa, and cultivated in Jamaica. It is put into the water of streams to intoxicate fish. *T. piscatoria* has similar uses.

Tephrosia leptostachya, De Candolle.—Senegambia. Leaves and root purgative.

TEREBENUM (U. S. P.)—TEREBENE.

FORMULA: $C_{10}H_{16}$. MOLECULAR WEIGHT: 135.7.

"A liquid consisting chiefly of pinene, and containing not more than very small proportions of terpinene and dipentene. Terebene should be kept in well-stoppered bottles, in a cool place, protected from light"—(*U. S. P.*).

History and Preparation.—Terebene is prepared by the repeated action of sulphuric acid upon oil of turpentine until its optical rotation has disappeared. It was first prepared in this manner by Deville, in 1841, although Soubeiran and Capitaine, one year before, applied the name "terebene" to an optically inactive terpene hydrocarbon, prepared in a different manner. Terebene was subsequently studied by Riban (1873), Armstrong and Tilden (1879), and others, and more recently by Power and Kleber (*Pharm. Rundschau*, 1894, pp. 16–19), whose conclusions do not agree with the pharmacopœial characteristics for terebene, as given above. Hager (*Handbuch d. Pharm. Praxis*, Vol. II, 1886, p. 1121) directs to place 1000 parts of (French) oil of turpentine into a retort, and cool it by means of ice-cold water, then add 50 parts of concentrated sulphuric acid, drop by drop, and with gentle agitation. Distill from a sand or oil-bath, taking care not to exceed a temperature of 210° C. (410° F.). The distillate contains some unaltered oil of turpentine. Repeat the process with the distillate, after adding $\frac{1}{20}$ of its weight of sulphuric acid. The second distillate is shaken with solution of sodium carbonate, the oil is separated and rectified. It still contains traces of optically active oil of turpentine, but a third distillation is impracticable, as it involves too much loss of material (see Dr. H. W. Jayne, p. 1919).

Description, Chemical Composition, and Tests.—The *U. S. P.* describes terebene as a "colorless, or slightly yellowish, thin liquid, having a rather agreeable, thyme-like odor, and an aromatic, somewhat terebinthinate taste. Specific gravity about 0.862 at 15° C. (59° F.). Only slightly soluble in water, but soluble in an equal volume of alcohol, glacial acetic acid, or carbon disulphide. It boils at 156° to 160° C. (312.8° to 320° F.). On exposure to light and air, terebene gradually becomes resinified, and acquires an acid reaction. In its chemical properties it resembles oil of turpentine. Terebene should possess its characteristic, agreeable odor, should not redden moistened blue litmus paper (absence of acids), and should not have more than a very slight action on polarized light (limit of unaltered oil of turpentine). When evaporated, it should not leave more than a very slight residue (absence of more than traces of resinous matters)"—(*U. S. P.*). The presence of resin is undesirable, as it is supposed to cause cutaneous eruptions (see *Amer. Jour. Pharm.*, 1886, p. 521).

In contradiction to some of the above statements, the researches of Power and Kleber (*loc. cit.*), as well as those of H. W. Jayne and G. H. Chase (*Amer. Jour. Pharm.*, 1887, p. 65, and 1894, p. 225), have shown that, with pure terebene, only a small fraction distills below 160° C. (320° F.)—*i. e.*, contains no (inactive) pinene. Most of the product distills between 178° and 182° C. (352.4° and 359.6° F.), and consists of the hydrocarbons *dipentene* and *terpinene*. Power and Kleber suggest the following corrected definition of terebene: "An optically inactive liquid, obtained by the action of concentrated sulphuric acid on oil of turpentine and subsequent rectification, and consisting for the most part of the hydrocarbons dipentene and terpinene, with some cymol and camphene. Specific gravity about 0.855 at 15° C. (59° F.), boiling point between 170° and 185° C. (338° and 365° F.)." Such a mixture can not be considered as resembling oil of turpentine in its chemical properties. In examining commercial specimens, it was found that those giving off fractions below 160° C. (320° F.), also possessed an optical rotation, and contained unaltered oil of turpentine. On the other hand, a specimen, almost devoid of optical rotation, was shown to be merely a mixture of (dextro-rotatory) American and (lævo-rotatory) French oil of turpentine.

Action, Medical Uses, and Dosage.—Terebene is reputed germicide, antiseptic, deodorant, and expectorant. It kills the yeast plant and renders vaccine virus innocuous. It was introduced into practice by Dr. Wm. Murrell, of London, as a remedy for "*winter cough*." In this form of *chronic bronchitis*, it has been very effectual, and is useful also in the secondary stages of *acute bronchial affections*, with mucous profluvia. In these affections it acts much like the turpentines. Terpene relieves *flatulent dyspepsia*. Applied to *wounds*, *ulcers*, *burns*, etc., it acts as a deodorant and protector, favoring rapid healing. It may be applied in full strength or diluted with olive oil (1 to 5 or 6). The dose of terebene is from 3 to 20 drops, 3 times a day, the average dose being 6 minims. It may be given upon a lump of sugar or upon bread-crumb (see Murrell, *Mat. Med. and Therap.*, 1896).

TEREBINTHINA (U. S. P.)—TURPENTINE.

A concrete oleoresin obtained from *Pinus palustris*, Miller (*Pinus australis*, Michaux), and from other species of *Pinus*.

Nat. Ord.—Coniferæ.

COMMON NAMES: (Of Pinus palustris) *Broom pine*, *Swamp pine*, *Yellow-pitch pine*, *Long-leaved pine;* (Of oleoresin) *White turpentine*, *Thus americanum*, or *Frankincense* (*Br. Pharm.*, 1898).

ILLUSTRATIONS: Bentley and Trimen, *Med. Plants*, 258 (*Pinus Tæda*, 259).

Botanical Source.—This tree is the *Pinus australis* of Michaux. Its trunk is from 60 to 80 feet high, about 40 or 50 feet of which distance, below the branches, has a diameter varying from 12 to 20 inches. The bark of the tree is slightly furrowed. The leaves are in threes, of a bright-green color, about a foot long, and conglomerate at the ends of the branches; the sheaths or stipules are pinnatifid, scaly, and persistent; the buds very long, whitish. Sterile aments violet-colored, 2 inches long. Strobiles or cones subcylindrical, muricate, with small recurved spines, and from 8 to 10 inches long. Seeds with a thin, white testa (W.).

This is a native tree, found in the middle, southern, and western states, in sandy plains and woods, but chiefly from Virginia to Florida, within 100 miles of the coast. Its timber is strong, compact, and durable, and is much used by carpenters and workers in wood. From this tree is obtained the principal supply of *naval stores*, *i. e.*, resin, tar, etc., used in this and other countries.

Pinus Tæda, Linné, *Loblolly*, or *Old-field pine.*—A tree 80 or more feet high, with a trunk often 3 feet in diameter. The top is wide and spreading. The leaves are pale-green, about 6 to 10 inches long, borne in threes, the fascicles being invested with long, nearly entire sheaths. The fruit is an ovate-oblong cone, shorter than the leaves, and deflexed, the scales being armed with a strong, inflexed spine. *Pinus Tæda* inhabits old, dry, abandoned fields, and the barren, sandy soils from Virginia to Florida. An abundance of turpentine flows from it, but not so large a quantity is collected from it as from the first-named species. It is recognized in the *British Pharmacopœia* as one of the sources of turpentine, named by that authority THUS AMERICANUM, or *Frankincense*.

Collection and Description.—In the southern states, turpentine is uniformly collected on the so-called *turpentine farms* by cutting a slanting cavity (*box*) into the tree, less than 1 foot above the ground. About the first of March, when the resin begins to flow, V-shaped strips of the bark above the box are removed, and, from time to time, when the edges of the cut bark become clogged, narrower strips are cut. The resin collects in the box during the warm season, especially in June, July, and August. That collected in the first year is called *virgin dip*. When the boxes are full, the turpentine is ladeled out into barrels, which are sent to the still in order to obtain from it oil of turpentine and resin (colophony). An inferior resin, called *scrape*, is that which is hardened and covers the denuded surface of the tree. Distilling of the oleoresin is carried out in the woods; the stills consist of copper retorts set into a brick furnace, each holding from 15 to 20 barrels of crude material. The resin is distilled with addition of water, the oil of turpentine (see *Oleum Terebinthinæ*) being condensed in a large condensing-worm surrounded by cold water. The residue in the retort is finally drawn off, and constitutes *resin* (see *Resina*), or *rosin* (*colophony*), commercially distinguished as W. W. (water white), W. G. (window glass), the best grade, or N., the next best, M. K., etc. In the southern states, four consecutive seasons of bleeding exhaust the trees, and, as the margin of profit from one tree is exceedingly small, an immense acreage is annually invaded and devastated in order to keep the industry at a profitable level (*United States Government Report*, 1892; see Bastin and Trimble, *Amer. Jour. Pharm.*, 1896, pp. 242–253; also see L. J. Vance, *ibid.*, 1895, p. 537, from *Garden and Forest*, 1895).

Ten thousand trees yield the first year 280 barrels of dip (each, 240 pounds) and 70 barrels of scrape; 1 barrel of dip yields 6½ gallons of spirits of turpentine, while 1 barrel of scrape yields only 3 gallons. The total result of the first year is 2000 to 2100 gallons of spirits of turpentine and 260 barrels of rosin (W. G.). The yield of dip decreases in subsequent years, while that of scrape increases, and is highest in the second year. The rosin of the fourth year's make is almost black, opaque, and generally inferior. In France, where a finer grade of turpentine is obtained from *Pinus Pinaster*, Solander, the trees last from 40 to 50 years, and longer, owing to a more economic management of the industry. The oleoresin is collected in cups, and the oil of turpentine distilled off by direct steam. The hardened oleoresin, which covers the scars, is scraped off, and is known as *galipot*. The turpentine of the American market has a yellowish tint, a rather agreeable odor, and a bitter, terebinthinate taste. It is readily dissolved in alcohol or ether (excepting mechanical impurities), and combines with the fixed oils. The *U. S. P.* describes terebinthina as "in yellowish, opaque, tough masses, brittle in the cold, crumbly-crystalline in the interior, of a terebinthinate odor and taste. The alcoholic solution has an acid reaction"—(*U. S. P.*). Chemically, it is a combination of resin (see *Resina*) and oil of turpentine (see *Oleum Terebinthinæ*). (For *Venice turpentine*, *Chios turpentine*, etc., see *Terebinthina Canadensis;* also see R. G. Dunwody, *Amer. Jour. Pharm.*, 1890, p. 284; and E. L. Murray, *ibid.*, p. 393, for interesting notes on turpentine.)

Action, Medical Uses, and Dosage.—The turpentines act as local irritants, occasioning heat, redness, and even inflammation of the skin. Taken internally, they act more especially on the mucous tissues, lessening excessive morbid discharges. They have a diuretic influence on the urinary apparatus, imparting to the urine an odor like that of violets. They also act as stimulants on the general system, quickening the pulse, increasing the temperature of the surface, and causing a sensation of warmth at the stomach. They likewise act as anthelmintics. In large doses, they act upon the bowels, or, if this effect is not produced, they are apt to cause loss of appetite, nausea, vomiting, griping, strangury, or bloody urine. They have been used in *gonorrhœa*, *gleet*, *chronic affections of the kidneys and bladder*, *leucorrhœa*, *chronic affections of the mucous membrane of the air passages*, *chronic rheumatism*, *hemorrhoids*, *intestinal ulcerations*, *tympanites*, *amenorrhœa*, *chronic mucous diarrhœa*, etc. Externally, they are detergents and digestives, and have sometimes been applied to *indolent and ill-conditioned ulcers;* also as rubefacients and stimulants. Their peculiar influence upon the body is chiefly owing to their essential oil. They also enter into various plasters and ointments, especially the white turpentine. An adhesive and strengthening plaster may be made as follows: Take of caoutchouc, reduced to fine shreds, 5 pounds, steep it in hot water to soften, then remove from the water, dry as quickly as possible, place in a vessel, and cover with oil of turpentine, which must be increased in quantity as the caoutchouc absorbs it. When the gum is sufficiently dissolved, press it through a fine sieve, and add to it the following mixtures: (1) White turpentine, melted and dissolved in a sufficient quantity of oil of turpentine to make it thin enough to strain; (2) capsicum, 4 ounces, heated in a quart of oil of turpentine, which must be filtered and gradually added and ground with a pound of litharge, and to which balsam of Peru, 6 ounces, is to be added. This plaster may be spread on paper, linen, or leather. The dose of the turpentines is from 10 to 60 grains, in the form of pill, emulsion, or electuary. They may be made into pills, when too soft, by the addition of powdered liquorice root, magnesia, etc. An emulsion may be made by rubbing them with yolk of egg, or mucilage of gum Arabic, sugar, and some aromatic water; sugar and honey mixed with them form an electuary (see also *Oleum Terebinthinæ*).

Related Products.—ANIMÉ, or *Gum animé*. There are two substances of this name, one derived from India, and known as *East Indian animé*, which does not enter our commerce, and one from South America, known as *South American animé*. The former is waxy in luster, friable, of a reddish or yellowish color, and has somewhat the odor of fennel. It is employed in Ceylon to check the alcoholic fermentation in *jaggery*, a spirituous beverage. It is thought to be derived from *Vateria Indica*. The South American kind forms irregular pieces of a lemon to a reddish-brown hue, translucent, covered with a whitish powder, friable, and pulverizable, and softens when masticated. It has an odor suggestive of olibanum. It consists of essential oil and two resinous bodies, one soluble and the other insoluble in cold alcohol. Claimed to be the product of *Hymenæa Courbaril*, Linné, a leguminous plant, but is probably derived from a *Burseracea*.

CARUBA DI GUIDEN.—Gall-like excrescences, the result of stings of an hemiptera, found upon species of *Pistacia*, notably the *Pistacia Terebinthus*. They are reputed useful in *asthma* and *chronic bronchitis*, being pulverized and burned in a vessel, or smoked in a pipe, so that the terebinthinous fumes may be inhaled.

TEREBINTHINA CANADENSIS (U. S. P.)—CANADA TURPENTINE.

"A liquid oleoresin obtained from *Abies balsamea* (Linné), Miller"—(*U. S. P.*) (*Pinus balsamea*, Linné; *Picea balsamea*, Loudon).

Nat. Ord.—Coniferæ.

COMMON NAMES: (Of oleoresin) *Canada balsam*, *Balsam of fir;* (Of tree) *Balsam fir*, *Balm of Gilead fir*, *Balsam spruce*, *Hemlock fir*.

ILLUSTRATION: (Of *Abies balsamea*) Bentley and Trimen, *Med. Plants*, 263.

Botanical Source.—This is a small, handsome tree, rarely above 30 feet high, and having a regular pyramidal head. The leaves range from $\frac{1}{2}$ to $\frac{3}{4}$ inch in length, evergreen, linear, obtuse, bright-green above, silvery-white underneath, with a grooved line above, and an elevated one beneath. The male flowers are yellow, numerous, axillary, solitary, and about as long as the leaves; the female catkins are lateral, cylindrical, erect, and green; the bracts are obovate, tipped with a point, somewhat minutely toothed, and shorter than the broad, compact scales. The cones are 2 or 3 inches in length, about 1 inch broad, erect, cylindric, lateral, reflexed on the margin, shining, and purplish (G. W.).

History.—This tree inhabits the northern portions of the United States and British North America, also lower latitudes on highly elevated situations. The juice procured from it is known by the names of *Canada balsam*, *Balsam of fir*, *Canada turpentine*, etc. It may be obtained by making incisions into the tree, but more generally by collecting the fluid, which is discharged from the cavities containing this oleoresin, which forms between the wood and the bark. Large amounts are gathered in the province of Quebec. After allowing the trees to rest for 2 or 3 years, they are again punctured but yield less oleoresin than when first tapped. *Abies Fraseri*, Pursh, of the mountains from New England to North Carolina also yields balsam of fir, as well as *Abies canadensis*, Michaux (compare *Pix Canadensis*).

Description.—Canada balsam is described by the *U. S. P.* as "a yellowish, or faintly greenish, transparent, viscid liquid, of an agreeable, terebinthinate odor, and a bitterish, slightly acrid taste. When exposed to the air, it gradually dries, forming a transparent mass. It is completely soluble in ether, chloroform or benzol"—(*U. S. P.*). Alcohol does not completely dissolve it, while ether and oil of turpentine dissolve it, and solution of potassa forms a soluble soap with part of its resin. Canada balsam is extensively used in microscopic investigations, as a cement, to impart a greater transparency to certain objects, and to preserve and mount objects. It is also employed in the construction of Nicol's prism, an essential part of polarizing microscopes.

Chemical Composition.—According to Flückiger, this balsam (or rather oleoresin) consists of resin soluble in alcohol and ether (60 per cent), resin soluble in ether, insoluble in alcohol (16 per cent), and volatile oil (about 24 per cent). The latter, distilled from fresh leaves and cones of *Abies balsamea*, Miller, was proved by C. G. Hunkel (*Amer. Jour. Pharm.*, 1895, p. 9) and H. L. Emmerich (*ibid.*, p. 135) to contain *lævo-pinene* and *lævo-bornyl-acetate*.

Action, Medical Uses, and Dosage.—In large doses, Canada balsam acts upon the bowels, and is apt to cause nausea. In small doses it increases the urinary secretion, and also acts as a stimulant to the general system. Its vermifuge properties are inferior to those of the oil of turpentine. From its direct stimulating action on mucous tissues, it has been found a very efficient internal remedy in *gonorrhœa*, *gleet*, *chronic mucous inflammation of the bladder*, *chronic laryngitis*, *bronchitis*, *catarrh*, *mucous diarrhœa*, *hemorrhoids*, and *rheumatic affections*. In gonorrhœa, where the use of copaiba is not desirable, I have found Canada balsam an excellent substitute in the following combination, viz.: Take of Canada balsam, 2 fluid ounces; oil of turpentine, 4 fluid drachms; spirits of nitric ether, 8 fluid ounces; pulverized camphor, 2 drachms. Mix these together. The dose is 1 fluid drachm, 3 times a day. In cases where the inflammatory symptoms have been subdued, pulverized kino, 2 drachms, may also be added (J. King).

Applied to the skin, Canada balsam produces redness and slight irritation; and is frequently employed as a stimulant to *indolent* and *erysipelatous ulcers;* it likewise enters into the composition of several salves and irritating plasters. The dose of Canada balsam varies from 5 to 20 grains, which may be repeated 2 or 3 times a day. It may be administered in emulsion, or in pill form. When mixed with about $\frac{1}{28}$ part of its own weight of calcined magnesia, Canada balsam solidifies in about 12 hours (P.).

European and Rarer Turpentines.—COMMON TURPENTINE (*Terebinthina communis*) is derived from *Pinus sylvestris*, Linné, that official in the *German Pharmacopœia* is obtained from *Pinus Pinaster*, Solander (*Pinus maritima*, Poiret), the source of *French* or *Bordeaux turpentine*, and from *Pinus Laricio*, Poiret, which yields *Austrian turpentine*.

The *French Codex* recognizes STRASBOURG TURPENTINE from *Pinus Picea*, Linné, BORDEAUX or COMMON TURPENTINE, VENICE and CHIO TURPENTINE. (Also see *Pix Burgundica*, *Pix Canadensis*, *Terebinthina*, *Resina*, etc.)

CHIAN TURPENTINE (*Terebinthina Chia; Terebinthina Cypria*) is obtained from the *Pistacia Terebinthus*, Linné, growing in western Asia and in the basin of the Mediterranean. It takes its name from the island of Chio or Scio, where most of it is collected. The use of Chian turpentine by Paracelsus as a cancer remedy was revived in 1880 by Mr. Clay, of England, who strongly recommended it for *uterine cancer*, others, however, declare it wholly inefficient. It is yellowish, greenish, or bluish-green, translucent, viscid, and thick like molasses. Its odor is rather pleasant and suggestive of fennel, and its taste less acrid than most of the turpentines. It gradually hardens by age, and is often adulterated with the cheaper turpentines.

VENICE TURPENTINE (*Terebenthina veneta*, *Terebenthina laricis*, or *laricina*), is furnished by the *Larix europæa*, De Candolle, or *Pinus Larix*, Linné. It is procured chiefly in Switzerland, Tyrol, and the French province—Dauphiny. When pure, it is limpid, with a yellow color, sometimes having a green tint, tenacious, and thick like molasses. Its odor is sweet, citron-like, and its taste hot, pungent, and somewhat bitter. It requires an exposure to the air for many years before it becomes hard and brittle. It contains from 18 to 25 per cent of oil of turpentine, dissolves slowly but freely in alcohol, and is dissolved by the caustic alkalies. It does not harden with magnesia, and is dissolved by glacial acetic acid, amylic alcohol, and acetone. The article sold under the name of Venice turpentine in this country is often a factitious product. Uses, those of the turpentines.

Hungarian Turpentine (*Terebinthina hungarica*) exudes in the spring-time from the cut-off tops of the *Pinus Pumilio*, Hænke. It is yellowish, thin, and clear, warm to the taste and aromatic in odor.

The *Balsam pine* (*Abies Menziensii*, Lindley) of the Pacific slope yields a pale-yellow, fluid turpentine, upon puncturing the vesicles in the bark. Upon standing, a granular substance slowly deposits and the product assumes a solid, opaque form. In Mexico, the *Pinus Teocotl*, Schlechtendal, furnishes turpentine. In Japan, the *Pinus densiflora* yields *akamatsu*, and the *Pinus thunbergii* yields *kuromatsu*. They contain 18 per cent of an oil, differing somewhat from that of European turpentine, and about 80 per cent of resin, not differing from that of the latter. *Pinus dammara*, Lambert, of the East India Islands, yields *Dammara turpentine*, a product which quickly becomes hard; and a glutinous milky product is derived from *Dombeya excelsa*, of Chili, and is known as *Dombeya turpentine*.

Related Drugs and Products.—Turiones, or Gemmæ Pini (*Pine shoots*). The shoots of *Pinus sylvestris* when about 2 inches long. They are coated with an oleoresinous exudate, and have a bitter resinous and sub-acrid taste, and a pleasant terebinthinate odor. They enter into the composition of a *Compound tincture of pine shoots* and a *Syrup of pine shoots*, the first a German, the second a French, pharmacal preparation.

Caranna.—A soft oleoresin from the *Icica Carrana*, Kunth, and related trees of Central and South America. It is greenish-brown in color, has a bitter taste and aromatic odor.

Tacamahaca.—From the American tropics; is derived from *Icica heptaphylla*, Aublet, and other related trees. It is brownish or yellowish, clear, glossy when broken, bitter in taste, and has an aroma which is increased by burning. A product of the same name is procured in India and the East India Islands from *Calophyllum Tacamahaca*, Willdenow (*Calophyllum Inophyllum*, Linné). The seeds of the latter yielded van Itallie (*Jahresb. der Pharm.*, 1888, p. 41) 72 per cent of a greenish, butyraceous fixed oil (*weandee* or *bitter oil*), its odor resembling that of fenugreek; it is used in India in the treatment of *rheumatism*.

TERPINI HYDRAS (U. S. P.)—TERPIN HYDRATE

Formula: $C_{10}H_{18}(OH)_2+H_2O$. Molecular Weight: 189.58.

"The hydrate of the diatomic alcohol terpin. Terpin hydrate should be kept in well-stoppered bottles"—(*U. S. P.*).

Preparation.—This compound is formed when *pinene* is kept in prolonged contact with diluted mineral acids (see *Oleum Terebinthinæ*). It is more frequently obtained by the action of alcoholic nitric acid upon oil of turpentine. Mr. Edward T. Hahn (*Amer. Jour. Pharm.*, 1897, p. 74) follows the proportions directed by Carl Hempel, and recommends the use of methyl alcohol in the place of ethyl alcohol.

Description and Tests.—Terpin ($C_{10}H_{18}[OH]_2$) is a saturated terpene derivative, according to the modern nomenclature, being classed among the *terpanes;* its special name is *terpa*-1, 4-*diol* (see instructive article, by Dr. E. Kremers, on *Hydrocymenes and Derivatives*, in *Proc. Amer. Pharm. Assoc.*, 1894, p. 251). When acted upon by diluted sulphuric or phosphoric acids, or by glacial acetic acid, terpin loses 1 molecule of water, being converted into the unsaturated alcohol *terpineol* ($C_{10}H_{18}O$), of which several isomers exist. Upon treatment with glacial acetic acid, it loses another molecule of water, the hydrocarbon *dipentene* being formed. The *U. S. P.* describes terpin hydrate as occurring in "colorless, lustrous, rhombic prisms, nearly odorless, and having a slightly aromatic and somewhat bitter taste. Permanent in the air. Soluble, at 15° C. (59° F.), in about 250 parts of water, and in 10 parts of alcohol; in 32 parts of boiling water, and in 2 parts of boiling alcohol; also soluble in about 100 parts of ether, 200 parts of chloroform, or 1 part of boiling glacial acetic acid. Terpin hydrate melts at 116° to 117° C. (240.8° to 242.6° F.), with the loss of water, and, at the temperature of boiling water, sublimes in fine needles. When heated in a flask, adapted for distillation, it first loses water. At 258° C. (496.4° F.) anhydrous terpin distills over without decomposition, soon solidifying to a crystalline, hygroscopic mass, which melts at 102° to 105° C. (215.6° to 221° F.). When strongly heated on platinum foil, it burns with a bright, smoky flame, leaving no residue. Terpin hydrate is dissolved by sulphuric acid with an orange-yellow color. If to its hot, aqueous solution a few drops of sulphuric acid be added, the liquid will become turbid and develop a strongly aromatic odor. Terpin hydrate should not have the odor of turpentine, and its hot, aqueous solution should not redden blue litmus paper (absence of adhering acid)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Terpin, which is hydrated oil of turpentine, acts upon the bronchial and renal tracts after the manner of balsam, and imparts to the secretions of the latter a peculiar odor. Excessive doses will cause strangury, renal congestion, hæmaturia, and albuminuria. It is employed as a remedy for *chronic inflammations of the bronchiæ and kidneys. Chronic nephritis*, with heart complications, and *degeneration of the cardiac muscle, albuminous urine*, and *anasarca*, are said to be cases for its exhibition, using it with care. Terpin hydrate is also used to prevent *flatulent distension of the abdomen*, and to assist the expulsion of *flatus* when already present. *Hay-fever* is said to be relieved by it, and it is reputed a good palliative in *pertussis*. Like the terebinthinates, it is of value in *gleet* and in *chronic cystitis*. The dose is from 1 to 3 grains, 3 or 4 times a day, being best administered in pill, tablet, or emulsion.

Related Product.—Terpineol. A mixture of several terpenes with varying proportions of terpinol ($C_{10}H_{17}OH$) and alcohol. It is produced by boiling together terpin and diluted hydrochloric or sulphuric acid. It is a colorless, oleaginous fluid, having a hyacinthine odor, and a specific gravity of 0.852. Insoluble in water, soluble in alcohol and ether. Employed in doses of from 3 to 5 grains, 4 times a day, as an expectorant, in *chronic catarrh*, with bronchial irritation, with lack of secretions; also in *bronchitis*. It is best administered in pill or capsule. Pure liquid *terpineol* is a colorless, oily, viscid fluid, having the odor of fresh lilacs; it is optically inactive, has a specific gravity of 0.940, and boils between 216° and 218° C. (420.8° and 424.4°F.) (Schimmel & Co., 1896). (As to the more recent chemistry of terpineol, see Gildemeister and Hoffmann, *Die Ætherischen Oele*, 1899, p. 200.)

TEUCRIUM.—GERMANDER.

The herb of *Teucrium Marum*, Linné.

Nat. Ord.—Labiatæ.

Common Names and Synonym: *Cat thyme, Germander, Herb mastich, Syrian herb mastich; Herba mari veri.*

Botanical Source.—This is a shrubby, much-branched plant, about 10 inches in height. Its oval or lance-ovate, petiolate leaves are about ½ inch in length, are whitish, woolly beneath, and have an entire, revolute margin. From the axils of the bracts, the single, rose-hued flowers project, forming a unilateral, spicate raceme. These flowers are of the characteristic kind distinguishing the genus. having a long lower lip, and a short, deeply-cleft upper lip, and from this division project the 4 stamens. It has a pungent, bitter taste, and a pronounced camphoraceous odor.

History and Chemical Composition.—Most of the species of the genus Teucrium are indigenous to Europe. All of them are bitter or bitterish, and have aromatic properties. The species under consideration, and those named below, owe their activities to tannin, a small amount of a bitter body, an essential oil, and a camphor-like body, volatile with boiling water.

Action, Medical Uses, and Dosage.—The many species of Teucrium possess stimulant and tonic properties in varying degrees. Besides these properties, the *Teucrium Marum* is credited with diuretic, diaphoretic, and emmenagogue qualities. It has been used in *amenorrhœa, leucorrhœa*, and *chronic bronchitis*, and with varying success in *chlorosis, gout, dropsy*, and *scrofula*. It is asserted to be of much value in *whooping-cough*, and, in powder, has been employed to cure *nasal polypi*. Dose of the powder, 20 to 40 grains, or the same quantity may be given in infusion.

Related Species.—*Teucrium Scordium*, Linné (*Herba scordii*), *Water germander*.—Europe. Flowers in whorls of 2 to 4, rose-colored. When fresh, it has a garlicky odor, and bitter, sharp taste. Formerly much employed internally in *chronic eruptive skin diseases*, simple and syphilitic, and in *dyspeptic conditions;* and internally and topically to *pruritis ani* and *hæmorrhoids*. Regarding *teucrin*, a sterilized, aqueo-alcoholic extract of this plant, see Mosetig-Moorhof, *Amer. Jour. Pharm.*, 1893, p. 171, from *Pharm. Centralhalle*.

Teucrium Chamædrys, Linné, *Chamædrys*. Europe. Flowers purple-red. Formerly employed in *rheumatism, gout*, and *scrofula*, and allied disorders, and in *intermittent fever* and *uterine affections*. It was a constituent of the famous gout remedy, *Portland powder*, composed of the leaves of *Ajuga Chamæpitys*, the leaves and tops of *Erythræa Centaureum* and *Teucrium Chamædrys*, and the roots of *Gentiana lutea* and *Aristolochia rotunda*, all in equal parts.

Teucrium Polium, Linné, *Polymountain.*—Europe. Said to be of value in *Asiatic cholera. Teucrium montanum*, Linné, has yellow flowers.

Teucrium canadense, Linné, *Germander*, *Wood sage.*—Indigenous in damp places in the United States. Flowers in a spike, and purplish. Stimulant and tonic. "Thought to exert a beneficial influence in nervous affections, as *hysteria*, *epilepsy*, *restlessness* (nervousness), and *inability to sleep*"—(*Spec. Med.*, p. 258).

Ajuga reptans, Linné, *Bugle.*—Europe. Blue flowers; bitter and feebly aromatic. *Ajuga pyramidalis*, Linné, *Mountain bugle*, has similar properties. Both have tonic and astringent properties. They were once employed in *hemorrhagic conditions*, *consumption*, and *biliary disorders.*

Ajuga Iva, Schreber (*Teucrium Iva*, Linné), *French ground pine.*—Resembles the next species, but has woolly, toothed, linear leaves, and red flowers. It has the odor of musk.

Ajuga Chamæpitys, Pursh (*Nat. Ord.*—Lamiaceæ), *Chamæpitys*, *Ground pine.*—A labiate plant with an annual, diffused stem, with 3-cleft leaves, and solitary, axillary flowers, shorter than the leaves, having stamens longer than the upper leaf, surmounted by reniform, 1-celled anthers. This herb inhabits Europe and several sections of the United States, where it is also known by the names *Bugle* or *Germander*. The parts used are the leaves and tops, which have a slightly terebinthinate, not unpleasant smell, and a rough taste, which properties are imparted to diluted alcohol. An essential oil, somewhat terebinthinate, is furnished by distillation. The leaves of this plant are somewhat excitant, and exert an influence on the urinary organs. They have proved efficient in *menstrual derangements* and *arthritic affections;* and are said to be of service in *dropsy*, *jaundice*, *strangury*, and *visceral obstructions*. From 30 to 60 grains of the pulverized leaves may be administered every 2 or 3 hours; but their vinous tincture is preferred in doses of from ½ to 1 fluid drachm.

THALICTRUM.—RUE ANEMONE.

The herb of *Thalictrum anemonoides*, Michaux (*Anemone thalictroides*, Linné).

Nat. Ord.—Ranunculaceæ.

COMMON NAMES: *Rue anemone*, *Anemone rue.*

ILLUSTRATION: *Botanical Magazine*, 866.

Botanical Source and History.—This is a little plant about 6 or 8 inches high, common in open woods throughout the middle and eastern United States. The root consists of a cluster of oblong tubers, bearing a few radical biternate leaves, and a flowering stem. The cauline leaves are clustered in a whorl at the top of the stem, forming an involucre at the base of the flowers. The flowers, which are centrifugal in development, have from 8 to 10 colored sepals, varying in color from a pale-pink to a pure white. This pretty little plant is one of the earliest spring flowers, blooming in March and April. It has been the subject of considerable diversity of opinion among botanists, concerning its position in the Natural System, being intermediate in character between the two genera, Anemone and Thalictrum; with the flower of the former, it has the fruit of the latter, and while the arrangement of the leaves is like that of the genus Anemone, their shape accords with that of the different species of Thalictrum. Linnæus, who was the first to give the plant a specific name, called it "*Anemone thalictroides*," which name it retained until Michaux transferred it to the genus Thalictrum under the name *Thalictrum anemonoides*. This change was accepted by De Candolle, and is now adopted by Gray and Bentham and Hooker. Pursh described a 1-flowered variety, but it is not generally considered distinct. Nothing is known of the chemical composition of any part of this plant.

Thalictrum flavus, Linné, and *Thalictrum majus*, Europe, are known in England as *Poor man's rhubarb*. From the root of *Thalictrum macrocarpum*, a plant growing in the Pyrenees, a neutral, crystallizable, yellow body, *macrocarpin*, and a crystallizable, white alkaloid, *thalictrine*, resembling aconitine, have been obtained by Hanriot and Doassans (*Amer. Jour. Pharm.*, 1881, p. 336).

Action, Medical Uses, and Dosage.—But little is known concerning the therapeutical properties of this plant. Dr. S. E. Barber, of Connsville, Mo., informs us that he has found it to be a valuable remedy in external and internal *hemorrhoids*, not accompanied with hemorrhage. The method of using it is to simply eat 3 or 4 of the small root-tubers, 3 times a day. We used some of the tubers, which he sent to us, in two cases of *blind piles*, and with apparent success. If further and more extensive trial of these tubers should confirm these conclusions as to their efficacy, it is probable that a fluid preparation could be made from them, possessing the same properties, and in a more convenient form (J. King).

THALLINÆ SULPHAS.—THALLINE SULPHATE.

FORMULA: $(C_9H_{10}[OCH_3]N)_2H_2SO_4+2H_2O$. MOLECULAR WEIGHT: 459.06.

Preparation and History.—The base thalline, discovered in 1884 by Skraup, is a derivative of quinoline (C_9H_7N), namely, *tetra-hydropara-methoxy-quinoline* ($C_9H_6[OCH_3]N.[H_4]$). As quinoline is prepared from aniline ($C_6H_5.NH_2$) by "Skraup's synthesis," so is thalline prepared from a substituted aniline, namely, *para-anisidine* ($C_6H_4[OCH_3].NH_2$) (see brief directions in *Amer. Jour. Pharm.*, 1886, p. 383). The intermediary product obtained is *para-methoxy-quinoline*, or *paraquinanisol*, from which thalline is obtained by reduction with tin and hydrochloric acid. *Thalline* has its name (meaning "green") from the deep emerald-green coloration it produces with ferric chloride or other oxidizing agents. It crystallizes in thick, white prisms, is sparingly soluble in water and light petroleum, readily soluble in alcohol, ether and benzene. It melts between 42° and 43° C. (107.6° and 109.4° F.), and is soluble in acids, with which it forms crystallizable salts.

Description.—Thalline sulphate is a white or whitish powder, consisting of a granular aggregation of crystals, permanent in the air, but gradually turning brown when exposed to light; resembling anise or coumarin in smell, and possessing a sharp, saline, bitter, and sickening taste. It is freely soluble in boiling water, while of cold water 7 parts, and of alcohol 100 parts are required for solution; the solutions, when exposed to light and air, turn brown. Upon adding a small amount of ferric chloride (or other oxidizer) to an aqueous solution of the salt, an emerald-green hue is produced, unaffected by sulphuric acid, but changing under the influence of reducing agents to purple, red, or yellow. The salt forms, with strong sulphuric acid, a colorless solution, which becomes deep-red upon the addition of a small quantity of nitric acid, the color gradually fading to yellow-red. The aqueous solution of the salt has an acid reaction, and yields precipitates with solution of iodine, with tannic acid, and with barium nitrate.

Action, Medical Uses, and Dosage.—Thalline is a prompt and certain antipyretic, but its use is attended with such deleterious effects that the consensus of opinion, even among those who favor the use of the synthetic antipyretics, is general in condemning its use as a medicine. While it produces a fall of temperature, it does not appear to shorten the course of febrile diseases, and may occasion vomiting and purging, albuminuria, or fatal syncope. Renal infarction, death of the glands, and fatty degenerations have been observed under its use upon animals (Ehrlich). It destroys the blood corpuscles, producing a condition of extreme anemia, which alone is sufficient to condemn it. The 1 or 2 per cent solution is said to be effectual as an injection in *gleet*. The hourly dose of the salts employed (the sulphate and tartrate) is ½ grain.

Related Compounds.—THALLINÆ TARTRAS, *Thalline tartrate*. A granular, crystalline, white powder, having the taste and odor of the sulphate, but requiring 10 parts of cold water for its solution. Ether scarcely dissolves it, alcohol somewhat better. Its solutions redden litmus, and the salt fuses at 155° C. (311° F.). (See also *Thallinæ Sulphas.*)

KAIRIN (*Kairine*).—Two synthetical compounds, discovered by O. Fischer, in 1882, are known as *Kairin A* and *Kairin M*. The first is *ethyl-kairin* the hydrochloride of oxyquinoline ethyl tetrahydride, ($C_9H_{10}[C_2H_5]NO.HCl$). It is the one referred to when simply kairin is mentioned. It forms odorless and colorless crystals, or usually occurs as a grayish-white, crystalline powder, having a bitter and salty taste. It is soluble in water (6 parts) and alcohol (20 parts). Treated with ferric chloride it turns deep-brown, striking purple upon the addition of sulphuric acid. Kairin M is the corresponding methyl compound ($C_9H_{10}[CH_3]NO.HCl$), methyl iodide, instead of ethyl iodide, being used in its preparation. Kairin is open to many of the objections to the thalline compounds. It is an antipyretic, but is a dangerous heart depressant. It should have no place in therapeutics.

Kairolin A (*Kairoline*) and *Kairolin M* are compounds resembling the preceding, and are the acid sulphates, respectively, of ethyl and methyl quinoline-tetrahydride. Kairolin differs from kairin in not containing oxygen. (See graphic formulæ of Kairin, Kairolin, Thalline, Antipyrin, etc., in *Pharm. Centralhalle*, 1887, p. 160.)

THAPSIA.—THAPSIA.

The root and prepared resin of *Thapsia garganica*, Linné.

Nat. Ord.—Umbelliferæ.

Botanical Source.—This plant is a herbaceous perennial, from 2 to 4 feet high. It has a round, smooth stem, and 3 pinnately-compound leaves, which are borne on sheathing leaf-stalks. The flowers are in large, compound umbels, and the yellow petals are elliptical, and with an inflexed point. The fruit consists of 2 dorsally-compressed carpels, which are 9-ribbed, with the 2 side-ribs winged. The root is large, from 1 to 2 feet long, and from 2 to 3 inches in diameter at the thickest part.

History and Chemical Composition.—This plant is a native of Spain and other parts of southern Europe, and also found in northern Africa. According to Dioscorides, it derives its name from the island of Thapsos, in which it was first discovered; in the time of Theophrastus, it was found in abundance on the promontory, called Gargano, hence its species name of *Garganica*. It contains an acrid, milky juice when fresh, and yields a resin when dried. The root is the part employed in medicine, and has long been in use with the Arabs. The resin of the African variety (*Thapsia Sylphium* of Viviani) is a strong irritant, both the resin and dried root being exported from Algeria in considerable amounts. The resin is obtained by extracting the dry root with alcohol, distilling the tincture, and washing the residue with water (Reboulleau and Bertherand, 1857). It is soluble in alcohol, ether, and carbon disulphide; becomes plastic at 16° C. (60.8° F.), has an amber-yellow color, and a specific gravity somewhat greater than that of water. It is said to be a component of a plaster made in France, and sold under the name *Thapsia Plaster*. Desnoix prepares this plaster as follows: Rosin, 15 parts; elemi, 12½ parts; yellow wax, 18 parts; turpentine, 5 parts; resin of thapsia, 3½ parts. Melt the rosin, elemi, and wax together, and then add the turpentine and thapsia resin. Strain through linen, and spread upon leather (*Dorvault, L'Officine*, 1872, p. 883). Thapsia also contains an irritating, volatile substance, which affects the exposed skin of those distilling the alcoholic tincture, and who have, consequently, to exercise much care during the operation. M. Yvon (*Pharm. Jour. Trans.*, Vol. VIII, 1877, p. 162) found *Thapsia Sylphium* to possess this property in a marked degree, while *T. garganica* did not exhibit it. F. Canzoneri (1883) obtained from the dried root of *Thapsia garganica*, by percotion with ether, a syrupy acid resin of strongly vesicating properties. It was differentiated into liquid *octoic* or *caprylic acid* ($C_8H_{16}O_2$), crystallizable *thapsic acid* ($C_{16}H_{30}N_4$), and a non-nitrogenous, neutral, vesicating substance (*Amer. Jour. Pharm.*, 1884, p. 325).

Action and Medical Uses.—The properties of this plant reside in its resin, which has been employed as a vesicating or irritating plaster in *rheumatic, neuralgic*, and other *local pains*, and in all cases in which a counter-irritant is indicated. According to its mode of preparation, and the length of time it is allowed to remain upon the part, its effect may be varied from that of a slight redness to the production of an intense irritation with the formation of vesicles; its action being, in this respect, similar to that of euphorbium, croton oil, mezereon, and other counter-irritants. It is more commonly employed in combination with other agents, to modify its more active effects. The tincture of the resin may be painted upon oilcloth, adhesive plaster, or other material, and used as a local counter-irritant. Internally, this agent is not employed, though it is stated to possess emeto-cathartic properties.

THEA.—TEA.

The leaves of *Thea chinensis*, Sims (*Camellia theifera*, Griffith; *Camellia Thea*, Link).

Nat. Ord.—Ternstrœmiaceæ.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 34.

Botanical Source.—The tea plant, *Thea chinensis*, is an evergreen shrub, when uncultivated, attaining as much as 30 feet in height, but seldom reaching more than 6 or 7 feet when under cultivation. There are several varieties of this plant, among them *Thea viridis* (green tea) and *Thea bohea* (black tea). The commercial terms, green and black tea, do not refer to this botanical distinction. The several botanical varieties were formerly regarded as distinct species.

Thea viridis has many alternate, bright-brown and smooth branches, which are green and downy when young. The leaves are alternate, bright deep-green, oval or oval-lanceolate, short-stalked, very convex, serrated, entire toward the base, and at the apex, which is acuminate and emarginate; shining on both sides, blistered when old, and slightly downy beneath. The flowers are small, white, axillary, and solitary, with a rather heavy odor. Corolla of 5 to 9 petals, unequal, the outer one being shorter. Calyx without bracts, 5-cleft; segments imbricated and equal. Stamens numerous, smooth, adhering to the very base of the petals; filaments white and awl-shaped; anthers rounded, reniform, and opening at the base. Ovary ovate and pubescent; style simple at the base and trifid above. Capsule spheroidal, 3-celled, and often, by abortion, 1 or 2-celled; cells opening at the apex, 1 or, rarely, 2-seeded. Seeds spheroidal, wingless (L.).

Fig. 242.

Thea chinensis.

Thea bohea, very much like the preceding, but the leaves are flatter, smaller, darker green, with small serratures, and terminating gradually in a point, and not at all acuminate or emarginate (L.). Flowers axillary and several together.

History, Preparation, and Description.—The tea plant is a native of eastern Asia, and was brought to Europe during the second half of the seventeenth century. It is extensively cultivated in China and Japan, also in Assam, Java, Bengal, Ceylon, Sicily, Portugal, Brazil, Jamaica, etc. It may also be successfully cultivated in South Carolina (see *Amer. Jour. Pharm.*, 1898, p. 251). China and Japan furnish the bulk of the tea of commerce. According to investigations by Robert Fortune (1852) and other travellers, it appears that all the teas are collected from the same species, but their quality is subject to climatic influences, and dependent also on the soil, culture, and preparation. The tender tops of the shrub yield the finest teas, while the lower leaves yield the common kinds. The first crop also yields finer teas than subsequent crops, which are successively of poorer quality to the fifth or sixth crop. The accompanying illustration, from Col. Money's *Tea Cultivation* (abstracted in *Food and Food Adulterants*, by Wiley, Spencer, and Ewell, *Bulletin No.* 13, *United States Department of Agriculture*, Part VII), shows a branch with leaves of different age, each representing a commercial grade of tea, as indicated. Distinction is made in commerce between *green tea* and *black tea*, the difference depending solely on the manner in which the leaves are treated in order to develop the aroma and taste of tea. Fresh tea leaves are non-aromatic, and have merely an astringent taste.

Fig. 243.

a. Flowery Pekoe.
b. Orange Pekoe.
c. Pekoe.
d. Souchong 1st.
e. Souchong 2d.
f. Congou.
a. b. When mixed together Pekoe.
a, b, c, d, e. (When mixed together) Pekoe Souchong
If there be another leaf below *f*, and it be taken, it is named and would make Bohea
Each of these leaves was first a flowery Pekoe leaf, i. e., it then became *b*, then *c*, and so on
At the base of the leaves *c, d, e, f* exist buds 1, 2, 3, 4, from which new shoots spring.

Green Teas are prepared by exposing the leaves to the sun's rays for 1 or 2 hours. In Japan they are treated with steam; subsequently they are roasted in iron pans over a charcoal fire; then they are rolled by hand on a bamboo table, and quickly dried in the roasting pan. This procedure "fixes" the green color of the tea. During the latter process, such additions as Prussian blue and gypsum are frequently made for the purpose of "improving" the green color (R. Fortune, *The Tea Districts of China and India*, 3d ed., Vol. II, 1853, p. 69, London). Commercial grades of green teas are *Twankay*, *Young Hyson*, *Hyson-skin*, *Imperial*, *Gunpowder*, etc.

Black Teas are obtained by a process of fermentatian. The leaves are allowed to lie on bamboo trays for about 12 hours, during which time they wither;

then they are agitated by hand, and again allowed to lie in heaps for an hour or longer. Finally the leaves are alternately heated in pans and rolled on tables, this being repeated several times. After the last drying, the tea is sorted by means of sieves, and divided chiefly into three classes, depending on the size of the leaves—namely, *Pekoe* (the leaf buds), *Souchong*, and *Bohea* (see illustration, p. 1928). Other commercial grades of black tea are *Congou*, *Caper*, and *Oolong*, etc. The rolling of the leaves is now frequently done by machinery, especially in Ceylon. This practice is preferable to the old method of peforming the rolling with the hands, or even with the feet, as witnessed, for example, by Prof. Tichomirow (see below). It has been customary in tea-growing districts to improve the flavor of inferior teas by mixing them temporarily with certain fragrant flowers, such as of *Jasminum Sambac*, Aiton; *Aglaia odorata*, Loureiro; *Gardenia pictorum*, Hasskarl, etc., and afterward separating them out again. This statement, however, is discredited by Prof. Tichomirow, though he has seen special and high-grade green teas encased in boxes containing a layer of the flowers of *Aglaia odorata*. The leaves of the green tea have a dark bluish-green color, a pleasant, somewhat fragrant odor, and a bitterish, slightly astringent, herbaceous taste. They impart their peculiar taste and odor to boiling water by infusion, forming an agreeable and invigorating drink. The leaves of black tea are much darker-colored than those of the green, and their taste and odor is not so pleasant. They form a brownish infusion with boiling water. In Ceylon, black tea alone is manufactured, while in Japan only green tea can be produced, because the Japanese variety of tea does not bear fermentation (Flückiger, *Pharmacognosie*, 1891).

BRICK TEA.—A *tablet tea* is manufactured at Hankow, China, from common tea-dust, by steaming it and pressing it into wooden molds. A smaller and high-grade tablet is made from fine tea-dust by pressing it (dry) into steel molds by means of machinery. These grades are consumed throughout Russian Siberia. *Brick tea* is made from leaves and stalks of the tea shrub, which are powdered, sifted, steamed, and pressed into bricks of the size of an ordinary brick. This tea is used in Chinese Mongolia and Thibet (*Bull. Kew Gardens*, 1890, p. 109). (For a most interesting and detailed account of the cultivation of tea in Ceylon and China, see Prof W. A. Tichomirow, *Pharm. Zeitschrift f. Russland*, 1892, p. 209, etc.)

Chemical Composition and Tests.—The aroma of tea leaves is due to a small quantity of volatile oil (0.6 to 1 per cent, Mulder). Other important constituents are *theine* (*caffeine*), varying in commercial specimens from 1 to 5 per cent, usually from 1 to 2½ per cent; large quantities of *tannic acid*, identical with gallotannic acid, from 7 to 21 per cent; gallic acid, oxalic acid, and *quercetin*, albuminous and coloring matters, and ash (3 to 7 per cent), of which about one-half is soluble in water. *Boheic acid* ($C_{14}H_{20}O_{12}$), a deliquescent, amorphous substance, soluble in alcohol and water, was observed in black tea by Rochleder (1848). It forms a precipitate with lead acetate. A. Kossel (1888) found, in tea extract, *theophylline* ($C_7H_8N_4O_2+H_2O$), isomeric with *theobromine* (see *Theobroma*), and melting at 264° C. (497.2° F.), and the base *adenine* ($C_5H_5N_5$).

The seeds of Assam tea, according to Boorsma, contain two saponin-like substances—*assamic acid* and *assamin* (*Proc. Amer. Pharm. Assoc.*, 1892, p. 784). David Hooper found the seeds to contain 9 per cent of total saponin, and 22.9 per cent of fixed oil, yet the latter can not be obtained free from the poisonous saponin (*Pharm. Jour. Trans.*, Vol. XXV, 1895, p. 605)

Black tea, according to analysis of Y. Kozai (*United States Bulletin No.* 13, *loc. cit.*), contains less tannic acid than green tea, prepared from the same lot of fresh leaves. It evidently decomposes during fermentation. The amount of theine is practically the same in both. *Theine* ($C_8H_{10}N_4O_2+H_2O$) was discovered in tea by Oudry (1827), and found identical with caffeine, in 1838, by Mulder and C. Jobst. (For its characteristics, see *Caffeina*.)

The "strength" of tea is not necessarily proportionate to the amount of *theine* present. David Hooper (*Jahresb. der Pharm.*, 1890, p. 181) determined the tannin in 65 specimens of India and Ceylon teas, and found them (dried) to vary from 10 to 21 per cent; the finest grades contained the most tannin. P. Dvorkovitch, however (*Amer. Jour. Pharm.*, 1892, p. 48), concludes that the quality or strength of tea is determined by the proportion of theine to total tannin, including that which is altered in the fermentation process. In the finest teas, the proportion of theine is large. Of great practical value and, of course, much simpler than the chemical analysis, is the infusion test, as carried out by experienced tea brokers. It consists in merely allowing the sample to lie in contact with a definite quantity of boiling water (about 1 in 40) for 5 minutes, and judging the quality of the infusion by its taste and flavor. This procedure removes only 20 per cent of extractive matter, while, if the tea were completely exhausted, about 35 to 40 per cent would be yielded, including all the tannin, which would make the decoction unpalatable and harmful. Messrs. Paul and Cownley have shown (*Amer. Jour. Pharm.*, 1887, p. 627, from *Pharm. Jour. Trans.*) that, in making tea, about one-half of the total theine is removed. In one instance the residue still contained 1.7 per cent of theine, while in another instance, where exhaustion was carried as far as practicable, as much as 0.13 per cent of theine remained in the "exhausted" tea leaves. D. Hooper (*loc. cit.*) found that 5 minutes' infusion with boiling water will remove about one-third of the total tannin. (For the determination of *theine* in tea, see Paul and Cownley, *loc. cit.*) Petit and Terrat believe that chloroform or diluted alcohol (60 to 80 per cent) completely and readily abstract theine from tea, provided the latter be previously moistened (*Proc. Amer. Pharm. Assoc.*, 1896, p. 602; also see P. Dvorkovitch, *loc. cit.*).

Tea is much subject to adulteration. Certain substances are mixed with it in order to give it a better appearance (*facing*), *e. g.*, Prussian blue, indigo, turmeric, gypsum, graphite, magnetic oxide of iron, etc. The improvement of the flavor has been mentioned. Catechu has been added to increase the astringency. Another practice is to substitute partially extracted tea leaves (see methods of detection, by A. Tichomirow, *Amer. Jour. Pharm.*, 1893, p. 302). Leaves of other plants which come into consideration as possible adulterants, and which are figured in the above *United States Government Report*, are those of maté, Paraguay tea (*Ilex Paraguayensis*), camellia (*C. japonica*), hawthorn, box-elder, horse chestnut, sycamore, rose, plum, elm, ash, willow, beech, oak, Missouri or golden currant, birch, poplar, raspberry, and Jersey tea (*Ceanothus Americanus*), also *Vaccinium Arctostaphylos* (see *Bull. Kew Gardens*, 1895, p. 61; also see *Related Products*, p. 1931).

Action, Medical Uses, and Dosage.—Tea is a mild stimulant and astringent. Used in moderation, the infusion, when not too strong, is a harmless and refreshing beverage. As to its effects upon the constitution, there is quite a diversity of opinion, but it is very probable that, with healthy persons, no pernicious influences arise from its use, unless taken in large quantities, or very strong. When made into a weak infusion, it is very agreeable to the invalid, and may be used in *fevers* and *inflammatory diseases*, when it is desired to check sleep. In *colds*, *catarrhs*, and slight attacks of *rheumatism*, warm tea is taken as a diluent, diuretic, and diaphoretic. It frequently relieves *headache*, and allays the *irritation of the stomach* produced by intemperance of the previous day. With some persons, however, tea produces very unpleasant nervous symptoms, as tremors, anxiety, headache, sleeplessness, etc. Tea is said to be a sedative to the heart and blood vessels, and Liebig considers it to possess considerable nutritive power. Black tea is generally preferred by those of weak or delicate nerves, on account of its being less apt to produce disagreeable nervous symptoms. Externally, the infusion has been used with advantage as a collyrium. The essential oil of tea exerts a most powerfully stimulating and intoxicating effect. In China, tea is seldom used till it is a year old, on account of the well-known intoxicating effects of new tea, due probably to the larger proportion of essential oil contained in the freshly-dried leaf (W. A. Miller). According to Dr. Lewin, the effects of theine and caffeine are identical, with the exception that the first is a less powerful toxic than the latter, requiring double the doses to produce the same effect, and likewise occasions convulsive movements in the limbs, which have not been noticed from the action of the latter (*Arch. de Phys., Norm., et Path.*, 1868).

Later investigators, however, consider theine and caffeine physiologically identical with each other, as well as with theobromine, cocaine, and guaranine. While their principles are thus identical, it is equally true that coffee and tea differ considerably in their effects and, of the two, the latter is more apt to harm the nervous system. Both tea and coffee induce wakefulness, but that of the former may partake of the character of a distressing insomnia, while the latter induces a pleasant, dreamy wakefulness. Both, however, in proper amounts, produce a feeling of mild exhilaration and well-being. Immoderate quantities of tea long-continued, may give rise to dyspepsia, constipation, headache, nervous unrest, hysteria, cardiac palpitation, and other irregularities, tremors, neuralgia, difficult breathing, ringing in the ears, physical and mental exhaustion, and other deleterious effects. The infusion of tea may be used freely; the fluid extract in doses of ½ to 1 fluid drachm, well diluted with water.

Related Products.—LIE TEA. "This substance, as its name implies, is an imitation of tea, usually containing fragments or dust of the genuine leaves, foreign leaves, and mineral matters, held together by means of a starch solution, and colored by one of the facing preparations. It is stated that gunpowder and imperial teas are more subject to this form of adulteration. Of the samples of tea examined by the Department of Agriculture, all were free from lie tea. According to Hassall, the percentage of ash in lie tea ranges from 13.05 to 52.92 for black teas, and 13.13 to 56.34 for green teas. The same authority also found black teas containing from 6 to 17.7 per cent of lie tea, and green teas containing 1.38 to 48.46 per cent of this adulterant. To detect lie tea, treat the suspected sample with boiling water. If it contains this adulterant, portions will break up into dust and leaf fragments" (*Food and Food Adulterants*, Wiley).

BUSH TEA (*Honig thee*).—South Africa. Species of *Cyclopia*, probably *C. brachypoda* and *C. longifolia*, are utilized by the inhabitants of Cape Colony as a substitute for tea (see *Pharm. Jour. Trans.*, Vol. XI, 1881, pp. 549 and 569). H. G. Greenish showed that it contained *cyclopin* ($C_{25}H_{28}O_{13}$), a glucosid, yielding sugar and *cyclopia-red*. No theine could be detected.

TEA OIL.—The Chinese use *tea oil* for lamps and as an article of food. It is pale-yellow, nearly odorless, of specific gravity 0.927, burns with a clear, white flame, is soluble in ether, but insoluble in alcohol and water. It is obtained, by warm pressure, from the seeds of various species of the genus *Camellia*, as the *C. japonica*, *C. oleifera*, Abel; *Thea oleosa*, Loureiro; or *C. sasangua*, Thunberg. The press-cake contains a poisonous, saponin-like substance (see *Bull. Kew Gardens*, 1888, p. 264).

Camellia drupifera, Loureiro, yields a similar oil.

Thea Japonica, Baillon (*Thea Camellia*, Hoffmann; *Camellia Japonica*, Linné).—This Japanese shrub, cultivated here for its ornamental beauty, yields poisonous seeds. Martin and Katsuyama (1878) obtained an acrid, semisolid, fixed oil, tannin, and a poisonous glucosid, *camellin*, somewhat soluble in hot water, little soluble in ether, easily soluble in alcohol.

THEOBROMA.—CACAO.

The seeds of *Theobroma Cacao*, Linne.

Nat. Ord.—Sterculiaceæ.

COMMON NAMES: *Cacao*, *Cocoa* (incorrectly), or *Chocolate tree*.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 38.

Botanical Source.—The genuine cacao tree is a small and handsome evergreen tree, growing in South America and the West Indies, from 12 to 25 feet high, and branching at the top; when cultivated it is not allowed to grow so high. The stem is erect, straight, 4 to 6 feet high; the wood light and white; the bark thin, somewhat smooth, and brownish. The leaves are alternate, petiolate, lanceolate-oblong, ribbed, veined, entire, smooth on both sides, dark-green, 8 to 10 inches long, the younger ones rose-colored; the petioles terete, thinner in the middle, with 2 small, linear, awl-shaped stipules at base. The flowers are very small, clustered, axillary, but emanate from the sides of the stems; they are white, with a reddish tint, and scentless. Pedicels uniflorous and filiform. The calyx consists of 5 sepals, and is deciduous; the divisions are ovally lanceolate, angustate, and pointed. Petals 5, vaulted at the base, ligulate above. Stamens, linear, awl-shaped, urceolate, the 5 sterile ones much longer than the 5 fruitful ones, and alternate with the petals; the 5 fruitful ones opposite the petals, and bearing 2 anthers. The style is 5-cleft at the apex; the stigmas simple. Ovary free, sessile, oval, elongated, 10-grooved, downy, with 8 ovules in 2 rows in each of the compartments. Fruit indehiscent, ovate-oblong, 5-celled, and covered with a ligneous, leather-like bark, emanating from the sides of the stems. The seeds are numerous, compressed, ½ inch long, reddish-brown externally,

Fig. 244.

Theobroma Cacao.

dark-brown internally, and imbedded in a whitish, sweetish, buttery pulp. (On the anatomical structure of cacao seed, see A. Tschirch, *Archiv. der Pharm.*, 1887, p. 605.)

Source, History, and Preparation.—This tree was extensively cultivated in Mexico, Central and South America for many years, indeed long before the discovery of America, and at one time formed the currency of the natives, who made an immense consumption of it in various ways. At present it is chiefly cultivated in Brazil, Costa Rica, Guayaquil, Ecuador, Venezuela, Peru, Guatemala, the island of Trinidad, and most of the other West India Islands; also in Africa, Ceylon, Samoa, and other parts of the globe. The cocoa or chocolate nuts of commerce are the seed taken from the fruit and deprived of a slimy covering. There are many varieties of this seed brought into the market, named, according to the place from which they have been imported, *e. g.*, Puerto Cabello, Cauca, Maracaibo, Caracas, Surinam, Java, Domingo, Bahia, etc.

Cacao seeds are prepared for commerce either by simple drying, in which case they retain their bitterness and astringency; or they are cured by a sweating process by which their bitter and astringent properties are much modified, and the color of the seed changed. The seeds are placed into closed boxes for a certain length of time, or buried in the ground for a few days; the best process is to allow the seeds to lie for a week in heaps covered with green leaves, such as plantain leaves, etc., after which time they are dried. Also see directions given by W. Cradwick, of Jamaica, for curing cacao seeds on a domestic scale, in *Amer. Jour. Pharm.*, 1895, p. 530.

Description.—The best cacao seeds are large, full and heavy, smooth, of a beautiful, light chestnut-brown color, free of foreign matter, well sieved, dry, not musty, without disagreeable or rancid smell, but of an agreeable odor, and a mild somewhat bitter and fatty taste, with but little astringency. When the kernels are separated from the shell and broken, they should be shining and violet-brown, not traversed by white streaks. It is said that under the most favorable circumstances cacao can not be preserved for more than three years. The *cracked cocoa*, or *cocoa nibs* of commerce is coarsely ground cacao previously roasted. Commercial *cocoa* may also consist of the powdered press-cake obtained when the oil or butter of cacao is partially removed by pressure. *Chocolate* is prepared by first roasting the seed, then removing their husks as soon as the requisite degree of aroma and of friability is obtained, allowed to cool, and cracked or ground between heated stones, which causes them to assume the consistence of paste, which is molded into rectangular cakes. When roasted cacao seeds are ground with about an equal amount of sugar and certain aromatics, the product constitutes *sweet chocolate*. Those who manufacture chocolate have various methods of preparing, sweetening, and aromatizing it. *Cacao shells* are also an article of commerce, being used in preparing a table beverage resembling chocolate or cocoa in taste, but being naturally weaker than these.

Chemical Composition.—Cacao seeds contain fat (40 to 50 per cent) (*oil of cacao, cacao butter;* see *Oleum Theobromatis*), the base *theobromine* ($C_7H_8N_4O_2$), small quantities of *caffeine* (*theine*), starch (from 1.3 to 7.5 per cent, Ridenour, *Amer. Jour. Pharm.*, 1895, p. 209), a red coloring matter (*cacao-red*), albuminous matter (6 to 18 per cent), and ash (2 to 4 per cent), etc.

In 18 commercial specimens of cacao, A. Eminger (*Forschungsberichte über Lebensmittel*, 1896, p. 275; also see *Amer. Jour. Pharm.*, 1897, p. 113) found theobromine to vary from 0.88 to 2.34 per cent, caffeine from 0.05 to 0.36 per cent. According to E. Knebel (1892), the presence of cacao-red is due to the decomposition of a glucosid under the influence of a diastatic ferment, resulting in dextrose, cacao-red, theobromine, and caffeine (compare *Kola*).

THEOBROMINE was discovered in cacao seeds by Woskresensky in 1841. It is also a constituent of Kola nuts (see *Kola*). It crystallizes in small rhombic needles, has a bitter taste and sublimes without decomposition at about 290° C. (554° F.). Its solubilities, as revised by Eminger (*loc. cit.*), are as follows: It requires 736.5 parts of water at 18° C. (64.4° F.), 136 parts at boiling temperature, 5399 parts of alcohol (90 per cent) at 18° C. (64.4° F.), 440 parts at boiling heat, and 818 parts of absolute alcohol at the boiling point; 21,000 parts of ether at 17° C. (62.6° F.); 4856 parts of methyl alcohol at 18° C. (64.4° F.); 5808 parts of chloroform at 18° C. (64.4° F.), and 2710 parts at the boiling point. It is insoluble in carbon tetrachloride (CCl_4) at 18° C. (64.4° F.), while caffeine at this temperature is soluble at the ratio of 1:1000. The author bases upon this a method of quantitative separation of caffeine from theobromine, which was before possible only by precipitating theobromine by means of nitrate of silver in ammoniated solution (compare W. Kunze, *Amer. Jour. Pharm.*, 1899, 145). Theobromine is insoluble in petroleum-ether. Its aqueous solution is neutral, but it forms crystallizable salts with acids. Chemically it is *dimethylxanthin* (E. Fischer, 1882). A. Eminger assays cacao for theobromine by extracting the fat with petroleum-ether, boiling the residue with a 3 to 4 per cent sulphuric acid to produce the insoluble cacao-red (theobromine is not affected), neutralizing the residue with barium hydroxide, evaporating to dryness with sand, extracting theobromine and caffeine with chloroform, and separating both by means of carbon tetrachloride in the cold. This process avoids warming with bases which more or less destroy theobromine. (On the analysis of 12 commercial samples of prepared cocoa, see Florence Yaple, in *Amer. Jour. Pharm.*, 1895, p. 318.)

Cacao shells were found by T. S. Clarkson (*Amer. Jour. Pharm.*, 1887, p. 277) to contain 0.9 per cent alkaloid, 10.9 per cent nitrogenous matter, 5.32 per cent of fat, a resin soluble in ether and alcohol, and having the odor of cacao, 5.6 per cent of mucilage, and 9.07 per cent of ash, containing aluminum.

Action, Medical Uses, and Dosage.—CHOCOLATE, when scraped into a coarse powder, and boiled in milk, or milk and water, is much used as an occasional substitute for coffee, and for a drink at meals. It is a very useful nutritive article of diet for invalids, persons convalescing from acute diseases, and others with whom its oily constituent does not disagree, as is apt to be the case with dyspeptics. BUTTER OF CACAO is a bland article, rather agreeable to the taste, and highly nutritious; it has been used as a substitute for, or an alternate with, cod-liver oil, and as an article of diet during the last days of pregnancy. It has also been employed in the formation of suppositories and pessaries, for *rectal, vaginal, and other difficulties* (see *Suppositories*). It likewise enters into preparations for *rough* or *chafed skin, chapped lips, sore nipples*, various cosmetics, pomatums, and fancy soaps; and has also been used for coating pills.

Theobromine when absorbed acts powerfully as a diuretic, and has a stimulant or exciting action which is not possessed by chocolate itself. It is, however, quite difficult of absorption, and is without effect upon the heart and circulation. It enters into the compound known as *Diuretin*, which, in certain conditions, is an active diuretic.

THUJA.—ARBOR VITÆ.

The branchlets and leaves of *Thuja occidentalis*, Linné.

Nat. Ord.—Coniferæ.

COMMON NAMES: *Arbor vitæ*, *Yellow cedar*, *False white cedar*, *Tree of life*.

Botanical Source.—This evergreen tree is indigenous to this country, growing wild in various parts of the United States, from Canada to the Carolinas, on the rocky borders of streams and lakes, and in swamps, flowering in May. It abounds especially in Canada and the northern states. The trunk of the tree is crooked, rapidly diminishing in size upward, throwing out recurved branches from base to summit; branches ancipital, flat, and broad. The wood is very light and soft, but exceedingly durable. The leaves are evergreen, rhomboid-ovate, with a gland on the back, squamose, appressed, and imbricated in 4 rows. The cones are terminal, oblong, and nodding; the scales pointless and 1-seeded; the seeds broadly winged (W.—G.).

History and Description.—The thuja, a well-known coniferous tree, attains a height of from 20 to 50 feet in its native habitat, which is in cold and wet swamps, growing among the tamarac and other allied species, or in wet, rocky situations. It is commonly known as Yellow cedar and (wrongly) White cedar, the latter name properly belonging to another tree, the *Cupressus thujoides*. It is best known to the public in general, when cultivated for ornamental gardening, as it frequently is, as the arbor vitæ, or "tree of life." When thus cultivated and neatly trimmed, it has a much more compact appearance than in the wild state, as in the latter the branches and leaves have a somewhat loose and straggling appearance. The wood is light, fine-grained, and soft, being somewhat resinous, and is very durable. The twigs and small leaflets of this tree furnish the drug of commerce.

Fig. 245.

Thuja occidentalis.

Thuja has been used in medicine to a slight extent for two centuries at least. Boerhaave lauded the distilled water of thuja as a remedy for dropsy. Homœopathy is indebted to Hahnemann for its introduction into that school. Schoepf states that it is useful in coughs, fevers, scurvy, and rheumatism. Peter Kalm, a Swedish traveller and collector of American plants, after whom our drug Kalmia is named, states that, in Canada, the bruised leaves were applied locally to relieve the pains of rheumatism. Parkinson advised the eating of the leaves and young sprouts on buttered bread to bring about the "expectoration of tenacious and vitiated humors." In the early part of the present century, the oil of thuja was employed as an anthelmintic and tænicide. Its use for this purpose, however, is dangerous, owing to its liability to produce a violent irritation of the gastro-intestinal tract.

The use of thuja by the Eclectic profession is of comparatively recent date. The first published account of its use by one of our school is in the *Eclectic Medical Journal* for 1862, though it was, undoubtedly, personally used by other Eclectics. In an editorial, the editor, Dr. Scudder, gives the experience of Dr. Dickey, of Preble County, Ohio, who used it as a discutient in scrofulous enlargements of the lymphatic glands. Equal parts of powdered Podophyllum peltatum were incorporated with thuja sprouts, and made into a poultice with milk. The same treatment was pursued in severe neuralgia and rheumatic complaints, affording great relief. In one case, in which the patient had been bed-ridden for over a year, in consequence of severe pain and weakness in the lumbar region, a speedy and complete cure was effected. How much of the relief came from the heat and moisture of the poultice does not appear, but as the doctor had exhausted his therapeutic resources, it is fair to presume that the relief was in part, at least, due to the thuja. The leaves and twigs are employed. They have a pleasant benzoinic odor, and a pungent, bitterish, aromatic taste. A yellowish, green, pungent, aromatic, essential oil may be procured from them by distillation. Water or alcohol extracts their virtues.

Chemical Composition.—The leaves and tops of thuja yield, by distillation with steam, about 0.5 to 1 per cent of volatile oil (*Oleum Thujæ, Oil of Arbor Vitæ*). It is colorless or green-yellow, has a bitter taste, and a strong, camphoraceous odor, resembling that of tansy. According to Jahns (1883) and Wallach (1892–1894), it contains chiefly *dextro-pinene*, *lævo-fenchone*, and *dextro-thujone* (see Gildemeister and Hoffmann, *Die Ætherischen Oele*, 1899, p. 344). Other constituents of the leaves of thuja are a bitter glucosid, *pinipicrin* (also contained in Pinus sylvestris), and a peculiar, astringent, yellow coloring matter, *thujin* ($C_{20}H_{22}O_{12}$, Rochleder and Kawalier, 1858), which is also a glucosid, closely related to *quercitrin;* with diluted acids, it splits into sugar and *thujigenin* ($C_{14}H_{12}O_7$), the latter takes up water and becomes *thujetin* ($C_{14}H_{14}O_8$). With barium hydroxide, thujin is decomposed into sugar and *thujetic acid* ($C_{28}H_{22}O_{13}$). (For experimental details regarding these bodies, see Husemann and Hilger, *Pflanzenstoffe*, 1882, p. 331).

Action, Medical Uses, and Dosage. Thuja was occasionally employed by doctors in the earlier years, but few new uses for it were developed. Like nearly all the drugs, which are not so dangerously active as to force themselves on the practitioner's notice, it only needed some conspicuous authority to announce the virtues of the remedy. The late Prof. Howe believed the drug valuable. It would seem that he was especially partial to the conifers. He reintroduced Pinus canadensis and thuja. Its present extensive use is largely due to his advocacy of the drug. It is true that Prof. King described thuja in the earlier editions of the *American Dispensatory*, and stated that a decoction of the leaves had been used in *remittent and intermittent fevers, coughs, rheumatic and scorbutic affections*, and gave the usual notice respecting its power to remove *warts*. With the exception of the latter use, this gave nothing further than Schoepf's statement.

Prof. Howe was desirous of seeing the remedy fully tested, so he began with the drug to determine its true value. In the *Eclectic Medical Journal* for 1880, p. 331, he gives a brief compilation of Eclectic uses of the drug, and concludes with his knowledge of it, and a notice of his intended lines of investigation. He says: "A tincture of fresh leaves of thuja will, locally applied, according to my experience, remove *warts* from the face and hands, *condylomata* about the nates, but will not destroy swiftly growing *venereal warts.* It will deaden *fungous granulations*, and utterly destroy them in some instances. But the best action of the drug is in overcoming the growing and spreading progress of *epithelioma*. I have seen it repress and overcome *fungoid and ulcerous epitheliomata* in an astonishingly happy manner." He further intimates that he shall try it in *croupous and diphtheritic cases*, and states that he shall inject some of the tincture into the *tunica vaginalis testis* for the cure of *hydrocele*, and may try it on the granulations of *trachoma*. Finally, he would see what could be done to a *bulging nævus* with it. Having carried out the last intention, he records his success (*Ec. Med. Jour.*, 1880, p. 391): "In the treatment of nævi, I feel that a specific has been brought out. I do not expect that it will take out the scarlet color of those vascular patches, called mother's mark, but that the agent will cause to shrink to insignificance those *puffy nævi*, which once called for the ligation of arteries. The thuja treatment is so safe and simple that a surgical operation is uncalled for, the operating surgeon losing by the discovery." Later, in the *Eclectic Annual*, he stated that, externally applied, it would lessen the size of a *nævus* or *mother's mark*. Many failures have been recorded in its use for the latter purpose. Thuja comes highly recommended as a dressing for *sloughing wounds*, *ulcers*, *bedsores*, senile and other forms of *gangrene*, serving a useful purpose in overcoming the horrible stench arising therefrom. It may likewise be used in *carcinomatous ulcerations*. Some even claim that it has power to check the latter disorder, but in all probability, this is claiming too much for the drug. It is frequently valuable to restrain *hemorrhages* occasioned by *malignant growths*.

Thuja is antiseptic and stimulant. Its general action is very much like that of the terebinthinates, and is said to resemble savin more than any other drug of this class. For this reason, it has been employed, as before stated, in *amenorrhœa*, with pelvic atony, and also in *catarrhal diseases of the female generative organs*. We have used it with good results as a topical application to thick, spongy, or tender os uteri, with leucorrhœal discharge. It is asserted that thuja has brought on abortion, acting not so much as a direct abortivant, but as a gastro-intestinal irritant, producing violent intestinal disturbances, giving rise, indirectly, to miscarriage. Thuja is a remedy for blood changes and glandular disorders. Tissue degenerations in the epithelial structures appear to be influenced by it. Good results have come from using an inhalation of thuja in *bronchial diseases* and *catarrhal affections* of a chronic type. We would suggest its inhalation in *fetid bronchitis* and *bronchorrhœa*. The preparation should be dropped on hot water and inhaled. It is first stimulant, afterward subastringent. It has successfully combatted *hemoptysis*. Its inhalation is serviceable in *diphtheria* and *membranous croup*. Rectal troubles, such as *fissured anus* and *hemorrhoids*, have been frequently cured with thuja. When it is thought necessary to inject a pile tumor, thuja may be used in preference to carbolic acid. It cures by inducing atrophy. In fissured anus, it is said that the drug at first aggravates the trouble, but, if persisted in, soon effects a permanent cure. Locally, or by hypodermatic injection, it has given good, but only temporary, results in *vascular rectum*, where, from a paralytic condition, the lower segment of the rectum bulges and sags, amounting almost to a prolapsus. Thuja is well known as Prof. Howe's specific for the cure of *hydrocele*. His method was to add to 1 ounce of warm, sterilized water 1 drachm of Lloyd's thuja. After tapping the sac, 2 drachms of this solution were then sent, hypodermatically, into the *tunica vaginalis testis*. The fluid was then squeezed into every part of the sac. At first some pain and considerable swelling results, but in a few days, if the work has been properly done, a permanent cure is accomplished. Alarming swelling has been reported in some instances operated upon in this manner, as well as some failures recorded. As before stated, Prof. Howe intimated that thuja might be applied to *trachomic lids*. Later, Dr. D. Thomas Long, of Topeka, Kan., employed a preparation of it in unctuous condition, now known as Long's thuja, with great success in the treatment of this disorder. The patient may be given a small box of the unguent and taught how to use it. Each application causes considerable smarting for a short time, accompanied by lachrymation, which, however, very quickly subsides, leaving no unpleasant after-effects. We have had excellent results in *chronic trachoma* from this treatment. Constitutional or tonic treatment may also be required. Perhaps, one of the best known properties ascribed to this drug, is its power to remove *warts*, whether of the hands, face, or genitals. Nearly every writer who has mentioned this drug, has reported success in this direction. Our experience from the local application of thuja to warts has been negative. Subcutaneous injection of it around the base of the growth has been recommended, and might be more effective than the preceding. Fearn (*Ec. Med. Gleaner*, 1894, from *Calif. Med. Jour.*) advises it where excrescences are sensitive and moist, with a foul-smelling secretion. Prof. Lyman Watkins, M. D., reports success with it in *urethral caruncle*. Several physicians have called attention to the fact that specific thuja proves an efficient remedy for *nocturnal enuresis*. Dr. Price (*Ec. Med. Jour.*, 1892) records interesting cases cured with this drug. Thuja was used first in 5-drop doses at bedtime, afterward reduced to 3 drops. Old men, with enlarged and greatly irritated prostate inducing a constant dribbling of urine, consequently staining the clothing and entailing much unpleasantness, are benefited by 5-drop doses of thuja. Another interesting report is that of Dr. George Herring (*Homœopathic World*), who employed it for *irritability of the bladder*, in gouty and eczematous patients. One case in particular mentioned by him, was that of an old man of 87 years, who was nearly exhausted from weakness consequent upon broken rest and frequent rising at night to empty his bladder. Thuja (first dilution), in 2-drop doses, brought complete relief. Prof. Howe (*Ec. Annual*) states that thuja, in 5 or 6-drop doses, will generally cure *enuresis* of children, and will alleviate *senile dribbling of urine*, if no paralysis exists. It has been successfully employed in *gleet*, when the continuance of the discharge was dependent on *granular urethritis*. A favorite injection for *gonorrhœa*, particularly in the latter stages, and for *gleet*, is composed of aqueous thuja, 1 part; Lloyd's colorless hydrastis, 1 part; water, 4 parts. The proportions may be varied as desired. It gives tone to the bladder walls, and is particularly of value in dribbling or expulsion of urine in plethoric women, with relaxed bladder tissues, where even a cough or slight muscular exertion causes an expulsion of urine. Thuja is a topical remedy of unsurpassed value in *syphilitic chancroid*. For this purpose the aqueous thuja is to be preferred. If applied early it relieves the pain, checks discharges, and promotes rapid healing. It acts best where softness and moisture are present. The parts should be cleansed with a borax wash before each application. Upon hard chancres it has little or no effect. This form of thuja is also valuable as an application to *post-nasal catarrh*, and to shrink *nasal polypi* and other *growths in the nose and nasopharynx*. Locally and internally, it gives excellent results in *chronic tonsillar affections*, and in the milder forms of *faucial and pharyngeal diphtheria*. It is also of value in some *chronic skin affections*, showing a tendency to vegetations. Dr. Foltz (*Dynam. Therap.*) states that specific thuja ($\frac{1}{5}$ to $\frac{1}{3}$-drop doses) acts upon the deep ocular tissues, and has been used in *scleritis*, *episcleritis*, *sclerochoroiditis*, and *syphilitic iritis*, with gummata on the iris; also externally and internally for the removal of *tarsal tumors*. Dose of specific thuja, from 1 to 20 drops; of aqueous thuja, 1 to 30 drops. Externally, Long's thuja, specific thuja, and aqueous thuja may be applied full strength, or diluted as required.

Specific Indications and Uses.—Enlarged prostate, with dribbling of urine in the aged; urine easily expelled upon coughing or slight muscular exertion; vesical irritation and atony; enuresis of children; verrucous vegetations; trachoma; chancroid.

Related Drug.—CYPRESS OIL. From *Cupressus sempervirens*. Lauded in *whooping-cough*. Used by sprinkling upon the clothing, bed, etc., of the patient.

THYMOL (U. S. P.)—THYMOL.

FORMULA: $C_{10}H_{14}O$. MOLECULAR WEIGHT: 149.66.

"A phenol occuring in the volatile oils of *Thymus vulgaris*, Linné, *Monarda punctata*, Linné (*Nat. Ord.*—Labiatæ), and *Carum Ajowan* (Roxburgh), Bentham et Hooker (*Nat. Ord.*—Umbelliferæ). It should be kept in well-stoppered bottles"—(*U. S. P.*).

SYNONYMS: *Acidum thymicum, Thymic acid.*

Source, History, and Preparation.—Thymol was discovered by Caspar Neumann in 1719. It was purified, in 1853, by M. Lallemand, who gave it the name "thymol," and ascribed the formula (old notation) $C_{20}H_{14}O_2$, the same being accepted at the present day as correct, corresponding to $C_{10}H_{14}O$ of the new notation. Thymol is a phenol (*iso-propyl-meta-cresol*), and is isomeric with carvacrol (*iso-propyl-ortho-cresol*). It is found in oil of thyme, oil of horsemint, and oil of *Carum Ajowan*, De Candolle (*Ptychotis Ajowan*), a plant from the East Indies; the thymol of commerce being derived from thyme oil. The yield of thymol from this source, however, is comparatively small and quite variable (from less than 1 to 38 per cent; see *Amer. Jour. Pharm.*, 1882, p. 521). Larger quantities of thymol occur in the oil of horsemint (see *Monarda*). Thymol exists in oil of thyme, associated with two hydrocarbons of greater volatility, cymol ($C_{10}H_{14}$), and thymene ($C_{10}H_{16}$) (see *Oleum Thymi*). Thymol may be obtained by fractionally distilling the pure oil of thyme; cymene and thymene pass over, and afterward the thymol, which may be purified by crystallization from alcohol; or, the thyme oil may be agitated with solution of caustic soda, the hydrocarbons forming the upper layer are removed, and the lower solution containing the thymolate of sodium is neutralized with hydrochloric acid, when thymol will rise to the surface, and may be purified by crystallization from its alcoholic solution.

Description.—Thymol, as described by the *U. S. P.*, forms "large, colorless, translucent crystals of the hexagonal system, having an aromatic, thyme-like odor, and a pungent, aromatic taste, with a very slight caustic effect upon the lips. Its specific gravity, as a solid, is 1.069 at 15° C. (59° F.), but when liquefied by fusion it is lighter than water. It melts at 50° to 51° C. (122° to 123.8° F.), remaining liquid at considerably lower temperatures. When triturated with about equal quantities of camphor, menthol, or chloral, it liquefies. Soluble in about 1200 parts of water at 15° C. (59° F.), and in less than its own weight of alcohol, ether, or chloroform; also readily soluble in carbon disulphide, glacial acetic acid, and in fixed or volatile oils. Its alcoholic solution is optically inactive"—(*U. S. P.*). Being a phenol, thymol readily dissolves in caustic alkalies and is regenerated by acids, even carbonic acid (see *Preparation*, above). Thymol also dissolves in 120 parts of glycerin. In making solutions of thymol with glycerin and water, it is best to triturate the thymol in a mortar with a small portion of alcohol, until it is dissolved, then add the desired menstruum. Thymol boils at 230° C. (446° F.) (Doveri and Lallemand).

Tests.—"If a very small crystal of thymol be dissolved in 1 Cc. of glacial acetic acid, and then 6 drops of sulphuric acid and 1 drop of nitric acid be added, the liquid will assume a deep bluish-green color. If 1 Gm. of thymol be heated in a test-tube, in a water-bath, with 5 Cc. of a 10 per cent solution of sodium hydrate, a clear, colorless, or very slightly reddish solution should be formed, which becomes darker on standing, but without the separation of oily drops (absence of *thymen*, or lævogyrate *pinene* ($C_{10}H_{16}$). If to this a few drops of chloroform be added, and the mixture agitated, a violet color will be produced. When a crystal of thymol is heated in an open capsule, or in a watch-glass, on a water-bath, it should gradually volatilize, leaving no residue (absence of *paraffin*, *spermaceti*, etc.)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Thymol is an antiseptic and disinfectant, and is considered by many who have experimented with it, to be superior, in these respects, to carbolic acid. By destroying the vitality of organized and living ferments, it prevents the occurrence of putrefaction, and arrests it when it has commenced. A small quantity of thymol added to albumen, milk, solutions of gum, or of gelatin, will preserve them for several months; and urine will be kept intact for several weeks. In contact with putrid pus, it promptly removes any odor emanating from this substance, and keeps it without change until complete desiccation occurs. Applied to *wounds*, *ulcers*, or *abscesses*, in the form of a weak solution, it promptly modifies their condition, and accelerates cicatrization. Fifteen grains of thymol dissolved in 2 pints of distilled water, forms an invaluable disinfectant; this has been found effective in disinfecting sick rooms, and as a local application to prevent *septicemia* during the parturient period, as well as at other times when there is reason to fear its development. M. Paquet has preserved viscera, portions of limbs, etc., free from the least trace of putrefaction for several months, by means of the following solution: Take of thymol, tannin, each, 1 drachm; anilin, ½ drachm; glycerin, 3 ounces. Mix. When employed in the dressing of ulcers, etc., the following solution has been recommended by M. Giraldes: Take of thymol, from ½ to 1 drachm; alcohol, 3 fluid ounces; distilled water, 30 fluid ounces. Mix. This has been found to act efficiently, even in cases in which iodine and other analogous topical applications had been fruitlessly employed. It is not necessary to employ too strong a solution, as pure thymol possesses caustic properties. M. Paquet has derived great benefit in dressing ulcers by the following: Take of thymol, ½ drachm; alcohol (85 per cent), 2 fluid drachms; distilled water, 33 fluid ounces. Mix. These solutions may be applied on lint, or by spray. Concentrated thymol may be advantageously substituted for nitric acid, or nitrate of silver, in cauterization of the dental nerves; its odor is not so disagreeable as that of carbolic acid.

Thymol has been employed in inhalations, by Bouillhon, Paquet, and others, in *bronchial* and other *affections of the respiratory organs*, attended with gangrenous exhalations. The respiratory mucous membranes become excited, the expectoration is diminished, becomes thinner and less tenacious, contains a much smaller amount of mucin, and is more freely passed. It suppresses the gangrenous odor, and prevents the diseased bronchial surfaces and the abnormal secretions covering them, from undergoing butyric fermentation, thus checking a poisoning of the blood. Ten drops of a thick, concentrated solution of thymol are placed in a small glass flask, furnished with a cork, through which pass two bent glass tubes, one descending nearly to the bottom of the flask, the other being short. This latter is held in the patient's mouth, who will aspire the air charged with the vapor of the thymol. These inhalations should be continued for 4 or 5 minutes, each time, and be repeated 8 or 10 times per day. Ten drops of the solution will suffice for inhalation during 4 or 5 days. If, during the inhalation, a slight sense of pricking is experienced in the posterior region of the pharynx, the inhalation should be suspended until this sensation passes off, and then be again continued. M. Lewin considers thymol very useful in *diphtheria* and other similar diseases dependent upon the action of living organisms; also in arresting the hypersecretion of various mucous membranes. In cases in which fermentation occurs in the stomach with dilatation of this organ, he states that thymol acts promptly in arresting the accompanying vomitings, and gradually effects a contraction of this dilated cavity.

M. Baelz, who has made some comparative experiments with thymol and salicylic acid (in the service of M. Wunderlich) upon persons in health, and also those affected with *typhoid fever*, *articular rheumatism*, *phthisis*, and *pyelitis*, states that in doses of ⅛ of a grain, repeated several times, no effect was observed; in order to obtain an appreciable therapeutical result, it was necessary to give daily from 25 to 30 grains. Upon coming in contact with the bucco-pharyngeal mucous membrane, the medicine occasioned a pricking sensation and a disagreeable taste; there was seldom any nausea, and vomiting occurred but once among 36 persons. Upon increasing the dose, a slight, but transient, sense of heat was experienced in the epigastrium; and, in some cases, a diarrhœa analogous to that in typhoid fever. In the majority of cases, half an hour or an hour after the gestion of thymol, more or less limited and profuse sweats appeared, but in all cases less than those occasioned by salicylic acid or jaborandi. An increase in the quantity of urine was frequently noticed; and the urine presented a dark, greenish color, as if it contained blood, and appeared a yellowish-brown when illuminated by reflected light. A solution of perchloride of iron added to the urine rendered it cloudy, and of a whitish-gray color. When the gray predominated, it reminded one of an icteric urine, or even of a nephritic urine mixed with blood; the absence of albumen, however, prevented any mistake as to the latter cause. The nervous phenomena were represented by tinnitus aurium, deafness, and a sense of constriction at the temples (*Archiv der Heilkunde*, Vol. XIV, Parts III and IV). In doses of from 30 to 60 grains, M. Baelz considers its action, as an antipyretic, decidedly inferior to that of salicylic acid.

Dr. B. Kussner has found that from 3 to 5 drops of a 1 per cent solution of thymol is beneficial in *diarrhœa of children*. Thymol injected into the veins lowers the temperature and induces stupor. Animals poisoned with it pass into a deep coma; after death their blood is dark and fluid, but no fatty degeneration of internal organs is observed (*Med. Press and Circ.*). Prof. Webster reports a satisfactory use of thymol in expelling *tapeworm*. A cathartic is administered at night, and 10 grains of thymol administered in the morning every 15 minutes until the worm is expelled. As it is a powerful depressant, it must be carefully used. It is a remedy for *chyluria*.

The preferable forms, for the internal administration of thymol are either to dissolve it in an alcoholic drink, or to form it into a thick, emulsioned fluid; but, thus far, the employment of this agent has been confined chiefly to its use as a topical application, and to utilize its antiseptic properties. The advantages derived from its internal administration have been very limited. The following has been advised as a method of preparing it into pills, the soap being indispensable to assure the division of the thymol: Take of thymol, 3 grains; medicinal soap, 6 grains; excipient, a sufficient quantity. Mix thoroughly, and divide into 20 pills. An ointment has likewise been advantageously employed, by thoroughly triturating together from 2 to 20 drops of a thick, alcoholic solution of thymol with 1 ounce of petrolatum or pure lard. This has been used as a local application in *burns*, *eczema*, *psoriasis*, *tinea*, *lichen*, and other *cutaneous affections*, and as a parasiticide. When much hyperemia is present, it must not be applied until this has been allayed. A very powerful antiseptic may be made thus: 1 part of thymol and 12 parts of chloral hydrate are triturated together, and then an equal quantity of camphor added, when the mixture assumes a liquid form; these proportions may be varied, if deemed necessary. Thymol enters into various antiseptic compounds used as local applications, for *catarrhal conditions*, etc.

Derivative.—THYMACETIN ($CH_3.CO.NH.C_6H_2[OC_2H_5].[CH_3].[C_3H_7]$). This substance is analogous to *phenacetin*, inasmuch as the phenol of the latter is substituted by thymol. It is a crystalline white powder, but little soluble in water. In doses of about 7 grains it is credited with hypnotic power. Analgesic properties are also possessed by it. Functional *nervous* and *neuralgic headaches*, and *mental and other nervous disorders* have been successfully treated with it. The dose ranges from 3 to 15 grains. It combines the properties of phenacetin with the antiseptic power of thymol.

Related Preparation.—LISTERINE. Listerine is an agreeable non-irritant and non-escharotic antiseptic preparation composed of the essential antiseptic constituents of thyme, eucalyptus, gaultheria, baptisia, and Mentha arvensis combined with refined benzo-boracic acid. Listerine is a transparent amber-colored fluid becoming cloudy or opaque below 60° F., but clearing again as the temperature reaches that figure. It has a fragrant, aromatic odor, a pungent taste, and in reaction is slightly acid. It mixes clear with water in all proportions. It is very extensively employed in the antiseptic treatment of operative and accidental *wounds*, and as a general cleansing agent in medical and dental practice. Its range of usefulness is practically unlimited in *surgery*, *gynæcology*, *urino-genital disorders*, and *dental practice*, being used as a deodorant and antiseptic wash. Internally it is administered in many *fermentative gastro-intestinal affections* requiring the stimulant and antiseptic properties of such a combination. It may be used freely, full strength or diluted, as a gargle mouth-wash, spray, injection or inhalation. The dose for internal use is 1 fluid drachm, 3 or 4 times a day, full strength or diluted with water. Listerine is a specialty of the Lambert Pharmacal Company of St. Louis.

THYMUS.—THYME.

The herb of *Thymus vulgaris*, Linne.

Nat. Ord.—Labiateæ.

COMMON NAME: *Thyme*.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 205.

Botanical Source.—*Thymus vulgaris*, Linné. Thyme is a small under shrub, with erect, suffruticose, numerous, branched stems, procumbent at base, and 6 to 10 inches in height. The leaves are oblong-ovate and lanceolate, numerous, and revolute at the sides. The flowers are bluish-purple, small, and borne in terminal, leafy, whorled spikes (W.).

Thymus Serpyllus, Linné, *Wild thyme*, or *Mother of thyme*, with a decumbent stem, flat, entire, elliptical punctate, obtuse, and petiolate leaves, ciliate at base, and purple, spotted, capitate flowers, has similar virtues to the above (W.). A variety of this species is the *Thymus citriodora*, Schreber (*Lemon thyme*), having a pleasant, lemon-melissa odor.

History, Description, and Chemical Composition.—These two plants are natives of Europe, introduced into this country, and extensively cultivated in gardens as culinary plants, especially the *T. vulgaris.* They blossom during the summer. The whole herb is used. It should be collected when in flower, and carefully dried. It has a strong, pungent, spicy, rather pleasant taste and odor, both of which are retained by careful drying. These properties are due to a reddish-brown volatile oil (*red oil of thyme*), procured by distilling the plant with water. Its specific gravity is similar to that of the oil of origanum, for which it is frequently substituted. The rectified oil is known as *white oil of thyme* (see *Oleum Thymi* and *Thymol*). The herb yields its virtues to alcohol, or to boiling water by infusion.

Fig. 246.

Thymus vulgaris.

Action, Medical Uses, and Dosage.—Thyme is tonic, carminative, emmenagogue, and antispasmodic. The cold infusion is useful in *dyspepsia*, with weak and irritable stomach, and as a stimulating tonic in convalescence from exhausting diseases. The warm infusion is beneficial in *hysteria*, *dysmenorrhœa*, *flatulence*, *colic*, *headache*, and to promote perspiration. Occasionally the leaves have been used externally, in fomentation. The oil is valuable as a local application to *neuralgic and rheumatic pains;* and, internally, to fulfil any of the indications for which the plant is used. Dose of the infusion, from 1 to 3 fluid ounces; of the oil, from 2 to 10 drops on sugar, or in emulsion. Thyme, scullcap, and rue, of each, 2 ounces; peony and black cohosh, of each, 1 ounce; macerated for 14 days in diluted alcohol, and then filtered, forms a good preparation for *nervous and spasmodic diseases of children.* It may be given in teaspoonful doses to a child 3 years old, repeating it 3 or 4 times a day, sweetening and diluting it, if desired. A strong infusion of the *Thymus Serpyllus*, slightly sweetened, and mixed with gum Arabic, is stated by M. Joset to be a valuable remedy for *whooping-cough*, *convulsive and catarrhal coughs*, and *stridulous sore throat*, the favorable result occurring at the end of a very few days. It may be taken *ad libitum.*

TILIA.—LINDEN FLOWERS.

The inflorescence of various species of *Tilia.*

Nat. Ord.—Tiliaceæ.

Common Names: *Linden*, *Basswood*, *Linn tree*, *White wood.*

Botanical Source and History.—The various linden species, bearing the above names, are all stately trees, from 40 to 100 feet in height, having a tough, fibrous bark, and a very soft, white, woody portion, yielding a very soft and light charcoal. The leaves are cordate, petiolate, alternate, serrate, and often oblique at base.

Tilia americana, Linné, has thick and smooth leaves (*T. glabra* of Ventenat), or has thinner leaves, softly pubescent underneath (*T. pubescens* of Aiton), and many-flowered cymes. The latter variety grows in the southern states, and the smooth leaved kind inhabits the United States and Canada.

Tilia heterophylla, Ventenat (*T. laxifolia*, Pursh; *T. alba*, Michaux) has bright-green leaves, smooth on upper surface, but silvery-white underneath. Pennsylvania, Ohio, and Mississippi valleys, and south.

Fig. 247.

Tilia americana.

Tilia ulmifolia, Scopoli (*T. microphylla*, Ventenat; *T. parvifolia*, Ehrhart).—Leaves pale-green beneath, and smooth, except in the vein-angles, where they are pubescent. About 7-flowered cymes. This and the next species constitute the *Tilia europæa* of Linne.

Tilia platyphyllos, Scopoli (*T. pauciflora*, Hayne; *T. grandiflora*, Ehrhart).—Cymes 3-flowered; leaves softly pubescent on under surface, and larger than those of preceding species.

Description.—Linden flowers are borne in cymes, which are axillary, and the peduncles are partly united to a greenish-yellow, linear, leaf-like bract. The petals are 5 and whitish, or approach yellow, are oblong, or lanceolate, generally notched. The calyx is 5-parted. The stamens are numerous and hypogynous, somewhat united at their bases so as to form 5 clusters (in the last two species), while in the others the stamens are connected at their bases with a petaloid scale opposite the petal. Ovary 5-celled; style 1; stigma 5-lobed; fruit a spherical, nut-like capsule, 1-celled, and 1 or 2-seeded. When fresh, the odor is agreeable; when dry, faint. The taste is mucilaginous and sweetish.

Chemical Composition.—Linden flowers contain sugar, tannin, mucilaginous matter, fatty substance, wax, yellow coloring matter, and a volatile oil, to which their fragrant odor is due. Upon the leaves of the European species, Boussingault detected a sweet exudate, having the composition of Mt. Sinai manna. A glucosid, *tiliacin*, has been isolated from the leaves of the linden, as well as from *Cirsium arvense* (P. A. Latschinow, *Amer. Jour. Pharm.*, 1890, p. 296).

Action, Medical Uses, and Dosage.—The European species (*Tilia europæa*) is a common domestic remedy in Europe for the relief of many *nervous and catarrhal disorders*. The leaves, flowers, and buds are employed, and their properties may be regarded as stimulant, lenitive, tonic, and nervine. The infusion is generally preferred, and may be given to allay irritation and restlessness, and to promote rest and sleep. The hot infusion is employed to check *diarrhœa* from cold, and in the various forms of *colds* and *catarrhal conditions*, while, either hot or cold, it may be used in *restlessness*, *nervous headaches*, *painful and difficult digestion*, and *mild hysteria*. The effects upon the nervous system are sometimes obtained by an enema, or bath, prepared from the flowers. The infusion is prepared from 30 or 40 grains of the flowers and 1 pint of water. It forms an agreeable vehicle for other medicines. A strong tincture may be prepared of the flowers (℥viij) and strong alcohol (Oj). Dose, 1 to 20 minims. The other species undoubtedly possess similar properties.

TINCTURÆ.—TINCTURES.

History.—Tinctures are obtained by subjecting certain medicinal substances to the action of alcohol, ether, etc., for the purpose of extracting their active principles. Some are prepared by simple maceration, or by percolation, at ordinary temperature, while others require certain degrees of temperature. When alcohol, or diluted alcohol, is employed as a solvent, the preparation is termed simply a *Tincture;* though sometimes a small portion of acid or alkali is added to facilitate its solvent action. Occasionally, spirit of ammonia or ether are employed as the solvents, furnishing *Ammoniated tinctures* and *Ethereal tinctures*. Tinctures are also prepared by means of gin, brandy, wine, etc., as the solvent. The former are termed *Spirituous tinctures*, and those with wine, *Vinous tinctures*, or *Medicated wines*. When the substance to be dissolved is insoluble in water, rectified spirit (alcohol of specific gravity 0.820) is preferred as the menstruum; when it is soluble in both alcohol and water, diluted or proof-spirit is preferred. The former is applicable to resins, volatile oils, oleoresins, camphor, etc., in which the addition of water would diminish or entirely prevent the solvent power of the alcohol. The latter is proper where the drugs contain gum-resins, tannates, extractive, saline matters, etc. A *Simple tincture* contains the active principles of a single substance; a *Compound tincture* contains the active principles of several articles. The term *Saturated tincture* is a misnomer, the supposition once being that the resultant products were saturated with the active constituents of the drugs. *Essential* or *Concentrated tinctures* are terms once given to *Alcoholic fluid extracts*. The term *Hydro-alcoholic tincture* is applied to those prepared with dilute, or even weaker, alcohol. *Alcoolatures*, or *Preserved juices*, are mixtures of expressed plant juices with alcohol. *Succi* of the *British Pharmacopœia*, are prepared with 3 parts, by measure, of the juice of the plant to 1 of spirit. The action of light, as well as of air, sometimes has a deleterious influence upon tinctures. In order to preserve them from evaporation, and thereby maintaining a uniform degree of strength, and also from decomposition or deterioration, all tinctures should be kept in bottles well closed with accurately-fitting stoppers, and in a cool place not exposed to sunlight.

Preparation.—I. By Maceration. The article or articles should be reduced to a powder of a proper degree of fineness, or, where this can not be done, should be sliced or bruised, and then be placed in alcohol or diluted alcohol, as may be required, and allowed to macerate, in a close glass bottle, usually for 14 days, with occasional agitation, after which they are expressed, if necessary, and the tincture filtered through paper. Tinctures of drugs rich in oleoresins, the majority of gum-resins, resins, and balsams, are best prepared by this method.

II. By Percolation.—The article or articles should be reduced to a powder of a proper degree of fineness, or, where this can not be done, should be sliced, bruised, or rasped, etc. They are then to be first covered with the menstruum with which the tincture is to be made, and allowed to stand until they are moistened throughout, which step generally requires from 24 to 36 hours. The whole is then transferred to a percolator, and the menstruum gradually poured on, and allowed to percolate or filter until the requisite amount has passed (see section on *Percolation*, under *Fluid Extracts*). The preparation of tinctures by percolation, is, with a few exceptions, the method now generally pursued by all pharmacists of this country. The *National Formulary* gives the following directions for preparing unofficial tinctures:

Tincturæ (N. F.), *Tinctures.*—General Process. "All tinctures, for which no working formula is provided by the *United States Pharmacopœia*, the *National Formulary*, or some other work of authority, and the strength of which is not otherwise specified by the prescriber, should be prepared in the following proportions: *The drug*, properly comminuted, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; *the menstruum*, enough to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. *Note.*—The choice of the menstruum will depend upon the nature of the drug, and, in some cases, upon the uses to which the tincture is to be applied. In general, it may be stated that, if the useful constituents are soluble in alcohol, and but slightly or not at all soluble in water, strong alcohol should be used as a menstruum. Whenever it is possible, and consistent with the intended use of the preparation, the alcoholic strength of the menstruum should be made to approach that of diluted alcohol, the object being not only to exhaust the drug of all its useful constituents, but also to retain them in solution. If the drug is fibrous, and can be dried or powdered without injury or loss of useful constituents, percolation is preferable. If the drug is resinous, and partly or almost wholly soluble in the menstruum, or if it is fibrous and can not well be powdered without undergoing injury, maceration should be resorted to. In the latter case, the drug, comminuted as much as possible, should be kept in contact with the full quantity of the menstruum for two weeks, or until the soluble matters are extracted, the liquid portion strained off, and the remainder of the tincture contained in the residue on the strainer carefully displaced by washing with a fresh portion of the menstruum until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained for every one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.] of drug used in the operation. The preparation of tinctures from fluid extracts, instead of from the original drugs themselves, is not recommended. In some special cases, however, when the crude drug is not accessible, or when a tincture, which is not at hand and otherwise unobtainable, is required for immediate use, it may be prepared, extemporaneously, from the corresponding fluid extract, provided that the latter is known to fully represent the active constituents of the drug which are intended to be contained in the tincture"—(*Nat. Form.*). The following general directions are given by the *National Formulary* for the preparation of *Ethereal tinctures:*

Tincturæ Æthereæ (N. F.), *Ethereal tinctures.*—General Formula. "*The drug*, properly comminuted, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; alcohol, ether (*U. S. P.*), of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Percolate the drug in the usual manner, but with proper precautions to avoid loss of menstruum by evaporation, with a mixture of one (1) volume of ether, and two (2) volumes of alcohol, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of percolate are obtained. *Note.*—This formula is to be used, when ethereal tinctures of belladonna, castor, digitalis, lobelia, valerian, or of other drugs, are to be prepared"—(*Nat. Form.*).

For extensive systematic work on the standardization of tinctures, see Messrs. Farr and Wright, *Pharm. Jour. Trans.*, Vol. XXIV, 1893–94, pp. 177–180; and *Proc. Amer. Pharm. Assoc.*, 1891 to 1895).

TINCTURA ACONITI (U. S. P.)—TINCTURE OF ACONITE.

SYNONYMS: *Tinctura aconiti radicis* (*U. S. P.*, 1870), *Tincture of aconite root.*

Preparation.—"Aconite, in No. 60 powder, three hundred and fifty grammes (350 Gm. [12 ozs. av., 151 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix alcohol and water in the proportion of seven hundred cubic centimeters (700 Cc.) [23 fl℥, 321 ♏] of alcohol to three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water. Having moistened the powder with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of menstruum, macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*).

Special care should be observed in the selection of aconite root, and it should be thoroughly powdered and the percolation carefully conducted. It yields a yellow-brown tincture, which, when added to water, renders the latter milky through precipitation of aconite resin.

Action, Medical Uses, and Dosage.—(See *Aconitum.*) This is a much stronger preparation than the tincture of the leaves, and care should be employed not to use the two tinctures indiscriminately. It may be used for the same purpose, but in smaller doses, commencing with a fraction of a drop, in a teaspoonful of water, and gradually increasing it to 5 drops.

Related Tinctures.—TINCTURA ACONITI, Fleming (N. F.), *Fleming's tincture of aconite.* (1) "Aconite (root), in fine powder, seven hundred grammes (700 Gm.) [1 lb. av., 8 ozs., 303 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the aconite with enough alcohol to render it distinctly damp and to maintain it so after 24 hours maceration in a well-covered vessel. Then pack it tightly in a percolator, and percolate it slowly, in the usual manner, with alcohol, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained. *Note.*—This preparation is still prescribed by many physicians. It is recommended that their attention be directed to the official fluid extract and tincture of aconite, so that the above preparation may be gradually abandoned. When this preparation is required for immediate use, and it is not otherwise available, it may be prepared in the following manner (see note to F. 396): (2) Fluid extract of aconite (*U. S. P.*), seventy cubic centimeters (70 Cc.) [2 fl℥, 176 ♏]; alcohol, thirty cubic centimeters (30 Cc.) [1 fl℥, 7 ♏]. Mix them"—(*Nat. Form.*). Dose, ¼ to 1 drop.

TINCTURA ACONITI FOLIORUM, *Tincture of aconite leaves.*—Take of the recently dried leaves of aconite, finely powdered, 2 ounces; diluted alcohol, 1 pint, or a sufficient quantity. Form into a tincture by maceration or percolation, as explained under *Tincturæ*, and make 1 pint of tincture. Tincture of aconite leaves possesses all the properties of Aconitum napellus, and may be used whenever the drug is indicated, in doses of from 1 to 15 drops. It should not be confounded with the tincture of the root, which is a much more powerful preparation and is the preparation now generally employed.

TINCTURA ALOES (U. S. P.)—TINCTURE OF ALOES.

Preparation.—"Purified aloes, in moderately fine powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; liquorice root, in No. 40 powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the powders, and, having moistened the mixture with eighty cubic centimeters (80 Cc.) [2 fl℥, 339 ♏] of diluted alcohol, macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour diluted alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This is a cathartic and tonic, but is seldom used on account of its disagreeable taste, aloes being preferred in the pill form. As a cathartic, the dose is from ½ to 1½ fluid ounces. As a local application, on lint, it has been found useful in *old sores, ulcers, wounds*, etc.

TINCTURA ALOES ET MYRRHÆ (U. S. P.)—TINCTURE OF ALOES AND MYRRH.

SYNONYMS: *Elixir proprietatis paracelsi, Tinctura aloes composita.*

Preparation.—"Purified aloes, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; myrrh, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; liquorice root, in No. 40 powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix alcohol and water in the proportion of seven hundred add fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol to two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water. Having mixed the aloes, myrrh, and liquorice root, reduce them to a moderately coarse (No. 40) powder. Moisten the powder with sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏] of the menstruum, and macerate for 24 hours; then pack it moderately in a cylindrical percolator, and gradually pour menstruum upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This is a deep red-brown tincture, precipitating when added to water. Older formulas contained saffron.

Action, Medical Uses, and Dosage.—This tincture is emmenagogue and cathartic; it has been beneficially employed in *anemic* and other *abnormal conditions of the female system*, connected with *derangement of the menstrual secretion*, and with *constipation*. It will likewise be found useful as a stimulating laxative, in cold, sluggish states of the system, unconnected with any menstrual difficulty. The dose is 1 or 2 fluid drachms.

TINCTURA ARALIÆ SPINOSÆ.—TINCTURE OF ARALIA SPINOSA.

SYNONYM: *Tincture of prickly elder.*

Preparation.—Take of prickly elder bark, in fine powder, 3 ounces; diluted alcohol, 1 pint, or a sufficient quantity. Form into a tincture by maceration or percolation, and make 1 pint of tincture.

Action, Medical Uses, and Dosage.—This tincture is tonic, stimulant, and alterative, and is an efficient remedy in *chronic rheumatism, pulmonary affections, colic, flatulence, cholera morbus*, and *Asiatic cholera*. It is useful in *syphilis*, in combination with the tincture of turkey-corn. During the prevalence of *cholera*, in 1849–50–51, it was added to emetic and cathartic medicines, for the purpose of preventing any tendency toward excessive discharges from the bowels. It also serves as a local stimulating application, when properly diluted with strong infusion of golden seal, in cases of *chronic ophthalmia*. The dose is from 10 to 60 drops, 3 or 4 times a day (J. King).

TINCTURA ARNICÆ FLORUM (U. S. P.)—TINCTURE OF ARNICA FLOWERS.

SYNONYM: *Tinctura arnicæ* (*U. S. P.*, 1870), *Tincture of leopard's bane.*

Preparation.—"Arnica flowers, in No. 20 powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Pack the powder firmly in a cylindrical percolator, and gradually pour diluted alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). A yellow-brown preparation, striking opalescent with water.

Action, Medical Uses, and Dosage.—This tincture is principally used as a local application to *sprains, bruises, wounds*, etc., but it may also be used internally in all cases where arnica would be applicable. The dose is from 1 to 30 drops.

TINCTURA ARNICÆ RADICIS (U. S. P.)—TINCTURE OF ARNICA ROOT.

Preparation.—"Arnica root, in No. 40 powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix alcohol and water in the proportion of six hundred and fifty cubic centimeters (650 Cc.) [21 fl℥, 470 ♏] of alcohol to three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of water. Moisten the powder with one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏] of the menstruum, and macerate for 24 hours; then pack it moderately in a cylindrical percolator, and gradually pour menstruum upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—(See *Arnica.*) Dose, 1 to 30 minims.

TINCTURA ASAFŒTIDÆ (U. S. P.)—TINCTURE OF ASAFETIDA.

Preparation.—"Asafetida, bruised, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the asafetida with eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of alcohol, and macerate for 7 days, in a closed vessel; then filter through paper, adding through the filter, enough alcohol to make the tincture measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*). This tincture has a yellowish or brownish-red color. Added to water, the resin separates, and the mixture becomes whitish.

Action, Medical Uses, and Dosage.—This tincture has all the efficiency of asafetida. The dose is from 30 to 60 drops.

Related Tincture.—TINCTURA ASAFŒTIDÆ COMPOSITA, *Compound tincture of asafetida.* Take of asafetida, lupulin, stramonium seeds, bruised, valerian root, in fine powder, each, 1 ounce; alcohol, 3 pints. Macerate for 14 days; express and filter. This tincture was formerly used principally in *epilepsy*, though it will be found useful in *hysteria*, *chorea*, and other *derangements of the nervous system*. The dose is a fluid drachm, repeated every 2 or 3 hours, in severe cases; and in ordinary cases, 3 times a day, to be taken in water, tea, or wine (J. King).

TINCTURA AURANTII AMARI (U. S. P.)—TINCTURE OF BITTER ORANGE PEEL.

SYNONYMS: *Tinctura aurantii*, *Tincture of orange peel.*

Preparation.—"Bitter orange peel, in No. 30 powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix alcohol and water in the proportion of six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of alcohol to four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of water. Moisten the powder with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of the menstruum, and macerate for 24 hours; then pack it moderately in a cylindrical percolator, and gradually pour menstruum upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*).

Uses and Dosage.—Used principally as a flavoring agent. Dose, 1 to 2 fluid drachms.

TINCTURA AURANTII DULCIS (U. S. P.)—TINCTURE OF SWEET ORANGE PEEL.

Preparation.—"Sweet orange peel, taken from the fresh fruit, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the orange peel (which should be as free as possible from the inner, white layer), previously cut into small pieces, with eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏]

of alcohol. and macerate for 24 hours; then pack it moderately in a conical percolator, and gradually pour alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This tincture has a golden color and fine aroma. The fresh peel may be grated, avoiding the white portion, or it may be carefully peeled off with a sharp knife.

Uses.—Employed exclusively as a flavoring agent.

TINCTURA AURANTII RECENTIS.—Tincture of Fresh Orange Peel.

Preparation.—"Take of bitter orange, rectified spirit, of each, a sufficiency. Carefully cut from the orange the colored part of the rind in thin slices, and macerate 6 ounces of this in 18 fluid ounces of the spirit for a week, with frequent agitation. Then pour off the liquid, press the dregs, mix the liquid products, and filter. Finally, if necessary, add spirit to make 1 pint"—(*Br. Pharm.*, 1885). The *British Pharmacopœia* (1898) directs for Tinctura Aurantii (*Tincture of orange*), to Take of "fresh bitter orange peel, cut small, 5 ounces (Imp.), or 250 grammes (Metric); alcohol (90 per cent), 1 pint, or 1000 cubic centimeters. Prepare by the maceration process"—(*Br. Pharm.*, 1898).

Uses and Dosage.—This tincture, like the other tinctures of orange, is used as a flavoring ingredient. It is stronger than that prepared from the dried peel. Dose, 1 to 2 fluid drachms.

TINCTURA BELLADONNÆ FOLIORUM (U. S. P.)—Tincture of Belladonna Leaves.

Synonyms: *Tincture of belladonna, Tinctura belladonnæ* (*U. S. P.*, 1880).

Preparation—"Belladonna leaves, in No. 60 powder, one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of diluted alcohol, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour diluted alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This tincture possesses all the virtues of belladonna, when prepared from the leaves, recently dried. The dose is from 5 to 10 drops. The imported leaves are of such uncertain strength that a tincture made from the alcoholic extract would be more trustworthy. Its uses are those of belladonna.

TINCTURA BENZOINI (U. S. P.)—Tincture of Benzoin.

Preparation.—"Benzoin, in moderately coarse powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the powder with eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of alcohol, and macerate for 7 days. in a closed vessel; then filter through paper, adding, through the filter, enough alcohol to make the tincture measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*). This tincture is of a brown-red color, and is acid in reaction. With water it produces an opalescent mixture. The cosmetic preparation, known as Lac Virginis, or *Virgin's milk*, is prepared by mixing various amounts of rose water (from 20 to 100 parts) with 1 part of tincture of benzoin.

Action, Medical Uses, and Dosage.—This agent was formerly extensively used in catarrhal affections of the breathing and urinary organs and digestive tube. By atomization, or by inhalation with steam, it sometimes gives relief in *acute and chronic laryngitis and bronchitis*, particularly if there be fetid expectoration. Tincture of benzoin is stimulant and protecting in the early stage of *coryza*. It has been applied with advantage to *irritable ulcers, bed-sores, sore nipples*, and, with glycerin, to *chapped hands and face*, for *freckles*, and other *cutaneous eruptions, excoriations*, and *abrasions*, and irritable condition of the parts about the anus; also to allay the itching of *eczema, urticaria*, and *chilblains*.

TINCTURA BENZOINI COMPOSITA (U. S. P.)—COMPOUND TINCTURE OF BENZOIN.

SYNONYMS: *Tinctura balsamica, Elixir traumaticum, Balsamum commendatoris.*

Preparation.—"Benzoin, in coarse powder, one hundred and twenty grammes (120 Gm.) [4 ozs. av., 102 grs.]; purified aloes, in coarse powder, twenty grammes (20 Gm.) [309 grs.]; storax, eighty grammes (80 Gm.) [2 ozs. av., 360 grs.]; balsam of tolu, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the benzoin, aloes, storax, and balsam of tolu with eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of alcohol, and digest the mixture, at a temperature not exceeding 65° C. (149° F.), for 2 hours in a closed vessel; then filter through paper, adding, through the filter, enough alcohol to make the tincture, when cold, measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*). Compound tincture of benzoin has a deep brownish-red color, and an acid reaction. When added to water, it produces an opaque mixture.

Action, Medical Uses, and Dosage.—A preparation similar to this has been known under various names, as *Balsamum traumaticum, Jesuits' drops, Wound balsam, Commander's balsam, Friar's balsam*, etc. It is used as an expectorant in *old coughs* and *catarrhs.* Compound tincture of benzoin is advised by inhalation, with steam, for the relief of *acute and chronic laryngitis*, and in *chronic bronchial irritation*, with free and fetid secretion. It was formerly used as a stimulating application to *obstinate ulcers.* Internally, the dose is from ½ to 1 or 2 fluid drachms. *Turlington's balsam*, a well-known remedy, was composed of benzoin, 6 ounces; liquid storax, 2 ounces; socotrine aloes, ½ ounce; Peruvian balsam, 1 ounce; myrrh, ½ ounce; angelica root, 2 drachms; balsam of tolu, 2 ounces; extract of liquorice, 2 ounces; alcohol, 4 pints. Mix, digest for 10 days, and strain (*Jour. of Phila. Col. of Pharm.*, Vol. V, p. 28). It is an improper application to fresh wounds, though it is often applied to *excoriations* and *abrasions*, and to *sore nipples*, as a protective. It sometimes relieves the itching of *chilblains, eczema*, and *urticaria*, and, combined with glycerin, is a useful application for *chapped hands and face.* This balsam is designed to represent the once popular preparation known by the above-given names, and as *Swedish, Persian, Wade's, St. Victor's*, and *Vervain's balsams.*

TINCTURA BRYONIÆ (U. S. P.)—TINCTURE OF BRYONIA.

Preparation.—"Bryonia, recently dried, and in No. 40 powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of alcohol, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This tincture should preferably be prepared with diluted alcohol, as the bitter principle is soluble in water. The tincture has a bitterish taste, and a brownish-yellow color.

Action, Medical Uses, and Dosage.—(See *Bryonia.*) The dose of this preparation, for its specific uses, should be small—from a fraction of a drop to 2 drops. By some it is employed as a purgative, in doses of from 20 to 90 drops. It is never used in the latter manner in Eclectic practice.

TINCTURA BUCHU.—TINCTURE OF BUCHU.

Preparation.—"Take of buchu leaves, in No. 20 powder, 2½ ounces (av.); proof-spirit, 1 pint (Imp.)"—(*Br. Pharm.*, 1885). Prepare as directed under *Tinctura Sennæ*). This produces a green-brown tincture, possessing the sensible properties of buchu. The preparation of the *British Pharmacopœia* (1898) is similar, except that 4 ounces of the leaves are directed, and alcohol (60 per cent), a sufficient quantity to make 1 pint of tincture.

Action, Medical Uses, and Dosage.—(See *Buchu.*) This preparation is less eligible than the infusion. Dose, 1 to 3 fluid drachms, well diluted with water.

TINCTURA CACTI.—TINCTURE OF CACTUS.

Preparation.—Take of the fresh flowers and stems of Cactus grandiflorus, cut into small pieces, 4 troy ounces; alcohol (95 per cent), 1 pint. Mix together, and macerate for 14 days, frequently agitating; then filter with expression.

Action, Medical Uses, and Dosage.—Used in the diseases named under *Cactus.* The dose is from 1 to 10 drops, 3 times a day, in water; or, 2 fluid drachms may be added to 3 fluid ounces of water, of which the dose is a teaspoonful, 3 or 4 times a day.

TINCTURA CALENDULÆ (U. S. P.)—TINCTURE OF CALENDULA.

SYNONYM: *Tincture of marigold.*

Preparation.—"Calendula, in No. 20 powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of alcohol, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). Freshly dried and powdered flowering calendula must be used in preparing this tincture. A weaker alcohol allows precipitation to occur. A non-alcoholic preparation is made by means of glycerin instead of alcohol.

Action and Medical Uses.—(See *Calendula.*) This tincture is used locally to *cuts*, *wounds*, etc, after the manner of employing tincture of arnica.

TINCTURA CALUMBÆ (U. S. P.)—TINCTURE OF CALUMBA.

SYNONYMS: *Tinctura colombæ*, *Tincture of colombo.*

Preparation.—"Calumba, in No. 20 powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix alcohol and water in the proportion of six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of alcohol to four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of water. Having moistened the powder with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of the menstruum, macerate for 24 hours; then pack it in a cylindrical percolator, and gradually pour menstruum upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). If diluted alcohol be employed, a tincture is obtained which deposits a greater amount of precipitate than when strong alcohol is used. This tincture has a brownish-yellow color.

Action, Medical Uses, and Dosage.—This tincture forms a bitter tonic; it may be added to liquid tonic preparations, whenever it is required, to slightly augment their tonic action. The dose is from 1 to 4 fluid drachms.

TINCTURA CANNABIS INDICÆ (U. S. P.)—TINCTURE OF INDIAN CANNABIS.

SYNONYMS: *Tincture of India hemp*, *Tincture of Indian hemp*, *Tincture of hemp*, *Tinctura cannabis* (*U. S. P.*, 1870).

Preparation.—"Indian cannabis, in No. 40 powder, one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏] of alcohol, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This forms a powerful sedative narcotic, which has been used in *neuralgia*, *cholera*, and other symptoms where the India hemp has been recommended, with much success. The dose is 5 drops, gradually increased to 20 or 40, according to its influence. The extract and fluid extract are, however, more frequently employed than the simple tincture.

TINCTURA CANTHARIDIS (U. S. P.)—TINCTURE OF CANTHARIDES.

Synonym: *Tincture of Spanish flies.*

Preparation.—"Cantharides, in No. 60 powder, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with thirty cubic centimeters (30 Cc.) [1 fl℥, 7 ♏] of alcohol, and pack it firmly in a cylindrical percolator; then gradually pour alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This tincture has a green-yellow color. When prepared with diluted alcohol, the color is brownish-yellow, and the tincture deposits a precipitate. It possesses the characteristic odor of cantharides and a pungent taste.

Action, Medical Uses, and Dosage.—This is the best form for the administration of cantharides, in *chronic gonorrhœa*, *gleet*, *amenorrhœa*, and some *urinary derangements*. Externally, it is sometimes used as a rubefacient, but care should be taken to avoid its vesicating action. The dose is from 1 to 20 drops, every 3 or 4 hours.

TINCTURA CAPSICI (U. S. P.)—TINCTURE OF CAPSICUM.

Synonym: *Tincture of cayenne pepper.*

Preparation.—"Capsicum, in No. 30 powder, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix alcohol and water in the proportion of nine hundred and fifty cubic centimeters (950 Cc.) [32 fl℥, 59 ♏] of alcohol to fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏] of water. Having moistened the powder with forty cubic centimeters (40 Cc.) [1 fl℥, 169 ♏] of the menstruum, pack it firmly in a cylindrical percolator; then gradually pour menstruum upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Tincture of cayenne pepper is a useful and permanent stimulant, and may be administered in *depressed states of the system*, with torpor of the stomach, as with *inebriates*, and in *typhoid stages of febrile diseases;* also to prevent the nausea which oil of turpentine is apt to occasion. It is also useful in *gangrenous sore throat*, and to remove *relaxation of the uvula*, applied to the part on a camel's-hair pencil, or as a gargle. For this purpose it may be diluted, if required, with mucilage of elm bark. It is also an excellent application to the eye in cases of *chronic ophthalmia*. It is frequently applied locally, with advantage, in cases of *swellings*, *rheumatic pains*, *partial paralysis*, *atrophied muscles*, etc. The dose is from 10 to 60 drops in water, 3, 4, or 5 times a day, according to the urgency of the case (see *Capsicum*).

TINCTURA CARDAMOMI (U. S. P.)—TINCTURE OF CARDAMOM.

Preparation.—"Cardamom, in No. 30 powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of diluted alcohol, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour diluted alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This tincture has the characteristic taste and odor of cardamom, and is of a brownish-yellow color.

Action, Medical Uses, and Dosage.—This tincture is aromatic and carminative, and is useful in *mild colic*, *flatulency*, *nausea*, *gastric debility*, etc. It is also advantageously added as a pleasant aromatic to several mixtures, tinctures, infusions, etc. The dose is 1 or 2 fluid drachms.

TINCTURA CARDAMOMI COMPOSITA (U. S. P.)—COMPOUND TINCTURE OF CARDAMOM.

Preparation.—"Cardamom, twenty grammes (20 Gm.) [309 grs.]; cassia cinnamon, twenty grammes (20 Gm.) [309 grs.]; caraway, ten grammes (10 Gm.) [154 grs.]; cochineal, five grammes (5 Gm.) [77 grs.]; glycerin, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the cardamom, cinnamon, caraway, and cochineal, and reduce them to a moderately coarse (No. 40) powder. Having moistened the powder with twenty-five cubic centimeters (25 Cc.) [406 ♏] of diluted alcohol, pack it firmly in a cylindrical percolator, and gradually pour diluted alcohol upon it, until nine hundred and fifty cubic centimeters (950 Cc.) [32 fl℥, 59 ♏] of tincture are obtained; then add the glycerin, and mix them"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This is a very pleasant aromatic tincture, and is used for the same purpose as the tincture of cardamom, and in the same doses.

TINCTURA CASCARILLÆ.—TINCTURE OF CASCARILLA.

Preparation.—"Take of cascarilla bark, in No. 40 powder, 2½ ounces (av.); proof-spirit, 1 pint (Imp.)"—(*Br. Pharm.*, 1885). Prepare as directed for *Tinctura Sennæ.* This tincture is red-brown in color. The *British Pharmacopœia* (1898) directs the employment of 4 ounces of cascarilla bark, and of alcohol (70 per cent), a sufficient quantity to make 1 pint of tincture.

Action, Medical Uses, and Dosage.—(See *Cascarilla.*) Dose, 20 to 120 drops.

TINCTURA CASTOREI.—TINCTURE OF CASTOR.

Preparation.—Take of castor, 10 drachms; alcohol, 1 pint. Form into a tincture by maceration, as explained under *Tincturæ*, and make 1 pint of tincture. This tincture has a dark red-brown color, and, with water, becomes opalescent. If water be in large quantity, a milky turbidity follows, and a reddish-brown, resin-like matter is deposited. If allowed to stand, it becomes somewhat transparent and nearly colorless.

Action, Medical Uses, and Dosage.—This tincture should always be prepared from the Russian castor, if possible. Its properties are the same as the castor in substance (see *Castor*), and may be given in doses of from 20 minims to 2 fluid drachms.

Related Tincture.—TINCTURA CASTOREI AMMONIATA, *Ammoniated tincture of castor.* Take of castor, 2½ ounces; asafetida, in small fragments, 10 drachms; spirit of ammonia, 2 pints (Imp.). Digest for 7 days in a well-closed vessel, strain, and strongly express the residuum, and filter (*Ed.*). This is antispasmodic and stimulant; useful in various *affections of the nervous system, hysteria, spasmodic affections of the stomach*, etc. Inflammation contraindicates its use. It may be given in doses of ½ to 2 fluid drachms.

TINCTURA CATECHU COMPOSITA (U. S. P.)—COMPOUND TINCTURE OF CATECHU.

Preparation.—"Catechu, in No. 40 powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; cassia cinnamon, in No. 40 powder, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the powders, and, without moistening, pack the mixture firmly in a cylindrical percolator; then gradually pour diluted alcohol upon it, until one thousand cubic centimeters (1000 Cc.)

[33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This tincture may also be made by maceration. It has a dark brown-red color, and is acid to test-paper. On long keeping it is apt to gelatinize, and thus become inert.

Action, Medical Uses, and Dosage.—This forms an astringent tincture, useful in *chronic diarrhœa*, *chronic dysentery*, etc. The dose is from ½ to 3 fluid drachms. It may be administered in some mucilage, sweetened water, or port wine.

TINCTURA CAULOPHYLLI COMPOSITA.—COMPOUND TINCTURE OF CAULOPHYLLUM.

SYNONYM: *Compound tincture of blue cohosh.*

Preparation.—Take of blue cohosh root, in fine powder, 2 ounces; ergot, water-pepper, in fine powder, each, 1 ounce; oil of savin, ½ fluid ounce; alcohol, 1½ pints, or a sufficient quantity. Add the powders to the alcohol, and form into tincture by maceration or percolation; adding, lastly, the oil of savin, the whole making 1½ pints of tincture.

Action, Medical Uses, and Dosage.—This forms an emmenagogue tincture, very useful in *amenorrhœa*, *dysmenorrhœa*, and other *uterine affections*. The dose is from 15 drops to 1 fluid drachm, 2 or 3 times a day.

TINCTURA CHIRATÆ (U. S. P.)—TINCTURE OF CHIRATA.

SYNONYM: *Tincture of chiretta.*

Preparation.—"Chirata, in No. 40 powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix alcohol and water in the proportion of six hundred and fifty cubic centimeters (650 Cc.) [21 fl℥, 470 ♏] of alcohol to three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of water. Having moistened the powder with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of the menstruum, macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—(See *Chirata.*) Dose, ½ to 2 fluid drachms.

TINCTURA CHLOROFORMI COMPOSITA.—COMPOUND TINCTURE OF CHLOROFORM.

Preparation.—"Take of chloroform, 2 fluid ounces; rectified spirit, 8 fluid ounces; compound tincture of cardamom, 10 fluid ounces. Mix."—(*British Pharmacopœia*, 1885).

Action, Medical Uses, and Dosage.—(See *Chloroformum.*) Dose, 10 to 60 drops, well diluted with water.

TINCTURA CHLOROFORMI ET MORPHINÆ.—TINCTURE OF CHLOROFORM AND MORPHINE.

Preparation.—"Take of chloroform, 1 fluid ounce; ether, 2 fluid drachms; rectified spirit, 1 fluid ounce; hydrochlorate of morphine, 8 grains; diluted hydrocyanic acid, ½ fluid ounce; oil of peppermint, 4 minims; liquid extract of liquorice, 1 fluid ounce; treacle, 1 fluid ounce; syrup, a sufficiency. Diffuse the hydrochlorate of morphine and oil of peppermint in the spirit, and add the chloroform and ether. Mix the liquid extract of liquorice and treacle with 3 fluid ounces of syrup, add this to the previously formed solution, mix them thoroughly, add the hydrocyanic acid, and increase the volume to 8 fluid ounces by further addition of syrup"—(*Br. Pharm.*, 1885).

This preparation contains in a 10-minim dose, chloroform, 1¼ minims; ether, ¼ minim; rectified spirit, 1¼ minims, morphine hydrochlorate, 1/48 grain; diluted hydrocyanic acid, 5/8 minim; oil of peppermint, 1/80 minim; and liquid extract of liquorice, 1¼ minims (also see *Related Compounds*, p. 1952).

Action, Medical Uses, and Dosage.—This agent is an anodyne, and may be used in various forms of *colic*, in *cough*, and *delirium tremens*. Dose, 10 to 60 minims.

Related Preparations.—Mistura Chloroformi et Opii (N. F.), *Mixture of chloroform and opium, Chloroform anodyne.* "Purified chloroform, 2 fluid ounces; oil of peppermint, 16 minims; tincture of Indian cannabis, 2 fluid ounces; tincture of quillaja (N. F.), 2 fluid ounces; fluid extract of belladonna, 128 minims; deodorized tincture of opium, 2¾ fluid ounces; tincture of capsicum, 1 fluid ounce; purified extract of glycyrrhiza, 240 grains; water, ½ fluid ounce; syrup, enough to make 16 fluid ounces. Triturate the purified extract of glycyrrhiza with the water and 1 fluid ounce of the syrup until it is dissolved. Mix the fluid extract of belladonna, deodorized tincture of opium and tincture of capsicum, and add them to the solution first prepared. Then mix the chloroform, oil of peppermint, tincture of Indian cannabis, and tincture of quillaja, and add them to the mixture. Finally, add enough syrup to make 16 fluid ounces, and mix the whole thoroughly together. This mixture should be shaken, whenever any of it is to be dispensed. Each fluid drachm represents 7½ minims of chloroform, 7½ minims of tincture of Indian cannabis, 3¾ minims of tincture of capsicum, 1 minim of fluid extract of belladonna, and about 1 grain of opium. *Note.*—This preparation is intended to fulfil the same purposes as the *Tinctura Chloroformi et Morphinæ* of the *British Pharmacopœia*, though the composition of the latter differs materially from that of the mixture above given"—(*Nat. Form.*).

Tinctura Chloroformi et Morphinæ Composita, *Compound tincture of chloroform and morphine.*—Take of "chloroform, 1½ fluid ounces (Imp.), or 75 cubic centimeters (Metric); morphine hydrochloride, 87½ grains, or 10 grammes; diluted hydrocyanic acid, 1 fluid ounce, or 50 cubic centimeters; tincture of capsicum, ½ fluid ounce, or 25 cubic centimeters; tincture of Indian hemp, 2 fluid ounces, or 100 cubic centimeters; oil of peppermint, 14 fluid ounces, or 1.5 cubic centimeters; glycerin, 5 fluid ounces, or 250 cubic centimeters; alcohol (90 per cent), a sufficient quantity. Mix the chloroform, tincture of capsicum, tincture of Indian hemp, oil of peppermint, and glycerin, with 9 fluid ounces of the alcohol, and dissolve the morphine hydrochloride in the mixture; add the diluted hydrocyanic acid; then mix with enough of the alcohol to form 1 pint (or 1000 cubic centimeters) of the compound tincture. Dose, 5 to 15 minims. This preparation contains in a 10-minim dose, ¾ minim of chloroform, ½ minim of diluted hydrocyanic acid, and $\frac{1}{11}$ grain of morphine hydrochloride; that is more than 4 times the proportion of morphine hydrochloride present in the corresponding preparation of the *British Pharmacopœia* of 1885"—(*Br. Pharm.*, 1898). (See also *Mistura Chloroformi et Cannabis Indicæ Composita* (N. F.), which is also called *Chloroform Anodyne.*)

TINCTURA CIMICIFUGÆ (U. S. P.)—TINCTURE OF CIMICIFUGA.

Synonyms: *Tincture of black snakeroot*, *Tincture of black cohosh*, *Tincture of actæa.*

Preparation.—"Cimicifuga, in No. 60 powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏] of alcohol, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This tincture may be used wherever black cohosh is indicated, as in *pulmonary*, *rheumatic*, *scrofulous*, *uterine*, *ophthalmic and neuralgic affections* (see *Cimicifuga*). The dose is 10 drops, gradually increased to 1 fluid drachm; if it affects the head or nervous system, the dose may be diminished (J. King).

TINCTURA CIMICIFUGÆ COMPOSITA.—COMPOUND TINCTURE OF CIMICIFUGA.

Synonym: *Compound tincture of black cohosh.*

Preparation.—Take of the tincture of black cohosh, 4 fluid ounces; tincture of bloodroot, 2 fluid ounces; tincture of poke-root, 1 fluid ounce. Mix together

Action, Medical Uses, and Dosage.—This is a valuable alterative and expectorant, and appears to exert a specific influence on the lungs, rendering the breathing easy, diminishing the frequency of the pulse, and the general excitability of the system. It is used in *pulmonary affections*, *hemoptysis*, *hepatic diseases*, *dyspepsia*, *laryngitis*, etc. The dose is from 10 drops to 1 fluid drachm, every 2 or 3 hours, according to the indications. A very slight degree of nausea produced and maintained by it, will be found to result in the most decided benefit (J. King).

TINCTURA CINCHONÆ (U. S. P.)—TINCTURE OF CINCHONA.

Synonyms: *Tincture of Peruvian bark, Tincture of yellow cinchona.*

Preparation.—"Cinchona, in No. 60 powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs]; glycerin, seventy-five cubic centimeters (75 Cc) [2 fl℥, 257 ♏]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the glycerin with six hundred and seventy-five cubic centimeters (675 Cc.) [22 fl℥, 396 ♏] of alcohol and two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water. Having moistened the powder with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of the menstruum, macerate for 24 hours; then pack it firmly in a cylindrical glass percolator, and pour on the remainder of the menstruum. When the liquid has disappeared from the surface, gradually pour on more of a mixture of alcohol and water, made in the same proportions as before, and continue the percolation, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). If too weak in alcohol, this tincture precipitates cinchona-red, together with cinchona alkaloids, in combination with kinic acid. The change is, in a measure, prevented, or at least retarded, by the addition of glycerin. This addition was suggested by Mr. A. B. Taylor (1865), who, upon experimentation, showed that the best menstruum for this tincture was one composed of 2 parts of alcohol and 1 part, each, of water and glycerin. The tincture has a reddish-brown color.

Action, Medical Uses, and Dosage.—This tincture is commonly used as an adjuvant to other preparations of cinchona or of quinine. It may be given in doses varying from 1 fluid drachm to ½ fluid ounce. However, it is seldom used alone.

Related Tincture.—Tinctura Cinchonæ Detannata (N. F.), *Detannated tincture of cinchona.* "Fluid extract of cinchona (*U.S.P.*), one hundred and eighty-five cubic centimeters (185 Cc.) [6 fl℥, 123 ♏]; alcohol, five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏]; solution of tersulphate of iron (*U. S. P.*), three hundred and seventy-five cubic centimeters (375 Cc.) [12 fl℥, 327 ♏]; water of ammonia (*U. S. P.*), three hundred and seventy-five cubic centimeters (375 Cc.) [12 fl℥, 327 ♏]; water, diluted alcohol (*U. S. P.*), of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. To the water of ammonia, diluted with fifteen hundred cubic centimeters (1500 Cc.) [50 fl℥, 346 ♏] of water, gradually add the solution of tersulphate of iron, previously diluted with twenty-five hundred cubic centimeters (2500 Cc.) [84 fl℥, 257 ♏] of water, under constant stirring. Pour this mixture, containing ferric hydrate as a precipitate, upon a wet muslin strainer (which has been tared, after having been wetted and deprived of excess of water by moderate pressure), and, when the liquid has drained off, return the precipitate to the vessel, and mix it intimately with about four thousand cubic centimeters (4000 Cc.) [135 fl℥, 122 ♏] of water. Again drain it on the strainer, transfer it once more to the vessel, and treat it as before. Finally drain and press the precipitate on the strainer until it weighs five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 278 grs.]. Mix the fluid extract of cinchona with five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of alcohol, and add the ferric hydrate, previously prepared. Agitate the mixture frequently, until the tincture is deprived of tannin, which may be known by the absence of a blackish-green color when a small portion of the clear tincture is treated with a drop or two of tincture of chloride of iron. Insert a plug of absorbent cotton into a suitable percolator, and introduce the mixture. As soon as the liquid has disappeared from the surface, pour on enough diluted alcohol to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. *Note.*—This preparation is practically identical, in strength of cinchona (without the tannin), with the official *Tinctura Cinchonæ*"—(*Nat. Form.*).

TINCTURA CINCHONÆ COMPOSITA (U. S. P.)—COMPOUND TINCTURE OF CINCHONA.

Synonyms: *Compound tincture of Peruvian bark, Huxham's tincture of bark.*

Preparation.—"Red cinchona, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; bitter orange peel, eighty grammes (80 Gm.) [2 ozs. av., 360 grs.]; serpentaria, twenty grammes (20 Gm.) [309 grs.]; glycerin, seventy-five cubic centimeters (75 Cc.) [2 fl℥, 257 ♏]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the glycerin with eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of alcohol and seventy-five cubic centimeters (75 Cc.) [2 fl℥, 257 ♏] of water. Having mixed the cinchona, bitter orange peel, and serpentaria, reduce them to a fine (No. 60) powder. Moisten the powder with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of the menstruum, and macerate for 24 hours; then pack it firmly in a cylindrical glass percolator, and gradually pour on the remainder of the menstruum. When the liquid has disappeared from the surface, gradually pour on more of a mixture of alcohol and water, made in the same proportions as before, and continue the percolation, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This aromatic tincture has a deep reddish-brown color, and an astringent, bitter taste. It is liable to precipitate, like tincture of cinchona, but this is, in a measure, retarded by the glycerin present.

Action, Medical Uses, and Dosage.—This tincture is an efficient stomachic bitters, and may be used wherever a mild tonic of this character is desired. The dose is 2 or 3 fluid drachms, or more.

Related Tinctures.—Tinctura Cinchonæ Composita, *Compound tincture of Peruvian bark.* The following is the old London formula modified by Prof. King: "Take of calisaya bark, in fine powder, 4 ounces; bitter orange peel, 3 ounces; Virginia snakeroot, in moderately fine powder, 6 drachms; saffron, in coarse powder, 2 drachms; cochineal, in fine powder, 1 drachm; good diluted alcohol, 20 fluid ounces, or a sufficient quantity"—(*Lond.*). Form it into a tincture by maceration or percolation, as explained under *Tincturæ*, and make 20 fluid ounces of tincture. This tincture is generally known as *Huxham's tincture of bark.* Prof. King preferred brandy as the menstruum.

Tinctura Antiperiodica (N. F.), *Antiperiodic tincture*, *Warburg's tincture.*—I. *Without aloes.* "Rhubarb, thirty-six grammes (36 Gm.) [1 oz. av., 118 grs.]; angelica seed, thirty-six grammes (36 Gm.) [1 oz. av., 118 grs.]; elecampane, eighteen grammes (18 Gm.) [278 grs.]; saffron, eighteen grammes (18 Gm.) [278 grs.]; fennel, eighteen grammes (18 Gm.) [278 grs.]; gentian, nine grammes (9 Gm.) [139 grs.]; zedoary root, nine grammes (9 Gm.) [139 grs.]; cubeb, nine grammes (9 Gm.) [139 grs.]; myrrh, nine grammes (9 Gm.) [139 grs.]; white agaric, nine grammes (9 Gm.) [139 grs.]; camphor, nine grammes (9 Gm.) [139 grs.]; quinine sulphate, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; diluted alcohol (*U. S. P.*), a sufficient quantity to make five thousand cubic centimeters (5000 Cc.) [169 fl℥, 33 ♏]. Reduce the fibrous vegetable drugs to a coarse (No. 20) powder, mix this with the myrrh and camphor, previously powdered, and digest the whole, during 12 hours, in a suitable, well-covered vessel, with forty-two hundred and fifty cubic centimeters (4250 Cc.) [143 fl℥, 140 ♏] of diluted alcohol, on a water-bath, avoiding, as much as possible, any loss of alcohol by evaporation. Then strain off the liquid with pressure, dissolve the quinine sulphate in the strained liquid, with a gentle heat, if necessary, filter, and pass enough diluted alcohol, first through the strainer and then through the filter, to make the product measure five thousand cubic centimeters (5000 Cc.) [169 fl℥, 33 ♏]. Each fluid ounce contains 10 grains of quinine sulphate. *Note.*—This preparation, made *without aloes*, is intended to serve as a stock tincture, from which the regular 'Warburg's Tincture' is to be made, when required. 'Warburg's Tincture without Aloes' is also often prescribed or asked for, and in this case the above preparation is to be dispensed. The original formula directed by Dr. Warburg, contained the old *Confectio Damocratis* as one of the ingredients. The latter is a very complex preparation, many of the constituents being unobtainable at the present day. It has, therefore, been omitted. II. *With aloes.*—Extract of aloes (*U. S. P.*), seventeen and one-half grammes (17.5 Gm.) [270 grs.]; antiperiodic tincture, without aloes, one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the extract in the tincture. *Note.*—When 'Warburg's Tincture,' without any further specification, is ordered, this preparation (containing aloes) is to be dispensed"—(*Nat. Form.*).

TINCTURA CINCHONÆ FERRATA.—FERRATED TINCTURE OF CINCHONA

Synonym: *Ferrated tincture of Peruvian bark.*

Preparation.—Take of the compound tincture of Peruvian bark, 1 pint; hydroxide of iron, recently precipitated, ½ ounce; ammonio-citrate of iron, 256 grains. To the compound tincture add the hydroxide, and digest until all the cinchotannin, whether pure, oxidized, or combined, is completely eliminated. Then filter, and wash the tannate and excess of oxide with boiling alcohol, to remove any trace of alkaloid which may have been precipitated with the tannin; this alcoholic solution may be evaporated to dryness, the product dissolved in a little water, acidulated with citric acid, and added to the filtered liquor along with the ammonio-citrate of iron (Samuel Simes).

Action, Medical Uses, and Dosage.—This forms an exceedingly agreeable and energetic invigorative, admirably adapted in the cases of weak and languid habits of children and females, where the body is in a pallid or flaccid state, and very susceptible of fatigue or morbid action. It does not solely depend on the quinine and iron it contains for its value as a curative agent; the grateful and by no means inefficient adjuvants, the orange peel, snakeroot, and other proximate principles of cinchona, independent of quinine, are by no means to be overlooked, and can not be replaced by salts of quinine and iron alone, however scientific their artificial combinations may appear. Each fluid ounce contains 16 grains of ammonio-citrate of iron. The dose is 1 or 2 fluid drachms, 3 or 4 times a day (Samuel Simes).

TINCTURA CINNAMOMI (U. S. P.)—TINCTURE OF CINNAMON.

Preparation.—"Ceylon cinnamon, in No. 40 powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; glycerin, fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [32 fl℥, 391 ♏]. Mix the glycerin with seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol and two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of water. Having moistened the powder with fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏] of the menstruum, pack it in a conical percolator, gradually pour on the remainder of the menstruum, and afterward more of a mixture of alcohol and water, made in the same proportions as before, and continue the percolation, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This aromatic tincture is of a reddish-brown color, and sweet in taste. If made with diluted alcohol, and without the presence of glycerin, it is liable to gelatinize. This the *U. S. P.* has attempted to avoid by the use of glycerin and alcohol.

Action, Medical Uses, and Dosage.—Tincture of cinnamon is an aromatic astringent, and may be used in *chronic diarrhœa*, *menorrhagia*, *uterine hæmorrhage*, and as an adjunct to other astringent solutions; 1, 2, or 4 fluid drachms, as required, may be administered for a dose, in sweetened or mucilaginous liquid.

Related Preparation.—TINCTURA AROMATICA (N. F.), *Aromatic tincture.* "Cinnamon (cassia), eighty-five grammes (85 Gm.) [3 ozs. av.]; ginger, thirty-six grammes (36 Gm.) [1 oz. av., 118 grs.]; galangal root, eighteen grammes (18 Gm.) [278 grs.]; cloves, eighteen grammes (18 Gm.) [278 grs.]; cardamom, eighteen grammes (18 Gm.) [278 grs.]; alcohol, water, of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Reduce the drugs to a moderately coarse (No. 40) powder, and percolate it, in the usual manner, with a mixture of two (2) volumes of alcohol and one (1) volume of water, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of percolate are obtained. *Note.*—This preparation is practically identical with that which is official in the *German Pharmacopœia.* Galangal is the root of *Alpinia officinarum*, Hance"—(*Nat. Form.*). This tincture may be used for its stimulant and carminative effects in *flatulence*, etc.

TINCTURA CINNAMOMI COMPOSITA.—COMPOUND TINCTURE OF CINNAMON.

Preparation.—Take of cinnamon, finely powdered, 1 ounce; cardamom, prickly ash berries, ginger, finely powdered, of each, 3 drachms; diluted alcohol, 2 pints, or a sufficient quantity. Form into a tincture by maceration or percolation, making 2 pints of tincture.

Action, Medical Uses, and Dosage.—This is a very warm and agreeable aromatic tincture, beneficial in *flatulence*, *debility*, or *spasm of the stomach*, and *chronic diarrhœa.* The dose is 1 or 2 fluid drachms, in sweetened water.

TINCTURA COCCI CACTI.—TINCTURE OF COCHINEAL.

Preparation.—"Take of cochineal, in fine powder, 2½ ounces (av.); proof-spirit, 1 pint. Macerate for 7 days in a closed vessel, with occasional agitation. Strain, press, filter, and add sufficient proof-spirit to make 1 pint (Imp.)"—(*Br. Pharm.*, 1885). Or, use diluted alcohol and form into a tincture by maceration, as explained under *Tincturæ*, and make 1 pint of tincture.

Action, Medical Uses, and Dosage.—This tincture is calmative and antispasmodic, and may be given in *pertussis*, *asthma*, *hysteria*, and *nervous diseases*, in doses of from 20 drops to a fluid drachm. It is now chiefly employed for coloring (deep-red) various fluid mixtures, although a solution of 1 drachm of No. 40 carmine, in a mixture of glycerin (4 ounces), water (12 ounces), and ammonia water (sufficient quantity) is to be preferred for this purpose.

Other Coloring Tinctures.—Tinctura Persionis (N. F.), *Tincture of cudbear.* "Cudbear, in fine powder, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; alcohol, water, of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Pack the cudbear in a suitable percolator, and percolate it with a mixture of one (1) volume of alcohol and two (2) volumes of water, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained. *Note.*—This preparation is intended as a coloring agent, when a bright-red tint or color is to be produced, particularly in acid liquids"—(*Nat. Form.*).

Tinctura Persionis Composita (N. F.), *Compound tincture of cudbear.*—"Cudbear, twenty grammes (20 Gm.) [309 grs.]; caramel, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; alcohol, water, of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc. [33 fl℥, 391 ♏]. Mix one (1) volume of alcohol with two (2) volumes of water. Macerate the cudbear with seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of the menstruum, during 12 hours, agitating occasionally, and then filter through paper, and add the caramel, previously dissolved in one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏] of water. Then pass enough of the before-mentioned menstruum through the filter to make the whole measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. *Note.*—This preparation is intended as a coloring agent, when a brownish-red tint or color is to be produced"—(*Nat. Form.*).

TINCTURA COLCHICI COMPOSITA.—COMPOUND TINCTURE OF COLCHICUM.

Preparation.—Take of colchicum seed, in fine powder, 2 ounces; black cohosh root, in fine powder, 3 ounces; diluted alcohol, 2 pints, or a sufficient quantity. Form it into a tincture by maceration or percolation, and make 2 pints of tincture. Or, it may be made by adding together equal parts of the tinctures of colchicum seed and black cohosh root.

Action, Medical Uses, and Dosage.—This forms an excellent agent in *inflammatory rheumatism* and *gout*, and has proved a superior remedy in *phlegmasia dolens*, or the *swelled leg of parturient women*. The dose is from 10 to 60 drops, or more, as circumstances indicate, every 1, 2, 3, or 4 hours. Iodide of potassium, 15 grains to 1 ounce of the tincture, may frequently be added with advantage (J. King).

TINCTURA COLCHICI SEMINIS (U. S. P.)—TINCTURE OF COLCHICUM SEED.

Synonyms: *Tincture of colchicum*, *Tinctura colchici* (*U. S. P.*, 1880).

Preparation.—"Colchicum seed, in No. 30 powder, one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix alcohol and water in the proportion of six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of alcohol and four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of water. Having moistened the powder with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of the menstruum, macerate for 24 hours; then pack it moderately in a cylindrical percolator, and gradually pour menstruum upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This produces a bitter, brown-yellow tincture, striking opalescent with water.

Action, Medical Uses, and Dosage.—This tincture may be used wherever colchicum is indicated. It is also employed as an external application in *gouty, neuralgic, and rheumatic pains*. The dose is from 30 drops, cautiously increased to 1 or 2 fluid drachms.

TINCTURA CONII.—TINCTURE OF HEMLOCK.

Preparation.—"Take of hemlock fruit, finely comminuted, 2½ ounces (av.); proof-spirit, 1 pint (Imp.)"—(*Br. Pharm.*, 1885). Prepare as directed for *Tinctura*

Sennæ. The *British Pharmacopœia* (1898) directs the use of conium fruit, recently reduced to No. 40 powder, 4 ounces (Imp.), and alcohol (70 per cent), a sufficient quantity to make 1 pint of tincture.

The juice of conium is considered a more effectual preparation than the preceding. The *U. S. P.* (1880) directed a percolated tincture of conium prepared practically as follows: Tinctura Conii, *Tincture of conium.* "Conium (fruit), in No. 30 powder, one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]; diluted hydrochloric acid, four grammes (4 Gm.) [62 grs.]; diluted alcohol, a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Moisten the powder with fifty grammes (50 Gm.) [1 oz. av., 334 grs.] of diluted alcohol, previously mixed with the diluted hydrochloric acid, and macerate for 24 hours; then pack it moderately in a conical glass percolator, and gradually pour diluted alcohol upon it, until one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.] of tincture are obtained"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—(See *Conium.*) Dose, 10 to 40 minims.

TINCTURA CORYDALIS.—TINCTURE OF CORYDALIS.

Synonym: *Tincture of turkey-corn.*

Preparation.—Take of the root of turkey-corn, in fine powder, 3 ounces; diluted alcohol, 1 pint, or a sufficient quantity. Form into a tincture by maceration or percolation, and make 1 pint of tincture.

Action, Medical Uses, and Dosage.—This forms an efficient alterative tonic, useful in all cases where simple tonics are indicated, and highly beneficial in *syphilitic and scrofulous affections* (see *Corydalis*). The dose is from 20 drops to 2 fluid drachms, 3 or 4 times a day.

TINCTURA CORYDALIS COMPOSITA.—COMPOUND TINCTURE OF CORYDALIS.

Synonym: *Scudder's alterative.*

Preparation.—Take of the roots of turkey-corn, yellow dock, bark of tag alder, and leaves and roots of figwort, each, in fine powder, 1 troy ounce; alcohol, a sufficient quantity. Form into a tincture by percolation, and after 10 fluid ounces have percolated through, add water, a sufficient quantity, until 19 fluid ounces of tincture have been obtained.

To mandrake root in fine powder, 1 troy ounce; add boiling water, 4 fluid ounces, and allow it to macerate in a hot place for 2 hours; then express, or obtain 4 fluid ounces of infusion, to which add white sugar, 4 troy ounces. To the syrup thus prepared, add the preceding tincture, and make 24 fluid ounces of the preparation. Prof. Scudder aimed in this preparation to obtain the alterative constituents of podophyllum, free or nearly so, of the cathartic resin.

Action, Medical Uses, and Dosage.—This is an excellent alterative, prepared according to Prof. Scudder's formula. He believed that water extracted more of the alterative properties of mandrake than alcohol. It has been employed with advantage in *scrofula, syphilis, cutaneous diseases, hepatic affections*, in *glandular affections* where there is a tendency to hypertrophy and suppuration, and in other cases where an alterative is required. The dose is from 1 fluid drachm to ½ fluid ounce, 3 or 4 times a day (J. King).

TINCTURA COTO (N. F.)—TINCTURE OF COTO.

Preparation.—"Coto bark, bruised, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Macerate the coto with eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of alcohol during 7 days; then pour off the liquid, press the residue, and filter the united liquids through paper. Lastly, wash the residue transferred to the filter with enough alcohol to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. *Note.*—Coto bark is derived from an undetermined tree, probably belonging to the natural order Lauraceæ, and is obtained from Bolivia. There are two varieties known, one as 'coto,' and the other as 'para-coto' bark. True coto bark is, at times, difficult to obtain in the market, and the para-coto bark is then frequently substituted for it. While they possess some useful properties in common, yet they differ materially in other respects. Hence, the para-coto bark should not be substituted for the true coto bark"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—(See *Coto.*) Dose, 1 to 2 fluid drachms.

TINCTURA CROCI (U. S. P.)—TINCTURE OF SAFFRON.

Preparation.—"Saffron, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the saffron with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of diluted alcohol, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour diluted alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This tincture preserves the saffron characteristics and is of a beautiful orange-yellow color.

Action, Medical Uses, and Dosage.—(See *Crocus.*) Sometimes used to color medicinal preparations. Dose, 1 to 2 fluid drachms.

TINCTURA CUBEBÆ (U. S. P.)—TINCTURE OF CUBEB.

Synonym: *Tincture of cubebs.*

Preparation.—"Cubeb, in No. 30 powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of alcohol, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*).

Formerly, tincture of cubeb was a comparatively weak preparation, but the present official tincture has been increased to double the strength of the 1880 preparation. Diluted alcohol was formerly used, but as this but imperfectly extracted the oil and resin, stronger alcohol was substituted which better dissolved these bodies. The tincture has a green-brown color, and when added to water produces a milky turbidity.

Action, Medical Uses, and Dosage.—(See *Cubeba.*) Dose, 10 drops to 2 fluid drachms.

TINCTURA DIGITALIS (U. S. P.)—TINCTURE OF DIGITALIS.

Synonym: *Tincture of foxglove.*

Preparation.—"Digitalis, in No. 60 powder, one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏] of diluted alcohol, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour diluted alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). Care should be exercised in the selection of digitalis. The resulting tincture has the odor of the drug, a bitter taste, and a greenish-brown color.

Action, Medical Uses, and Dosage.—This preparation possesses the virtues of foxglove, and affords an excellent mode of exhibiting that drug (see *Digitalis*). The dose is from 1 to 20 drops, 2 or 3 times a day, and increased, if required, with much care.

TINCTURA ERGOTÆ.—TINCTURE OF ERGOT.

Synonym: *Tinctura secale cornuti.*

Preparation.—"Take of ergot, finely comminuted, 5 ounces (av.); proof-spirit, 1 pint (Imp.). Prepare as directed for *Tinctura Sennæ*"—(*Br. Pharm.*, 1885).

Action, Medical Uses, and Dosage.—This tincture may be used in all cases where the action of ergot is indicated or desired. The dose is 10 drops to 2 fluid drachms.

Related Preparation.—TINCTURA ERGOTÆ AMMONIATA, *Ammoniated tincture of ergot.* Take of "ergot, in No. 20 powder, 5 ounces (Imp.), or 250 grammes (Metric); solution of ammonia, 2 fluid ounces, or 100 cubic centimeters; alcohol (60 per cent), a sufficient quantity. Mix the solution of ammonia with 18 fluid ounces (or 900 cubic centimeters) of the alcohol; moisten the powder with 2 fluid ounces (or 100 cubic centimeters) of this mixture, and percolate with the remainder; press the marc; mix the expressed liquid with the percolate; add enough of the alcohol to form 1 pint (or 1000 cubic centimeters) of the tincture. Set aside for 24 hours; filter. Dose, ½ to 1 fluid drachm"—(*Br. Pharm.*, 1898).

TINCTURA FERRI ACETATIS.—TINCTURE OF ACETATE OF IRON.

Preparation.—Take of sulphate of iron, 8 ounces; distilled water, ½ pint; pure sulphuric acid, 6 fluid drachms; pure nitric acid, ½ fluid ounce; acetate of potassium, 8 ounces; rectified spirit, ½ gallon. (The above weights are avoirdupois, and the measures Imperial.) To 9 fluid ounces of the water, add the sulphuric acid, and in the mixture, with the aid of heat, dissolve the sulphate of iron. Add next the nitric acid, first diluted with the remaining fluid ounce of water, and evaporate the resulting solution to the consistence of a thick syrup. Dissolve this in 1 quart (2 pints, Imp.), and the acetate of potassium in the remainder of the spirit, and, having mixed the solutions, and shaken the mixture repeatedly in a large bottle, let the whole be thrown upon a calico filter. When any further liquid ceases to trickle through, subject the filter, with its contents, to expression, and, having cleared the turbid tincture thus procured by filtration through paper, let it be added to that already obtained. The specific gravity of this tincture is 0.891 (*Dub.*).

"Take of strong solution of acetate of iron, 5 fluid ounces; acetic acid, 1 fluid ounce; rectified spirit, 5 fluid ounces; distilled water, 9 fluid ounces. Mix, and then add sufficient distilled water to make 1 pint. Preserve in a stoppered bottle"—(*Br. Pharm.*, 1885; not in that of 1898).

In the first formula, by the mutual action of sulphate of iron, sulphuric acid, and nitric acid, a solution of ferric sulphate is obtained. This is decomposed by the acetate of potassium, the products being ferric acetate and potassium sulphate; the former remains in the liquid, the latter is precipitated. Tincture of acetate of iron is a transparent, claret-colored tincture, having a strong, chalybeate taste.

Action, Medical Uses, and Dosage.—This is tonic and astringent, and, besides its internal administration as a chalybeate, it forms an excellent vaginal enema for *leucorrhœa*, when properly diluted with water. It is one of the best of internal styptics. Following the indications given below, it will be found an admirable remedy in diseased conditions requiring an acid preparation of iron other than that containing hydrochloric acid. Thus it proves useful in *female diseases*, the *prostration of typhoid and other adynamic fevers*, *scurvy*, *low cachectic states*, *constitutional syphilis*, and *anemic conditions*. The dose of it is from 10 drops to 1 fluid drachm, given in a sufficient quantity of water, the smaller doses (1 to 10 drops) being preferred for specific effects.

Specific Indications and Uses.—Pale, transparent skin; bluish coloration of tissues; blueness of veins; dull, heavy pain in back of head.

TINCTURA FERRI CHLORIDI (U. S. P.)—TINCTURE OF FERRIC CHLORIDE.

"A hydro-alcoholic solution of ferric chloride (Fe_2Cl_6 = 323.98) containing about 13.6 per cent of the anhydrous salt, and corresponding to about 4.7 (4.69) per cent of metallic iron"—(*U. S. P.*).

SYNONYMS: *Tinctura ferri sesquichloridi*, *Tincture of chloride of iron*, *Tincture of perchloride of iron*, *Tincture of muriate of iron*, *Tinctura ferri muriatis*, *Muriated tincture of iron.*

Preparation.—"Solution of ferric chloride, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the solution with enough alcohol to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Let the tincture stand, in a closely-covered vessel, at least 3 months; then transfer it to glass-stoppered bottles, and keep it protected from light"—(*U. S. P.*). When this mixture is allowed to stand, a variety of reactions take place; the alcohol reduces ferric chloride to ferrous chloride, very markedly so in direct sunlight (see experiments, by M. W. Coleman, in *Amer. Jour. Pharm.*, 1883, p. 387). Free chlorine is also formed when the tincture is exposed to sunlight, and this element, acting upon the alcohol, forms ethereal chlorine compounds. The aqueous solution of ferric chloride is permanent.

This tincture is a "bright, brownish liquid, having a slightly ethereal odor, a very astringent, styptic taste, and an acid reaction. Specific gravity about 0.960 at 15° C. (59° F.)"—(*U. S. P.*). It stains white paper yellow, and has an odor of hydrochloric ether. On exposure to the air, a small deposit of iron compound may take place, slightly diminishing the strength of the tincture, but a small quantity of hydrochloric acid added will redissolve this deposit. When the tincture is evaporated, a dark orange-colored residue is obtained, which is hardly crystallizable and is deliquescent. Tincture of chloride of iron is incompatible with vegetable astringent infusions, gum Arabic solution, alkalies and their carbonates.

Tests.—"The tincture yields a brownish-red precipitate with ammonia water, a blue one with potassium ferrocyanide T.S., and a white one, insoluble in nitric acid, with silver nitrate T.S. After the tincture has been exposed for some time to daylight, it yields a greenish or greenish-blue color with potassium ferricyanide T.S., showing the presence of some ferrous salt, due to reduction. If the iron be completely precipitated from a portion of the tincture by an excess of ammonia water, the filtrate should be colorless, and should not yield a white or dark-colored precipitate with hydrogen sulphide T.S. (absence of zinc or copper), nor should it leave a fixed residue on evaporation and gentle ignition (absence of salts of the fixed alkalies). On adding a clear crystal of ferrous sulphate to a cooled mixture of equal volumes of concentrated sulphuric acid and a moderately dilute portion of the tincture, the crystal should not become colored brown, nor should there be a brownish-black zone developed around it (absence of nitric acid). On diluting 1 Cc. of the tincture with water to 12 Cc., and boiling, the liquid should remain clear (absence of oxychloride). If 1.12 (1.1176) Gm. of the tincture be introduced into a glass-stoppered bottle (having a capacity of about 100 Cc.), together with 15 Cc. of water and 2 Cc. of hydrochloric acid, and, after the addition of 1 Gm. of potassium iodide, the mixture be kept for half an hour at a temperature of 40° C. (104° F.), then cooled, and mixed with a few drops of starch T.S., it should require about 9.4 Cc. of decinormal sodium hyposulphite V.S. to discharge the blue or greenish color of the liquid (each cubic centimeter of the volumetric solution indicating 0.5 per cent of metallic iron)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Tincture of chloride of iron is tonic, alterative, diuretic, astringent, and restorative. (For the general uses of iron, see *Ferrum*.) This agent is one of the strongest of the iron preparations, and is to be used chiefly in atonic conditions. Large doses of it are apt to disorder the stomach. However, it has been shown that small doses of chalybeates are preferable to large doses. In administering this agent, it is well to give it through a glass tube, avoiding, as much as possible, contact with the teeth, and afterward rinsing the mouth with sodium bicarbonate solution, unless a local effect upon the tissues of the mouth and throat is the object sought. The specific indications should be closely followed to give good results. The deep-red coloration of mucous tissues, and deep-red color in local diseases, are the direct indications to its use. Sometimes the coloration is so deep as to appear a solid blue, and there may be dull pain in the back of the head. When the trouble is located in the mucous tissues, as in diphtheria and other disorders, the local manifestations of which are in the mouth or throat, the tongue, fauces, and pharyngeal vault are somewhat full, and have a deep-red, glistening, erysipelatoid appearance. Tincture of chloride of iron has long been given in *anemia*, and the train of disorders depending upon such a condition. It is particularly valuable in the anemia following great loss of blood, the quality of the blood not being specially impaired, but the quantity deficient. It is also of great value when anemia is progressive, and due to alteration in the red blood corpuscles, or when the result of prolonged disease. It is frequently a valuable chalybeate in *chlorotic anemia*. As a tonic, it is very useful in *scrofula, rachitis, tabes mesenterica, extensive ulcerative or suppurative processes*, with *colliquative sweating* and *hectic fever, tabes dorsalis, asthenic dropsies*, from loss of blood, and in *amenorrhœa*, with anemia. *Leucorrhœa*, with anemia, *gonorrhœa* (latter stages), *gleet, retention of urine from spasmodic stricture* (10 drops, frequently repeated), *chronic mucous discharges from the urinary organs, dysuria, irritability of the bladder*, in females especially, *diabetes*, and in the *diarrhœa of phthisis and low forms of fevers* it is a useful drug. The dose in these disorders should be from 10 to 20 drops, in plenty of water, 2 or 3 times a day.

This agent is of great value in *passive hemorrhage* from bladder and kidneys (5 drops every 3 hours). It has been employed in *post-partum hemorrhage*, but is not equal to ergot and cinnamon. In *phthisis*, it checks hemorrhage, diarrhœa, profuse expectoration, and lessens night sweats. In *chronic dysentery* and *chronic cholera infantum*, with marked relaxation, it has sometimes proved serviceable. It sometimes relieves the *dysmenorrhœa* of anemic subjects. In genito-urinary disorders, it is contraindicated, as a rule, by *active* inflammation. Some prefer the ethereal tincture (see *Related Tinctures*) in renal disorders, and the dose is much smaller (3 to 5 drops).

In urinary affections, tincture of iron is frequently combined with uva ursi, buchu, or opium. In *pyelitis*, it lessens the quantity of pus, and, by its diuretic action, tends to lessen the danger of dropsy. In *chronic nephritis*, with *albuminuria*, it is a very important remedy, as it is in the latter stage of *scarlatina*, with albumen in the urine. In *chronic ague*, tincture of iron may be given in conjunction with antiperiodics, if anemia is present. Tincture of iron has long been regarded as an efficient agent in *diphtheria*. The tissues are swollen and deep-red. It is often combined as follows: ℞ Tincture of chloride of iron, flʒj; potassium chlorate, grs. xv; water, fl℥ii. From ½ to 1 teaspoonful, every 2 hours, according to age of child. A gargle of the diluted tincture may also be used. Tincture of iron is often of service in disorders produced by the absorption of septic material. It sustains strength, and is often antagonistic to the poison itself.

The most direct specific results from this agent have been obtained in the treatment of *erysipelas*. It is not the remedy for all cases, but for those showing a deep-red, glistening surface, and having but a moderate amount of burning, and showing deep-redness of tongue. In these cases it reduces fever, allays pain and inflammation, increases the urinary flow, cleans the tongue, and gives rest. From 5 to 30 drops, well diluted, should be given every ½ hour, and the surface should be painted with the pure tincture, or the tincture diluted with glycerin (Scudder). Prof. Locke advises the following for local use: ℞ Tincture of chloride of iron, flʒss; glycerin, flʒjss. Mix. Paint upon the parts and cover with cotton. As a general tonic, after severe *gastric, nervous, malarial*, or other *debilitating diseases*, the following combination has been advised: ℞ Tincture of chloride of iron, flʒiii; diluted phosphoric acid, flʒiv; glycerin, fl℥i; simple elixir, q.s. to make fl℥iii. Mix. Sig. One teaspoonful, in water, every 2 or 3 hours (Ellingwood).

"Externally, it has proved useful in destroying *venereal warts*, and is one of the best applications that can be applied to a *venereal chancre;* in this last, it should be applied by means of a feather, and a piece of lint, moistened with it, should be kept in constant contact with the surface of the ulcer. As an application to chancre, it is the only one that I have made for the last 28 years (except the nitric acid during its pustular stage), and is, in my opinion, decidedly the best local remedy for this kind of ulcer that can be used. Occasionally, it causes severe pain, when it should be diluted with as little water as possible; but, in the majority of instances, after the first or second application, patients hardly notice it. It keeps the chancre clean, its surface soft, and changes the poisonous character of the virus, so that its absorption is followed by no bad result. As the chancre soon becomes so changed, by the use of this tincture, that it is frequently difficult to detect it from the healthy surrounding integuments, the practitioner must be careful not to be misled by this appearance, and cease his internal treatment too soon. I have used this tincture, as above named, since the year 1836, and, as far as I know, am the first one in the profession who employed it in this manner, or made its value known in the above diseases" (J. King). Diluted with water, tincture of iron may be used as a stimulating dressing for *sluggish ulcers*, and to reduce *excessive granulations*.

Specific Indications and Uses.—Erysipelatous redness, with glistening surfaces, deep-redness of mucous tissues, approaching a solid blue in color; dull pain in back of head; swollen, reddened tissues.

Related Tinctures.—TINCTURA FERRI CHLORIDI ÆTHEREA (N. F.), *Ethereal tincture of chloride of iron, Bestucheff's tincture, Lamotte's drops.* "Solution of chloride of iron (*U. S. P.*), forty-five cubic centimeters (45 Cc.) [1 fl℥, 250 ♏]; ether (*U. S. P.*), two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the solution of chloride of iron with six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of alcohol, add the ether, and lastly, enough alcohol to make one thousand cubic centimeters (1000 Cc. [33 fl℥, 391 ♏]. Introduce the tincture into bottles made of white (flint) glass, which should not be entirely filled. Cork them tightly, and expose them to the rays of the sun, until the tincture has been completely decolorized. Then remove the bottles to a shady place, and open them occasionally, until the contents have again assumed a yellow color. Lastly, transfer the tincture to bottles, which should be well stoppered and kept in a cool and dark place. Each fluid drachm represents about ½ grain of metallic iron. *Note.*—This preparation is practically identical with that official in the *German Pharmacopœia*"—(*Nat. Form.*). Dose, 1 to 10 minims, well diluted.

TINCTURA FERRI CITRO-CHLORIDI (N. F.), *Tincture of citro-chloride of iron, Tasteless tincture of chloride of iron, Tasteless tincture of iron.*—"Solution of chloride of iron (*U. S. P.*), two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; sodium citrate, four hundred and sixty grammes (460 Gm.) [16 ozs. av., 99 grs.]; alcohol, one hundred and sixty cubic centimeters (160 Cc.) [5 fl℥, 197 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the solution of chloride of iron with two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water, and dissolve in this mixture the sodium citrate, with the aid of a gentle heat. Then add the alcohol, and, when the solution has become cold, make up the volume with water to one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Set the product aside in a cold place for a few days, if convenient, so that the excess of saline matter may separate. Then filter, and pass enough cold water through the filter to restore the original volume. Each fluid drachm contains an amount of iron equivalent to about 7½ grains of dry chloride of iron (ferric). *Note.*—This preparation is practically identical in the strength of iron, but not in the quantity of alcohol, with the official *Tinctura Ferri Chloridi*"—(*Nat. Form.*).

TINCTURA FERRI POMATA (N. F.), *Tincture of ferrated extract of apples. Tinctura ferri malatis crudi, Tincture of crude malate of iron.*—"Ferrated tincture of apples (F. 156), one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; alcohol, one hundred cubic centimeters (100 Cc. [3 fl℥, 183 ♏]; cinnamon water (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the ferrated extract of apples in seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of cinnamon water, add the alcohol, filter, and pass enough cinnamon water through the filter to make one thousand cubic centimeters (33 fl℥, 391 ♏]. Each fluid drachm represents about ⅜ grain of metallic iron. *Note.*—This preparation is practically identical with that official in the *German Pharmacopœia*"—(*Nat. Form.*).

Other Iron Preparations.—FERRATIN. This is an organic preparation of iron, the natural ferruginous element of all food (animal and vegetable) deposited in the liver and other organs of the body, "as reserve iron for blood formation," discovered and introduced by Prof. Schmiedeberg, of Strassburg. It is a reddish powder, without odor or taste, prepared by exposing a mixture of albumen and tartrate of iron to a slight heat in the presence of an alkali. It does not readily dissolve in water, but is rendered soluble by the addition of sodium bicarbonate. It contains about 7 per cent of iron, is absorbed to the extent of 20 per cent (Marfori, and others), and has the advantage over other iron salts in that they must first be converted into ferratin before being assimilated. Scarcely any of the salt, when taken, is eliminated by the kidneys or bowels. It is a blood food, for administration when the proportion of red blood corpuscles is unduly low, as in *anemia*, *chlorosis*, *nervous affections*, *heart and kidney diseases*, and *convalescence from acute diseases*. Ferratin is a specialty of C. F. Boehringer & Soehne, of New York City.

FERRO-SALICYLATA.—This specialty of the Wm. S. Merrell Chemical Co., of Cincinnati, Ohio, contains salicylic acid (from oil of wintergreen), tincture of chloride of iron, in tasteless form, and ammonium citrate. This agent is used in *acute rheumatism*, especially the articular variety, and in persons of delicate or anemic habit, and in those poorly-nourished and broken down in general health.

TINCTURA GALLÆ (U. S. P.)—TINCTURE OF NUTGALL.

SYNONYM: *Tincture of galls.*

Preparation.—"Nutgall, in No. 40 powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; glycerin, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; alcohol, a sufficient quantity to make one thousand cubic centimeters

(1000 Cc.) [33 fl℥, 391 ♏]. Mix the glycerin with nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of alcohol. Pack the powder, without moistening it, in a conical glass percolator; then gradually pour upon it the menstruum, and, afterward, alcohol, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This is a powerfully astringent, yellow-brown tincture, acid to test paper. With ferric compounds it strikes a blue-black color. The formation of gallic acid is retarded by the glycerin.

Action, Medical Uses, and Dosage. (See *Galla.*) Dose, ½ to 2 fluid drachms. Employed chiefly externally as an astringent.

TINCTURA GELSEMII (U. S. P.)—TINCTURE OF GELSEMIUM.

SYNONYM: *Tincture of yellow jessamine.*

Preparation.—"Gelsemium, in No. 60 powder, one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix alcohol and water in the proportion of six hundred and fifty cubic centimeters (650 Cc.) [21 fl℥, 470 ♏] of alcohol to three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of water. Having moistened the powder with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of the menstruum, macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*).

Or, take of the fresh root of yellow jessamine, cut into small pieces, 4 troy ounces; diluted alcohol, 1 pint. Macerate for 14 days; express and filter. This forms a tincture of a beautiful violet tint; it has a peculiar odor, somewhat resembling that of new honey, and a faint, peculiar, not unpleasant taste.

The official tincture has the bitter taste and nauseous odor of gelsemium, and is of a brownish-yellow color. It renders water milky. Gelsemium tincture has been found of greatest therapeutic efficiency in Eclectic medicine when prepared from the green root. Therefore the second formula is to be preferred to the official process.

Action, Medical Uses, and Dosage.—This tincture possesses the active properties of the root, and may be given as a febrifuge in *intermittent, remittent, typhus, typhoid*, and many other *fevers;* it is likewise beneficial in *neuralgia, nervous headache, toothache*, etc. And combined with tincture of cimicifuga, or tincture of colchicum, it proves decidedly efficient in *rheumatism* and *gout*. In *rigidity of the os uteri* (with thin, sharp edges), *puerperal convulsions, puerperal peritonitis*, and *painful dysmenorrhœa*, I consider this among the best agents in the materia medica. I have employed it in all these various conditions, and with the most marked success. It is, in most cases, preferable to lobelia as a relaxant, when the cervix is thin, sharp, and rigid, as it does not occasion any nausea or vomiting. Lobelia is applicable when the cervix is full, thick, and rigid. To one young lady laboring under a most agonizing *dysmenorrhœa*, I administered a teaspoonful of the tincture every ½ hour for 4 hours, before it produced its influence upon her; after which smaller doses sufficed to maintain its effect, and she suffered no further pain during the menstruation. While it produces a relaxation of the rigid os uteri, it seems to exert an influence on the uterine contractility, promoting the action of the organ. The dose of the tincture of gelsemium is from 5 drops to ½ fluid drachm, according to circumstances, and the urgency of the case. The dose of a fluid drachm is seldom required and should be used with extreme caution. The effects of an overdose may be removed by holding aqua ammoniæ to the nostrils, with the internal administration of stimulants (J. King).

TINCTURA GENTIANÆ COMPOSITA (U. S. P.)—COMPOUND TINCTURE OF GENTIAN.

Preparation.—"Gentian, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; bitter orange peel, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; cardamom, ten grammes (10 Gm.) [154 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the gentian, orange peel, and cardamom, and reduce the mixture to a moderately coarse (No. 40) powder. Mix alcohol and water in the proportion of six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of alcohol to four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of water. Having moistened the powder with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of menstruum, macerate for 24 hours; then pack it in a cylindrical percolator, and gradually pour menstruum upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This produces a bitter, brown-yellow tincture having a pleasant aromatic odor.

Action, Medical Uses, and Dosage.—An aromatic, bitter, and stomachic; inferior, however, to the preparation of same name given below. Dose, 30 to 120 drops.

Related Tincture.—Tinctura Gentianæ Composita, *Compound tincture of gentian.* Take of gentian, colombo, swamp milkweed, rhubarb, prickly-ash berries, sassafras, each, 1 ounce; good French brandy, 4 pints, or a sufficient quantity. Form into a tincture by maceration or percolation, as explained under *Tincturæ*, and make 4 pints of tincture. This is a mild aperient, stimulant, and tonic, and is especially adapted to children with *debilitated stomachs* or *disordered condition of the digestive organs*, after the administration of anthelmintics for the removal of *worms*, and during convalescence from exhausting diseases, as *summer complaint*, *diarrhœa*, *dysentery*, *fevers*, etc. The dose is from 10 drops to 1 teaspoonful, 3 or 4 times a day, in sweetened water (J. King).

Tinctura Amara (N. F.), *Bitter tincture, Stomachic tincture, Bitter stomachic drops, Stomach drops.*—"Gentian, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; centaury, herb, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; bitter orange peel, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; orange berries, seventeen grammes (17 Gm.) [262 grs.]; zedoary, root, seventeen grammes (17 Gm.) [262 grs.]; alcohol, water, of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Reduce the drugs to a moderately coarse (No. 40) powder, and percolate it, in the usual manner, with a mixture of 2 volumes of alcohol and 1 volume of water, until one thousand cubic centimeters (1000 Cc. [33 fl℥, 391 ♏] of percolate are obtained. *Note.*—Centaury is the herb of *Erythræa Centaurium*, Persoon. Orange berries are the unripe fruit of *Citrus vulgaris*, Risso, collected while small. Zedoary is the rhizome of *Curcuma Zedoaria*, Roscoe. The product obtained by the above formula is practically identical with that which is official in the *German Pharmacopœia*"—(*Nat. Form.*).

TINCTURA GUAIACI (U. S. P.)—TINCTURE OF GUAIAC.

Synonym: *Tincture of guaiacum.*

Preparation.—"Guaiac, in coarse powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the powder with eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of alcohol, and macerate, for 7 days, in a closed vessel; then filter through paper, adding, through the filter, enough alcohol to make the tincture measure one thousand cubic centimeters (1000 Cc. [33 fl℥, 391 ♏]"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This tincture is used in *gout*, *rheumatism*, *dysentery*, *amenorrhœa*, and *dysmenorrhœa* (see *Guaiacum*). The dose is from 1 to 3 fluid drachms, 3 or 4 times a day, given in mucilage, milk, or sweetened water.

Related Tinctures.—Dewees' Tincture of Guaiacum (*Tinctura guaiaci alkalini*), recommended in *suppression of the menses* and *dysmenorrhœa*, is made as follows: Take of the best guaiac, in powder, 4 ounces; carbonate of sodium or potassium, 1½ drachms; pimenta, in powder, 1 ounce; diluted alcohol, 1 pound. Digest for a few days. Dose, a teaspoonful, 3 times a day, to be gradually increased, if necessary (Dewees, on *Diseases of Females*, 1826, p. 81). Or, as modified by the *National Formulary*:

Tinctura Guaiaci Composita (N. F.), *Compound tincture of guaiac, Dewees' tincture of guaiac.*—"Guaiac (*U. S. P.*), one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; potassium carbonate, six grammes (6 Gm.) [93 grs.]; pimenta, in moderately fine powder, thirty grammes (30 Gm.) [1 oz. av., 25 grs.]; pumice, in fine powder, sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; alcohol, four hundred and thirty-five cubic centimeters (435 Cc.) [14 fl℥, 340 ♏]; water, four hundred and thirty-five cubic centimeters (435 Cc.) [14 fl℥, 340 ♏]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the guaiac and potassium carbonate with the pimenta and the pumice, and afterward gradually with the alcohol. Next add slowly four hundred and thirty-five cubic centimeters (435 Cc.) [14 fl℥, 340 ♏] of cold water, and triturate the mixture thoroughly. Then filter, and pass enough diluted alcohol through the filter to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents 7½ grains of guaiac"—(*Nat. Form.*).

Tinctura Guaiaci Aromatica, *Aromatic tincture of guaiacum, Greenhow's cholera mixture.* Take of guaiacum, cloves, and cinnamon, each, in moderately fine powder, 1 ounce; brandy, 2 pints. Macerate for 14 days; then filter. This tincture is an excellent aromatic stimulant, astringent, and diaphoretic. It was extensively used in Cincinnati, by practitioners, during the *cholera* of 1849-50-51, and with excellent effect. The late Prof. T. V. Morrow, M. D., considered it as one of the best agents in the treatment of that disease. The dose is from a teaspoonful to a tablespoonful, in sweetened water, every 15 or 20 minutes, until relief is obtained The addition of an ounce of prickly ash berries to this tincture will materially enhance its efficacy (J. King).

Tinctura Antacrida (N. F.), *Antacrid tincture, Dysmenorrhœa mixture, Fenner's guaiac mixture.* "Corrosive chloride of mercury, five and one-half grammes (5.5 Gm.) [85 grs.]; guaiac (*U. S. P.*), in fine powder, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; Canada turpentine, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; oil of sassafras, thirty cubic centimeters (30 Cc.) [1 fl℥, 7 ♏]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Introduce the guaiac and the Canada turpentine into a flask, together with seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol, cork the flask loosely, and heat the contents, on a water-bath, slowly to boiling. Then cool the flask, and filter the contents through a small filter. Dissolve the corrosive chloride of mercury in thirty cubic centimeters (30 Cc.) [1 fl℥, 7 ♏] of alcohol, and add this solution, as well as the oil of sassafras, to the filtrate. Lastly, pass enough alcohol through the filter to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm contains nearly ⅓ grain of corrosive chloride of mercury. *Note.*—The dose of this preparation is about 10 to 20 minims"—(*Nat. Form.*).

TINCTURA GUAIACI AMMONIATA (U. S. P.)—AMMONIATED TINCTURE OF GUAIAC.

Synonym: *Tinctura guaiaci composita.*

Preparation.—"Guaiac, in coarse powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; aromatic spirit of ammonia, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the powder with eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of aromatic spirit of ammonia, and macerate for 7 days, in a closed vessel; then filter through paper in a well-covered funnel, and add, through the filter, aromatic spirit of ammonia, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This tincture resembles simple tincture of guaiac, except that it possesses the taste and odor of ammonia.

Action, Medical Uses, and Dosage.—(See *Guaiacum.*) This tincture is extensively employed, locally and internally, to abort *acute tonsilitis.* It may be given in drachm doses, in milk, emulsion, or white wine.

TINCTURÆ HERBARUM RECENTIUM (U. S. P.)—TINCTURES OF FRESH HERBS.

"These tinctures, when not otherwise directed, are to be prepared by the following formula: Take of the fresh herb, bruised or crushed, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]; alcohol, one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Macerate the herb with the alcohol for 14 days; then express the liquid and filter"—(*U. S. P.*).

This formula was introduced to insure, as nearly as possible, uniformity in the preparation of these tinctures. It is particularly adapted to drugs holding volatile or evanescent constituents, which are dissipated upon exposure in drying. Tinctures of rhus, gelsemium, thuja, salix nigra aments, pulsatilla, etc., may be prepared in this way. Homœopathic tinctures, introduced by Hahnemann, are of this character. The following are the general directions for preparing Mother Tinctures:

"Homœopathic mother tinctures are prepared: (1) By expressing the juice from freshly-gathered plants, and mixing that juice with an equal bulk of alcohol, allowing it to stand 8 days in a dark, cool place, and finally filtering the product; (2) by mixing 2 parts of alcohol with 3 parts of the comminuted plant, straining the liquid through new muslin, and proceeding further as above directed; (3) by taking 2 parts of alcohol to 1 part of the comminuted plant and macerating them together for 8 days in a well-filled bottle, and lastly, decanting, straining, and filtering; (4) by taking alcohol, 5 parts, to the comminuted drug (vegetable or animal), 1 part, macerating 8 days, shaking twice daily, and lastly, decanting, straining, and filtering the product" (Locke's *Syl. of Mat. Med.*),

TINCTURA HUMULI (U. S. P.)—TINCTURE OF HOPS.

Preparation.—"Hops, well dried, and in No. 20 powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of diluted alcohol, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour diluted alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This tincture possesses the odor and taste of hops, and has a yellow-brown color. On account of the bulky character of hops, they must be first reduced to powder. In order to do this, they must be air-dried (not artificially), and then rubbed in a mortar with sand, which will effectually accomplish their comminution. Drying somewhat diminishes the activity of hops. A tincture of lupulin is more uniform in character than this preparation.

Action, Medical Uses, and Dosage.—(See *Humulus.*) Dose, ½ to 3 fluidrachms.

TINCTURA HYDRASTIS (U. S. P.)—TINCTURE OF HYDRASTIS.

SYNONYM: *Tincture of golden seal.*

Preparation.—"Hydrastis, in No. 60 powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏] of diluted alcohol, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour diluted alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This tincture may also be made by maceration. It has a brownish-yellow color, and the characteristic bitter taste of golden seal.

Action, Medical Uses, and Dosage.—This tincture is tonic, and will be found beneficial in *chronic gastric affections*, *hepatic diseases*, *chronic diarrhœa*, and *general debility*. Diluted and applied locally, it forms an efficient remedy in *leucorrhœa* and *ophthalmia*. The dose is from 10 to 60 drops, 2 or 3 times a day, in water (J. King).

TINCTURA HYDRASTIS COMPOSITA.—COMPOUND TINCTURE OF HYDRASTIS.

SYNONYM: *Compound tincture of golden seal.*

Preparation.—Take of golden seal root, lobelia seed, each, in moderately fine powder, 2 ounces; diluted alcohol, 1 pint, or a sufficient quantity. Form into a tincture by maceration or percolation, and make 1 pint of tincture. Or, it may be made by adding together equal parts of the tinctures of golden seal and lobelia.

Action, Medical Uses, and Dosage.—(See uses of *Lobelia* and *Hydrastis.*) This is a valuable application to diseased mucous surfaces. It is highly recommended in *chronic catarrh*, to be snuffed up into the nostrils, or applied by means of a camel's-hair pencil. It is also useful, when diluted with water, in *chronic ophthalmic diseases* (J. King).

TINCTURA HYOSCYAMI (U. S. P.)—TINCTURE OF HYOSCYAMUS.

Preparation.—"Hyoscyamus, in No. 60 powder, one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏] of diluted alcohol, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour diluted alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This tincture is greenish-brown in color, and possesses the characteristic bitter taste and narcotic odor of the crude drug.

Action, Medical Uses, and Dosage.—(See *Hyoscyamus.*) This tincture is sedative and soporific, and is frequently used in cases where opium does not agree, or where its constipating effects are not desired. Sometimes tincture of henbane purges; when this is the case, a small portion of laudanum may be added to it. The dose is from ½ to 1 fluid drachm.

TINCTURA HYPERICI.—TINCTURE OF HYPERICUM.

Synonym: *Tincture of St. John's wort.*

Preparation.—Take of the blossoms of St. John's wort (recent), 5 ounces; alcohol, 1 pint. Macerate for 14 days; express and filter.

Action, Medical Uses, and Dosage.—This tincture may be used to fulfil the indications of the plant, but its principal use is as a local application to *wounds, bruises, ulcers, swellings, tumors, ecchymoses*, etc. As a local application, it is equal to arnica. The dose internally, is from ½ to 1 fluid drachm.

TINCTURA IGNATIÆ (N. F.)—TINCTURE OF IGNATIA.

Synonym: *Tincture of St. Ignatius' bean.*

Preparation.—"Ignatia, in No. 60 powder, ten grammes (10 Gm.) [154 grs.]; alcohol, water, of each, a sufficient quantity. Mix alcohol and water in the protion of eight (8) parts, by weight, of alcohol to one (1) part of water. Moisten the powder with ten grammes (10 Gm.) [154 grs.] of the menstruum, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until the ignatia is exhausted. Reserve the first ninety grammes (90 Gm.) [3 ozs. av., 76 grs.], evaporate the remainder to ten grammes (10 Gm.) [154 grs.] and mix with the reserved portion. Of this tincture, take any convenient number of parts, and, by means of a water-bath, evaporate it to dryness. Weigh the resulting extract, and from its weight calculate the quantity of extract contained in the one hundred (100) parts of tincture obtained; then dissolve the dried extract in the remainder of the tincture, and add enough of the above menstruum to make the product weigh so many parts that each one hundred (100) parts of tincture shall contain one (1) part of dry extract. Lastly, mix thoroughly, and filter through paper. Tincture of ignatia thus prepared represents about 10 grammes of ignatia in 100 grammes"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—Administered in *nervous affections*, and wherever a tincture is indicated. The dose is 1 to 10 drops, 3 times a day.

TINCTURA IODI (U. S. P.)—TINCTURE OF IODINE.

Synonym: *Tinctura iodinii* (*U. S. P.*, 1870).

Preparation.—"Iodine, seventy grammes (70 Gm.) [2 ozs. av., 205 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the iodine rapidly, in a mortar, to a coarse powder, and transfer it at once to a graduated bottle. Rinse the mortar with several successive portions of alcohol, and pour the rinsings into the bottle. Then add alcohol, shaking the bottle occasionally, until the iodine is dissolved, and the finished tincture measures one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]" (*U. S. P.*). Prof. A. B. Stevens (*Proc. Amer. Pharm. Assoc.*, 1897, p. 451) proposes to obtain this tincture by percolation of the iodine with alcohol, in a long glass tube, the iodine being previously triturated with coarsely-powdered glass or sand. Tincture of iodine should be placed in closely-stopped vials. It is inferior to the compound tincture of iodine (see p. 1968), on account of being decomposed by the action of light, or of air, through the reaction of iodine and alcohol upon each, giving rise to hydriodic acid (see A. B. Stevens, *loc. cit.*), free iodine, etc. This change takes place at ordinary temperatures, but is accelerated by heat. Besides, it is more apt to irritate the stomach, from the deposition of solid iodine when the tincture is taken in water. In preparing the tincture, the iodine should be well dried. It has a deep-brown color, becomes gradually decomposed upon standing, or on the addition of water. When decomposition, above referred to, has ensued, the tincture no longer precipitates iodine. The tincture, when evaporated, should leave no fixed residue. It should not be prepared in large quantities.

Tests.—"If 6.3 Cc. of the tincture be mixed with a solution of 2 Gm. of potassium iodide in 25 Cc. of water, and a little starch T.S. added, it should require, for complete decoloration, about 35 Cc. of decinormal sodium hyposulphite V.S. (corresponding to about 7 Gm. of iodine in 100 Cc.)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—(See *Iodinum.*) This preparation is seldom administered internally, on account of the tendency to deposition of iodine, and consequent irritation produced by the crude iodine. When given, the dose is 10 drops, gradually increased to 30, 2 or 3 times a day, to be administered in water sweetened with loaf-sugar, or in wine. Thirty drops (15 minims) are about equal to 1 grain of iodine. Its principal use is, externally, in *cutaneous scrofula*, *erysipelatous diseases*, *pernio*, *eczema*, *pityriasis*, and other *diseases of the skin*, *acute rheumatism*, *ulcers*, etc. It may be applied by means of a camel's-hair pencil (J. King).

Related Preparations.—TINCTURA IODINII COMPOSITA, *Compound tincture of iodine.* Take of iodine, 1 ounce; iodide of potassium, 2 ounces; alcohol, 2 pints. Macerate till they are dissolved, and filter. The filtering ordered in this formula is unnecessary, and may be dispensed with. This tincture agrees in strength with that of the *U. S. P.*, 1870, which was discarded on account of being so frequently confounded with compound solution of iodine (see *Liquor Iodi Compositus*). This tincture may be used internally for all the purposes to which iodine is applicable. Unlike the tincture of iodine, it is not decomposed when water is added to it. The dose is 5 drops, 3 times a day, gradually increased to 30, if required.

TINCTURA IODI, CHURCHILL (N. F.), *Churchill's tincture of iodine.*—"Iodine, one hundred and sixty-five grammes (165 Gm.) [5 ozs. av., 359 grs.]; potassium iodide, thirty-three grammes (33 Gm. [1 oz. av., 72 grs.]; water, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the potassium iodide in the water, then add the iodine, and lastly, enough alcohol to make the tincture, when completed, measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. *Note.*—Churchill's Tincture of Iodine should not be confounded with Churchill's Iodine Caustic (*Liquor Iodi Causticus*)"—(*Nat. Form.*).

TINCTURA IODI DECOLORATA (N. F.), *Decolorized tincture of iodine.*—"Iodine, eighty-three grammes (83 Gm.) [2 ozs. av., 406 grs.]; sodium hyposulphite, eighty-three grammes (83 Gm. [2 ozs. av., 406 grs.]; water, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; stronger water of ammonia (*U. S. P.*), sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Digest the iodine, sodium hyposulphite, and water, at a gentle heat, until a perfect solution, of a dark reddish-brown color, is produced. Then add one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏] of alcohol, and afterward, the stronger water of ammonia. Shake a few minutes until no more bubbles of gas escape, and the liquid has become colorless, with a whitish precipitate (of sulphur) suspended in it. Cool it, if necessary, and add enough alcohol to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Place the bottle containing it in a refrigerator for a few hours, or longer, if convenient, then filter, in a covered funnel, and preserve the liquid for use. *Note.*—On prolonged standing, a crystalline precipitate of sodium tetrathionate will usually form in the liquid. This may be removed by filtration"—(*Nat. Form.*). This is not a solution of iodine, but of iodine compounds; hence, the term tincture of iodine is a misnomer.

TINCTURA IPECACUANHÆ ET OPII (U. S. P.)—TINCTURE OF IPECAC AND OPIUM.

Preparation.—"Tincture of deodorized opium, one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]; fluid extract of ipecac, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Evaporate the tincture of deodorized opium, in a tared capsule, on a water-bath, until it weighs eight hundred grammes (800 Gm.) [1 lb. av., 12 ozs., 96 grs.]. When it has become cold, add to it the fluid extract of ipecac, filter the mixture, and pass enough diluted alcohol through the filter to make the tincture measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*). This tincture is intended to give a uniform preparation similar to the fluids known as "*Liquid Dover's powder*," or *Tincture of Dover's powder*.

Action, Medical Uses, and Dosage.—The uses of this preparation are those of *Dover's powder*. Dose, 10 minims, which represent 1 grain each of opium and ipecacuanha.

TINCTURA IRIDIS.—TINCTURE OF IRIS.

Synonym: *Tincture of blue flag.*

Preparation.—Take of blue flag root (recent), in fine powder, 3 ounces; alcohol, 1 pint, or a sufficient quantity. Form into a tincture by maceration or percolation, as explained under *Tinctura*, and make 1 pint of tincture.

Action, Medical Uses, and Dosage.—The tincture of blue flag possesses the same alterative and cathartic properties as the root, and may be used in all cases as a substitute for the powder, in doses of from 10 to 60 drops, according to the effect desired, 2 or 3 times a day. Six fluid drachms, each, of the tinctures of blue flag and mandrake roots, with 2 fluid drachms of a saturated tincture of nux vomica, form an efficient remedy in *obstinate constipation, hepatic torpor, derangements of the spleen, sick headache, want of appetite, syphilitic affections, gleet, recent stricture of the urethra, impotency from masturbation, recent disease of the prostate*, etc. The mixture may be given in doses of from 10 to 15 drops, in water, 2 or 3 times a day (J. King).

TINCTURA JABORANDI.—TINCTURE OF JABORANDI.

Preparation.—"Take of jaborandi, in No. 40 powder, 5 ounces (av.); proof-spirit, 1 pint (Imp.)"—(*Br. Pharm.*, 1885). Prepare as directed for *Tinctura Sennæ*. The *British Pharmacopœia* (1898) directs: Take of "jaborandi leaves, in No. 40 powder, 4 ounces (Imp.), or 200 grammes (Metric); alcohol (45 per cent), a sufficient quantity. Moisten the powder with 2½ fluid ounces (or 125 cubic centimeters) of alcohol, and complete the percolation process. The resulting tincture should measure 1 pint, or 1000 cubic centimeters"—(*Br. Pharm.*, 1898).

Action, Medical Uses, and Dosage.—(See *Pilocarpus*.) Dose, 10 to 60 minims.

TINCTURA JALAPÆ (N. F.)—TINCTURE OF JALAP.

Preparation.—"Jalap, in fine powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; alcohol, water, of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix 2 volumes of alcohol with 1 volume of water. Percolate the jalap with this mixture, in the usual manner, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained. *Note.*—This preparation was official in the *U. S. P.* of 1870"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—(See *Jalapa*.) Seldom used, except as an addition to other purgatives. Dose, ½ to 2 fluid drachms.

Related Tincture.—Tinctura Jalapæ Composita (N. F.), *Compound tincture of jalap*. "Jalap, in fine powder, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; scammony, in powder, thirty-two grammes (32 Gm.) [1 oz. av., 56 grs.]; alcohol, water, of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix 2 volumes of alcohol with 1 volume of water. Mix the powders with half their weight of sand; moisten the mixture with a sufficient quantity of the menstruum, pack it in a percolator, and percolate it with the menstruum, in the usual manner, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*Nat. Form.*).

TINCTURA KALMIÆ.—TINCTURE OF KALMIA.

Synonym: *Tincture of sheep laurel.*

Preparation.—Take of sheep laurel leaves, in coarse powder, 3 ounces; diluted alcohol, 1 pint, or a sufficient quantity. Form into a tincture by maceration or percolation, and make 1 pint of tincture.

Action, Medical Uses, and Dosage.—This preparation is sedative and alterative, and may be successfully used in *jaundice, syphilitic diseases, palpitation of the heart, neuralgia of the eye*, etc., in doses of 10 drops, carefully and gradually increased to 30. In *obstinate syphilitic affections*, I frequently add a portion of this tincture to the compound syrup of stillingia, with marked advantage. Externally, the tincture is beneficial in *itch*, and some other *cutaneous affections* (J. King).

TINCTURA KINO (U. S. P.)—TINCTURE OF KINO.

Preparation.—"Kino, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; glycerin, one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏]; water, two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the glycerin with the water and six hundred and fifty cubic centimeters (650 Cc.) [21 fl℥, 470 ♏] of alcohol. Rub the kino, in a mortar, adding gradually a sufficient quantity of the menstruum, until a smooth paste is produced. Transfer this to a bottle, add the remainder of the menstruum, and macerate for 24 hours, with occasional agitation. Then filter through paper, adding, through the filter, enough alcohol to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Keep the tincture in small, completely-filled and well-stoppered bottles, in a cool place"—(*U. S. P.*). The substitution of glycerin for a portion of water was suggested by Haselden (1860) as tending to prevent gelatinization.

Action, Medical Uses, and Dosage.—Tincture of kino is astringent, and is principally used, in doses of 1 or 2 fluid drachms, in *diarrhœa*, *cholera morbus*, *cholera*, etc. It is frequently added to astringent mixtures (see *Kino*).

Related Tincture.—TINCTURA KINO COMPOSITA (N. F.), *Compound tincture of kino.* "Tincture of kino (*U. S. P.*), one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; tincture of opium (*U. S. P.*), one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; spirit of camphor (*U. S. P.*), sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; oil of cloves, one and one-half cubic centimeters (1.5 Cc.) [24 ♏]; cochineal, in powder, nine grammes (9 Gm.) [139 grs.]; aromatic spirit of ammonia (*U. S. P.*), eight cubic centimeters (8 Cc.) [130 ♏]; diluted alcohol (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the cochineal with the aromatic spirit of ammonia, and gradually add seven hundred cubic centimeters (700 Cc.) [23 fl℥, 321 ♏] of diluted alcohol. Then add the two tinctures, the spirit of camphor, and the oil of cloves, and filter the mixture through paper. Lastly, pass enough diluted alcohol through the filter to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents about ½ grain, each, of kino and of powdered opium"—(*Nat. Form.*).

TINCTURA KRAMERIÆ (U. S. P.)—TINCTURE OF KRAMERIA.

SYNONYM: *Tincture of rhatany.*

Preparation.—"Krameria, in No. 40 powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of diluted alcohol, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour diluted alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This forms a strongly astringent, brownish-red tincture, liable to precipitate rhatany-red, and sometimes gelatinizing. Prepare it in small amounts, and keep it in well-filled bottles. Glycerin, as a part of the menstruum, will aid in preserving it.

Action, Medical Uses, and Dosage.—This is useful in *chronic diarrhœa*, and other cases where an astringent is required. It likewise forms an excellent local application to the gums, where they are tender, spongy, and bleed. The dose is 1 or 2 fluid drachms, in sweetened water or wine, if not contraindicated, 3 or 4 times a day.

TINCTURA LACTUCARII (U. S. P.)—TINCTURE OF LACTUCARIUM.

Preparation.—"Lactucarium, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]; glycerin, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; water, alcohol, benzin, diluted alcohol, each, a sufficient quantity. Beat the lactucarium in an iron mortar, with clean sand, to a coarse powder, and introduce it into a bottle; add two thousand cubic centimeters (2000 Cc.) [67 fl℥, 301 ♏] of benzin, cork the bottle tightly, and set it aside for 48 hours, frequently agitating the mixture. Pour the mixture on a double filter, and allow it to drain. Wash the residue by gradually adding fifteen hundred cubic centimeters (1500 Cc.) [50 fl℥, 346 ♏] of benzin. Allow the lactucarium to dry by exposing it to a current of air. When it is dry, and free from the odor of benzin, reduce it to powder, using more sand, if necessary, and pack it moderately in a conical percolator. Mix the glycerin with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of water, and five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of alcohol, and moisten the powder with five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of the mixture. When the liquid begins to drop from the percolator, close the lower orifice, and, having closely covered the percolator, macerate for 24 hours; then allow the percolation to proceed very slowly, gradually adding, first, the remainder of the menstruum, and then diluted alcohol, until the lactucarium is exhausted. Reserve the first seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of the percolate, evaporate the remainder, on a water-bath, at a temperature not exceeding 70° C. (158° F.), to two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏], and mix this with the reserved portion. Filter, and add enough diluted alcohol through the filter to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*). About 7½ grains of lactucarium are contained in 16 minims of this tincture.

Uses.—Tincture of lactucarium is employed in the preparation of *Syrup of Lactucarium*, and, for this purpose, must be freed from caoutchouc, which it contains. This is accomplished by the benzin, and rendered fit to form an unclouded syrup. A pure benzin should be selected, and the percolate should pass very slowly. Tincture of lactucarium is less efficient than syrup of lactucarium, and is but little valued in Eclectic practice.

TINCTURA LARICIS COMPOSITA.—COMPOUND TINCTURE OF LARCH.

SYNONYMS: *Tinctura pinus pendulæ composita, Compound tincture of tamarac.*

Preparation.—Take of tamarac bark, juniper berries, of each, in fine powder, 6 ounces; prickly ash bark, in fine powder, 4 ounces; wild cherry bark, seneca snakeroot, of each, in fine powder, 3 ounces; tansy, coarsely powdered, 1 ounce; whiskey, 5 pints; molasses, 1½ pints; hydro-alcoholic extract of mandrake, 1½ ounces; water, a sufficient quantity. Let the medicinal herbs, roots, and barks be mixed together. To the mixture add 3 pints of the whiskey, and let it stand 24 hours; then place the whole in a percolator, and percolate with whiskey until 24 pints are obtained. To this add the molasses and the hydro-alcoholic extract of mandrake, which last must be thoroughly dissolved.

Action, Medical Uses, and Dosage.—Although not properly a tincture, yet to avoid a new class of pharmaceutic agents (*bitters*), I place this compound among the tinctures. It is an improvement upon the old preparation called *Bone's Bitters*, and is generally preferred by physicians. It possesses nearly four times the strength of that heretofore made, and, consequently, must be taken in a much smaller dose, a desideratum with all medicines containing alcohol. The whiskey and juniper berries are less expensive, and more readily obtainable than the pure Holland gin recommended in the original, and likewise render the preparation more actively diuretic; and the substitution of the extract of mandrake for the bitter and, to many patients, unbearable taste of aloes, renders it much more valuable as a cholagogue, alterative, and aperient. It forms an excellent alterative tonic and aperient for *dyspeptic affections, menstrual derangements, hepatic torpor, constipation, urinary difficulties*, etc. The dose is ½ fluid ounce, 3 times a day, about an hour previous to each meal (J. King).

Related Tincture. TINCTURA LARICIS, *Tincture of larch.* "Take of larch bark, in No. 40 powder, 2½ ounces (av.); rectified spirit, 1 pint (Imp.)."—*Br. Pharm.*, 1885; not in edition of 1898). Prepare as directed under *Tinctura Sennæ*. Unless carefully preserved, this tincture decomposes; it has a reddish-brown color. This agent is used for the same purposes as many of the terebinthinates. Dose, 10 to 30 minims.

TINCTURA LAVANDULÆ COMPOSITA (U. S. P.)—COMPOUND TINCTURE OF LAVENDER.

SYNONYMS: *Compound spirit of lavender, Spiritus lavandulæ compositus, Lavender drops.*

Preparation.—"Oil of lavender flowers, eight cubic centimeters (8 Cc.) [130 ♏]; oil of rosemary, two cubic centimeters (2 Cc.) [32 ♏]; cassia cinnamon, in coarse powder, twenty grammes (20 Gm.) [309 grs.]; cloves, five grammes (5 Gm.) [77 grs.]; nutmeg, ten grammes (10 Gm.) [154 grs.]; red saunders, in coarse powder, ten grammes (10 Gm.) [154 grs.]; alcohol, seven hundred cubic centimeters (700 Cc.) [23 fl℥, 321 ♏]; water, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the oils in the alcohol, and add the water. Crush the nutmeg in a mortar, mix it with the cinnamon, cloves, and red saunders, and reduce the mixture, by grinding, to a coarse (No. 20) powder. Moisten the mixture with a sufficient quantity of the alcoholic solution of the oils, pack it firmly in a cylindrical percolator, gradually pour upon it the remainder of the alcoholic solution, and, afterward, diluted alcohol, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This forms a red tincture of agreeable odor and taste; the addition of water renders it turbid.

Action, Medical Uses, and Dosage.—This forms a delightful preparation, which is much employed as a remedy for *flatulence*, *hysteria*, *gastric uneasiness*, *nausea*, and *general languor*, or *faintness*. It is also used as an adjuvant and corrigent of other medicines. The dose is from 30 drops to 1 or 2 fluid drachms, given in sweetened water, or on sugar (J. King).

TINCTURA LEPTANDRÆ.—TINCTURE OF BLACK ROOT.

Preparation.—Take of black root, in moderately fine powder, 3 ounces; diluted alcohol, 1 pint, or a sufficient quantity. Form into a tincture by maceration or percolation, as explained under *Tincturæ*, and make 1 pint of tincture.

Action, Medical Uses, and Dosage.—(See *Leptandra.*) This preparation is aperient and cholagogue, and is employed in various *derangements of the biliary organs*. It is also added to medicines for *summer complaint*, *chronic diarrhœa*, *remittent fever*, etc. The dose is from ½ to 2 fluid drachms, 2 or 3 times a day (J. King).

TINCTURA LIMONIS.—TINCTURE OF LEMON PEEL.

Preparation.—"Take of fresh lemon peel, cut small, 2½ ounces (av.); proof-spirit, 1 pint (Imp.). Macerate for 7 days in a closed vessel, with occasional agitation; strain, press, and filter; then add sufficient proof-spirit to make 1 pint"—(*Br. Pharm.*, 1885). The *British Pharmacopœia* (1898) prepares this tincture from 5 ounces (Imp.) of fresh lemon peel with 1 pint of alcohol (90 per cent). Dose, from ½ to 1 fluid drachm.

Action, Medical Uses, and Dosage.—(See *Limon.*) Used chiefly in flavoring medicines. Dose, of first preparation, ½ to 2 fluid drachms.

TINCTURA LOBELIÆ (U. S. P.)—TINCTURE OF LOBELIA.

Preparation.—"Lobelia, in No. 40 powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of diluted alcohol, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour diluted alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). Tincture of lobelia has the characteristic acrid and bitterish taste of lobelia, and a somewhat heavy odor. It is of a greenish-brown color.

Action, Medical Uses, and Dosage.—This tincture possesses the same properties as lobelia; the dose is from 30 to 60 drops as a nauseant; and ½ fluid ounce, or more, as an emetic. A tincture prepared of equal parts of vinegar and alcohol, instead of diluted alcohol, is preferable to the above, in cases where it is not to be kept for a length of time. Externally, the tincture of lobelia is beneficial as a local application in *erysipelas*, *tetter*, and similar *cutaneous eruptions*, *stings of insects*, and in the *poisoning by rhus*, having been successfully used by our practitioners in these affections, for more than 60 years past (J. King).

Related Tincture.—TINCTURA LOBELIÆ ÆTHEREA, *Ethereal tincture of lobelia*. "Take of lobelia, in No. 40 powder, 4 ounces (Imp.); spirit of ether, a sufficient quantity. Moisten the powder with 2 fluid ounces of spirit of ether, and complete the percolation process. The resulting tincture should measure 1 pint. Dose, 5 to 15 minims. This preparation is made with rather more than 1⅓ times the proportion of lobelia ordered for the corresponding preparation in the *British Pharmacopœia* of 1885"—*Br. Pharm.*, 1898).

TINCTURA LOBELIÆ COMPOSITA.—COMPOUND TINCTURE OF LOBELIA.

SYNONYM: *Dr. J. King's expectorant tincture.*

Preparation.—Take of lobelia (herb), bloodroot, skunk-cabbage root, wild ginger root, and pleurisy root, each, in moderately fine powder, 1 ounce; water (or vinegar), 1 pint; alcohol, 3 pints, or a sufficient quantity. Form a tincture by maceration or percolation, as explained under *Tincturæ*, and make 4 pints of tincture.

Action, Medical Uses, and Dosage.—This tincture forms an excellent emetic for children and infants, and may be safely used in *croup*, *whooping-cough*, *bronchitis*, *asthma*, *convulsions*, and in all cases where an emetic is required. It will likewise be found beneficial as an expectorant, or nauseant in *coughs*, *pleuritic affections*, *asthma*, *pertussis*, and whenever expectorants are indicated It is a most valuable compound.

In *croup*, for children 1 year old, give ½ tablespoonful in a tablespoonful of syrup or molasses, and repeat it every 15 minutes, until it vomits; after which a teaspoonful may be given every hour or two, as required—the vomit to be repeated 2 or 3 times a day. A child from 2 to 6 months old, may take from ½ to 1 teaspoonful for a dose; less than 2 months old, from 15 to 25 drops, to be repeated every 10 minutes, if vomiting is required. Children from 3 to 6 years old, may take 1 tablespoonful, in molasses or warm water, every 10 minutes, until it vomits. Warm boneset tea ought always to be given in order to facilitate its operation as an emetic. For *cough*, *asthma*, etc., to promote expectoration and remove tightness across the chest; and in all ordinary cases where an expectorant is required, adults may take 1 or 2 teaspoonfuls in ½ wineglassful of slippery-elm tea, 3 to 5 times a day, or as often as required. Children from 1 to 10 years old, may take from ½ to 1 teaspoonful in the same manner; and for those less than 1 year, from 10 to 30 drops. Should the above doses vomit, they should be lessened, except when vomiting is desired. The stomach and bowels must be kept regular in all cases, by gentle medicines (J. King).

TINCTURA LOBELIÆ ET CAPSICI COMPOSITA.—COMPOUND TINCTURE OF LOBELIA AND CAPSICUM.

SYNONYM: *Antispasmodic tincture.*

Preparation.—Take of lobelia, capsicum, and skunk-cabbage root, each, in moderately fine powder, 2 ounces; diluted alcohol, 2 pints, or a sufficient quantity. Form into a tincture by maceration and percolation, as explained under *Tincturæ*, and make 2 pints of tincture; or, it may be made by combining together equal parts of the saturated tinctures of lobelia, capsicum, and skunk-cabbage root.

Action, Medical Uses, and Dosage.—This tincture is a powerful antispasmodic and relaxant, and will be found highly efficient in *cramps*, *spasms*, *convulsions*, *tetanus*, etc. The dose is from ½ teaspoonful to 1 teaspoonful, every 10 or 20 minutes, as often as the urgency of the case requires.

In *hysteria*, *convulsions*, and *tetanus*, in which swallowing is difficult, it may be poured into the corner of the mouth, and repeated as often as necessary; it will find its way into the stomach; generally, the effect is almost instantaneous. This valuable preparation should always be in the possession of every physician. In *rigidity of the os uteri* (with thick doughy edges), 1 teaspoonful administered by mouth, or by enema into the rectum, and repeated in 15 or 20 minutes, will be found to produce a state of softness and dilatability (J. King).

TINCTURA LUPULINI.—TINCTURE OF LUPULIN.

Preparation.—"Take of lupulin, 4 troy ounces; alcohol, a sufficient quantity. Pack the lupulin in a cylindrical percolator, and gradually pour alcohol upon it, until 2 pints of tincture are obtained"—(*U. S. P.*, 1870).

Action, Medical Uses, and Dosage.—Lupulin is the active principle of hops, and as the quantity of it varies in different specimens of hops, a tincture of it is decidedly preferable to one made of hops. It may be employed with advantage in *coughs*, *after-pains*, and in all cases where opium is inadmissible. (For further uses, see *Lupulinum*.) The dose is 1 or 2 fluid drachms, in mucilage, or sweetened fluid of some kind.

TINCTURA MATICO (U. S. P.)—TINCTURE OF MATICO.

Preparation.—"Matico, in No. 40 powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the matico with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of diluted alcohol, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour diluted alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This tincture has a green-brown color. When prepared with strong alcohol (which is the better menstruum), it has a brown-green hue.

Action, Medical Uses, and Dosage.—(See *Matico*.) Dose, ½ to 2 fluid drachms.

TINCTURA MOSCHI (U. S. P.)—TINCTURE OF MUSK.

Preparation.—"Musk, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; alcohol, four hundred and fifty cubic centimeters (450 Cc.) [15 fl℥, 104 ♏]; water, four hundred and fifty cubic centimeters (450 Cc.) [15 fl℥, 104 ♏]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Rub the musk in a mortar, first, with a little of the water, until a smooth mixture is made, and then with the remainder of the water. Transfer the whole to a bottle, add the alcohol, and macerate the mixture for 7 days, occasionally shaking the bottle. Then filter through paper, adding, through the filter, enough diluted alcohol to make the tincture measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*). This produces a pale-brown tincture, striking faintly opalescent with water. When made with a weaker alcohol, the odor is strong, the color deep red-brown, and, when mixed with water, the mixture remains transparent. A grain of musk is contained in 20 minims.

Action, Medical Uses, and Dosage.—(See *Moschus*.) Dose, ½ to 2 fluid drachms.

TINCTURA MENTHÆ VIRIDIS.—TINCTURE OF MENTHA VIRIDIS.

Synonyms: *Tincture of spearmint*, *Spirits of mint*.

Preparation.—Take of the fresh herb of spearmint, a sufficient quantity to fill a glass jar, and cover with good Holland gin. Macerate for 7 days; express and filter (Beach's *Amer. Prac.*).

Action, Medical Uses, and Dosage.—This tincture is diuretic and stimulant. It may be beneficially employed in *strangury*, *retention of urine*, *gravel*, and various *chronic nephritic diseases*. The dose is 2 to 4 ounces, 3 times a day, but, in severe and painful cases, it may be repeated every ½ or 1 hour, until relief is obtained. Externally, it forms an excellent application to *hemorrhoids*, when in a state of inflammation. Cotton must be moistened with it, and applied to the parts.

TINCTURA MYRRHÆ (U. S. P.)—TINCTURE OF MYRRH.

Preparation.—"Myrrh, in moderately coarse powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the powder with eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of alcohol, and macerate for 7 days in a closed vessel; then filter through paper, adding, through the filter, enough alcohol to make the tincture measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*). A brown or red-yellow tincture, of a bitter, balsamic taste and an aromatic odor. When added to water, resin is precipitated.

Action, Medical Uses, and Dosage.—Tincture of myrrh is used as a stimulating application to *obstinate, fetid ulcers*, and to promote the *exfoliation of carious bones* (Coxe). It is also useful as a wash, either alone or diluted with water, in *ulceration of the mouth and throat, spongy and bleeding gums*, etc. Internally, it has been used in *chronic cough, catarrh*, etc., as a stimulating expectorant; also as an emmenagogue. The dose is from ½ to 1 fluid drachm.

TINCTURA MYRRHÆ COMPOSITA.—COMPOUND TINCTURE OF MYRRH.

Preparation.—Take of myrrh, in rather fine powder, 8 ounces; capsicum, in fine powder, 2 ounces; alcohol, 1 gallon, or a sufficient quantity. Form into a tincture by maceration, as explained under *Tincturæ*, and make 1 gallon of tincture.

Action, Medical Uses, and Dosage.—This preparation, frequently termed *Hot Drops*, from its resemblance to a compound of similar composition formerly in use, is rarely employed internally. Occasionally, however, it is used in doses of from ½ to 1 fluid drachm, in sweetened water, in cases of *nausea, gastric distress*, especially after a hearty meal, *flatulence*, etc. Its internal employment is contraindicated when inflammation is present. It is principally used externally, when it proves an excellent local application to *sprains, bruises, fresh wounds, cuts, rheumatism, offensive ulcers*, etc.

Related Preparations.—Practically the same as the preceding is the TINCTURA CAPSICI ET MYRRHÆ (N. F.), *Tincture of capsicum and myrrh, Hot drops*. "Capsicum, in No. 20 powder, thirty-two grammes (32 Gm.) [1 oz. av., 56 grs.]; myrrh, in moderately coarse powder, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; alcohol, water, of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the powders with an equal bulk of clean, fine sand, and percolate them, in the usual manner, with a mixture of nine (9) volumes of alcohol and one (1) volume of water, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of percolate are obtained. *Note.*—This preparation is known in some parts of this country by the old Thompsonian name 'Number Six'"—(*Nat. Form.*).

TINCTURA NUCIS VOMICÆ (U. S. P.)—TINCTURE OF NUX VOMICA.

Preparation.—"Extract of nux vomica, dried at 100° C. (212° F.), twenty grammes (20 Gm.) [309 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the extract of nux vomica (which should contain fifteen [15] per cent of alkaloids) in a sufficient quantity of a mixture of three (3) volumes of alcohol and one (1) volume of water, to make the tincture measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*). This produces a very bitter, yellowish tincture, striking opalescent with water.

Test.—"If 100 Cc. of tincture of nux vomica be evaporated to dryness, and the residue tested by the process of assay given under *Extractum Nucis Vomicæ*, it should be found to contain 0.3 Gm. of alkaloids"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This tincture possesses the properties of nux vomica (which see). Its extreme bitterness is a great objection to the employment of this tincture. It is occasionally employed in doses of from 5 to 10 or 20 drops, and as an external application in *local paralytic affections*.

Related Tincture.—Tinctura Strychninæ Composita, *Compound tincture of strychnine*. Take of strychnine, in crystals, 16 grains; distilled water, alcohol, each, 7½ fluid ounces; acetic acid, compound tincture of cardamom, each, ½ fluid ounce. Dissolve the strychnine in the alcohol and acetic acid mixed together, and then add the remaining articles. This tincture is useful in *impaired spinal energy*, or *spinal exhaustion*, whether the result of excessive study muscular effort, sexual indulgence, masturbation, etc. It is likewise efficient in *paralysis, constipation, debility of the generative organs, malarial diseases, chronic splenitis*, and *recent diseases of the prostate gland*. It is contraindicated in irritation of the spinal nerves. Two fluid drachms of the tincture contain ⅛ grain of strychnine. The dose is from 10 to 30 drops, 3 times a day.

TINTCURA OPII (U. S. P.)—TINCTURE OF OPIUM.

Synonyms: *Laudanum, Tinctura meconii, Tinctura thebaica.*

Preparation.—"Powdered opium, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; precipitated calcium phosphate, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; water, four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏]; alcohol, four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Rub the powders, in a mortar, with the water previously heated to the temperature of 90° C. (194° F.), until a smooth mixture is made, and macerate for 12 hours; then add the alcohol, mix thoroughly, and transfer the whole to a cylindrical percolator. Return to the percolator the first portion of the percolate, until it runs through clear, and, when the liquid ceases to drop, gradually pour on diluted alcohol, continuing the percolation slowly, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*).

History and Description.—This tincture is universally known in this and other English-speaking countries as *laudanum*. It has been known throughout Europe as *Laudanum Liquidum Simplex*, in contradistinction to solid opium preparations, which were also called by the name *laudanum*, usually with some qualifying term, as *Laudanum Antihystericum*, etc. Tincture of opium has a deep red-brown color, and the characteristic odor and taste of opium. Lest concentration take place, through evaporation of its alcohol, it should be kept in securely-stoppered bottles. Each fluid drachm represents 5.7 grains of dry opium, or 1 grain of opium in about 10.5 minims of the tincture.

In preparing this tincture, it is essential that well-dried opium should be used, to insure a full-strength product, and it should be in a finely-powdered form. The admixture with calcium phosphate aids in its percolation, which could not otherwise be readily accomplished with diluted alcohol. The percolate passes slowly, and about 60 per cent of the opium constituents are obtained in solution by the use of the diluted alcohol. The Pharmacopœia directs the drug to be macerated 12 hours previous to percolation. Twice that length of time, however, will better insure the complete disintegration of the opium. After completion of the percolation, water should abstract nothing from the dried residue, and only mere traces of alkaloids, or their compounds, should be abstracted by diluted acids.

Valuation.—"If 100 Cc. of tincture of opium be assayed by the process immediately following, it should yield from 1.3 to 1.5 Gm. of crystallized morphine"—(*U. S. P.*).

Assay of Tincture of Opium.—"Tincture of opium, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; ammonia water, three and five-tenths cubic centimeters (3.5 Cc.) [57 ♏]; alcohol, ether, water, each, a sufficient quantity. Evaporate the tincture to about 20 Cc., add 40 Cc. of water, mix thoroughly, and set the liquid aside for an hour, occasionally stirring, and disintegrate the resinous flakes adhering to the capsule. Then filter, and wash the filter and residue with water, until all soluble matters are extracted, collecting the washings separately. Evaporate in a tared capsule, first, the washings to a small volume, then add the first filtrate, and evaporate the whole to a weight of 14 Gm. Rotate the concentrated solution about in the capsule until the rings of extract are redissolved, pour the liquid into a tared Erlenmeyer flask having a capacity of about 100 Cc., and rinse the capsule with a few drops of water at a time, until the entire solution weighs 20 Gm. Then add 10 Gm. (or 12.2 Cc.) of alcohol, shake well, add 25 Cc. of ether, and shake again. Now add the ammonia water from a graduated pipette or burette, stopper the flask with a sound cork, shake it thoroughly during 10 minutes, and then set it aside, in a moderately cool place, for at least 6 hours, or over night. Remove the stopper carefully, and, should any crystals adhere to it, brush them into the flask. Place in a small funnel 2 rapidly-acting filters, of a diameter of 7 Cm., plainly folded, one within the other (the triple fold of the inner filter being laid against the single side of the outer filter), wet them well with ether, and decant the ethereal solution as completely as possible upon the inner filter. Add 10 Cc. of ether to the contents of the flask, rotate it, and again decant the ethereal layer upon the inner filter. Repeat this operation with another portion of 10 Cc. of ether. Then pour into the filter the liquid in the flask, in portions, in such a way as to transfer the greater portion of the crystals to the filter, and, when this has passed through, transfer the remaining crystals to the filter by washing the flask with several portions of water, using not more than about 10 Cc. in all. Allow the double filter to drain, then apply water to the crystals, drop by drop, until they are practically free from mother water, and afterward wash them, drop by drop from a pipette, with alcohol previously saturated with powdered morphine. When this has passed through, displace the remaining alcohol by ether, using about 10 Cc., or more, if necessary. Allow the filter to dry in a moderately warm place, at a temperature not exceeding 60° C. (140° F.), until its weight remains constant, then carefully transfer the crystals to a tared watch-glass and weigh them. The weight found represents the amount of crystallized morphine obtained from 100 Cc. of the tincture"—(*U.S.P.*).

Action, Medical Uses, and Dosage.—This tincture, occasionally termed *Tinctura Thebaica*, possesses the medicinal virtues of opium, and may be used in all cases where the drug is indicated, in doses of from 5 to 30 drops (see *Opium*).

Related Preparations.—TINCTURA OPII ACETATA. If diluted acetic acid be employed instead of water, it will form a much better tincture of opium, and one less liable to vary in strength (TINCTURA OPII ACETATA, or *Acetated Tincture of Opium*), and which may be given in the same doses as above. It is, however, seldom prescribed at the present day. The *U. S. P.* (1870) directed 2 troy ounces of dry-powdered opium to be macerated for 7 days in a mixture of 8 fluid ounces of alcohol and 12 fluid ounces of distilled vinegar; express and filter. Twenty fluid ounces are obtained. One grain of opium is contained in each 10 minims.

TINCTURA OPII MURIATICA.—In a mixture of hydrochloric acid, 1 fluid ounce, and water, 15 fluid ounces, macerate 1 ounce of powdered opium for 14 days, and filter. Then add sufficient water to make 1 pint of tincture. No alcohol is present. This is not quite half as strong as tincture of opium.

TINCTURA PAPAVERIS (N. F.), *Tincture of poppy.*—"Poppy capsules, freed from seeds, and in coarse powder, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]; glycerin, one hundred and twenty-five cubic centimeters (125 Cc.) [4 flʒ, 109 ♏]; alcohol, water, of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 flʒ, 391 ♏]. Digest the poppy capsules with three thousand cubic centimeters (3000 Cc.) [101 flʒ, 212 ♏] of boiling water during 2 hours, then express and strain. Evaporate the strained liquid to five hundred cubic centimeters (500 Cc.) [16 flʒ, 435 ♏], mix it with two hundred and fifty cubic centimeters (250 Cc.) [8 flʒ, 218 ♏] of alcohol, and set the mixture aside, well covered, until it is quite cold. Then filter, add the glycerin to the filtrate, and pass enough of a mixture of two (2) volumes of water and one (1) volume of alcohol through the filter, to make the product measure one thousand cubic centimeters (1000 Cc.) [33 flʒ, 391 ♏]. Each fluid drachm represents 30 grains of poppy (capsule) freed from seeds"—(*Nat. Form.*).

TINCTURA OPII DEODORATI (U. S. P.)—TINCTURE OF DEODORIZED OPIUM.

SYNONYM: *Tinctura opii deodorata* (*U. S. P.*, 1880).

Preparation.—"Powdered opium, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; precipitated calcium phosphate, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; ether, two hundred cubic centimeters (200 Cc.) [6 flʒ, 366 ♏]; alcohol, two hundred cubic centimeters (200 Cc.) [6 flʒ, 366 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 flʒ, 391 ♏]. Rub the powders in a mortar with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of water, previously heated to the temperature of 90° C. (194° F.), until a smooth mixture is made, and macerate for 12 hours; then pour the mixture on a filter, or transfer it to a cylindrical percolator, and gradually pour on water until the opium is practically exhausted. Reduce the percolate, by evaporation on a water-bath, to one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏], and, when it has cooled, shake it repeatedly with the ether in a bottle. When the ethereal solution has separated by standing, pour it off, and evaporate the remaining liquid until all traces of ether have disappeared. Mix the residue with five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of water, and filter the mixture through paper. When the liquid has ceased to pass, add enough water, through the filter, to make the filtered liquid measure eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏]. Lastly, add the alcohol, and mix them"—(*U. S. P.*).

Test.—"If 100 Cc. of tincture of deodorized opium be assayed by the process given under *Tinctura Opii*, it should yield from 1.3 to 1.5 Gm. of crystallized morphine"—(*U. S. P.*).

Several *elixirs of opium* and a denarcotized tincture of opium are upon the market, which this preparation is designed to displace. Tincture of denarcotized opium contains the same amount of opium as tincture of opium, *i.e.*, 1 grain in about every 10.5 minims It is not so dark in color as laudanum. The drug is deprived of its narcotine and odor-giving principles by means of the ether employed. This is successfully, though somewhat difficultly, performed by following the official directions. The trouble is due to the formation of an emulsion produced by shaking together the concentrated aqueous preparation and the ether. This may be avoided, according to Prof. Maisch, if the opium be first denarcotized and deodorized, and an infusion made and evaporated to the necessary quantity, and the requisite amount of alcohol added to bring the tincture to the desired strength. Benzin has been suggested to denarcotize and deodorize this preparation, but it is not suitable, as it leaves its own disagreeable odor.

Action, Medical Uses, and Dosage.—(See *Opium.*) Dose, from 10 to 20 minims.

Related Preparation.—The following was offered to the profession by Eugene Dupuy, a pharmacist of New York, as a substitute for *McMunn's Elixir of Opium*. It is said that none of the unpleasant effects attributed to laudanum have as yet attended its administration: Take of opium, 10 drachms, make it into a thin pulp, with a sufficient quantity of water; then allow the mixture to stand in a cool place 48 hours, after which transfer it to an elongated glass funnel containing filtering paper, and add a superstratum of water equivalent to the bulk of the whole mass. When 12 ounces of liquid have filtered, add to the filtered solution alcohol (95 per cent), 4 ounces. The solution is an aqueous solution of opium, nearly free from narcotine, preserved by alcohol, and contains about two-thirds of the substance of the opium—the residue consisting chiefly of resin, narcotine, caoutchouc, ligneous matter, etc.

TINCTURA OPII CAMPHORATA (U. S. P.)—CAMPHORATED TINCTURE OF OPIUM.

SYNONYMS: *Paregoric*, *Elixir paregoricum*, *Paregoric elixir.*

Preparation.—"Powdered opium, four grammes (4 Gm.) [62 grs.]; benzoic acid, four grammes (4 Gm.) [62 grs.]; camphor, four grammes (4 Gm.) [62 grs.]; oil of anise, four cubic centimeters (4 Cc.) [65 ♏]; glycerin, forty cubic centimeters (40 Cc.) [1 fl℥, 169 ♏]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Add nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of diluted alcohol to the other ingredients, contained in a suitable vessel, and macerate for 3 days, shaking frequently; then filter through paper, in a well-covered funnel, and pass enough diluted alcohol through the filter to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*). This tincture has a brown-yellow color, a sweetish and somewhat bitter, sharply aromatic taste, and an odor resembling that of camphor and anise combined. In reaction it is acid, and, when added to water, renders the latter milky. It contains, in every 263 minims, 1 grain of opium. True benzoic acid should be preferred to that made from the urine of herbivorous animals.

Action, Medical Uses, and Dosage.—This is a very valuable and useful opiate, which is efficient in allaying troublesome *cough*, *nausea*, *whooping-cough*, slight *gastric and intestinal pains;* to cause sleep, and palliate *diarrhœa*. The dose for an adult is 1 to 2 fluid drachms; for an infant, 5 to 10 or 20 drops.

Related Preparations.—The liquids known by the names of *Godfrey's Cordial*, and *Bateman's Drops*, two very dangerous articles in the hands of nurses and many non-professional persons, are generally prepared as follows:

Godfrey's Cordial.—Dissolve carbonate of potassium, 6 drachms, in water, 6½ pints; add sugar-house molasses, 4 pints, and gently heat them to form a solution, removing any scum which floats upon the surface. Remove from the fire and add laudanum, 6 fluid ounces; alcohol, 8 fluid ounces, in which has been dissolved 1 fluid drachm of oil of sassafras. A fluid drachm of this cordial is equivalent to somewhat more than ¼ grain of opium.

Bateman's Pectoral Drops.—Take powdered opium, powdered catechu, camphor, red saunders, rasped, each, 2 drachms; oil of anise, ½ fluid drachm; diluted alcohol, 4 pints. Mix and macerate for 12 or 14 days. Two fluid drachms are equivalent to about ¼ grain of opium. The following is the modified formula of the *National Formulary:*

Tinctura Pectoralis (N. F.), *Pectoral tincture, Guttæ pectorales, Pectoral drops, Bateman's pectoral drops.*—"Tincture of opium (*U. S. P.*), forty-two cubic centimeters (42 Cc.) [1 fl℥, 202 ♏]; compound tincture of catechu (*U. S. P.*), thirty cubic centimeters (30 Cc.) [1 fl℥, 7 ♏]; spirit of camphor (*U. S. P.*), forty cubic centimeters (40 Cc.) [1 fl℥, 169 ♏]; oil of anise, one cubic centimeter (1 Cc.) [16 ♏]; caramel, sixteen cubic centimeters (16 Cc.) [260 ♏]; diluted alcohol (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the first 5 ingredients with enough diluted alcohol to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and filter. Each fluid drachm contains 2½ minims of tincture of opium"—(*Nat. Form.*).

Tinctura Opii Ammoniata, *Ammoniated tincture of opium.*—Take of "tincture of opium, 3 fluid ounces (Imp.), or 150 cubic centimeters (Metric); benzoic acid, 180 grains, or 20.6 grammes; oil of anise, 1 fluid drachm, or 6.25 cubic centimeters; solution of ammonia, 4 fluid ounces, or 200 cubic centimeters; alcohol (90 per cent), a sufficient quantity. Dissolve the oil of anise and the benzoic acid in 12 fluid ounces (or 600 cubic centimeters) of the alcohol; add the tincture of opium and the solution of ammonia; mix well; filter; add enough of the alcohol to form 1 pint (or 1000 cubic centimeters) of the tincture. Dose, ½ to 1 fluid drachm. This preparation contains the soluble matter of nearly 0.62 grain of opium (containing 10 per cent of morphine, reckoned as anhydrous) in 1 fluid drachm, or of nearly 5 grains of such opium in 1 fluid ounce"(—*Br. Pharm.*, 1898). This preparation is formulated after the old *Edinburgh Pharmacopœia* formula for *Elixir Paregoricum Scoticum*, or *Scotch Paregoric Elixir*, and was used to fulfil the same indications that our paregoric is designed to meet. The excess of ammonia employed and the alcohol hold the opium alkaloids in solution in a free condition. A weaker solution of ammonia would be apt to precipitate the morphine. It is an unsatisfactory preparation, and has once been discarded by the *British Pharmacopœia*. Being much used by the people of Great Britain, it has been reinstated. About 1 grain of opium is represented in every 90 minims.

TINCTURA PHYSOSTIGMATIS (U. S. P.)—TINCTURE OF PHYSOSTIGMA.

Preparation.—"Physostigma, in No. 40 powder, one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of alcohol, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—(See *Physostigma*.) Dose, from 1 to 40 minims, beginning with the smaller doses.

TINCTURA PHYTOLACCÆ.—TINCTURE OF PHYTOLACCA.

Synonym: *Tincture of poke.*

Preparation.—Take of recently dried poke-root, in fine powder, 3 ounces; diluted alcohol, 1 pint, or a sufficient quantity. Form into a tincture by maceration or percolation, and make 1 pint of tincture.

Action, Medical Uses, and Dosage.—This tincture possesses the properties of the root (see *Phytolacca*), and may be used where that is indicated, as in *rheumatism*, *scrofula*, *syphilis*, etc. The dose is from 1 to 40 drops, which may be repeated as required.

TINCTURA PODOPHYLLI.—TINCTURE OF PODOPHYLLUM.

SYNONYM: *Tincture of mandrake.*

Preparation.—Take of mandrake root, in fine powder, 3 ounces; alcohol, 1 pint, or a sufficient quantity. Form into a tincture by maceration or percolation, and make 1 pint of tincture. Or, "take of resin of podophyllum, 160 grains; rectified spirit, 1 pint (Imp.). Dissolve and filter. It contains 1 grain of the resin in 1 fluid drachm"—(*Br. Pharm.*).

Action, Medical Uses, and Dosage.—This tincture possesses the alterative, cholagogue, purgative, and other properties of the root. The tincture prepared from the root is to be preferred to that made by dissolving the resin. The dose is from 10 to 60 drops.

TINCTURA POLYGONI.—TINCTURE OF POLYGONUM.

SYNONYM: *Tincture of water-pepper.*

Preparation.—Take of water-pepper, the fresh herb, a sufficient quantity to fill a quart jar; then add Holland gin, or proof-spirit, as much as can be held in the jar. Macerate for 7 days; express and filter. This tincture may likewise be made from the dried herb, in powder, 6 ounces, to 1½ pints of proof-spirit, and macerating for 14 days; or by percolation, as explained under *Tincturæ.*

Action, Medical Uses, and Dosage.—This tincture has been used with efficacy in *amenorrhœa*, *dysmenorrhœa*, *suppressed lochial discharge*, and in moderate *menorrhagia.* The dose is a teaspoonful, 3 or 4 times a day.

TINCTURA PULSATILLÆ.—TINCTURE OF PULSATILLA.

Preparation.—Take of the recent herb pulsatilla, cut into small pieces, 8 ounces; absolute alcohol, 1 pint, or a sufficient quantity. Form into a tincture by maceration or percolation, and make 1 pint of tincture.

Action, Medical Uses, and Dosage.—(See *Pulsatilla.*) One fluid drachm of this tincture may be added to 4 fluid ounces of water, the dose of which is a teaspoonful, to be repeated several times a day.

TINCTURA PYRETHRI (U. S. P.)—TINCTURE OF PYRETHRUM.

SYNONYM: *Tincture of pellitory.*

Preparation.—"Pyrethrum, in No. 40 powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏] of alcohol, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This acrid tincture has a brown-yellow color, and, when in contact with water, becomes milky and opalescent.

Action and Medical Uses.—Used only in tooth and mouth washes; intended as local irritants in *toothache* and *paralytic states of the tongue and fauces.*

TINCTURA QUASSIÆ (U. S. P.)—TINCTURE OF QUASSIA.

Preparation.—"Quassia, in No. 40 powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix alcohol and water in the proportion of three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of alcohol to six hundred and fifty cubic centimeters (650 Cc.) [21 fl℥, 470 ♏] of water. Having moistened the powder with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of the menstruum, macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). An intensely bitter, pale brown-yellow tincture. It should not strike black with ferric compounds.

Action, Medical Uses, and Dosage.—(See *Quassia.*) Dose, ½ to 1 fluid drachm. In enema, it destroys *ascarides*.

TINCTURA QUILLAJÆ (U. S. P.)—TINCTURE OF QUILLAJA.

SYNONYM: *Tincture of soap bark.*

Preparation.—"Quillaja, coarsely ground, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; alcohol, three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Boil the quillaja, placed in a suitable vessel, with eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of water for 15 minutes, strain, and wash the residue on the strainer with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of water. Then boil the strained liquid down to six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏], allow it to cool, mix it with the alcohol, and, when the insoluble matter has subsided, filter the liquid portion through paper, and add enough water to make the tincture measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Uses.—(See *Quillaja.*) This preparation, aside from its therapeutic use, is chiefly employed as an emulsifying agent for oils, balsams, and resins.

TINCTURA QUININÆ COMPOSITA.—COMPOUND TINCTURE OF QUININE.

SYNONYM: *Ague bitters.*

Preparation.—Take of quinine, 30 grains; cream of tartar, 1 ounce; cloves, in powder, 1 ounce; diluted alcohol, 1 pint. Macerate for 24 hours, and filter.

Action, Medical Uses, and Dosage.—This tincture is febrifuge, antiperiodic, and tonic, and is used in *intermittent and remittent fevers*, and other diseases attended with symptoms of a periodical character. In *intermittent fever*, the dose for an adult is ½ fluid ounce every hour during the intermission, until 2 or 3 hours previous to the return of the next expected chill, when the dose should be given every ½ hour. The dose for children is 1 to 2 fluid drachms (T. V. Morrow, M. D.).

Related Tinctures.—TINCTURA QUININÆ, *Tincture of quinine*. "Take of hydrochlorate of quinine, 160 grains; tincture of orange peel, 1 pint (Imp.). Dissolve the hydrochlorate of quinine in the tincture with the aid of a little heat; then allow the solution to remain for 3 days in a closed vessel, shaking occasionally, and afterward filter"—(*Br. Pharm.*, 1885). Each fluid drachm contains 1¼ grains of the quinine salt. The preparation of the *British Pharmacopœia* (1898) contains 175 grains of the quinine salt to 1 pint of tincture of orange.

TINCTURA QUININÆ AMMONIATA, *Ammoniated tincture of quinine.*—"Take of sulphate of quinine, 160 grains; solution of ammonia, 2½ fluid ounces; proof-spirit, 17½ fluid ounces. Dissolve the sulphate of quinine in the spirit with the aid of a little heat, and add the solution of ammonia"—(*Br. Pharm.*, 1885). The preparation of the *British Pharmacopœia* (1898) is about $\frac{1}{11}$ stronger in alkaloid than that of 1885. Each fluid drachm contains 1 grain of the quinine salt. Used in *nervous debility* and *neuralgia*, and other troubles arising therefrom.

TINCTURA RHEI (U. S. P.)—TINCTURE OF RHUBARB.

Preparation.—"Rhubarb, one hundred grammes (100 Gm.) [3 oz. av., 231 grs.]; cardamom, twenty grammes (20 Gm.) [309 grs.]; glycerin, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the rhubarb and cardamom, and reduce the mixture to a moderately coarse (No. 40) powder. Mix the glycerin with six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of alcohol, and three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏] of water. Moisten the powder with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of the menstruum, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour on the remainder of the menstruum. When the liquid has disappeared from the surface, gradually pour on more of a mixture of alcohol and water, made in the same proportions as before, and continue the percolation, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). Tincture of rhubarb deposits upon standing yellow, granular, or crystalline matter, a mixture of *chrysophanic acid* and *emodin*, together with some other rhubarb constituents. The *U. S. P.* aims to prevent this precipitation by directing the use of glycerin and strong alcohol. This does not wholly prevent this phenomenon.

Action, Medical Uses, and Dosage.—This tincture is purgative, stomachic, and tonic. It is principally used in *flatulent colic*, *dyspepsia*, *constipation*, and rarely in *low forms of fever*. The dose, as a purgative, is from ½ to 1 fluid ounce; as a stomachic, 1, 2, or 3 fluid drachms.

Related Tinctures.—TINCTURA RHEI VINOSA (N. F.), *Vinous tincture of rhubarb.* "Fluid extract of rhubarb (*U. S. P.*), eighty cubic centimeters (80 Cc.) [2 fl℥, 339 ♏]; fluid extract of bitter orange peel (*U. S. P.*), twenty cubic centimeters (20 Cc.) [325 ♏]; tincture of cardamom (*U. S. P.*), eighty cubic centimeters (80 Cc.) [2 fl℥, 339 ♏]; sugar, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; sherry wine, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the fluid extracts and the tinctures with five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of sherry wine. In this dissolve the sugar by agitation, then add enough sherry wine to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and filter. *Note.*—This preparation corresponds, in strength, to that which is official in the *German Pharmacopœia*"—(*Nat. Form.*).

TINCTURA RHEI ET GENTIANÆ (N. F.), *Tincture of rhubarb and gentian.*—I. "Rhubarb, seventy grammes (70 Gm.) [2 ozs. av., 205 grs.]; gentian, seventeen and one-half grammes (17.5 Gm.) [270 grs.]; diluted alcohol (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Reduce the solids to a moderately coarse (No. 40) powder, and percolate it, in the usual manner, with diluted alcohol, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of percolate are obtained. Each fluid drachm represents 4 grains of rhubarb and 1 grain of gentian. *Note.*—When this preparation is required for immediate use, and it is not otherwise obtainable, it may be prepared in the following manner: II. Fluid extract of rhubarb (*U. S. P.*), seventy cubic centimeters (70 Cc.) [2 fl℥, 176 ♏]; fluid extract of gentian (*U. S. P.*), seventeen and one-half cubic centimeters (17.5 Cc.) [284 ♏]; diluted alcohol (*U. S. P.*), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the fluid extracts with enough diluted alcohol to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and filter"—(*Nat. Form.*).

TINCTURA RHEI AQUOSA (N. F.), *Aqueous tincture of rhubarb.*—I. "Rhubarb, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; sodium borate, ten grammes (10 Gm.) [154 grs.]; potassium carbonate, ten grammes (10 Gm.) [154 grs.]; cinnamon water (*U. S. P.*), one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏]; alcohol, one hundred and twenty cubic centimeters (120 Cc.) [4 fl℥, 28 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the sodium borate and the potassium carbonate in seven hundred cubic centimeters (700 Cc.) [23 fl℥, 321 ♏] of water, and macerate in this solution, during 24 hours, the rhubarb, cut into thin slices and carefully freed from any adhering fine powder. Then strain it through muslin, heat the strained liquid to boiling, add the cinnamon water and alcohol, stir it well and filter, while warm, in a covered funnel. To the cold filtrate add enough water to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents about 5⅔ grains of rhubarb. *Note.*—The product is practically identical with that obtained by the process of the *Ger. Pharm.*, in which this preparation is official. It is liable to deteriorate when kept too long, and should not be prepared in larger quantity than may be consumed within a short time. When this preparation is required for immediate use, and it is not otherwise obtainable, it may be prepared in the following manner: II. Fluid extract of rhubarb (*U. S. P.*), one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; sodium borate, ten grammes (10 Gm.) [154 grs.]; potassium carbonate, ten grammes (10 Gm.) [154 grs.]; cinnamon water (*U. S. P.*), one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏]; alcohol, seventy-five cubic centimeters (75 Cc.) [2 fl℥, 257 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the sodium borate and the potassium carbonate in about five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of water. Add the cinnamon water, alcohol, and fluid extract of rhubarb, and lastly, enough water to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Filter if necessary" (*Nat. Form.*).

TINCTURA RHEI COMPOSITA, *Compound tincture of rhubarb.*—Take of rhubarb, in fine powder, 4 ounces; bitter root, golden seal, gentian, prickly ash berries, each, in fine powder, 2 ounces; sassafras, cardamom seeds, each, in fine powder, 1 ounce; diluted alcohol, 5 pints, or a sufficient quantity. Form into a tincture by maceration or percolation, as explained under *Tincturæ*, and make 5 pints of tincture. Compound tincture of rhubarb is laxative, tonic, and stomachic; it is especially useful in debilitated conditions of the digestive organs, *hepatic torpor*, *dyspepsia*, *constipation*, and to restore the tone of the bowels after the removal of *worms*, after *diarrhœas*, *dysenteries*, etc. The dose is from ½ to 1 fluid ounce, 2 or 3 times a day, in sweetened water, or sufficient to procure one, but not over two alvine evacuations daily (J. King).

TINCTURA RHEI AROMATICA (U. S. P.)—AROMATIC TINCTURE OF RHUBARB.

Preparation.—"Rhubarb, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; cassia cinnamon, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; cloves, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; nutmeg, twenty grammes (20 Gm.) [309 grs]; glycerin, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; alcohol, water, diluted alcohol, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the rhubarb, cinnamon, cloves, and nutmeg, and reduce the mixture to a moderately coarse (No. 40) powder. Mix the glycerin with five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of alcohol and four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of water. Moisten the powder with one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏] of the menstruum, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour on the remainder of the menstruum. When the liquid has disappeared from the surface, gradually pour diluted alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*).

Uses and Dosage.—This tincture has a deep reddish-brown color, and precipitates when mixed with water. It is designed for the purpose of preparing an aromatic syrup of rhubarb. It is liable to precipitate substances like those forming in tincture of rhubarb. It may be added to many purgative tinctures. Dose, 1 to 4 fluid drachms.

TINCTURA RHEI DULCIS (U. S. P.)—SWEET TINCTURE OF RHUBARB.

Preparation.—"Rhubarb, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; glycyrrhiza, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; anise, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; cardamom, ten grammes (10 Gm.) [154 grs.]; glycerin, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; alcohol, water, diluted alcohol, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the rhubarb, glycyrrhiza, anise, and cardamom, and reduce the mixture to a moderately coarse (No. 40) powder. Mix the glycerin with five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of alcohol and four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of water. Moisten the powder with one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏] of the menstruum, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour on the remainder of the menstruum. When the liquid has disappeared from the surface, gradually pour diluted alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This preparation contains one-third less rhubarb than tincture of rhubarb, and is of a pleasanter taste than the latter.

Action, Medical Uses, and Dosage.—(See *Rheum.*) Dose, 1 to 3 fluid drachms.

TINCTURA SABINÆ.—TINCTURE OF SAVIN.

Preparation.—"Take of savin tops, dried and coarsely powdered, 2½ ounces (av.); proof-spirit, 1 pint (Imp.)"—(*Br. Pharm.*). Prepare as directed for *Tinctura Sennæ*. This tincture would more nearly represent savin if a stronger alcoholic menstruum were employed. It has a brownish-green color.

Action, Medical Uses, and Dosage.—(See *Sabina.*) Dose, 10 to 60 minims.

TINCTURA SANGUINARIÆ (U. S. P.)—TINCTURE OF SANGUINARIA.

SYNONYMS: *Tincture of bloodroot.*

Preparation.—"Sanguinaria, in No. 60 powder, one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]; acetic acid, twenty cubic centimeters

(20 Cc.) [325 ♏]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix alcohol and water in the proportion of six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of alcohol to four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of water. Moisten the powder with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of the mixture to which the acetic acid had previously been added, and macerate for 24 hours; then pack it firmly in a cylindrical glass percolator, gradually pour on more of a mixture of alcohol and water, made in the same proportions as before, and continue the percolation, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). The acetic acid in this preparation very materially assists in the extraction of the virtues of the drug, and prevents, in a measure, the precipitation which is liable to occur. This tincture has the characteristic acidity of the drug and is of a deep brown-red color.

Action, Medical Uses, and Dosage.—In the dose of 2 to 4 fluid drachms, this tincture will prove emetic; and from 10 to 60 drops will act as a nauseant, expectorant, stimulant, and alterative (see *Sanguinaria*).

TINCTURA SANGUINARIÆ ACETATA COMPOSITA.—COMPOUND ACETATED TINCTURE OF SANGUINARIA.

SYNONYMS: *Compound acetated tincture of bloodroot, Acetous emetic tincture.*

Preparation.—Take of bloodroot, lobelia, skunk-cabbage root, each, in fine powder, 2 ounces; distilled vinegar, 2 pints, or a sufficient quantity; alcohol, 2 fluid ounces. Place the drugs in the vinegar, and form into a tincture by maceration or percolation, as explained under *Tincturæ*, and make 2 pints of tincture, to which add the alcohol.

Action, Medical Uses, and Dosage.—This preparation was formerly much used by physicians as an emetic and expectorant, in all cases where such agents were required. As an emetic, the dose is from 1 to 4 fluid drachms, in some sweetened aromatic infusion, to be repeated every 10 or 15 minutes until vomiting is produced; as an expectorant the dose is from 20 to 60 drops, every 1 or 2 hours. It also forms a useful external application to *erysipelas*, *tetter*, and other forms of *cutaneous disease*.

Related Tincture.—TINCTURA SANGUINARIÆ COMPOSITA, *Compound tincture of bloodroot, Emetic tincture.* Take of bloodroot, lobelia, skunk-cabbage root, each, in fine powder, 2 ounces; diluted alcohol, 2 pints, or a sufficient quantity. Form into a tincture by maceration or percolation, as explained under *Tincturæ*, and make 2 pints of tincture. This tincture is used for the same purposes, in the same manner and dose, as the preceding.

TINCTURA SAPONIS VIRIDIS COMPOSITA (N. F.)—COMPOUND TINCTURE OF GREEN SOAP.

Preparation.—"Soft soap (*U. S. P.*), one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]; oil of cade, twenty cubic centimeters (20 Cc.) [325 ♏]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc. [33 fl℥, 391 ♏]. Dissolve the soft soap in seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol, add the oil of cade, and then enough alcohol to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏], and filter"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—Employed as an external application in *itching* and *scaly skin diseases* (see *Oleum Cadinum*).

TINCTURA SCILLÆ (U. S. P.)—TINCTURE OF SQUILL.

Preparation.—"Squill, in No. 30 powder, one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix alcohol and water in the proportion of seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol to two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water. Moisten the powder with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of the menstruum, and macerate for 24 hours; then pack it moderately in a conical percolator, and gradually pour menstruum upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This is a pale-yellow tincture, having the nauseant taste of the crude drug. Lustrous tufts of an acrid, bitter substance are precipitated in this tincture, according to Ménière.

Action, Medical Uses, and Dosage.—(See *Scilla.*) Dose, 10 to 20 minims.

TINCTURA SENEGÆ.—TINCTURE OF SENEGA.

Preparation.—Take of "senega root, in No. 40 powder, 4 ounces (Imp.), or 200 grammes (Metric); alcohol (60 per cent), a sufficient quantity. Moisten the powder with 4 fluid ounces (or 200 cubic centimeters) of the alcohol, and complete the percolation process. The resulting tincture should measure 1 pint (or 1000 cubic centimeters)"—(*Br. Pharm.*, 1898). This tincture possesses the acridity of senega, and has a yellow-brown color.

Action, Medical Uses, and Dosage.—(See *Senega.*) Dose, from ½ to 2 fluid drachms.

TINCTURA SENNÆ.—TINCTURE OF SENNA.

SYNONYMS: *Tinctura sennæ composita*, *Elixir salutis.*

Preparation.—"Take of senna, broken small, 2½ ounces (av.); raisins, freed from seeds, 2 ounces (av.); caraway fruit, bruised, ½ ounce (av.); coriander fruit, bruised, ½ ounce (av.); proof-spirit, 1 pint (Imp.). Macerate the solid ingredients for 48 hours in 15 fluid ounces of the spirit, in a closed vessel, agitating occasionally; then transfer to a percolator, and when the fluid ceases to pass, continue the percolation with the remaining 5 ounces of spirit. Afterward subject the contents of the percolator to pressure, filter the product, mix the liquids, and add sufficient proof-spirit to make 1 pint"—(*Br. Pharm.*, 1885). The *British Pharmacopœia* (1898) directs the employment of a somewhat larger quantity of senna (4 ounces, Imp.).

Action, Medical Uses, and Dosage.—(See *Sennæ.*) Dose, from 1 to 4 fluid drachms.

Related Tincture.—TINCTURA SENNÆ COMPOSITA, *Compound tincture of senna, Elixir salutis.* Take of Alexandria senna, 2 ounces; jalap, in fine powder, 1 ounce; fennel or coriander seeds, ½ ounce; raisins, deprived of their seeds, 3 ounces; best French brandy, or diluted alcohol, 2 pints, or a sufficient quantity. Form into a tincture by maceration or percolation, as explained under *Tincturæ*, and make 2 pints of tincture (*Ed.—Lond.*). This is an excellent purgative, especially for children, as it acts mildly and pleasantly. It is also useful in cases of *constipation* attended with *flatulence*. The dose for an adult is from ½ to 1 fluid ounce; for a child a year old, 1 fluid drachm. It may be given in a little sweetened water.

TINCTURA SERPENTARIÆ (U. S. P.)—TINCTURE OF SERPENTARIA.

Preparation.—"Serpentaria, in No. 40 powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix alcohol and water in the proportion of six hundred and fifty cubic centimeters (650 Cc.) [21 fl℥, 470 ♏] of alcohol to three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of water. Moisten the powder with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of the menstruum, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This tincture has the characteristic taste and odor of Virginia snakeroot, and a brown-yellow color.

Action, Medical Uses, and Dosage.—(See *Serpentaria.*) Dose, from 1 to 3 fluid drachms.

TINCTURA SERPENTARIÆ COMPOSITA.—COMPOUND TINCTURE OF SERPENTARIA.

SYNONYMS: *Compound tincture of Virginia snakeroot*, *Sudorific tincture.*

Preparation.—Take of Virginia snakeroot, ipecacuanha, each, in fine powder, saffron, camphor, and opium, each, in moderately coarse powder, 2 ounces; Holland gin, or diluted alcohol, 6 pints. Macerate for 14 days; express and filter through paper (Beach's *Amer. Prac.*). This tincture may also be prepared by percolation. The above is the original, and undoubtedly the best form of preparing this tincture, yet some physicians are opposed to the opium, and substitute in its place ladies'-slipper root, 8 ounces.

Action, Medical Uses, and Dosage.—This is a powerful sudorific, and is used in all cases where a copious perspiration is required, or where it is desired to lessen pain, allay nervous excitability, procure sleep, and keep up a determination to the skin. One teaspoonful in some warm herb tea, repeated every hour, aided by warm infusions and bathing the feet, will soon produce copious diaphoresis. In *pleurisy*, a much larger dose may be given. In other cases, it may be given in doses of from 10 to 60 drops. It will be found beneficial in *after-pains*, *painful dysmenorrhœa*, *amenorrhœa*, from recent exposure to cold, *cramp in the stomach*, *hysteria*, in *fevers* and *inflammatory diseases*, etc. Forty-eight minims of this tincture are equivalent to 1 grain of opium, as well as 1 grain of camphor, etc.

TINCTURA STAPHISAGRIÆ.—TINCTURE OF STAPHISAGRIA.

SYNONYM: *Tincture of stavesacre.*

Preparation.—Take of the seeds of stavesacre, in fine powder, 5 ounces; absolute alcohol, 8 fluid ounces, or a sufficient quantity. Form into a tincture by maceration or percolation, and make ½ pint of tincture.

Action, Medical Uses, and Dosage.—(See *Staphisagria.*) From 10 to 60 drops of this tincture may be added to 3 or 4 fluid ounces of water, the dose of which is a teaspoonful, to be repeated 3 or 4 times a day.

TINCTURA STILLINGIÆ.—TINCTURE OF STILLINGIA.

SYNONYM: *Tincture of queen's root.*

Preparation.—Take of the recent queen's root, cut into small pieces and bruised, 3 ounces; diluted alcohol, 1 pint, or a sufficient quantity. Form into a tincture by maceration, and make 1 pint of tincture.

Action, Medical Uses, and Dosage.—This tincture possesses the virtues of the root, and may be used as a substitute for it in *scrofulous, syphilitic and rheumatic diseases.* It is likewise beneficial in *laryngeal*, *bronchial*, and *pulmonary affections.* The dose is from 10 to 30 or even 60 drops, to be administered in sweetened water. It may likewise be advantageously added to alterative syrups or tinctures.

TINCTURA STRAMONII SEMINIS (U. S. P.)—TINCTURE OF STRAMONIUM SEED.

SYNONYM: *Tinctura stramonii* (*U. S. P.*, 1880).

Preparation.—"Stramonium seed, in No. 40 powder, one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]; diluted alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of diluted alcohol, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour diluted alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). The official tincture has a brown-yellow color, and, when dropped into, water renders it opalescent.

Action, Medical Uses, and Dosage.—This preparation may be administered wherever stramonium is indicated (see *Stramonium*). The dose is from 5 to 40 drops (employing the smaller doses at first), repeated every 3 or 4 hours, gradually increasing it, if necessary.

TINCTURA STROPHANTHI (U. S. P.)—TINCTURE OF STROPHANTHUS.

Preparation.—"Strophanthus, in No. 30 powder, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix alcohol and water in the proportion of six hundred and fifty cubic centimeters (650 Cc.) [21 fl℥, 470 ♏] of alcohol to three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of water. Digest the powder with seventy cubic centimeters (70 Cc.) [2 fl℥, 176 ♏] of the menstruum for 2 days, then transfer to a cylindrical percolator, gradually pour menstruum upon it, and continue the percolation very slowly, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained" (*U. S. P.*). Strophanthus seeds are not easily bruised, and, to facilitate their comminution, Dr. Squibb proposed to bruise them with fragments of glass in an iron mortar (*Ephemeris*, Vol. III, p. 15). An abundance of oil is contained in the seeds, for the removal of which no provision has been made in the official process. The process (see below) given by the *National Formulary* directs the use of ether in order to extract the oil. If made according to the *U. S. P.* official directions, the tincture has a brown-yellow or amber color; if according to the *National Formulary*, the color is green-yellow. It has a very bitter taste. The use of benzin to extract the oil has been suggested, but is not desirable, because it is difficult to remove from the tincture the benzin odor imparted to it. The tincture of strophanthus of the *British Pharmacopœia*, 1885 (*Additions*, 1890), likewise has the strength of 1 in 20, but directions are given to remove the oil with ether. The tincture of strophanthus of the *British Pharmacopœia* (1898) is prepared with half the proportion of strophanthus seeds used in the preceding Pharmacopœia; the previous extraction of oil by means of ether is omitted. Regarding the assay of tincture of strophanthus, see under *Strophanthus*.)

Action, Medical Uses, and Dosage.—(See *Strophanthus*.) Dose, from 1 to 10 minims.

Related Tincture.—TINCTURA STROPHANTHI (N. F.), *Tincture of strophanthus*. "Strophanthus seeds, freed from their comose appendage, reduced to No. 30 powder, and dried at 50° C. (122° F.), 1 troy ounce; stronger ether, a sufficient quantity; alcohol, enough to make 20 fluid ounces. Pack the strophanthus in a suitable percolator, pour on enough stronger ether to saturate the powder thoroughly, cover the percolator, and macerate during 24 hours. Then allow the percolation to proceed, gradually pouring on stronger ether, until the liquid passes through colorless. This ethereal percolate is to be rejected. Remove the marc from the percolator, and dry it, first by exposure to air, then at a temperature of 50° C. (122° F.). Again reduce it to powder, moisten it with alcohol, repack it in the percolator, and macerate during 48 hours. Then percolate it with alcohol, in the usual manner, until twenty (20) fluid ounces of tincture are obtained. Each fluid drachm represents 3 grains of strophanthus. The dose is about 2 to 10 minims. *Note.*—Strophanthus seeds are obtained from one or more species of *Strophanthus*, growing in eastern Africa, and are usually referred to *Strophanthus Kombé*, Oliver"—(*Nat. Form.*, 1st. ed.).

TINCTURA SUMBUL (U. S. P.)—TINCTURE OF SUMBUL.

Preparation.—"Sumbul, in No. 30 powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix alcohol and water in the proportion of six hundred and fifty cubic centimeters (650 Cc.) [21 fl℥, 470 ♏] of alcohol to three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of water. Moisten the powder with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of the menstruum, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—(See *Sumbul*.) Dose, 10 to 60 minims.

TINCTURA SYMPLOCARPI.—TINCTURE OF SYMPLOCARPUS.

SYNONYM: *Tincture of skunk-cabbage.*

Preparation.—Take of recently dried skunk-cabbage root, in fine powder 3 ounces; diluted alcohol, 1 pint, or a sufficient quantity (Beach's *Amer. Prac.*). Form into a tincture by maceration or percolation, and make 1 pint of tincture.

Action, Medical Uses, and Dosage.—Tincture of skunk-cabbage is antispasmodic, and will be found useful in *asthma*, *pertussis*, *hysteria*, and other *spasmodic affections*. It is also beneficial in *irritable or excitable conditions of the nervous system*. The dose is from 1 fluid drachm to ½ fluid ounce, repeated as often as required.

TINCTURA TOLUTANA (U. S. P.)—TINCTURE OF TOLU.

Preparation.—"Balsam of tolu, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Add the balsam of tolu to nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of alcohol, and macerate until it is dissolved; then filter through paper, adding through the filter, enough alcohol to make the tincture measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*). A yellow tincture, striking milky with water.

Action, Medical Uses, and Dosage.—This tincture possesses the properties of balsam of tolu, and may be used in *cough* and *chronic catarrhal diseases;* also as an adjunct to cough and expectorant compounds. The dose is from ½ to 1 or 2 fluid drachms.

Related Tincture.—TINCTURA TOLUTANA SOLUBILIS (N. F.), *Soluble tincture of tolu.* "Balsam of tolu, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; magnesium carbonate, ten grammes (10 Gm.) [154 grs.]; glycerin, four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏]; water, alcohol, of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of alcohol with the glycerin, and dissolve the balsam of tolu in the mixture with the aid of heat, avoiding loss by evaporation. Next add four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of water, and allow the mixture to become cold. Pour off the milky liquid from the resinous precipitate (which latter is to be rejected), mix it with the magnesium carbonate, by trituration, and filter. Lastly, pass enough of a mixture of one (1) volume of alcohol and two (2) volumes of water through the filter, to make the whole filtrate measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. *Note.*—This preparation may be added to syrup or water without producing cloudiness. A mixture of 1 fluid ounce of this preparation with 15 fluid ounces of syrup yields a product which may be used as syrup of tolu in all cases where the official preparation is not required"—(*Nat. Form.*).

TINCTURA TOXICODENDRI.—TINCTURE OF POISON OAK.

SYNONYM: *Tincture of Rhus Toxicodendron.*

Preparation.—Take of fresh leaves of poison oak, 4 ounces; alcohol, 3 fluid ounces. Macerate for 14 days; express and filter under cover.

Action, Medical Uses, and Dosage.—This tincture may be used for all the purposes for which the poison oak is given, in the dose of from a fraction of a drop to 5 drops, in water. It should be kept in vials, well stoppered, as its active principle becomes dissipated on exposure.

TINCTURA VALERIANÆ (U. S. P.)—TINCTURE OF VALERIAN.

Preparation.—"Valerian, in No. 60 powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix alcohol and water in the proportion of seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol to two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of water. Moisten the powder with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of the menstruum, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour menstruum upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). Tincture of valerian depends, for its color, upon the condition of the valerian employed. Its color is either brown or red-brown, and, when added to water, it renders the latter turbid. The odor and taste of valerian is well preserved.

Action, Medical Uses, and Dosage.—(See *Valeriana.*) Dose, from ½ to 2 fluid drachms.

TINCTURA VALERIANÆ AMMONIATA (U. S. P.)—AMMONIATED TINCTURE OF VALERIAN.

Synonym: *Tinctura valerianæ composita.*

Preparation.—"Valerian, in No. 60 powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; aromatic spirit of ammonia, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏] of aromatic spirit of ammonia, and macerate for 24 hours, in a closed vessel; then pack it firmly in a cylindrical glass percolator, and gradually pour aromatic spirit of ammonia upon it, keeping the percolator well covered, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This tincture exhibits the sensible properties of ammonia and valerian. It has a brown color.

Action, Medical Uses, and Dosage.—This forms an excellent antispasmodic in *hysterical and nervous attacks*, especially when attended with *gastric acidity*. The dose is 1 or 2 fluid drachms, in mucilage, milk, or some sweetened fluid.

TINCTURA VANILLÆ (U. S. P.)—TINCTURE OF VANILLA.

Preparation.—"Vanilla, cut into small pieces and bruised, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; sugar, in coarse powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; alcohol, water, each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix alcohol and water in the proportion of six hundred and fifty cubic centimeters (650 Cc.) [21 fl℥, 470 ♏] of alcohol to three hundred and fifty cubic centimeters (350 Cc.) [11 fl℥, 401 ♏] of water. Macerate the vanilla in five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of this mixture for 12 hours, then drain off the liquid, and set it aside. Transfer the vanilla to a mortar, beat it with the sugar into a uniform powder, then pack it in a percolator, and pour upon it the reserved liquid. When this has disappeared from the surface, gradually pour on menstruum, and continue the percolation, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This tincture represents what was known as *Fluid extract* or *Essence of vanilla.* It is, however, much stronger than commercial extract of vanilla (1 ounce to 1 pint). When added to syrup in the proportion of ounce to pint, it yields a good *Syrup of vanilla.*

Uses.—Tincture of vanilla is used exclusively as a flavoring substance.

Related Tincture.—Tinctura Vanillini Composita (N. F.), *Compound tincture of vanillin, Compound essence of vanillin.* "Vanillin, six and one-half grammes (6.5 Gm.) [100 grs.]; cumarin, four decigrammes (0.4 Gm.) [6 grs.]; alcohol, two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏]; glycerin, one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; syrup (*U. S. P.*), one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; compound tincture of cudbear (F. 419), sixteen cubic centimeters (16 Cc.) [260 ♏]; water, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the vanillin and cumarin in the alcohol, add the glycerin and syrup, and compound tincture of cudbear, and lastly, enough water to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*Nat. Form*).

TINCTURA VERATRI VIRIDIS (U. S. P.)—TINCTURE OF VERATRUM VIRIDE.

Synonyms: *Tincture of American hellebore, Tincture of green hellebore.*

Preparation.—"Veratrum viride, in No. 60 powder, four hundred grammes (400 Gm.) [14 ozs. av., 48 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powder with one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏] of alcohol, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). This tincture has a dark reddish-brown color. When dropped into water it produces an opalescence and renders the mixture turbid. Its taste is acrid and bitter. It should not be confused with *Tincture of Helleborus viridis*, a European drug.

Action, Medical Uses, and Dosage.—(See *Veratrum.*) The dose is from 1 to 5 minims.

TINCTURA VIBURNI COMPOSITA.—COMPOUND TINCTURE OF VIBURNUM.

SYNONYM: *Compound tincture of high-cranberry bark.*

Preparation.—Take of high-cranberry bark, in fine powder, 2 ounces; lobelia seed, skunk-cabbage seed, each, in fine powder, 1 ounce; stramonium seed, bruised, capsicum, bloodroot, each, in fine powder, ½ ounce; alcohol, 4 pints, or a sufficient quantity. Form into a tincture by maceration or percolation, as explained under *Tincturæ*, and make 4 pints of tincture.

Action, Medical Uses, and Dosage.—This old Eclectic tincture is a stimulant and antispasmodic, and will be found efficacious in *asthma*, *hysteria*, and *nervous and spasmodic diseases.* I have effected many cures of asthma (uncomplicated) with this remedy. The dose is from 20 to 60 drops, 3 times a day; or, during a paroxysm, as often as required (J. King).

TINCTURA VIBURNI OPULI COMPOSITA (N. F.), *Compound tincture of viburnum.*—"Viburnum opulus, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; dioscorea, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; scullcap, ten grammes (10 Gm.) [154 grs.]; cloves, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; cinnamon, sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.]; glycerin, sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; alcohol, water, of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Reduce the drugs to a moderately coarse (No. 40) powder. Mix the glycerin with seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of alcohol and moisten the powder with one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏] of this mixture, and macerate for 48 hours in a percolator. Then percolate with the remainder of this menstruum, followed by a mixture of five (5) volumes of alcohol and one (1) volume of water, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*Nat. Form.*).

TINCTURA XANTHOXYLI.—TINCTURE OF XANTHOXYLUM.

SYNONYM: *Tincture of prickly ash berries.*

Preparation.—Take of prickly ash berries, in fine powder, 8 ounces; diluted alcohol, 2 pints, or a sufficient quantity. Form into a tincture by maceration or percolation, as explained under *Tincturæ*, and make 2 pints of tincture.

Action, Medical Uses, and Dosage.—This tincture possesses all the virtues of the berries (see *Prickly Ash Berries*). In *cholera*, the dose is from ½ to 1 fluid ounce, repeated as often as required; in ordinary cases, from 1 to 4 fluid drachms, given in water. Probably a tincture of the oil of the berries will effect the same results (J. King).

TINCTURA ZEDOARIÆ AMARA (N. F.)—BITTER TINCTURE OF ZEDOARY.

SYNONYM: *Compound tincture of zedoary.*

Preparation.—"Zedoary, root, two hundred and fifty grammes (250 Gm.) [8 ozs. av., 358 grs.]; aloes, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; rhubarb, sixty-two grammes (62 Gm.) [2 ozs. av., 82 grs.]; gentian, sixty-two grammes (62 Gm.) [2 ozs. av., 82 grs.]; white agaric, sixty-two grammes (62 Gm.) [2 ozs. av., 82 grs.]; saffron, sixty-two grammes (62 Gm.) [2 ozs. av., 82 grs.]; glycerin, one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏]; alcohol, water, of each, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Reduce the solids to a moderately coarse (No. 40) powder, moisten this with a sufficient quantity of a mixture of two (2) volumes of alcohol and one (1) volume of water, and percolate it in the usual manner, with this menstruum, until seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of percolate are obtained. Add to this the glycerin, and set it aside. Then continue the percolation until the drugs are practically exhausted. Evaporate the new percolate to one hundred and twenty-five cubic centimeters (125 Cc.) [4 fl℥, 109 ♏], and add it to the reserved portion. Each fluid drachm represents 15 grains of zedoary, 7½ grains of aloes, and 3¾ grains, each, of the other drugs. *Note.*—The above preparation is not identical with the *Tinctura Zedoariæ Composita* (also known as *Tinctura Carminativa*, *Tinctura Wedelii*), which was formerly official in some continental pharmacopœias"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—(See *Zedoary.*)

TINCTURA ZINGIBERIS (U. S. P.)—TINCTURE OF GINGER.

Preparation.—"Ginger, in No. 40 powder, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; alcohol, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the ginger with fifty cubic centimeters (50 Cc.) [1 fl℥, 332 ♏] of alcohol, and macerate for 24 hours; then pack it firmly in a cylindrical percolator, and gradually pour alcohol upon it, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of tincture are obtained"—(*U. S. P.*). Good Jamaica ginger is required in preparing this tincture. A turbid tincture results if dilute alcohol be employed. The preparation has a brown-yellow or reddish color, and has the characteristic pungent taste and aroma of ginger. When added to water, it renders the latter milky.

Action, Medical Uses, and Dosage.—(See *Zingiber.*) Tincture of ginger is an aromatic carminative, and may be added to tonic, purgative, and aromatic preparations with advantage. It may be used in *flatulency*, *torpor of the digestive organs*, and in *debilitated conditions of the alimentary canal*. The dose is from 10 to 60 drops, in sweetened water, milk, wine, or mucilage, as the indications will allow. Its chief use is in the preparation of syrup of ginger.

Related Tincture.—TINCTURA ZINGIBERIS FORTIOR, *Strong tincture of ginger*, *Essence of ginger*. "Take of ginger, in fine powder, 10 ounces (av.); rectified spirit, a sufficiency. Pack the ginger tightly in a percolator, and pour over it carefully ½ pint of the spirit, at the expiration of 2 hours add more spirit, and let it percolate slowly until 1 pint of tincture has been collected"—(*Br. Pharm.*, 1885). Dose, 15 to 60 minims.

TORMENTILLA.—TORMENTIL.

The root of *Potentilla Tormentilla*, Schrank (*Tormentilla erecta*, Willdenow; *Tormentilla officinalis*, Smith).

Nat. Ord.—Rosaceæ.

COMMON NAMES: *Tormentil*, *Septfoil*.

Botanical Source.—Tormentil has a perennial, tough, woody rhizome, about the thickness and length of the upper joint of the forefinger, with numerous radicles. The stems are slender, weak, erect, often procumbent, branching at the summit, and 5 or 10 inches high. The leaves are almost sessile, and consist of 3 oblong, acute, deeply serrated, somewhat hairy leaflets; the stipules are smaller than the leaflets, and deeply cut. The flowers are small, bright-yellow, with the parts of the calyx and corolla in fours, and borne on slender, axillary, hairy stalks much longer than the leaves. Carpels corrugated when ripe (L.).

History and Description.—Tormentil, or septfoil, is a plant common to Europe. All parts of it are astringent, but the rhizome is the part usually employed. It has a very irregular external form, being sometimes cylindrical, at others, tuberculated. Externally, it is of a dark red-brown color; internally, flesh-red or brownish. Its taste is strongly astringent, and its odor faintly aromatic. Water takes up its astringent principle; the infusion forms a black-greenish precipitate of tannate of iron with ferric chloride, and a grayish, curdy one of tannate of gelatin with a solution of gelatin. In the Faroe and Orkney islands it is used in tanning leather; in Lapland it is used as a red dye. It is equally applicable in medicine with catechu, kino, and other foreign astringents.

Chemical Composition.—According to Rembold (1867), tormentilla root contains *tormentilla-tannic acid* ($C_{26}H_{22}O_{11}$; 24 to 30 per cent, Bowman, 1869), with *quinovic* ($C_{24}H_{38}O_4$, Hlasiwetz) and some *ellagic acid* ($C_{14}H_6O_8$). When the tannic acid is heated with diluted sulphuric acid, insoluble *tormentilla-red*, a phlobaphene, but no sugar, is formed. Rembold believes it identical with rhatany-red and hippocastanum-red. Fused with caustic potash, it forms *phloroglucin* and *protocatechuic acid*. Calcium oxalate is also a constituent of the root.

Action, Medical Uses, and Dosage.—Tormentil is astringent and tonic, and may be used in *chronic diarrhœa* and *dysentery*, *passive hemorrhages*, etc., in decoction; also as an astringent injection, and as a local application to flabby *ulcers*. Dose of the decoction, 1 or 2 fluid ounces; of the extract, 10 or 15 grains; of the powdered root, from 30 to 60 grains, 3 or 4 times a day. The extract may be made by boiling 1 part of the coarsely-bruised root with 8 parts of water; straining; repeating the boiling with another equal quantity of water; mixing the two strained decoctions; and evaporating to the consistence of an extract. Alum or tannic acid may be added to this, as required.

Related Species.—*Potentilla canadensis*, Linné, *Five-finger.*—This is a perennial, villose-pubescent plant, frequently known by the name of *Cinque-foil.* It has a sarmentose, procumbent and ascending stem, 2 to 18 inches in length. Leaves palmately 5-foliate; leaflets obovate, silky beneath, cut-dentate toward the apex, entire and attenuate toward the base. Stipules ovate, hairy, deeply 2 or 3-cleft, or entire. Flowers yellow, on long, axillary, solitary pedicels. Calyx segments lanceolate or linear; bracteoles of the calyx longer than the segments, nearly as long as the petals; petals obcordate, longer than the calyx. There are two varieties of this plant, the *Potentilla canadensis*, var. *pumila*, which is very small and delicate, flowering in April and May, growing in dry, sandy soils, and the stem rising about 3 or 4 inches. The other is the *Potentilla canadensis*, var. *simplex*, which is less hirsute, with a simple stem, erect or ascending at base, and oval-cuneiform leaflets. It grows in richer soils to 12 and 16 inches high, and flowers from June to August (W.—G.). Five-finger is common to the United States, growing by roadsides, on meadow banks and waste grounds, and flowering from April to October. It is the *Potentilla sarmentosa* of some botanists. The root is the part used. It has a bitterish, styptic taste, and yields its virtues to water. This plant is a tonic and astringent. A decoction has been found useful in *fevers*, *bowel complaints*, *night-sweats*, *menorrhagia*, and other *hemorrhages*; also, it is an excellent local application in form of gargle, for *spongy*, *bleeding gums*, and *ulcerated mouth and throat.* The European herb, *Potentilla reptans*, possesses similar properties.

The following species contain a bitter body, mucilage, tannin, etc.: *Potentilla reptans*, Linné, *Creeping cinque-foil; P. fruticosa*, Linné, *Shrubby cinque-foil; P. palustris*, Scopoli. *Marsh cinque-foil; P. anserina*, Linné, *Silverweed*, *Goose-grass;* and *P. argentea*, Linné, *Silvery cinque-foil.*

TRAGACANTHA (U. S. P.)—TRAGACANTH.

"A gummy exudation from *Astragalus gummifer*, Labillardière, and from other species of *Astragalus*"—(*U. S. P.*).

Nat. Ord.—Leguminosæ.

Common Names and Synonym: *Tragacanth*, *Gum tragacanth; Gummi tragacantha.*

Botanical Source and History.—"Tragacanth is the gummy exudation from the stems of several species of *Astragalus*, belonging to the subgenus *Tragacantha.* The plants of this group are low perennial shrubs, remarkable for their leaves having a strong, persistent, spiny petiole. As the leaves and shoots are very numerous and regular, many of the species have the singular aspect of thorny, hemispherical cushions, lying close to the ground, while others, which are those furnishing the gum, grow erect with a naked, woody stem, and somewhat resemble furze bushes. A few species occur in southwestern Europe, others are found in Greece and Turkey; but the largest number are inhabitants of the mountainous regions of Asia Minor, Syria, Armenia, Kurdistan, and Persia. The tragacanth of commerce is produced in the last-named countries" (*Pharmacographia*). The same authority enumerates, among others, the following species, the list being based upon Boissier's *Flora Orientalis* (1872), and revised by Haussknecht, who studied the gum-yielding shrubs in their native habitat:

I. *Astragalus adscendens*, Boissier and Haussknecht.—Mountains of southwest Persia. Yields an abundance of gum.

II. *Astragalus leioclados*, Boissier.

III. *Astragalus brachycalyx*, Fischer.—Mountains of Persian Kurdistan.

IV. *Astragalus gummifer*, Labillardière. A small shrub of wide distribution, occurring on the Lebanon and Mount Hermon, in Syria; the Beryt Dagh, in Cataonia; the Arjish Dagh (Mount Argæus), near Kaisariyeh, in central Asia Minor; and in Armenia and northern Kurdistan.

V. *Astragalus microcephalus*, Willdenow. From the southwest of Asia Minor to the northeast coast, and to Turkish and Russian Armenia.

VI. *Astragalus pycnocladus*, Boissier and Haussknecht. Closely related to the preceding. High mountains of Persia. Yields gum in abundance.

VII. *Astragalus stromatodes*, Bunge.—Northern Syria. This and the next species are the chief source of so-called *Aintab tragacanth*.

VIII. *Astragalus kurdicus*, Boissier.—Mountains of Cilicia and Cappadocia, extending to Kurdistan.

IX. *Astragalus Parnassi*, Boissier, var. *cyllenea*.—Northern mountains of Morea. Yields the tragacanth of Greece.

X. *Astragalus verus*, Olivier.—Northwest Persia and Asia Minor. Probably yields some tragacanth.

Collection, Description, and Tests.—Tragacanth exudes naturally from July to September, either from wounds cut into the shrub, or from spontaneous fissures. It usually assumes the form of tortuous bands of a parchment-like appearance. Sometimes it exudes in large tears, which have more or less the vermicular form, it then has a reddish color, and is less pure. As officially described, tragacanth occurs in "narrow or broad bands, more or less curved or contorted, marked by parallel lines or ridges, white or faintly yellowish, translucent, horn-like, tough, and rendered more easily pulverizable by a heat of 50° C. (122° F.). On treating tragacanth with water, it swells, and gradually forms a gelatinous mass, which is tinged blue by iodine T.S., and the fluid portion of which is precipitated on the addition of alcohol, but is not colored blue by iodine T.S."—(*U. S. P.*). Solution of gum tragacanth, when dry, is more adhesive than gum Arabic.

According to Sidney H. Maltass (*Amer. Jour. Pharm.*, 1855, p. 423), tragacanth is collected principally in Caissar, Yalavatz, Isbarta, Bourdur, and Angora. In July and August the natives clear away the earth from the lower part of the stem of the shrub, and make several longitudinal incisions in the bark with a knife. The gum exudes the whole length of the incision, and dries in flakes, and in 3 or 4 days is collected. If the weather be hot and dry, the gum is white and clean; if it be damp, with but moderate heat, the gum requires a longer time to dry, and assumes a brown or yellow tinge. When packed for exportation, the large, white, flaky or *leaf gum* is picked out, and the residue is sifted through a coarse sieve; what remains upon the sieve is *common* or *sorts gum*. The gum which passed through the first sieve is now resifted in a finer sieve, that which passes through being termed *Sesame seed*, and that remaining on the sieve, *Vermicelli*. All these latter varieties are carefully picked by women, who reject the impurities, and place the purer pieces with the first two qualities. Tragacanth is very liable to adulteration with Moussul gum and Caramania gum (an exudation from plum and almond trees, sometimes known as *Bassora gum*, *Hog gum tragacanth*, or *Kutera gum*), two inferior articles, of a dark color, and which do not occur in flaky pieces, but which are pounded into small, angular pieces after having been whitened with white lead. In English commerce, the best tragacanth is known as *Syrian tragacanth*. In this country, distinction is made between *Aleppo* and *Turkey tragacanth*, the latter commanding a somewhat higher price.

Chemical Composition.—Gum tragacanth, according to Giraud (*Amer. Jour. Pharm.*, 1875, p. 329, and 1878, p. 127), consists of water (20 per cent), pectic compounds (*bassorin*, perhaps Frémy's *pectose*, 60 per cent; it is insoluble in water, but swells up when in contact with it; also called *tragacanthin*, *adraganthin*), soluble gum (*pectin*, not arabin [see *Acacia*], 8 to 10 per cent), cellulose (3 per cent), starch (2 to 3 per cent), mineral matters (3 per cent), nitrogenous matters (traces). John Ogle's results (*ibid.*, 1889, p. 427, from *Pharm. Jour. Trans.*) show moisture (18.92 per cent), soluble gum (35.94 per cent), ash (2.75 per cent), and insoluble gum (42.39 per cent). No starch was found, although its non occurrence is very rare (see Prof. Maisch, *ibid.*, foot-note; and E. Masing, *Archiv der Pharm.*, Vol. CXVII, 1880, p. 41). The insoluble part can be converted into water-soluble pectin by boiling the gum for 3 hours with a 1 per cent acid solution; also by long-continued boiling with water alone (Giraud). The resulting pectin is insoluble in alcohol. Non-fermentable sugar is likewise formed in this reaction. The insoluble part of gum tragacanth is dissolved with yellow color by strong alkalies. The soluble portion presents the following differences from arabin (see *Acacia*). It does not exhibit an acid reaction (Flückiger, 1891), does not precipitate with solution of borax, nor of ferric chloride. It is precipitated both by neutral and basic lead acetate, while acacia is precipitated by the basic lead salt only. E. Masing (*loc. cit.*) found the ash in 24 specimens to vary from 1.8 to 4.5 per cent; in exceptional cases (*Sterculia gums*, etc.) it was 6.4 to 8 per cent. (For a chemical comparison of the Australian sterculia gums with tragacanth, see J. H. Maiden, *Amer. Jour. Pharm.*, 1890, p. 26.)

Action and Medical Uses—Tragacanth can only act as a demulcent; but on account of its insolubility, it is rarely given internally. In powder, it is used as a vehicle for active and heavy medicines, for the purpose of giving cohesion and firmness to lozenges, and to form paste, which druggists use to label their prescriptions. Tragacanth, 1 ounce; gum Arabic, white sugar, each, 2 ounces, mixed together, in very fine powder, forms an excellent paste for covering microscopic slides with paper, as it dries quickly before it can become sour or moldy. It should be made into paste only as required for use, though a paste for labelling purposes may be preserved for a considerable time by the addition of a few drops of oil of cloves, adding water, when necessary, to thin the product.

Related Gums.—(See *Hog Gum.*) SARCOCOLLA. The gum-resinous exudate from *Penæa Sarcocolla*, Linné; *Penæa mucronata*, Linné, and other species of *Penææ* (*Nat. Ord.*—Penæaceæ). Shrubs of central and south Africa. The exudation, according to Dymock (1879), also comes from Bushire. The latter product is usually accompanied by fragments and seeds of a leguminous plant, probably an *Astragalus*. Sarcocolla consists of small, rounded, yellowish, reddish or brownish, sponge-like grains, quite friable, and often in agglutinated masses. Fine hairs are often found intermixed with it. It has no odor, except, when heated, it evolves the odor of burning sugar, but has an insipid and sweetish taste, followed by bitterish acridity; the taste has been compared to that of liquorice root. Water dissolves the gum; in alcohol it is nearly wholly soluble, the residue consisting of impurities. According to Pelletier (1834), ether separates from it a resin; from the residue, alcohol extracts a peculiar body (*sarcocollin*), white gummy material remaining. *Sarcocollin* ($C_{13}H_{23}O_6$), or pure sarcocolla, constitutes about 65 per cent of the drug. It is amorphous, both bitter and sweet to the taste, and soluble in water and alcohol. It was regarded by Dr. Thompson as holding a position intermediate between gum and sugar. Sarcocolla is not now employed in medicine, but was formerly used to heal *wounds*, check *otorrhœa*, and as an application to *scrofulous enlargements* and *chronic articular inflammations*.

SASSA GUM.—A gum introduced from the Orient, forming mammillated masses, or convoluted, translucent segments, of a reddish hue, and somewhat shiny surface. It resembles tragacanth in taste, except that it is also subacrid. It softens in water, swelling to 3 or 4 times its bulk, and becomes white. It does not, however, form a mucilage. Iodine colors it blue.

CASHEW GUM.—A brownish-yellow gum, which is translucent, feebly iridescent, and partially dissolved by water, is obtained from the *Anacardium occidentale*, Linné. It is also known as *Gomme acajou*.

CHERRY GUM.—Irregular and nodular masses exuded from various species of plum and cherry. It is translucent, imperfectly soluble in water, and has a brownish or amber color.

Related Species.—*Astragalus bœoticus*, Linné. Mediterranean basin. Seeds have been substituted for coffee.

Astragalus glycyphyllos, Linné.—Leaves and seeds diuretic.

Astragalus escapus, Linné.—Root is bitter, astringent, and mucilaginous; diuretic.

LOCO OR CRAZY WEEDS.—Under these common names several western weeds have been known, and poisonous effects upon horses and cattle have been attributed to them. A small amount of an alkaloid was isolated from one of the plants, but no toxic effects were produced. Prof. J. U. Lloyd, who has studied the subject, suggests that, possibly, the poisonous effects may be due to a ferment, such as gives jequirity its virulence. The subject has not yet been settled. These plants are the *Astragalus mollissimus*, Torrey, west of the Mississippi, from Nebraska south to Texas, *Oxytropis Lamberti*, *Crotalaria sagittalis*, and other plants. From Lloyd's papers on *Loco* (*Ec. Med. Jour.*), we abstract the following:

"Loco yields the usual constituents of herbs. It may be safely said that, if a specimen of the plant were to be examined, in the ordinary manner, by a chemist who had no idea of its importance, he would report that it did not contain a characteristic proximate constituent. Gum, chlorophyll, fat, resin, coloring matter, mineral salts abound, and, as is usual with most plants, alkaloidal reactions. No alkaloids in abundance, none toxic at least, no toxic glucosid. Such were my experiences. The physiological investigations were, in turn, as barren of results. Neither any constituent, nor the tincture or extract of the herb, seemed to be dominated by any physiologically active agent. I became skeptical concerning even the reputed virulence of loco, and would chew the plant, and swallow the spittle. Whether it be that conditions were not favorable to my research, or that my methods were at fault, remained undetermined; loco products would not 'loco.'"

"Preparations of the loco plant and the plant in substance have no physiological effect on men, rabbits, cats, or dogs. Cattle, horses, and sheep are the animals subject to the disease, 'locoed.' Horses are the most easily affected, cattle being less subject than either horses or sheep. The principal symptoms, as manifested in the horse, are hallucination, followed by dangerous and uncontrollable mania. The muscular system is seriously impaired, the movements of the beast being uncertain and staggering, not unlike those of intoxicated beings. The animal loses the power to back. A characteristic feature in this disease is the peculiar high step taken by the animal, which often, when urged over a very small obstacle, leaps as if making an effort to get over a very high object. A prominent characteristic is the great emaciation, the body soon becoming totally devoid of fat. In the more advanced stage, the animal becomes stupid, prefers to be alone, wanders around listlessly and aimlessly, and will eat no other food but the loco, wandering from the loco to water, and from water back to loco. Any excitement brings on fits, more especially if the animal be driven through water, when it frequently becomes so exhausted as to fall helplessly into the stream, and is drowned; even a depth of 1 or 2 feet is sufficient. The mucous tissues are extremely pallid, the bowels constipated, the hair becomes rough and lusterless. The principal post-mortem changes seem to be a softening of the intestinal tract, which is infested with an enormous amount of parasites of various kinds. The intestines are, in some places, perforated, or at least so friable as to prevent handling without breaking apart in places. A constant feature in horses is a hemorrhagic floating clot in the fourth ventricle, and at the base of the brain, suspended in an abnormally large quantity of serum. All the serous cavities are filled with an excessive secretion of serum. The animal appears to perish from starvation, with constant excitement of the nervous system, but sometimes appears to suffer acute pain, causing him to expend his strength in running wildly from place to place, pawing and rolling until he falls and dies in a few minutes. Cattle, in addition to appearing wasted, seem to be stunted in their growth, so that a 4-year-old animal, affected with loco during its growth, becomes no larger than it should be at 2 years. This briefly gives the results of the disease as condensed from *Bulletin No.* 25 of the *Colorado State Agricultural College*, the subject being admirably treated by the author, David O'Brine." For full information on this subject, consult the papers referred to.)

Baccharis cordifolia.—The South American composite, *Mio Mio*, exerts a deadly force upon sheep and cattle. It contains an alkaloid, *baccharine*, isolated by P. N. Arata (*Pharm. Jour. Trans.*, Vol. X, 1879, p. 6[illegible]).

TRIFOLIUM.—RED CLOVER.

The blossoms of *Trifolium pratense*, Linné.

Nat. Ord.—Leguminosæ.

Botanical Source.—Red clover is a biennial plant with several stems arising from the same root, ascending, somewhat hairy, and varying much in its height. The leaves are ternate; the leaflets oval or obovate, entire, nearly smooth, often notched at the end, and lighter colored in the center. Stipules ovate and mucronate. Flowers red, fragrant, in short, dense, ovate, sessile spikes or heads. Corollas unequal, monopetalous; lower tooth of the calyx longer than the four others, which are equal, and all shorter than the rose-red corolla (W.—G.).

History.—This plant is common to the United States, being extensively cultivated in grass lands, with herds-grass (*Phleum pratense*) and other grasses, and often alone: it flowers throughout the summer. The blossoms or flowers, are the parts used. A strong decoction is made of them, which is evaporated to the consistence of an extract. A tincture is also prepared. Frederick Graser obtained from the flower-heads two resins, fat, chlorophyll, tannin, ash (7½ per cent), etc. The ether-soluble resin dissolves green in ammonia, and yellow in potassa (*Amer. Jour. Pharm.*, 1883, p. 194).

Action, Medical Uses, and Dosage.—Red clover is an excellent alterative, and one of the few remedies which favorably influences *pertussis*. In earlier editions of this work it was stated that "a strong infusion of the plant is said to afford prompt relief in *whooping-cough*, suspending the spasmodic cough entirely in 2 or 3 days; it is to be given in ½ fluid ounce, every 1 or 2 hours, throughout the day." Since then the remedy has come into extensive use, but the statement should be modified, as it does not reach all classes of cases. When the proper case is found it acts promptly, but as yet the specific indications in this complaint have not been discovered. It is also a remedy in other *spasmodic coughs*, as those of *measles*, *bronchitis*, *laryngitis*, *phthisis*, etc. It is an excellent internal agent for those individuals disposed to tibial and other forms of *ulcers*, and it unquestionably retards the growth of *carcinomata*, and may be freely administered to those of a *cancerous diathesis*. The extract, spread on linen or soft leather, has long been said to be an excellent remedy for cancerous ulcers. This assertion, however, has not been so well verified as its action in retarding the growths when administered internally for a prolonged period. It is also highly recommended in ill-conditioned *ulcers* of every kind, and deep, ragged-edged, and otherwise badly-conditioned *burns*. It possesses a peculiar soothing property, proves an efficient detergent, and promotes a healthful granulation. The infusion (℥i to water Oj) may be used freely; a strong tincture may be prepared from the recently dried flowers (℥viii) in 50 per cent alcohol (Oj). The dose of this will range from 1 to 60 drops; specific trifolium, 1 to 60 drops.

Specific Indications and Uses.—Some forms of whooping-cough; irritation of the larnygo-pulmonic passages; provoking spasmodic cough; cough of measles; cancerous diathesis.

Pharmaceutical Preparation of Clover.—Extract of Trifolium Compound. This preparation is a specialty of the Wm. S. Merrell Chemical Co., of Cincinnati, Ohio. It is a combination of the alterative, tonic, and eliminative properties of the recently expressed juices or extracts from fresh or green plants with potassium iodide. The compound contains the extracts of Trifolium pratense, Stillingia sylvatica, Lappa minor, Phytolacca decandra. Cascara amarga, Berberis aquifolium, Podophyllum peltatum, tincture of Xanthoxylum carolinianum and potassium iodide. It is designed for administration in *syphilis, scrofula, chronic rheumatism, glandular and various skin affections.*

TRIGLOCHIN.—ARROW-GRASS.

The herb of *Triglochin maritimum*, Linné.

Nat. Ord.—Juncaginaceæ.

Common Name: *Arrow-grass.*

Botanical Source.—This is an herbaceous plant, found in marshes and other damp situations throughout the United States, especially near the sea coast. It has numerous narrow, grass-like, but fleshy leaves, all radical and sheathed at the base. The flowers are very small, greenish, and borne in slender, spicate racemes on erect scapes, which are from 1 to 2 feet high. The sepals are 3, ovate; the petals are also 3, and colored green like the sepals. The pistil consists of 6 united ovaries, which divides, in fruit, into 6 dry, linear, 1-seeded carpels.

Triglochin palustre, a smaller species, with only 3 carpels, is found in similar situations. Both species grow in Europe. Their constituents have probably never been examined chemically.

Action and Medical Uses.—Triglochin maritimum is said to be much sought after by cattle, especially subsequent to frost; they thrive upon it, and grow fat; while, with cows giving suck, it greatly increases the quantity and richness of their milk. Dr. E. F. Jones, of Colorado, reports it to be an active diuretic, of considerable value in *kidney and bladder affections*. To be employed in infusions.

TRILLIUM.—BETHROOT.

The root of *Trillium erectum*, Linné, var. *album* (*Trillium pendulum*, Muhlenberg), and other species of *Trillium*.

Nat. Ord.—Liliaceæ.

Common Names: (See below.)

Botanical Source, History, and Description.—This is one of an extensive genus of North American, herbaceous, perennial plants, which are variously known under the names of *Wake-robin*, *Birth-root*, *Indian-balm*, *Lamb's quarter*, *Ground lily*, etc. It has an oblong, tuberous root, from which arises a slender stem, 10 to 15 inches in height. Leaves, 3 in number, are whorled at the top of the stem, suborbicular-rhomboidal, abruptly acuminate, 3 to 5 inches in diameter, and borne on petioles about a line in length. The flowers are white, solitary, terminal, cernuous, on a recurved peduncle from 1 to 2½ inches long. Sepals green, oblong-lanceolate, acuminate, and 1 inch long; petals oblong-ovate, acute, and 1¼ inches in length by ½ an inch broad. Styles 3, erect, with recurved stigmas (B. — W.).

This plant is common to the middle and western states, growing in rich soils, in damp, rocky, and shady woods, and flowering in May and June. Nearly all the species of the genus Trillium are medicinal, and possess analogous properties; and among them the most common, and consequently the most frequently collected and employed are those given below, under the heading *Related Species.*

Fig. 248.

Trillium erectum.

These plants may be generally known by their 3 verticillate, net-veined leaves, and their solitary, terminal flower, which varies in color in the different species, being white, red, purple, whitish-yellow, or reddish-white; the peduncle will also be found erect in some species, and recurved in others. The roots of these plants are oblong or terete, somewhat tuberous, dark or brownish externally, white internally, from 1 to 5 inches in length, and from ½ to 1½ inches in diameter, beset with a few branching fibers laterally. They have a faint, slightly terebinthinate odor, and a peculiar aromatic and sweetish taste; when chewed they impart an acrid astringent impression in the mouth, causing a flow of saliva, and a sensation of heat in the throat and fauces. The rootlets have but little of the acrimony of the root. The latter yields its active principles to water, and its tonic and stimulant virtues to diluted alcohol.

Chemical Composition.—The acrid principle of this root, *trilline*, was obtained by Prof. Wayne in 1856. (For its preparation, see this *Dispensatory*, preceding edition.) This principle is probably identical with *saponin*, of which V. J. Reid (*Amer. Jour. Pharm.*, 1892, p. 67) obtained 4.86 per cent; other constituents of the root are fixed oil (about 8 per cent), starch, tannin, and an acid crystalline principle, probably a decomposition product of saponin. No volatile oil is present (D. J. Prendergast, *Amer. Drug.*, 1887, p. 206).

Action, Medical Uses, and Dosage.—Bethroot is astringent, tonic, and antiseptic; it has been employed successfully in *hemoptysis*, *hematuria*, *menorrhagia*, *uterine hemorrhage*, *metrorrhagia*, *leucorrhœa*, *cough*, *asthma*, and *difficult breathing*, and is said to have been much used by the Indian women to promote parturition. The astringent varieties of Trillium have been found useful in *hemorrhages;* the acrid species in *chronic affections* of the *respiratory organs*, *phthisis*, *hectic fever*, etc. All the varieties have been found efficient, either internally or externally, in *chronic mucous discharges*, *bronchorrhœa*, *leucorrhœa*, *menorrhagia*, etc. Boiled in milk, it has been administered with benefit in *diarrhœa* and *dysentery;* and an infusion of equal parts of Trillium and Lycopus virginicus, has been highly recommended for the cure of *diabetes*. It does not diminish the amount of sugar excreted in the saccharine form, but restrains the secretion of the renal discharges in both forms. Externally, the root, made into a poultice, is very useful in *tumors*, *indolent* or *offensive ulcers*, *anthrax*, *buboes*, *stings of insects*, and to restrain *gangrene*. In some instances its efficacy has been increased by combination with bloodroot. The red bethroots will, it is said, check ordinary *epistaxis*, by merely smelling the freshly-exposed surface of the recent root, and it is therefore probable that they contain an astringent principle of a volatile nature. The leaves of the beth plants, boiled in lard, have been much used, in some sections of the country, as an application to *ulcers*, *tumors*, etc. Dose, of powdered bethroot, 1 drachm, to be given in hot water; of the strong infusion, which is the most common form of administration, from 2 to 4 fluid ounces. A strong tincture of the fresh root (℥viii in alcohol, 76 per cent, Oj) may be given in doses of from 1 to 20 drops. These plants undoubtedly possess active properties, and deserve further investigation. *Trilline*, as prepared by Prof. Wayne, has not been used in medicine; but a less-active agent, of no therapeutical value, has been sold under the same name.

Specific Indications and Uses.—Relaxation of tissues, with mucous discharges or passive hemorrhage.

Related Species.—*Trillium sessile*, Linné. Leaves sessile, mottled, a deep-purple; flower sessile and dull-purple; petals erect, some spreading.

Trillium recurvatum, Beck.—Leaves petioled; sepals green and reflexed; petals erect or recurved; flower dull-purple.

Trillium nivale Riddell.—Leaves petiolate; flower erect on peduncles, and white; petals half longer than the sepals.

Trillium erythyrocarpum, Michaux, *Smiling wake-robin.*—Flower erect and peduncled; petals recurved, longer by twice than sepals, wavy, and penciled at base, a beautiful purple.

Trillium grandiflorum, Salisbury.—Leaves sessile, sharply acuminate; petals much longer than sepals; white, or shading to rose; flower suberect.

Trillium erectum, Linné, *Bath flowers.*—Leaves almost petiolate, broad as long; scarcely erect peduncle; nodding, dark-purple flower; ill-scented.

Trillium cernuum, Linné.—Peduncle long, twice the length of flower, and half as long as and deflexed under the leaves; flower white or rose; petals flat, and stigmas the length of the anthers.

Trillium stylosum, Nuttall.—Peduncle no longer than the flower, and decurved; petals larger than sepals, and recurved; flower white or rose; styles united.

TRIMETHYLAMINA.—TRIMETHYLAMINE.

FORMULA: $N(CH_3)_3$. MOLECULAR WEIGHT: 58.92.

History and Description.—Trimethylamine is isomeric with propylamine, under which name it was described by the older works. It was discovered by Wertheim (1850), and first employed in medicine by Avenarius, a physician of St. Petersburg (1854). It is a constituent of the three closely-related substances—*choline* (*neurine*), *muscarine*, and *betaïne* (see *Related Substances*, below), and, when found in nature, it is probably a decomposition product of one of these. It occurs in herring-brine, wherein it was first discovered; in *Chenopodium vulvaria*, Linné, or Stinking goosefoot; in ergot (*secaline*, of Winckler; see *Ergota*), and the rust of wheat; in the flowers of some species of Rosaceæ, *e. g.*, *Cratægus Oxyacantha*, Linné, *Pyrus communis*, Linné; in *Arnica montana;* in the leaf of the sugar-beet (*Beta vulgaris*, Linné); in the seeds of the beech; in putrefactive processes, *e. g.*, when urine, calves' blood, brains, bile, cod-liver oil, yeast, etc., undergo decomposition. It is among the early decomposition products in the cadaver. Trimethylamine was obtained synthetically by Prof. A. W. Hofmann in 1851. It was formerly prepared almost exclusively from fish-brine, by mixing the brine with excess of slaked lime, distilling, and saturating the distillate with hydrochloric acid, and evaporating. Exhaust the residue with alcohol, filter, evaporate the filtrate to dryness, and distill carefully from an excess of slaked lime made into a paste with water. At present the beet-sugar industry yields large quantities of trimethylamine, from the spent beet-molasses. The product, however, is liable to be mixed with dimethylamine ($NH[CH_3]_2$) (as much as 50 per cent), and monomethylamine (NH_2CH_3), propylamine and butylamine. (For their detection, see Duvillier and Buisine, *Amer. Jour. Pharm.*, 1880, p. 33.)

Trimethylamine ($N[CH_3]_3$) at low temperatures, is a colorless fluid of a strongly alkaline character, at ordinary temperature, a gas; has an odor similar to that of herring-brine, boils at less than 9° C. (48.2°F.), is soluble with avidity in alcohol, water, and ether, is inflammable, and forms soluble salts with bases.

Hydrochlorate of Trimethylamine (*Trimethylamine hydrochloride*) is chiefly used in medicine, and is often known under the improper name "*Chloride of Propylamin.*" It is made by decomposing the crude hydrochlorate, obtained from brine, with caustic lime or potash, passing the vapor of trimethylamine, that is given off, into dilute hydrochloric acid, evaporating the solution thus obtained, and recrystallizing the residue from stronger alcohol. It is a white, deliquescent salt, of a slight odor, a saline taste, and soluble in alcohol and water. An aqueous solution of trimethylamine has been largely sold as *propylamine.*

Action, Medical Uses, and Dosage.—Trimethylamine has a depressive action upon the pulse and the temperature, reducing the former from 2 to 18 beats per hour, and the latter from 1 to 3 degrees; depending upon the dose administered, and the condition of the person experimented upon. It appears to exert no action upon the surface of the body unless applied with friction, when it occasions rubefaction. Upon mucous membranes it has an irritating and caustic action, on which account it is necessary in administering it to employ it in mixtures. It appears to possess no diaphoretic or diuretic effect, and, properly given, occasions no derangement of the digestive organs. According to M. Peltier, the physiological action of trimethylamine is, a gentle excitant of the skin, a caustic to the mucuos membrane, a sedative to the nervous system, a hyposthenizant to the arterial system, and a modifier of urea in the urine, diminishing its amount considerably; therapeutically, it calms the pains in *rheumatism*, diminishes the articular congestion, at the same time rapidly reducing the fever. The hydrochlorate of trimethylamine occasions the same effects, and is generally preferred for therapeutical use, on account of its taste and odor being more agreeable. These agents have been highly recommended in *acute articular rheumatism*, in which they promptly allay the pain, and are said to cure in a very short time, from 4 to 12 days. They have likewise been found promptly efficient in the treatment of *chorea*. The method pursued by Avenarius, probably the best for the administration of trimethylamine, is as follows: To 6 fluid ounces of peppermint water add 2 drachms of white sugar, and 24 drops of trimethylamine. The dose of this is ½ fluid ounce, to be repeated, according to the urgency of the case, every 2, 3, or 4 hours. The dose of the hydrochlorate of trimethylamine is from 5 to 15 grains, in the course of 24 hours. It may be prepared for administration, in a very agreeable form as follows: Mix together, hydrochlorate of trimethylamine, 154 grains; tincture of the yellow rind of orange, 1 fluid ounce; syrup, 2 pints. The dose of this is from ½ to 1½ fluid ounces (J. King). Dr. Scudder cautioned regarding the employment of trimethylamine, stating, that in one instance under its use, he had developed a typical case of typhoid fever; nevertheless he believed that in small doses it would be useful "to strengthen the circulation, improve nutrition, and stimulate waste and repair." In rheumatic complaints, he regarded it a safe remedy only after the circulation had been brought under the control of the special sedatives, and the secretions were well established. The remedy, although evidently of much value, has now been displaced by other agents, and is at present seldom employed. The dose of trimethylamine is from 1 to 5 drops, every 4 hours; of the hydrochlorate, from 1 to 8 grains. For its influence on waste and nutrition, Prof. Scudder suggested: R Trimethylamine hydrochlorate, grs. x; sugar of milk, grs. 1000; triturate thoroughly. Dose, 1 to 5 grains.

Related Substances.—PROPYLAMINE (normal, C_3H_9N) is obtained by hydrogenation of proprionitril ($C_2H_5.CN$) (cyanide of ethyl), as follows: $C_2H_5.CN+2H_2=C_2H_5CH_2.NH_2$, and may also be prepared by other chemical processes. It is a strongly alkaline liquid, boils at 50° C. (122° F.), has the specific gravity 0.7283 at 0° C. (32° F.), and forms a platino-chloride which crystallizes in orange-yellow monoclinic prisms (Fowne). It is not used in medicine, though it agrees with trimethylamine hydrochlorate in effects. Other related bodies are:

AMYLAMINE ($NH_2C_5H_{11}$), a colorless fluid.

AMYLAMINE HYDROCHLORATE, or *Amylamine chloride* ($C_5H_{13}N.HCl$) forms 4-sided, efflorescent octohedra or scales, freely soluble in alcohol or water. In doses of from 7 to 15 grains, it slows the pulse and diminishes the temperature in man.

METHYLAMINE (NH_2CH_3) and DIMETHYLAMINE ($NH[CH_3]_2$) are both colorless and inflammable gases.

CHOLINE, or *Neurine* ($C_5H_{15}NO_2$), an alkaline fluid, is a constituent of the complex substance *lecithine*, which is found in bile, eggs, brains, milk, yeast, etc.; choline also occurs in white mustard (*sinkaline*), in cotton-seeds, herring-brine, in the seeds of fenugreek, in the fly-agaric (*Agaricus muscarius*), and is an early decomposition product of the human cadaver (Brieger).

MUSCARINE ($C_5H_{13}NO_2$) is a deliquescent, crystallizable and poisonous alkaloid, occuring in the fly-agaric, together with choline, and is obtainable by oxidation of choline.

BETAINE ($C_5H_{11}NO_2$), forming neutral deliquescent crystals, is the inner anhydride of an acid obtainable by oxidation of muscarine, and hence of choline; also by way of several other chemical processes. Its chief occurrence is in the juice of the beet-root, and of the beet-root molasses. *Choline*, *muscarine*, and *betaine*, respectively, stand in the relation of alcohol to aldehyde and acid. All three contain the trimethylamine group.

TRIOSTEUM.—FEVER-ROOT.

The bark of the root of *Triosteum perfoliatum*, Linné.

Nat. Ord.—Caprifoliaceæ.

COMMON NAMES: *Fever-wort*, *Wild ipecac*, *Bastard ipecac*, *Horse-gentian*, *Wild coffee*, *Dr. Tinker's weed*.

Botanical Source.—This plant is indigenous, with a perennial, thick, and fleshy root, subdivided into numerous horizontal branches. The stems are several from same root, simple, stout, erect, round, hollow, soft, pubescent, and from 2 to 4 feet high. The leaves are opposite, oval-acuminate, mostly connate, entire, abruptly contracted at base, nearly smooth above, pubescent beneath, prominently veined, 6 inches long by 3 broad; in some plants the upper leaves are almost amplexicaul. Flowers dull-purple, axillary, sessile, mostly in clusters of 3 or 5, in the form of whorls, rarely solitary. Calyx-tube ovoid; limb 5-parted; segments linear-lanceolate, leaf-like, and persistent, having a solitary bract; corolla tubular, gibbous at the base, somewhat equally 5-lobed, and scarcely longer than the calyx. Stamens 5, included; filaments hairy. Ovary inferior; style long and slender; stigma capitate and lobed. The fruit is an oval berry, about 9 lines long and 6 thick, of an orange-red or purple color when ripe, hairy, somewhat 3-sided, crowned with the persistent calyx, 3-celled, each cell containing a hard, bony, furrowed seed (W.—G.—B.).

History and Description.—Fever-root is found throughout the United States, in lime-stone and rich soils, in shady locations, and among rocks, flowering from May to August. The root is the medicinal part. It is of a dirty yellowish-brown color externally, about 1½ feet long, and about 9 lines in diameter, whitish internally, sends out fibers, has a nauseous smell, and a disagreeable amarous taste. When dried, it is readily reduced to powder. Its virtues are imparted to water, alcohol, or ether. The root has been used as, perhaps, an unintentional substitute for ipecac root and senega root. C. Hartwich (*Pharm. Rundschau*, 1895, p. 104) found it to contain starch, and an alkaloid differing from emetine; he named it *triosteine*. Schlotterbeck and Teeters (*ibid*, p. 180) made a complete analysis of the root, and confirmed the presence of alkaloid.

Action, Medical Uses, and Dosage.—The bark of the root is emetic when recent, or when administered in large doses of the powder. In doses of from 20 grains to 1 drachm, the powder is a mild, but slow, cathartic, with a tonic influence. It is feebly sedative, and the secretions are augmented by it. Its action upon the skin is similar to, but less decided, than that of asclepias. Small doses may be given to lessen the frequency of the heart-action, and reduce the temperature in *febriculæ* and *mild inflammatory complaints*. In the early stages of *fever*, it may be given in all cases where a gentle action on the bowels is desired. It has been recommended as a laxative tonic in *dyspepsia* and *autumnal fevers*, also in *hysteria*, *hypochondria*, and convalescence after febrile diseases. Some have stated it to possess diuretic properties, and have employed it in *chronic rheumatism* with success. Rafinesque considered the leaves to be diaphoretic. The hard seeds are said to be very similar in flavor to coffee, when roasted and ground. Dose of the tincture, from 1 to 4 fluid drachms; of a strong tincture of the recent root for its sedative effects, 1 to 10 drops; of the extract, which is one of the best forms of administration, from 5 to 15 grains.

Specific Indications and Uses.—Headache; colic; bilious vomiting and diarrhœa.

Related Species.—*Triosteum angustifolium*, Linné, smaller than the above, with a bristly, hairy stem; lanceolate and subconnate leaves, tapering to the base; peduncles opposite; 1-flowered, and flower of a greenish-cream color, possesses analogous properties, and may be substituted as an equivalent for the above (W.).

TRITICUM (U. S. P.)—TRITICUM.

"The rhizome of *Agropyrum repens* (Linné), Beauvois, gathered in the spring and deprived of the roots"—(*U. S. P.*) (*Triticum repens*, Linné).

Nat. Ord.—Gramineæ.

Common Names: *Couch-grass*, *Quick-grass*, *Quitch*, *Quitch-grass*, *Quickens*, *Dog-grass*.

Botanical Source and History.—This perennial plant has a jointed, long, whitish rhizome, each joint giving off a tuft of fibrous radicles. The flowering spikes surmount the culm, which grows from 2 to 4 feet high. The spikes are from 4 to 8-flowered, and are 3 to 4 inches long. The florets are pointed or obtuse, variable, and generally awnless. It has flat, rough leaves. The plant grows on cultivated grounds and along roadsides, usually in rich soils, and has become a nuisance in some situations. It is a native of Europe, but has become naturalized in this country.

Description and Chemical Composition.—"Very long and creeping; about 2 Mm. (½ inch) thick; as met with in the shops, cut into sections about 1 Cm. (⅖ inch) long; smooth, but wrinkled; hollow in the center, straw-yellow; inodorous; taste sweetish"—(*U. S. P.*) The rhizome of couch-grass, according to Ludwig and Muller (*Jahresb. der Pharm.*, 1872, p. 22, and 1873, p. 25), contains *lævulose* (from 2.5 to 3.3 per cent); *triticin*, a very hygroscopic, lævo-rotatory substance allied to inulin, soluble in diluted alcohol and water, insoluble in ether, little soluble in strong alcohol. Upon hydrolysis with water or diluted acids, it yields lævulose. Other constituents of the rhizome are *acid malates*, and about 11 per cent of a nitrogenous gummy substance forming insoluble compounds with neutral and with basic lead acetate. The dried rhizome yields 4.5 per cent of ash, containing much silicic acid. (For some possible economic uses of the rhizome, see Plauchud, *Jour. Pharm. Chim.*, 1877, p. 389.

Action, Medical Uses, and Dosage.—Couch-grass is diuretic and slightly aperient. It is an excellent agent in cases of excessive *irritability of the bladder* from any cause, lessening the frequency and pain of urination. It is a very efficient agent in *cystitis*, and those forms of *dysuria* due to *chronic cystic irritability*. It is highly praised as a remedy for *incipient nephritis*, allaying irritation, congestion and inflammation. Triticum is valued in *pyelitis* and other *catarrhal and purulent urinary affections*. It has been advised in *gonorrhœa*, *chronic prostatitis with enlarged prostate*, *hematuria*, and *strangury*. It is also recommended for its effects upon the renal secretion in *gout*, *rheumatism*, and *jaundice*. Infusion of triticum has long been used as a *fever* drink, and it has the well-merited reputation of preventing gravelly conditions. As a "spring medicine," for which it has been used by some, it is undoubtedly effectual in removing the broken-down material by way of the kidneys. The infusion is the best form of administration. To prepare the infusion: 1 ounce of the underground stem (or so-called root) is infused for 1 hour in a pint of boiling water. When strained, and cool, it may be given in wineglassful doses several times a day. It may likewise be used in the form of syrup. Specific triticum is a reliable alcoholic preparation, the dose being from 1 to 20 drops, in water.

Specific Indications and Uses.—Irritation of the urinary apparatus; pain in the back; frequent and difficult or painful urination; gravelly deposits in the urine; catarrhal and purulent discharges from urethra.

Pharmaceutical Preparation.—TRITIPALM. This is a specialty of Frederick Stearns & Co., of Detroit, Mich. It represents a combination of 60 grains of the fresh root of triticum and 30 grains of the fresh fruit of saw palmetto (*Serenoa serrulata*), in each fluid drachm. It is a palatable compound fluid extract, and is designed as a general nutrient tonic and sedative to *irritated and inflamed states of the mucous membranes of nose*, *throat*, and *bronchiæ*, especially arresting purulent discharges; it also acts upon the glandular appendages of the reproductive tract. It is specially recommended in *nephritis*, *simple and gonorrhœal urethritis*, *cystitis*, *vesical irritability*, *strangury*, *dysuria*, and *atrophy of the mammæ*, *testes*, *ovaries*, *uterus*, and especially of the *prostate gland*. The dose is 1 fluid drachm, followed by a draught of water, 4 times a day.

Related Species. *Cynodon Dactylon*, Persoon, *Scotch grass*, *Bermuda grass*. The rhizome is used like couch-grass by the Mexicans and Spaniards.

Sorghum vulgare, *Broom-corn*.—The seeds of this plant are employed by the negroes of the southern states as a remedy for *bladder troubles*, such as *cystitis*. They make a decoction of the seeds (2 ounces) in 1 quart of water, and boil it down to 1 pint.

TRITURATIONES (U. S. P.)—TRITURATIONS.

Preparation.—"Unless otherwise directed, triturations are to be prepared by the following formula: Take of the substance, ten grammes (10 Gm.) [154 grs.]; sugar of milk, in moderately fine powder, ninety grammes (90 Gm.) [3 ozs. av., 76 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Weigh the substance and the sugar of milk, separately; then place the substance, previously reduced, if necessary, to a moderately fine powder, in a mortar; add about an equal measure of sugar of milk, mix well by means of a spatula, and triturate them thoroughly together. Then add fresh portions of the sugar of milk, from time to time, until the whole is added, and continue the trituration until the substance is intimately mixed with the sugar of milk and reduced to a fine powder"—(*U. S. P.*).

History.—The official triturations are prepared according to the Homœopathic method. While only a definite proportion is aimed at by the Pharmacopœia, in Homœopathic pharmacy triturations not only are considered in the light of definite quantities, but are believed to assume increased medicinal power.

The drug is, from their view, "potentiated." Homœopathic triturations are denominated decimal or centesimal, according to the amount of active ingredient contained therein. If 1 part of the medicine be triturated with 9 parts of sugar of milk, gradually added, the first decimal trituration (1 x) is formed; if, however, 1 part of the medicine be triturated with 99 parts of milk-sugar, gradually added, the resulting preparation is the first centesimal trituration (1). By adding 1 part of the first decimal trituration to 9 parts of sugar of milk, or 1 part of the centesimal trituration to 99 parts of sugar of milk, gradually added, we obtain respectively the second decimal (2 x) or second centesimal trituration (2), and so on up the scale. Great care is to be observed that the mortar is perfectly clean, it being first washed with cold, then with hot water, and finally a little alcohol is burned in it. Moreover, each substance is triturated for a definite length of time. Similar preparations to the Homœopathic and official forms are what were introduced under the following term, and were described in previous editions of this *Dispensatory*, as

LACTINATED PREPARATIONS.—"These are forms, in which active and powerful medicines are presented to the profession by the manufacturers. The medicinal lactinated preparations are composed of alcoholic extracts, essential or inspissated tinctures, and juices, resinoids, etc., thoroughly triturated with lactin or sugar of milk. They are said to be best formed in the process of mixture, by mixing the lactin with the medicine before it is dried, and then carefully drying and powdering them together. This combination of medicines with lactin has the advantage: (1) of presenting many of the soft resinoids and inspissated tinctures, in the dry powdered form, without changing their chemical character, as is liable to be done by mixing them with alkalies or mineral substances; (2) of rendering them soluble, or at least readily miscible in water, and thus more easily administered, and more readily diffused in the stomach; (3) of greatly increasing the activity of all the resinoids, and such other preparations as are but partially soluble in water. Four grains of such a mixture, although it contains only 1 grain of the medicine, will generally be found as active as 2 grains of the same medicine given in its isolated state, while at the same time it produces less irritation and other unpleasant effects. Many concentrated agents are much improved by this mode of combination, and are kept prepared in this way, as in their pure state they are so concentrated and insoluble as to act as irritants on the stomach before they can be sufficiently diffused and absorbed to produce their therapeutical effects.

"The lactinated medicines should be kept in 1 ounce or 2 ounce vials, with as little exposure to air and light as possible. All articles containing volatile principles, as the essential oils, soft resinoids, and oleoresins, should be kept in ½ ounce or 1 ounce vials, as by frequently exposing them to the air they become inert. Those articles which absorb moisture from the air, and thus render the combination hard, or which require very large proportions of lactin to form a dry mixture, should not be lactinated.

"Lactinated preparations are made of various proportions of lactin, and which are expressed on the label of the vials containing them; thus, there may be equal parts, each, of the medicine and the sugar of milk; or to 1 part of the former, there may be added 2, 5, or 10 parts of the latter.

"Ordinary cane-sugar, saturated with concentrated alcohol, or ethereal tinctures of various medicines, and then dried, has been used by medical men, and found very useful; but it will be found inferior to, and less permanent than, a lactinated medicine properly prepared" (J. King).

It will be observed that these preparations preceded the "Abstracts" of the *U. S. P.*, 1880.

TRITURATIO CALCII SULPHIDUM.—TRITURATION OF CALCIUM SULPHIDE.

Preparation.—Take of calcium sulphide, 1 part; sugar of milk, 99 parts; to make 100 parts. Mix thoroughly by trituration. This forms the first centesimal trituration (1). To prepare the first decimal (1 x): Take calcium sulphide, 10 parts; sugar of milk, 90 parts; to make 100 parts. Mix thoroughly by trituration.

Action, Medical Uses, and Dosage.—(See *Calcii Sulphidum.*) These preparations usually pass under the names of triturations of *Hepar Sulphuris*, a misnomer, as true *hepar sulphur* is potassium sulphide. The dose of the first centesimal (1) is from 5 to 20 grains; of the first decimal (1 x), ½ to 2 grains.

TRITURATIO CARBO LIGNI.—TRITURATION OF WOOD CHARCOAL.

SYNONYMS: *Trituration of carbo vegetabilis, Trituration of vegetable charcoal.*

Preparation.—Take of carbo ligni, 1 part; sugar of milk, 99 parts. Mix thoroughly by trituration. This forms the first centesimal trituration (1). To prepare the first decimal (1 x): Take of carbo ligni, 10 parts; sugar of milk, 90 parts; to make 100 parts. Mix thoroughly by trituration.

Action, Medical Uses, and Dosage.—(See *Carbo Ligni.*) Dose, 1 to 10 grains.

TRITURATIO ELATERINI (U. S. P.)—TRITURATION OF ELATERIN.

Preparation.—"Elaterin, ten grammes (10 Gm.) [154 grs.]; sugar of milk, in moderately fine powder, ninety grammes (90 Gm.) [3 ozs. av., 76 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Mix them thoroughly by trituration"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—(See *Elaterinum.*) Dose, ¼ to ¾ grain.

TRITURATIO PODOPHYLLI.—TRITURATION OF PODOPHYLLIN.

Preparation.—Take of resin of podophyllum, 1 part; sugar of milk, 99 parts; to make, 100 parts. Mix thoroughly by trituration. This forms the first centesimal trituration (1). To prepare the first decimal (1 x): Take of resin of podophyllum, 10 parts; sugar of milk, 90 parts; to make 100 parts. Mix thoroughly by trituration.

Action, Medical Uses, and Dosage.—(See *Resina Podophylli.*) These preparations are extensively used in Eclectic practice. The dose of the first centesimal (1) is from 1 to 10 grains; of the first decimal (1 x), 1 to 3 grains.

TRITURATIO SANTONINI ET PODOPHYLLI.—TRITURATION OF SANTONIN AND PODOPHYLLIN.

Preparation.—Take of santonin, 10 grains; resin of podophyllum, 2 grains; white sugar (or milk sugar), 2 drachms. Mix thoroughly by trituration. Divide into 20 powders (see Scudder's *Prac. of Med.*).

Action, Medical Uses, and Dosage.—This trituration is an admirable form for administering santonin, with a laxative, for the removal of *intestinal worms*. The dose is 1 powder, night and morning. Each powder contains about 6½ grains of the trituration, representing ½ grain of santonin and $\frac{1}{10}$ grain of resin of podophyllum.

TROCHISCI.—TROCHES.

Troches, or lozenges, are medicinal substances in powder, which are formed into solid cakes, by the aid of sugar and gum. These cakes are circular, flat, a line or so in thickness, and about ½ inch in diameter. They are usually intended for gradual solution while retained in the mouth, and form a very pleasant mode of exhibiting many useful remedies. Gum Arabic and tragacanth are both employed, but the latter is preferred on account of the greater cohesiveness of its gum. In preparing troches, the best tragacanth should be selected, and placed in sufficient cold water to form a mucilage of the consistence of paste; this must be strained previous to using it. The medicinal powders having been well incorporated with the sugar, are by means of a sufficient quantity of the mucilage of tragacanth, worked into a soft dough, upon a plate of marble or porcelain. After all have been duly incorporated, the thick paste or dough is rolled out on the marble plate, its adhesion to the roller being prevented by sprinkling over it, from time to time, some powdered starch, or a powder of starch and sugar. Uniformity of thickness is effected by the use of a frame of wood or iron, which is placed upon the marble plate, and upon which the extremities of the roller move during the process of rolling. The rolled-out or extended layer of dough is now sprinkled with some of the powdered starch, and the troches are cut of the required shape and size by means of a tin-plate punch. The troches are then placed on a sieve, and dried in a drying-room or closet, after which the superfluous powder is removed by means of the sieve, and the troches placed in well-covered bottles (Mohr and Redwood).

"Lozenges are frequently composed of extract of liquorice and gum Arabic with sugar, which renders them quite tough, so as to become unmanageable by long standing. In such cases, the best mode is to thoroughly mix the articles together, and then add the sugar, in the form of a dense syrup, made with but two-thirds of the usual quantity of water required for simple syrup, mix it quickly, and, while yet warm, roll the mass into long cylinders, and, when nearly dry, cut them of the required size" (W. Procter, Jr.). It may be added that troches are not now used as freely as they were when the foregoing was written. Sugar and gelatin-coated pills, triturations, and tablets have largely superseded them.

TROCHISCI ACIDI TANNICI (U. S. P.)—TROCHES OF TANNIC ACID.

Preparation.—"Tannic acid, six grammes (6 Gm.) [93 grs.]; sugar, in fine powder, sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.]; tragacanth, in fine powder, two grammes (2 Gm.) [31 grs.]; stronger orange-flower water, a sufficient quantity to make 100 troches. Rub the powders together until they are thoroughly mixed; then, with stronger orange-flower water, form a mass, to be divided into 100 troches"—(*U. S. P.*). Nearly 1 grain of the acid is contained in each troche.

Action and Medical Uses.—(See *Acidum Tannicum.*)

TROCHISCI AMMONII CHLORIDI (U. S. P.)—TROCHES OF AMMONIUM CHLORIDE.

Preparation.—"Ammonium chloride, in fine powder, ten grammes (10 Gm.) [154 grs.]; extract of glycyrrhiza, in fine powder, twenty-five grammes (25 Gm.) [386 grs.]; tragacanth, in fine powder, two grammes (2 Gm.) [31 grs.]; sugar, in fine powder, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; syrup of tolu, a sufficient quantity to make 100 troches. Rub the powders together until they are thoroughly mixed; then, with syrup of tolu, form a mass, to be divided into 100 troches"—(*U. S. P.*). A little over 1½ grains of the salt are contained in each troche (see also *Trochisci Glycyrrhiza Composita*).

Action and Medical Uses.—(See *Ammonii Chloridum.*)

TROCHISCI CAPSICI.—TROCHES OF CAPSICUM.

Preparation.—Take of capsicum, in powder, ½ ounce; sugar, 6 ounces; mucilage of gum tragacanth, a sufficient quantity. Mix the sugar and capsicum thoroughly together, and, with the mucilage, beat them into a proper mass for making 240 lozenges.

Action and Medical Uses.—These troches will be found useful in *dryness and irritation of the throat, relaxed uvula*, and in all cases where capsicum is indicated. Each troche contains 1 grain of capsicum.

TROCHISCI CAPSICI ET LOBELIÆ.—TROCHES OF CAPSICUM AND LOBELIA.

Preparation.—Take of capsicum, in powder, ½ ounce; oil of lobelia, 24 minims; sugar, 6 ounces; mucilage of tragacanth, a sufficient quantity. Mix the sugar and capsicum thoroughly together, add the oil, and, with the mucilage, beat them into a proper mass for making 240 lozenges.

Action and Medical Uses.—These troches are stimulant and expectorant, and may be employed wherever such a combination is desired. Each troche contains 1 grain of capsicum, and $\frac{1}{10}$ minim of oil of lobelia.

TROCHISCI CATECHU (U. S. P.)—TROCHES OF CATECHU.

SYNONYM: *Catechu lozenge.*

Preparation.—"Catechu, in fine powder, six grammes (6 Gm.) [93 grs.]; sugar, in fine powder, sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.]; tragacanth, in fine powder, two grammes (2 Gm.) [31 grs.]; stronger orange-flower water, a sufficient quantity to make 100 troches. Rub the powders together until they are thoroughly mixed; then, with stronger orange-flower water, form a mass, to be divided into 100 troches"—(*U. S. P.*). About 1 grain of catechu is contained in each troche.

Action, Medical Uses, and Dosage.—May be used for the same purposes and in the same doses as troches of krameria. They are commonly employed in *hoarseness* due to *catarrhal states of the pharynx and larynx.*

TROCHISCI CRETÆ (U. S. P.)—TROCHES OF CHALK.

Preparation.—"Prepared chalk, twenty-five grammes (25 Gm.) [386 grs.]; acacia, in fine powder, seven grammes (7 Gm.) [108 grs.]; spirit of nutmeg, three cubic centimeters (3 Cc.) [49 ♏]; sugar, in fine powder, forty grammes (40 Gm.) [1 oz., 180 grs.]; water, a sufficient quantity to make 100 troches. Rub the powders with the spirit of nutmeg until they are thoroughly mixed; then, with water, form a mass, to be divided into 100 troches"—(*U. S. P.*). Nearly 4 grains of chalk are contained in each troche.

Action and Medical Uses.—Troches of chalk are antacid, and are sometimes employed to check slight *diarrhœa*, with acidity.

TROCHISCI CUBEBÆ (U. S. P.)—TROCHES OF CUBEB.

Preparation.—"Oleoresin of cubeb, four grammes (4 Gm.) [62 grs.]; oil of sassafras, one cubic centimeter (1 Cc.) [16 ♏]; extract of glycyrrhiza, in fine powder, twenty-five grammes (25 Gm.) [386 grs.]; acacia, in fine powder, twelve grammes (12 Gm.) [185 grs.]; syrup of tolu, a sufficient quantity to make 100 troches. Rub the powders together until they are thoroughly mixed; then add the oleoresin and the oil, and incorporate them with the mixture. Lastly, with syrup of tolu, form a mass, to be divided into 100 troches"—(*U. S. P.*). Nearly ⅔ grain of oleoresin of cubeb is contained in each troche.

Action and Medical Uses.—These troches are employed in *pharyngeal and laryngeal inflammations* of subacute or chronic type, where there is tenacious catarrhal secretion.

TROCHISCI DIOSCOREÆ.—TROCHES OF DIOSCOREA.

Preparation.—Take of extract of dioscorea, 1 ounce; ginger, ½ ounce; oil of peppermint, 24 minims; sugar, 6 ounces; mucilage of tragacanth, a sufficient quantity. Mix the sugar, extract of dioscorea, and ginger thoroughly together, add the oil, and, with the mucilage, beat them into a proper mass for making 240 lozenges.

Action and Medical Uses.—These troches are useful in cases of *colic*, *flatulency*, *borborygmi*, and to cure as well as prevent a return of *bilious colic.* Each troche contains 2 grains of extract of dioscorea (J. King).

TROCHISCI FERRI (U. S. P.)—TROCHES OF IRON.

Preparation.—"Ferric hydrate, dried at a temperature not exceeding 80° C. (176° F.) thirty grammes (30 Gm.) [463 grs.]; vanilla, cut into slices, one gramme (1 Gm.) [15 grs.]; sugar, in fine powder, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; mucilage of tragacanth, a sufficient quantity to make 100 troches. Rub the vanilla, first, with a portion of the sugar to a uniform powder, and afterwards with the ferric hydrate and the remainder of the sugar, until they are thoroughly mixed; then, with mucilage of tragacanth, form a mass, to be divided into 100 troches"—(*U. S. P.*). Nearly 5 grains of ferric hydroxide are contained in each troche.

Action, Medical Uses, and Dosage.—An unnecessary preparation, intended as a convenient method of administering iron. Dose, 1 to 3 troches.

TROCHISCI GLYCYRRHIZÆ COMPOSITA.—COMPOUND TROCHES OF LIQUORICE.

Preparation.—Take of ammonium chloride, in powder, 1½ drachms; hydrochlorate of morphine, 6 grains; gum Arabic, sugar, extract of liquorice, each, in powder, 7 drachms; oil of sassafras, 30 minims; oil of stillingia, 20 minims; tincture of balsam of tolu, 3 fluid drachms. Mix the powders thoroughly together, then add the oils and tincture, and with water form them into a mass, to be divided into 180 troches.

Action, Medical Uses, and Dosage.—These troches are very valuable in *cough*, *irritation* or *tickling of the throat*, *laryngitis* and *bronchitis*, in which affections they are unrivaled. Each troche contains $\frac{1}{30}$ grain of morphine hydrochlorate (J. King). (See also *Trochisci Ammonii Chloridi*, *U. S. P.*)

TROCHISCI GLYCYRRHIZÆ ET OPII (U. S. P.)—TROCHES OF GLYCYRRHIZA AND OPIUM.

SYNONYM: *Opium lozenge.*

Preparation.—"Extract of glycyrrhiza, in fine powder, fifteen grammes (15 Gm.) [232 grs.]; powdered opium, one-half gramme (0.5 Gm.) [8 grs.]; acacia, in fine powder, twelve grammes (12 Gm.) [185 grs.]; sugar, in fine powder, twenty grammes (20 Gm.) [309 grs.]; oil of anise, two-tenths of a cubic centimeter (0.2 Cc.) [3 ♏]; water, a sufficient quantity to make 100 troches. Rub the powders together until they are thoroughly mixed; then add the oil of anise (equivalent to about 4 drops), and incorporate it with the mixture. Lastly, with water, form a mass, to be divided into 100 troches"—(*U. S. P.*). About $\frac{1}{12}$ grain of opium is contained in each troche. A similar troche, bearing same title as the official preparation, was very popular under the name of *Wistar's Cough Lozenge.* (The official troche is also known by this common name.) Wistar's cough lozenges are prepared as follows: Take of powdered opium, 1 drachm; powdered liquorice, 3 ounces; powdered gum Arabic, 2½ ounces; powdered white sugar, 2 ounces. Triturate these thoroughly together, with oil of anise 20 minims, and finally add a sufficient quantity of water to form a mass of the proper consistence. Divide into troches of 5 or 6 grains each. Ten lozenges contain 1 grain of opium.

Action and Medical Uses.—These lozenges are a soothing and lenitive preparation for *catarrhs* and *tickling coughs*, in cases where opium is not contraindicated.

TROCHISCI IPECACUANHÆ (U. S. P.)—TROCHES OF IPECAC.

SYNONYM: *Ipecacuanha lozenge.*

Preparation.—"Ipecac, in No. 60 powder, two grammes (2 Gm.) [31 grs.]; tragacanth, in fine powder, two grammes (2 Gm.) [31 grs.]; sugar, in fine powder, sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.]; syrup of orange, a sufficient quantity to make 100 troches. Rub the powders together until they are thoroughly mixed; then, with syrup of orange, form a mass, to be divided into 100 troches"—(*U. S. P.*). Nearly $\frac{1}{3}$ grain of ipecac is contained in each lozenge.

Action and Medical Uses.—These troches are expectorant, and will be found valuable in *coughs*, *catarrhs*, etc.

TROCHISCI KRAMERIÆ (U. S. P.)—TROCHES OF KRAMERIA.

Preparation.—"Extract of krameria, six grammes (6 Gm. [93 grs.]; sugar, in fine powder, sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.]; tragacanth, in fine powder, two grammes (2 Gm.) [31 grs.]; stronger orange-flower water, a sufficient quantity to make 100 troches. Rub the powders together until they are thoroughly mixed; then, with stronger orange-flower water, form a mass, to be divided into 100 troches"—(*U. S. P.*). Nearly 1 grain of krameria is contained in each troche.

Action, Medical Uses, and Dosage.—(See *Krameria.*) Troches of krameria are used in relaxed condition of the mucous surfaces of the throat and alimentary canal. Dose, 1 to 10 or more troches.

TROCHISCI MAGNESIÆ (N. F.)—TROCHES OF MAGNESIA.

Preparation.—"Magnesia, nineteen and one-half grammes (19.5 Gm.) [301 grs.]; nutmeg, in fine powder, one gramme (1 Gm.) [15 grs.]; sugar, in fine powder, fifty-eight and one-half grammes (58.5 Gm.) [2 ozs. av., 28 grs.]; mucilage of tragacanth (*U. S. P.*), a sufficient quantity to make 100 troches. Rub the magnesia and the powders together until they are thoroughly mixed; then, with mucilage of tragacanth, form a mass, to be divided into 100 troches"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—These are antacid and laxative, and may be used in cases of *gastric acidity* and *costiveness*. Dose, 1 to 3 troches.

TROCHISCI MENTHÆ PIPERITÆ (U. S. P.)—TROCHES OF PEPPERMINT.

Preparation.—"Oil of peppermint, one cubic centimeter (1 Cc.) [16 ♏]; sugar, in fine powder, eighty grammes (80 Gm.) [2 ozs. av., 360 grs.]; mucilage of tragacanth, a sufficient quantity to make 100 troches. Rub the oil of peppermint and the sugar together until they are thoroughly mixed; then, with mucilage of tragacanth, form a mass, to be divided into 100 troches"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—These are carminative and antispasmodic, and will be found useful in *sick stomach*, *slight pains in the stomach or bowels*, *flatulency*, and griping from purgative medicines. If eaten too freely, they cause derangement of the stomach. Dose, 1 to 5 or more troches.

TROCHISCI MORPHINÆ.—MORPHINE LOZENGES.

Preparation.—"Take of hydrochlorate of morphine, 20 grains; tincture of tolu, $\frac{1}{2}$ fluid ounce; refined sugar, in powder, 24 ounces (av.); gum acacia, in powder, 1 ounce (av.); mucilage of gum acacia, a sufficiency; distilled water, $\frac{1}{2}$ fluid ounce. Dissolve the hydrochlorate of morphine in the water; add this solution to the tincture of tolu, previously mixed with 2 fluid ounces of the mucilage; then add the gum and sugar, previously mixed, and more mucilage, if necessary, to form a proper mass. Divide into 720 lozenges, and dry these in a hot-air chamber at a moderate temperature. Each lozenge contains $\frac{1}{36}$ grain of hydrochlorate of morphine"—(*Br. Pharm.*, 1885). The present *British Pharmacopœia* (1898) directs *Trochiscus Morphinæ* of the same strength; it is made by incorporating morphine hydrochloride with the tolu basis.

Action, Medical Uses, and Dosage.—(See *Morphinæ.*)

TROCHISCI MORPHINÆ ET IPECACUANHÆ (U. S. P.)—TROCHES OF MORPHINE AND IPECAC.

SYNONYM: *Morphine and ipecacuanha lozenge.*

Preparation.—"Morphine sulphate, sixteen centigrammes (0.16 Gm.) [2.5 grs.]; ipecac, in No. 60 powder, fifty centigrammes (0.50 Gm.) [8 grs.]; sugar, in fine powder, sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.]; oil of gaultheria, two-tenths cubic centimeter (0.2 Cc.) [3 ♏]; mucilage of tragacanth, a sufficient quantity to make 100 troches. Rub the powders together until they are thoroughly mixed; then add the oil of gaultheria (equivalent to about 4 drops), and incorporate it with the mixture. Lastly, with mucilage of tragacanth, form a mass, to be divided into 100 troches"—(*U. S. P.*). About $\frac{1}{40}$ grain of morphine sulphate and $\frac{1}{12}$ grain of ipecacuanha are contained in each troche.

Action, Medical Uses, and Dosage.—These troches are employed to relieve *cough*. Dose, 1 to 2 troches.

TROCHISCI OLEI CROTONIS.—TROCHES OF CROTON OIL.

Preparation.—Take of croton oil, 5 minims; starch, 20 grains; sugar, 1 drachm; chocolate, 2 drachms. Mix the oil with the solid ingredients in powder, and add a sufficient quantity of water to form a mass of proper consistence for 30 lozenges.

Action and Medical Uses.—These lozenges are cathartic. Each lozenge contains $\frac{1}{6}$ minim of croton oil.

TROCHISCI POTASSII CHLORATIS (U. S. P.)—TROCHES OF POTASSIUM CHLORATE.

SYNONYM: *Chlorate of potash lozenge.*

Preparation.—"Potassium chlorate, in fine powder, thirty grammes (30 Gm.) [463 grs.]; sugar, in fine powder, one hundred and twenty grammes (120 Gm.) [4 ozs. av., 102 grs.]; tragacanth, in fine powder, six grammes (6 Gm.) [93 grs.]; spirit of lemon, one cubic centimeter (1 Cc.) [16 ♏]; water, a sufficient quantity to make 100 troches. Mix the sugar with the tragacanth and the spirit of lemon, by trituration, in a mortar; then transfer the mixture to a sheet of paper, and, by means of a bone spatula, mix it with the potassium chlorate, being careful, by avoiding trituration or pressure, to prevent the mixture from igniting or exploding. Lastly, with water, form a mass, to be divided into 100 troches"—(*U. S. P.*). On account of the explosiveness of potassium chlorate, when rubbed with organic matter, great care must be exercised in preparing this lozenge. The official directions should be exactly followed.

Action and Medical Uses.—These lozenges are useful in *sore mouth* and *throat*, *laryngitis*, *chronic gastritis*, *mercurial sore mouth*, *nurse's sore mouth*, etc. Solutions of the salt are far preferable.

TROCHISCI RESINÆ PODOPHYLLI.—TROCHES OF RESIN OF PODOPHYLLUM.

Preparation.—Take of resin of podophyllum, 20 grains; extract of leptandra, 80 grains; oil of sassafras, 1 fluid drachm; sugar, 6 ounces; mucilage of tragacanth, a sufficient quantity. Rub the sugar, resin of podophyllum, and extract of leptandra together until they are thoroughly mixed; then add the oil, and, with the mucilage, beat them into a proper mass for 480 lozenges.

Action, Medical Uses, and Dosage. Cholagogue, alterative, and purgative, Patients laboring under *constipation*, *hepatic torpor*, *dysentery*, or other diseases in which the above combination is desired or indicated, may use several of these troches a day, according to the effects which they produce. Each troche contains $\frac{1}{24}$ grain of resin of podophyllum, and $\frac{1}{5}$ grain of extract of leptandra; in ordinary cases, 12 troches used per day will maintain regularity of the bowels. If it be desired to have these lozenges more active, 40 or 60 grains of resin of podophyllum may be added for the same number.

TROCHISCI RHEI ET POTASSÆ.—TROCHES OF RHUBARB AND POTASSA.

Preparation.—Take of rhubarb, in powder, 2 ounces; bicarbonate of potassium, 1 ounce; oil of peppermint, 1 fluid drachm; sugar, 12 ounces; mucilage of tragacanth, a sufficient quantity. Rub the rhubarb, sugar, and potassium salt thoroughly together; then add the oil, and, with the mucilage, beat them into a proper mass for 500 lozenges.

Action, Medical Uses, and Dosage.—These troches may be used by persons subject to or laboring under *diarrhœa, dysentery, cholera morbus, acidity of stomach, heartburn*, etc. They will also prove tonic in small quantity. From 6 to 12 may be used daily. Each troche contains 2 grains of rhubarb.

TROCHISCI SANTONINI (U. S. P.)—TROCHES OF SANTONIN.

SYNONYM: *Santonin lozenge.*

Preparation.—"Santonin, in fine powder, three grammes (3 Gm.) [46 grs.]; sugar, in fine powder, one hundred and ten grammes (110 Gm.) [3 ozs. av., 385 grs.]; tragacanth, in fine powder, three grammes (3 Gm.) [46 grs.]; stronger orange-flower water, a sufficient quantity to make 100 troches. Rub the powders together until they are thoroughly mixed; then, with stronger orange-flower water, form a mass, to be divided into 100 troches. Troches of santonin should be kept in dark, amber-colored vials"—(*U. S. P.*). Nearly ½ grain of santonin is contained in each troche.

Action, Medical Uses, and Dosage.—To expel intestinal *worms*, 1 troche, night and morning.

Related Preparation.—TROCHISCI SODII SANTONINATIS (N. F.), *Troches of sodium santoninate.* "Sodium santoninate, in fine powder, six and one-half grammes (6.5 Gm.) [100 grs.]; sugar, in fine powder, one hundred and thirty grammes (130 Gm.) [4 ozs. av., 256 grs.]; tragacanth, in fine powder, three and three-fourths grammes (3.75 Gm.) [58 grs.]; orange-flower water, a sufficient quantity to make 100 troches. Rub the powders together until they are thoroughly mixed; then, with orange-flower water, form a mass, to be divided into 100 troches. Troches of sodium santoninate should be kept in dark amber-colored vials"—(*Nat. Form.*). This troche contains 1 grain of sodium santoninate.

TROCHISCI SANTONINI COMPOSITA.—COMPOUND TROCHES OF SANTONIN.

Preparation.—Take of santonin 25 grains; resin of jalap, 10 grains; gum Arabic, in powder, 30 grains; pure chocolate, 60 grains; white sugar, 160 grains; water, a sufficient quantity (about 15 minims). Rub the santonin, resin of jalap, gum Arabic, chocolate, and sugar together until they are thoroughly mixed; then add enough water to form a mass of proper consistence. Divide into 64 pills or troches, and coat with sugar. Gamboge or resin of podophyllum may be substituted for the resin of jalap.

Action, Medical Uses, and Dosage.—These are useful as a vermifuge. For a child from 3 to 6 years of age, from 2 to 4 may be used daily, as long as required. Said to be similar to the formula of Fougera, of New York. (See also *Trituratio Santonini et Podophylli.*)

TROCHISCI SODII BICARBONATIS (U. S. P.)—TROCHES OF SODIUM BICARBONATE.

SYNONYM: *Bicarbonate of soda lozenge.*

Preparation.—"Sodium bicarbonate, twenty grammes (20 Gm.) [309 grs.]; sugar, in fine powder, sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; nutmeg, bruised, one gramme (1 Gm.) [15 grs.]; mucilage of tragacanth, a sufficient quantity to make 100 troches. Triturate the nutmeg with the sugar, gradually added, until they are reduced to a fine powder, and mix this intimately with the sodium bicarbonate; then, with mucilage of tragacanth, form a mass, to be divided into 100 troches"—(*U. S. P.*). About 3 grains of sodium bicarbonate are contained in each lozenge.

Action and Medical Uses.—These are antacid, and will be found useful in *heartburn*, especially during pregnancy, in *acid stomach*, and in urine containing *excess of uric acid*.

TROCHISCI STILLINGIÆ COMPOSITA.—COMPOUND TROCHES OF STILLINGIA.

Preparation.—Take of oil of stillingia, 1 fluid drachm; oil of prickly ash berries, oil of sassafras, each, 4 fluid drachms; sugar, 10 ounces; mucilage of gum tragacanth, a sufficient quantity. Rub the oils with the sugar until they are thoroughly mixed; then, with the mucilage, form a mass, to be divided into 480 lozenges.

Action and Medical Uses.—These troches form a very agreeable remedy for *rheumatic*, *syphilitic*, *scrofulous*, *bronchial and laryngeal affections*, and may be used somewhat freely by patients thus afflicted. Eight lozenges contain 1 minim of oil of stillingia, and the quantity used per day must be regulated according to their influence on the stomach and bowels. They will likewise be found beneficial in *chronic affections of the mucous membranes* (J. King).

TROCHISCI SULPHURIS.—SULPHUR LOZENGES.

Preparation.—"Take of precipitated sulphur, 3600 grains; acid tartrate of potassium, 720 grains; refined sugar, in powder, 5760 grains; gum acacia, in powder, 720 grains; tincture of orange peel, 720 minims; mucilage of acacia, 720 minims. Mix the tincture of orange with the powders, and add the mucilage to form a suitable mass. Divide into 720 lozenges, and dry these in a hot-air chamber at a moderate temperature. Each lozenge contains 5 grains of sulphur"—(*Br. Pharm.*, 1885). The process of the *British Pharmacopœia* (1898) agrees with this. Each troche also contains 1 grain of cream of tartar.

Action and Medical Uses.—(See *Sulphur*.)

TROCHISCI ZINGIBERIS (U. S. P.)—TROCHES OF GINGER.

Preparation.—"Tincture of ginger, twenty cubic centimeters (20 Cc.) [325 ♏]; tragacanth, in fine powder, four grammes (4 Gm.) [62 grs.]; sugar, in fine powder, one hundred and thirty grammes (130 Gm.) [4 ozs. av., 256 grs.]; syrup of ginger, a sufficient quantity to make 100 troches. Mix the tincture of ginger with the sugar, and, having exposed the mixture to the air until dry, reduce it to a fine powder. To this add the tragacanth, and mix thoroughly. Lastly, with syrup of ginger, form a mass, to be divided into 100 troches"—(*U. S. P.*). About 3 minims of tincture of ginger are contained in each troche.

Action and Medical Uses.—These form a grateful cordial stimulant, and may be used in all cases of *flatulence*, *debility of the stomach*, etc.

TUSSILAGO.—COLTSFOOT.

The leaves and flowers of *Tussilago Farfara*, Linné.

Nat. Ord.—Compositæ.

COMMON NAME: *Coltsfoot*.

Botanical Source.—Coltsfoot has a long, perennial, creeping, horizontal rhizome, with many fibers. The leaves are radical, erect, on furrowed, channelled foot-stalks, heart-shaped, slightly lobed, copiously and sharply toothed, very smooth, of a slightly glaucous-green above, pure white and densely cottony, with prominent veins beneath; when young, they are revolute, and thickly enveloped in cottony down. They do not appear until after the flowers are withered; they are 5 to 8 inches long by 3 to 6 broad. The flowers are large, bright-yellow, and compound; the heads drooping in the bud, and about 1 inch broad; the rays are spreading, copious, and very narrow. Each flower-head is borne on a simple, round, woolly scape, about 5 inches high, scaly, with numerous, reddish, smooth, scattered bracts, and crowded under the head like an exterior involucre. Receptacle naked. Anthers scarcely tailed; styles of the disk inclosed and abortive; of the ray bifid, with taper arms. Achenium of the ray oblong-cylindrical; of the disk abortive. Pappus of the ray in many rows; of the disk in 1 row, consisting of very fine setæ (L.).

History and Description.—This plant grows in Europe, the Crimea, Persia, Siberia, and the East Indies, from the seashore to elevations of nearly 8000 feet; it also grows in this country in wet places, on the sides of brooks, flowering in March and April. Its presence is a certain indication of a clayey soil (W.). The flowers are rather fragrant, and continue so after having been carefully dried. The leaves are the parts used, though all parts of the plant are active, and should always be employed, especially the leaves, flowers, and root. The leaves should be collected at about the period they have nearly reached their full size; the flowers as soon as they commence opening; and the root immediately after the maturity of the leaves. When dried, all parts have a bitter, mucilaginous taste, and yield their properties to water or diluted alcohol.

Chemical Composition.—According to analysis by C. S. Bondurant (*Amer. Jour. Pharm.*, 1887, p. 340), the leaves contain a small quantity of an acrid volatile oil, wax, caoutchouc, a bitter glucosid, soluble in ether and water, resin, tannin, *saponin*, albuminous matter, mucilage (3.4 per cent), etc. The dried leaves yielded 17 per cent of ash.

Action, Medical Uses, and Dosage.—Coltsfoot may be regarded as emollient, demulcent, and slightly tonic (P.). It relieves irritation of the mucous tissues. The decoction is usually administered in doses of from 1 to 3 or 4 fluid ounces, and has been found useful in *coughs*, *asthma*, *whooping-cough*, *laryngitis*, *pharyngitis*, *bronchitis*, and other *pulmonary affections;* in *gastric and intestinal catarrh;* and is said to have been useful in *scrofula*. The powdered leaves form a good errhine for *giddiness*, *headache*, *nasal obstructions*, etc. Used externally, in form of poultice, to *scrofulous tumors*. A strong tincture of the leaves and the flowers, using strong alcohol, may be given in doses of 1 to 10 drops.

Related Species.—*Aplopappus laricifolius* (*Nat. Ord.*—Compositæ), *Yerba del Pasmo*. Southwestern United States. This plant is mentioned by Prof. H. T. Webster, M.D. (*Dynam. Therap.*, p. 120), as a remedy worthy of investigation, reports having been made of its efficacy in "*tetanus*, *eclampsia*, *chorea*, and other *spasmodic affections*." A tea of the herb is made use of in small and oft-repeated doses, and, in *traumatic tetanus*, the parts are also bathed with the infusion.

Cineraria maritima (*Nat. Ord.*—Compositæ). South America. The fresh juice of this plant is accredited with curative properties in ocular disorders, especially in *ophthalmia*. It has been lauded as a remedy to cure *cataract* by absorption (see *Pharm. Jour. Trans.*, Vol. XVIII, 1887–88, p. 985). Two drops of the milky juice are to be dropped into the palpebral fissure, and the tissues subjected to gentle massage.

Mutisia viciæfolia, Cavanilles (*Nat. Ord.*—Compositæ), *Scale-flowers*, *Span*, *Chinchircoma*.—Western South America (see illustration and description, by Dr. Rusby, in *Drug. Bull.*, 1888, p. 369). Flowers reputed antispasmodic and cardiac tonic. Employed in *respiratory affections*, particularly for *cough and croup disorders*. It has also been used for *hysteria* and *cardiac weakness*, brought on by high altitudes. The dose of the fluid extract has been given as 10 to 60 minims.

Siegesbeckia orientalis, Linné. Mauritius Islands. Contains a white crystalline body, *darutyne*, resembling salicylic acid. Plant used in *leprosy*, *syphilis*, and various *skin diseases*.

TYPHA.—CATTAIL FLAG.

The root of *Typha latifolia*, Linné.

Nat. Ord.—Typhaceæ.

COMMON NAMES: *Cattail*, *Cattail flag*, *Cattail rush*, *Reed mace*.

Botanical Source.—Cattail flag is a perennial plant, with a smooth, round stem, 3 to 5 feet high, leafy below, and terminated by large cylindric spikes. The leaves are flat, erect, ensiform, slightly concave within near the base, 2 to 4 feet long, and nearly 1 inch wide. Flowers very numerous. Spikes of a brownish color, 6 to 10 inches in length, and about 1 inch in diameter, composed of slender, downy flowers, so compact, particularly the fertile ones, as to be of considerable hardness. The upper portion is smaller, and composed of the sterile flowers, so that the staminate and pistillate parts of the spike approximate, or, are almost continuous (W.—G.).

History.—This plant is common to all parts of the United States, and is found growing in ditches, muddy pools, borders of ponds, and other wet places, flowering in July. The leaves are called flags, and are used for weaving the seats of chairs. The flowers have been used for making beds. The root is the part used. It yields its properties to water. The Pah-Ute Indians used the flowering ends of the plant as a food, either raw, or boiled in water (Edward Palmer, *Amer. Jour. Pharm.*, 1878, p. 547).

Action, Medical Uses, and Dosage.—Astringent and emollient. Boiled with milk, it has been found useful in *dysentery*, *diarrhœa*, and *infantile summer complaint*, and a decoction of it has been beneficial in *gonorrhœa*. Externally, the root, in combination with elm and aromatics, forms an excellent poultice for *white swellings*, *tumors*, and *ulcers*. The root, bruised until it becomes like a jelly, forms an excellent application for *burns* and *scalds*, *erysipelas*, *ophthalmia*, and all *local inflammations*.

ULMUS (U. S. P.)—ELM.

"The inner bark of *Ulmus fulva*, Michaux"—(*U. S. P.*) (*Ulmus rubra*, F. A. Michaux).

Nat. Ord.—Urticaceæ.

Common Names and Synonyms: *Slippery-elm*, *Elm bark*; *Ulmi cortex*, *Cortex ulmi interior*.

Illustration: Bentley and Trimen, *Med. Plants*, 233.

Botanical Source.—Slippery-elm, also called *Red elm* and *Moose-elm*, is a tree from 20 to 60 feet in height, and 1 to 2 feet in diameter. The bark is brownish, that of the branches whitish and scabrous. The leaves are 4 to 6 inches long, 2 to 3 inches broad, lanceolate-oval, or obovate-oblong, conspicuously acuminate, doubly serrate, the upper surface scabrous, beneath tomentose-pubescent, and standing on downy foot-stalks about 4 lines long. Buds rusty-woolly. Flowers sessile, in dense, lateral clusters, and appear before the leaves. Calyx about 7-lobed, campanulate and downy; corolla none; stamens 5 or 7, short and reddish. The fruit is an orbicular samara, compressed, with a broad, membranaceous border, not fringed, and about 6 lines in diameter; seed 1, and round (W.—G.—Darlington).

History and Description.—The slippery-elm is a large tree, common to this country, especially in the western states. It grows in woods and low grounds, along fences, and in rich, dry, or moist soils, flowering in April. The official part is the inner bark, which is generally separated from the tree in long strips. The *U. S. P.* describes it as "in flat pieces, varying in length and width about 3 Mm. (⅛ inch) thick, tough, pale brownish-white, the inner surface finely ridged; fracture fibrous and mealy; the transverse section delicately checkered; odor slight, peculiar; taste mucilaginous, insipid"—(*U. S. P.*). It is also met with in the form of a ragged, fibrous mass, and in very fine powder, of a whitish-yellow or pale-fawn color, which is obtained by grinding the bark. The ground bark is often adulterated with starch.

Chemical Composition.—Slippery-elm bark consists principally of mucilage and woody fiber. Water takes up its mucilage, from which it is precipitated by the acetates of lead. The presence of starch has been demonstrated by J. U. Lloyd; at the same time it was shown that the mucilage contains a principle which decolorizes iodide of starch, the color being partly restored by diluted sulphuric acid (see *Amer. Jour. Pharm.*, 1895, p. 459). Dr. C. W. Wright states that, when fatty substances are heated for several minutes with slippery-elm bark, in the proportion of 1 part of the bark to 128 parts of the fat, and then the fat be removed by straining, this has acquired the property of not undergoing rancidity (*Amer. Jour. Pharm.*, 1852, p. 180).

Action, Medical Uses, and Dosage.—Elm bark is nutritive, expectorant, diuretic, demulcent, and emollient, and is a very valuable remedial agent. In *mucous inflammations of the lungs, bowels, stomach, bladder*, or *kidneys*, used freely in the form of a mucilaginous drink (1 ounce of the powdered bark to 1 pint of water), it is highly beneficial, as well as in *diarrhœa, dysentery, coughs, pleurisy, strangury*, and *sore throat*, in all of which it tends powerfully to allay the inflammation. A tablespoonful of the powder boiled in a pint of new milk, affords a nourishing diet for infants weaned from the breast, preventing the bowel complaints to which they are subject, and rendering them fat and healthy. Some physicians consider the constant use of it, during and after the seventh month of gestation, as advantageous in facilitating and causing an easy delivery; ½ pint of the infusion to be drank daily. Elm bark has likewise been successfully employed externally in *cutaneous diseases*, especially in obstinate cases of *herpetic and syphilitic eruptions*, and certainly possesses more efficient virtues than are commonly supposed. As an emollient poultice, the bark has been found very serviceable when applied to *inflamed parts, suppurating tumors, fresh wounds, burns, scalds, bruises*, and *ulcers;* and in the excruciating *pains of the testes*, which accompany the *metastasis of mumps*, whether of recent or long standing, the constant use of an elm poultice, regularly changed every 4 hours, will be found a superior remedy. Notwithstanding its general value as an application to *ulcers*, it will often be found injurious, especially when used as a cataplasm to *ulcers of the limbs*, rendering the ulcer more irritable and difficult to heal, and frequently converting a simple sore, which might be cured by astringent or other washes, into an almost intractable ulcer; much care is, therefore, required in the application of this bark externally. As an injection, the infusion will prove useful in *diarrhœa, dysentery. tenesmus*, and *hemorrhoids*, also in *gonorrhœa* and *gleet*. The powder, sprinkled on the surface of the body, will prevent and heal *excoriations* and *chafings*, and allay the itching and heat of *erysipelas*. As the bark increases in bulk by imbibing moisture, it has been recommended to form bougies and tents of it for the dilatation of *strictures, fistulas*, etc., but in urethral strictures it has proved troublesome, from the liability of the part behind the stricture breaking off in the attempt to withdraw it, and passing into the bladder. The infusion of the bark is the common form of administration, and may be drank *ad libitum* (J. King). (See *Mucilago Ulmi.*)

Related Species.—*Ulmus campestris*, Linné, or *European elm*, is official in the *French Codex*, being used, like our slippery-elm, for the production of a mucilage, and, being astringent, has been used against *tapeworms*, and in *chronic skin affections*, syphilitic or otherwise. Its mucilage resembles that of flaxseed (Braconnot, 1846). A bitter glucosid, not yet isolated, much mucilage, some resin, and iron-greening tannin (Johnson, 1875) are contained in it. The bark is thinner than slippery-elm bark, cinnamon-colored on both sides, and has but little odor, and a bitterish, astringent and mucilaginous taste. The tree has been introduced into New England.

Ulmus effusa, Willdenow, *European black elm*, also yields some elm bark.

Ulmus americana, Linné, *White elm.*—America. A magnificent shade tree. Its inner bark is collected in Michigan.

Ulmus alata, Michaux, or *Winged elm*, of the southern United States, yields a bark, which is used in making cordage.

Celtis reticulosa.—An East Indian tree, from which Prof. Dunstan has isolated *skatole*, the characteristic odorous principle of human fæces (*Pharm. Jour. Trans.*, 1889).

UNGUENTA.—OINTMENTS.

Ointments are fatty substances, designed for external use, in which are incorporated certain medicines; their consistence is somewhat like that of good lard, being sufficiently soft to admit of being rubbed into the skin. They are most commonly prepared with benzoinated lard as a vehicle, which should be entirely free from salt or rancidity; soft and hard petrolatum are directed by the *British Pharmacopœia* in many instances under the name of hard and soft paraffins; occasionally wax, combined with olive or almond oils, is employed. About one-fifth part of yellow wax is added to the lard in the preparation of many ointments. Glycerite of starch and hydrous wool fat (*Adeps Lanæ Hydrosus*) are also convenient ointment vehicles; they readily mix with water. Sometimes fresh butter is used. Lard may be prepared for this purpose by melting it in twice its quantity of boiling water, stirring the mixture constantly; then setting it aside to cool, and separating the lard when it has solidified. This forms a fair prepared lard (*Adeps Suillus Præparatus*), or the benzoinated lard of the Pharmacopœia may be used. Substances entering into the formation of ointments, and which are not soluble in the fatty matter, should be reduced to a very fine powder previous to incorporation with it; or, if they are dissolved in alcohol or water as hard extracts, etc., they may be first softened by trituration with a small quantity of one of these solvents. Alcoholic fluids are more difficult to incorporate than concentrated aqueous preparations, and the latter should be employed slightly warmed. When ointments prepared of animal fats are long kept they are very apt to become rancid, hence it is usually preferable to make up only small portions at a time, or whenever required for use. Either benzoic acid, or poplar buds, if not objectionable, or incompatible with the ointment, will, when added to it, prevent in a great degree the disposition to rancidity. About 1 drachm of tincture of benzoin to each pound of lard has been found to answer the purpose much better than benzoic acid in the preservation of this fat from rancidity. This, however, is unnecessary where benzoinated lard has been employed. The greasy odor of ointments may be removed by triturating each ounce of ointment with 10 drops of sweet spirit of niter. According to Dr. C. W. Wright, fats and fixed oils may be preserved free from rancidity and disagreeable odor, for a long time, by melting them with powdered slippery-elm, in the proportion of 1 drachm of the bark to 1 pound of the fat; after 10 or 15 minutes' application of heat, the fat must be strained off. The elm bark communicates an odor to the fat that is scarcely distinguishable from that of the kernel of the hickory nut. Prof. E. S. Wayne long ago recommended paraffin as a substitute for lard; it might be added to lard if some third body could be found which would prevent separation on cooling, or it can be used alone, as is now commended in the British preparations. In European pharmacy the term *unguenta* includes both ointments and cerates. *Onguent*, in French pharmacy, has reference only to ointments containing resinous matter; *cerates*, to mixtures of fatty bodies and wax; and *pommades*, to those containing fats only.

Oleic Ointments.—Ointments of the Oleates. M. L'Hermite proposed as a substitute for the oleaginous and glycerinic solution of the alkaloids, solutions of these bases in *oleic acid*. He objected to the oils from their incapability of dissolving the alkaloids, and to the glycerin from its not possessing unctuous properties. Oleic acid triturated with the alkaloids, dissolves them and their salts perfectly, and may then be perfumed. Oleate of Morphine.—A grain and a half of powdered morphine, 1 ounce of pure oleic acid, and 6 drops of essence of bergamot. Oleate of Quinine.—A drachm of powdered sulphate of quinine to 10 drachms of aromatized oleic acid; dissolved by the aid of a gentle heat. Oleate of Veratrine.—Six grains of powdered veratrine dissolved in an ounce of oleic acid. Oleate of Atropine, or of Strychnine.—Three to 15 grains of atropine, or strychnine, dissolved in 10 drachms of oleic acid. These oleates will serve for the preparation of ointments, and may be hardened by the addition of stearic acid or a mixture of stearic and palmitic acids, which acids will also dissolve the vegetable bases when heated. Thus: Oleic Ointment of Quinine.—Take of sulphate of quinine, 1 drachm; oleic acid, 7½ drachms; stearic acid (of candles), 2¼ drachms; fuse and dissolve. Oleic Ointment of Veratrine.—Take of veratrine, 6 grains; oleic acid, 6 drachms; stearic acid, 2 drachms; mix and dissolve, etc. Oleic acid is also a good solvent for resinous matters and the volatile oils (*Amer. Jour. Pharm.*, Vol. XXVII, p. 72). (See also *Unguentum Zinci Oleati.*)

UNGUENTUM (U. S. P.)—OINTMENT.

Synonyms: *Unguentum simplex, Unguentum adipis, Simple ointment.*

Preparation.—"Lard, eight hundred grammes (800 Gm.) [1 lb. av., 12 ozs., 96 grs.]; yellow wax, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Melt the yellow wax, and gradually add to it the lard; then stir the mixture constantly until it is cool"—(*U. S. P.*).

Action and Medical Uses.—This is an emollient ointment, employed as a mild and cooling dressing to *ulcers*, *excoriations*, *blisters*, etc. It enters into the formation of several ointments.

Related Preparation.—Unguentum Paraffini, *Paraffin ointment*. "Take of hard paraffin, 3 ounces (Imp.) or 90 grammes (Metric); soft paraffin, 7 ounces (Imp.) or 210 grammes. Melt together in a shallow evaporating dish; as the liquid cools triturate constantly, until, when cold, a uniform plastic ointment is produced. When paraffin ointment is used as the basis of white ointments, it should be prepared with the white variety of soft paraffin; and when used in colored ointments, it should be prepared with the yellow variety of soft paraffin. The proportions of hard and soft paraffins in paraffin ointment may be modified to meet the exigencies of climate and prevailing temperature"—(*Br. Pharm.*, 1898). This ointment enters into the composition of several ointments of the *British Pharmacopœia*, 1898. It is used in the manner of simple ointments.

UNGUENTUM ACIDI BORICI.—OINTMENT OF BORIC ACID.

SYNONYM: *Ointment of boracic acid.*

Preparation.—"Take of boric acid, in fine powder, 2½ ounces (av.); soft paraffin, 10 ounces (av.); hard paraffin, 5 ounces (av.). Melt the hard and soft paraffins together, and add the boric acid distributed over the surface of the liquid by passing it through a sieve, then stir together constantly until cold"—(*Br. Pharm.*, 1885).

Action and Medical Uses.—(See *Acidum Boricum.*)

UNGUENTUM ACIDI CARBOLICI (U. S. P.)—OINTMENT OF CARBOLIC ACID.

Preparation.—"Carbolic acid, five grammes (5 Gm.) [77 grs.]; ointment, ninety-five grammes (95 Gm.) [3 ozs. av., 154 grs.]; to make one hundred grammes 100 Gm.) [3 ozs. av., 231 grs.]. Mix thoroughly"—(*U. S. P.*). This is a sufficiently strong ointment, and contains 5 per cent of carbolic acid. The *U. S. P.* (1880) preparation contained double that amount.

Action and Medical Uses.—(See *Acidum Carbolicum.*) Used in the treatment of various *skin affections.*

UNGUENTUM ACIDI HYDROCHLORICI.—OINTMENT OF HYDROCHLORIC ACID.

Preparation.—Take of hydrochloric acid, 1 fluid drachm; spermaceti ointment, 1 ounce. Mix together in a glass or porcelain mortar.

Action and Medical Uses.—This ointment is used in *scald-head*, to be applied night and morning, after the scabs have been removed by a poultice (Corrigan). Prof. Bloyer prefers a lotion made of carbolic acid, 1½ drachms; glycerin, 4 drachms; water, 1 pint. To be applied to the affected parts freely whenever the scalp itches or becomes dry.

UNGUENTUM ACIDI SALICYLICI.—OINTMENT OF SALICYLIC ACID.

Preparation.—"Take of salicylic acid, 60 grains; soft paraffin, 1080 grains; hard paraffin, 540 grains. Melt the hard and soft paraffins together, add the salicylic acid, and stir the whole constantly until cold"—(*Br. Pharm.*, 1885). The salicylic acid strength is here 1 in 28. The *British Pharmacopœia* (1898) directs a strength of but 1 in 50.

UNGUENTUM ACIDI SULPHURICI.—OINTMENT OF SULPHURIC ACID.

Preparation.—Take of sulphuric acid, 1 fluid drachm; prepared lard, 1 ounce. Mix together in a glass or porcelain mortar.

Action and Medical Uses.—Used in *ringworm*, *itch*, and other *cutaneous diseases;* also in *rheumatism* and *neuralgia* (Brugnatelli).

UNGUENTUM ACIDI TANNICI (U. S. P.)—OINTMENT OF TANNIC ACID.

Preparation.—"Tannic acid, in fine powder, twenty grammes (20 Gm.) [309 grs.]; benzoinated lard, eighty grammes (80 Gm.) [2 ozs. av., 360 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Rub the tannic acid with the benzoinated lard, gradually added, until they are thoroughly mixed, avoiding the use of iron utensils"—(*U. S. P.*).

Action and Medical Uses.—Astringent and antiseptic. Useful in *piles, ulcers,* some forms of *cutaneous disease,* and where such indications are required.

UNGUENTUM ACONITI.—OINTMENT OF ACONITE.

Preparation.—Take of alcoholic extract of aconite, 1 drachm; lard, 2 drachms. Soften the extract with a small quantity of alcohol, if necessary, and mix with the lard (see *Stramonium Ointment*).

Action and Medical Uses.—This ointment is used in violent *neuralgic and rheumatic pains* (Turnbull).

Related Ointment.—UNGUENTUM ACONITINÆ. The *British Pharmacopœia* (1898) gives an *Unguentum Aconitinæ* (*Aconitine ointment*), made by rubbing 10 grains (Imp.), or 0.5 gramme, of aconite with 80 grains, or 4 grammes, of oleic acid, and gently warming the mixture until dissolved; add 410 grains, or 20.5 grammes, of lard. Mix. These ointments must not be applied to wounds, ulcers, cuts, or abrasions, etc.

UNGUENTUM ALKALINUM.—ALKALINE OINTMENT.

Preparation.—Take of carbonate of sodium, 2 drachms; tincture of opium, 1 fluid drachm; lard, 1 ounce. Rub together in a porcelain or Wedgewood mortar.

Action and Medical Uses.—This is used in several forms of cutaneous diseases, as *lichen, lepra, psoriasis, ichthyosis, porrigo, favosa,* etc. (Soubeiran).

UNGUENTUM ALKALINUM CAMPHORATUM.—CAMPHORATED ALKALINE OINTMENT.

Preparation.—Take of carbonate of potassium, 20 grains; camphor, 6 grains; lard, 7 drachms. Rub together in a mortar.

Action and Medical Uses.—This ointment is used in *sycosis,* and several forms of *cutaneous diseases* (Cazenave).

UNGUENTUM AMMONIACALE.—AMMONIACAL OINTMENT.

SYNONYM: *Gondret's pomade.*

Preparation.—Take of lard, 6 drachms; suet, 4 drachms; almond oil, 2 drachms; stronger solution of ammonia, 12 fluid drachms. Melt the lard, suet, and oil together, then add the ammonia, and shake the whole together in a closed bottle.

Action and Medical Uses.—This preparation is rubefacient and vesicant. To produce its vesicating influence, it must be covered with a compress after inunction.

UNGUENTUM ANTIMONII TARTARATI.—OINTMENT OF TARTARATED ANTIMONY.

SYNONYMS: *Tartar emetic ointment, Antimonial ointment, Unguentum antimonii, Unguentum stibiatum, Unguentum stibio-kali tartarici.*

Preparation.—"Take of tartarated antimony, in fine powder, ¼ ounce (av.); simple ointment, 1 ounce (av.). Mix thoroughly"—(*Br. Pharm.,* 1885).

Action and Medical Uses.—This agent was formerly in common use to produce its peculiar pustular eruption, as a means of counter-irritation. Unless very carefully used, painful inflammation and ulceration—occasionally gangrene may result from its application. The scars left thereafter are permanent. This ointment was not used by Eclectic doctors, and has been practically abandoned in other schools.

UNGUENTUM AQUÆ ROSÆ (U. S. P.)—OINTMENT OF ROSE WATER.

Synonym: *Cold cream.*

Preparation.—"Spermaceti, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; white wax, one hundred and twenty grammes (120 Gm.) [4 ozs. av., 120 grs.]; expressed oil of almond, six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏]; stronger rose water, one hundred and ninety cubic centimeters (190 Cc.) [6 fl℥, 204 ♏]; sodium borate, in fine powder, five grammes (5 Gm.) [77 grs.]. Reduce the spermaceti and the white wax to fine shavings, and melt them at a moderate heat; then add the expressed oil of almond, pour the mixture into a warmed, shallow Wedgwood mortar, carefully add, without stirring, the whole of the stronger rose water, in which the sodium borate had previously been dissolved, and stir rapidly and continuously, until the mixture becomes uniformly soft and creamy"—(*U. S. P.*). An egg-beater provides an excellent means for stirring the mixture.

Description.—This ointment should be very soft and pure white, and a perfectly homogeneous mass. It gradually becomes rancid. Ointment of rose water contains 20 per cent of rose water. A little glycerin or benzoic acid tends to prevent rancidity.

Action and Medical Uses.—This is a delightful cooling ointment, much employed as an application to *irritated, chapped and abraded surfaces*, as *chapped lips, hands*, etc. It was formerly made of white wax, 1 part; spermaceti, 4 parts; rose water, 8 parts; oil of almond, 16 parts; but, on account of its tendency to decomposition and rancidity, the preceding formula is preferred.

UNGUENTUM BAPTISIÆ.—OINTMENT OF WILD INDIGO.

Preparation.—Take of wild indigo root, in coarse powder, 20 pounds; fresh butter, 10 pounds; beeswax, 3 pounds; tallow, 1½ pounds; diluted alcohol, a sufficient quantity. Macerate the root in diluted alcohol for 48 hours; then transfer it to a percolator, and gradually pour upon it diluted alcohol, until the liquid passes nearly tasteless. Add the filtered liquor to the other ingredients, and carefully digest with heat, until the alcohol and water have evaporated; then strain the mixture (Beach's *Amer. Prac.*).

Action and Medical Uses.—This ointment is cleansing, detergent, discutient, antiseptic, etc. It is useful in many *cutaneous affections, erysipelas, scrofulous, gangrenous*, and all other forms of *ulcers, piles*, etc.

UNGUENTUM BELLADONNÆ (U. S. P.)—BELLADONNA OINTMENT.

Preparation.—"Alcoholic extract of belladonna leaves, ten grammes (10 Gm.) [154 grs.]; diluted alcohol, five grammes (5 Gm.) [77 grs.]; benzoinated lard, eighty-five grammes (85 Gm.) [3 ozs. av.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Rub the extract with the diluted alcohol until it is uniformly soft, then gradually add the lard, and mix thoroughly"—(*U. S. P.*).

Action and Medical Uses.—This forms an anodyne application for the relief of *pain* and *spasm*, and may be advantageously applied to *local neuralgia*, to *painful joints*, to dilate the pupil, and also the os uteri, and to the denuded spine in violent *tetanus, delirium tremens*, and *puerperal convulsions*. It is to be preferred to atropine ointment as an application to the uterus and vagina.

Related Ointment.—Unguentum Atropinæ (*Br. Pharm.*, 1898), for similar purposes, is made by triturating atropine, 10 grains (Imp.), or 0.5 gramme, with oleic acid, 40 grains (Imp.), or 2 grammes, and gently warming the mixture until dissolved; then add lard, 450 grains (Imp.), or 22.5 grammes, and mix. It must be used with caution, and not be applied on abraded surfaces. It is used to allay *irritation*, particularly of the urethra and rectum, and to control *pain* and *spasm*. It is most largely employed as a local anodyne in *superficial neuralgias*.

UNGUENTUM BENZOINI.—OINTMENT OF BENZOIN.

SYNONYMS: *Benzoated lard*, *Benzoinated lard.*

Preparation and History.—(See *Adeps Benzoinatus.*)

Action and Medical Uses.—This forms an excellent vehicle for ointments, as benzoin enables the lard to resist rancidity. Poplar buds have the same effect.

UNGUENTUM CAMPHORÆ (N. F.)—CAMPHOR OINTMENT.

SYNONYM: *Unguentum camphoratum.*

Preparation.—"Camphor, in coarse powder, twenty-two grammes (22 Gm.) [339 grs.]; white wax, eleven grammes (11 Gm.) [170 grs.]; lard, sixty-seven grammes (67 Gm.) [2 ozs. av., 159 grs.]. Melt the white wax and lard with a gentle heat, then add the camphor, and stir the ointment until it is cold"—(*Nat. Form*).

Action and Medical Uses.—This ointment is a convenient form for the local application of camphor, for the uses of which see *Camphora.*

UNGUENTUM CANTHARIDIS.—OINTMENT OF CANTHARIDES.

SYNONYMS: *Ointment of Spanish flies*, *Unguentum irritans.*

Preparation.—"Take of cantharides, yellow wax, of each, 1 ounce (av.); olive oil, 6 fluid ounces. Infuse the cantharides in the oil, in a covered vessel, for 12 hours; then place the vessel in boiling water for 15 minutes, strain through muslin with strong pressure, add the product to the wax previously melted, and stir constantly while the mixture cools"—(*Br. Pharm.*, 1885). The *British Pharmacopœia* (1898) directs cantharides 1 part, and benzoated lard 10 parts. Another formula is as follows:

Take of finely powdered Spanish flies, olive oil, each, 3 ounces; oil of turpentine, 1½ fluid ounces; yellow wax, resin, each, 2 ounces. Mix the flies, olive oil, and turpentine, place them in a vessel on a water-bath, and continue the heat until the turpentine has nearly evaporated, stirring the mixture occasionally. Then add the wax and resin previously melted together, and heat till the articles are thoroughly incorporated; remove from the bath and stir till cold (W. Procter, Jr.).

Action and Medical Uses.—This is used not for the purpose of causing vesication, but as a rubefacient stimulating dressing to blisters, to induce a continuation of the discharge, whenever such is desirable. It has also been applied in *alopecia* and *muscular rheumatism.*

UNGUENTUM CETACEI.—OINTMENT OF SPERMACETI.

Preparation.—"Take of spermaceti, 200 parts by weight; white beeswax, 80 parts; almond oil, 720 parts; benzoin, in coarse powder, 20 parts. Melt together the spermaceti, beeswax and almond oil; add the benzoin, and, frequently stirring the mixture, continue the application of heat for 2 hours; remove from the source of heat, strain, and stir the ointment constantly until cold"—(*Br. Pharm.*, 1898).

Action and Medical Uses.—This is a mild emollient ointment, employed as a dressing for *excoriations*, *wounds*, *vesicated surfaces*, etc. Owing to its disposition to rancidity, but a small quantity should be prepared at a time. This change is retarded somewhat by the benzoin.

UNGUENTUM CHRYSAROBINI (U. S. P.)—CHRYSAROBIN OINTMENT.

Preparation.—"Chrysarobin, five grammes (5 Gm.) [77 grs.]; benzoinated lard, ninety-five grammes (95 Gm.) [3 ozs. av., 154 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Rub the chrysarobin with the benzoinated lard, gradually added, until they are thoroughly mixed"—(*U. S. P.*). This ointment should be perfectly smooth, and of a yellow color. It will stain garments.

Action and Medical Uses.—(See *Chrysarobinum.*)

UNGUENTUM COCCULI.—OINTMENT OF COCCULUS INDICUS.

Preparation.—"Take of the kernels of Cocculus Indicus, 1 ounce; prepared lard, 5 ounces. Beat the kernels well in a mortar, first alone, and then with a little of the prepared lard; and then gradually add the rest of the lard" (*Ed.*).

Action and Medical Uses.—This ointment is employed in the treatment of *itch* and *porrigo scutulata*, as well as an application to destroy *lice*. An ointment composed of picrotoxin 1 grain, lard 48 grains, is used for similar purposes.

UNGUENTUM CREASOTI.—OINTMENT OF CREASOTE.

Preparation.—"Take of creasote, 1 fluid drachm; simple ointment, 1 ounce (av.). Mix thoroughly"—(*Br. Pharm.*, 1885).

Action and Medical Uses.—This ointment is used in some cutaneous diseases, *porrigo of the scalp*, and as an antiseptic and stimulant to *indolent* or *gangrenous ulcers*, or flabby, fungoid tissues with unhealthy discharges, and is an invaluable application to *burns*, when diluted by the addition of lard, 2 ounces. Its further uses are those of creasote, externally applied (see *Creosotum*).

UNGUENTUM CUCUMIS.—OINTMENT OF CUCUMBER.

Preparation.—Take of green cucumbers (suitable for table use), 7 pounds pure white lard, 24 ounces; selected veal suet, cut in pieces, 15 ounces. The unpared cucumbers, after being washed, are to be reduced to a pulp by grating, and the juice expressed and strained. The suet is to be heated over a salt water-bath until the fat is fused out from the membranes; then add the lard, and, when liquefied, strain the mixture through muslin into a wide-mouthed earthen vessel capable of holding a gallon, and stir it until it commences to thicken, when one-third of the cucumber juice is to be added and beaten with the ointment, by means of a wooden spatula, until its odor has been almost wholly extracted. Then allow it to stand until the fluid separates, which must be removed by decantation, and add another third of the juice. This must be beaten in like manner until exhausted, then decanted, and finally the last third added and similarly treated. The jar is then to be closely covered and placed in a water-bath, where it must remain an hour, or until the fatty matter entirely separates from the enveloped juice. The green albuminous coagulum which floats upon the surface is then to be skimmed off, and the jar put aside in a cool place, that the ointment may solidify. The crude ointment is then to be carefully separated from the watery liquid on which it floats, melted by a gentle heat, and strained—part in a jar, and closely sealed for keeping—the remainder into a mortar, and triturated with a little rose water, until it is very white and creamy, for present use. It is usual to keep this ointment in nearly-filled glass jars, and to cover it with rose water to prevent the access of air. Thus prepared, cucumber ointment readily keeps from season to season (W. Procter, Jr.).

Action and Medical Uses.—This forms an emollient application, very useful for *chapped lips and hands*, *irritated* or *excoriated surfaces*, etc.

UNGUENTUM DIACHYLON (U. S. P.)—DIACHYLON OINTMENT.

SYNONYMS: *Unguentum plumbi Hebræ*, *Hebra's lead ointment.*

Preparation.—"Lead plaster, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]; olive oil, four hundred and ninety grammes (490 Gm.) [1 lb. av., 1 oz., 124 grs.]; oil of lavender flowers, ten cubic centimeters (10 Cc.) [16 ♏]; to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Melt together the lead plaster and the olive oil on a water-bath; then, having allowed the mixture to become partly cool, add the oil of lavender flowers, and stir constantly, until the ointment is cold"—(*U. S. P.*).

Action and Medical Uses.—This ointment is a favorite with many dermatologists as an application in numerous *skin diseases*, particularly those of an *eczematous type*, and in *sycosis menti*. *Offensive sweating of the feet* is said to be checked by it.

UNGUENTUM EUCALYPTI.—OINTMENT OF EUCALYPTUS.

Preparation.—"Take oil of eucalyptus, by weight, 1 ounce (av.); soft paraffin, hard paraffin, of each, 2 ounces (av.). Melt the hard and soft paraffins together add the oil, and stir until cold"—(*Br. Pharm.*, 1885). The *British Pharmacopœia* (1898) directs an ointment of half the above strength in oil of eucalyptus.

Action and Medical Uses.—(See *Eucalyptus*.) This ointment is used chiefly in *skin diseases*, and as an antiseptic and stimulant dressing for *old ulcers*.

UNGUENTUM FULIGINIS.—OINTMENT OF WOOD-SOOT.

Preparation.—Take of wood-soot, in very fine powder, ½ ounce; lard, 2 ounces Triturate them together (Soubeiran).

Action and Medical Uses.—Applied on cotton batting, this ointment is very useful in *burns* and *erysipelatous inflammations;* and is also beneficial in *tinea capitis* and several *cutaneous diseases*.

UNGUENTUM GALLÆ (U. S. P.)—NUTGALL OINTMENT.

SYNONYM: *Ointment of galls.*

Preparation.—"Nutgall, in No. 80 powder, twenty grammes (20 Gm.) [309 grs.]; benzoinated lard, eighty grammes (80 Gm.) [2 ozs. av., 360 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Rub the nutgall with the benzoinated lard, gradually added, until they are thoroughly mixed"—(*U. S. P.*).

Action and Medical Uses.—This ointment is useful in *falling of the bowels*, *external hemorrhoidal swellings*, and *foul, obstinate ulcers*. When the piles are irritable, half a drachm of pulverized opium may be advantageously added.

Related Ointment.—UNGUENTUM ACIDI GALLICI (N. F.), *Ointment of gallic acid*. "Gallic acid, ten grammes (10 Gm.) [154 grs.]; benzoinated lard (*U. S. P.*), ninety grammes (90 Gm.) [3 ozs. av., 76 grs.]. Rub the gallic acid with the benzoinated lard, gradually added, until they are thoroughly mixed, avoiding the use of an iron spatula"—(*Nat. Form.*).

UNGUENTUM GALLÆ CUM OPIO.—OINTMENT OF GALLS AND OPIUM.

Preparation.—"Take of gall ointment, 925 grains (Imp.), or 92.5 grammes; opium, in very fine powder, 75 grains (Imp.), or 7.5 grammes. Mix by trituration; 100 parts of this ointment contain 7½ parts of opium"—(*Br. Pharm.*, 1898).

Action and Medical Uses.—This ointment is of value in *piles* and *rectal prolapse;* it is also of service in *vaginal relaxation*. Owing to the large amount of opium present, care should be exercised in its employment on mucous surfaces.

UNGUENTUM HYDRARGYRI NITRATIS (U. S. P.)—OINTMENT OF MERCURIC NITRATE.

SYNONYMS: *Citrine ointment*, *Unguentum citrinum*, *Unguentum hydrargyri citrinum*, *Ointment of nitrate of mercury*, *Mercurial balsam*, *Yellow citrine ointment*.

Preparation.—"Mercury, seventy grammes (70 Gm.) [2 ozs. av., 205 grs.]. nitric acid, one hundred and seventy-five grammes (175 Gm.) [6 ozs. av., 76 grs.]; lard oil, seven hundred and sixty grammes (760 Gm.) [1 lb. av., 10 ozs., 353 grs.].

Heat the lard oil, in a glass or porcelain vessel, to a temperature of 100° C. (212° F.); then withdraw the heat, gradually add seventy grammes (70 Gm.) [2 ozs. av., 205 grs.] of nitric acid, and when the reaction moderates reapply the heat, until effervescence ceases. Then allow the mixture to cool to about 40° C. (104° F.). Having dissolved the mercury in the remainder of the nitric acid with the aid of sufficient heat to prevent the solution from crystallizing, add this solution to the mixture. When the mass has become entirely cold mix it thoroughly by trituration, avoiding the use of a metallic spatula"—(*U. S. P.*). The official process is based upon that of Mr. Rother.

Action and Medical Uses.—This ointment has been used in *herpes*, *porrigo*, *eczema*, *psoriasis*, and similar obstinate cutaneous affections, in *ophthalmia tarsi*, and those slight excoriations of the tarsi attended with extreme itching, and in all the inflammations of the eyes attended by eruptive disorders of the hairy scalp or face; it may be applied by means of a camel's-hair pencil. It is also used as a dressing to stimulate *syphilitic*, *phagedenic*, and *obstinate ulcers*, and particularly for the *squamous* and *tubercular syphilitic skin affections*. It is also employed to destroy *pediculi* and various *parasites* giving rise to *parasitic skin affections*. In ophthalmic affections it is frequently applied mixed with an equal weight of almond oil. A milder ointment of nitrate of mercury is made by rubbing together 1 part of ointment of nitrate of mercury with 7 parts of lard. It should be prepared only as required (see also below). Occasionally employed by Eclectic physicians. Brown citrine ointment has been used by Prof. J. M. Scudder and others in *chronic eczema*, *sycosis*, *barbers' itch*, and in some cases of *pruritis* (*Spec. Med.*).

Related Ointments.—UNGUENTUM HYDRARGYRI NITRATIS DILUTUM, *Diluted ointment of nitrate of mercury*. "Take of nitrate of mercury ointment, 1 ounce (av.); soft paraffin, 2 ounces (av.). Mix"—(*Br. Pharm.*, 1885). The latest *British Pharmacopœia* directs double the amount of soft yellow paraffin.

BROWN CITRINE OINTMENT.—Cod-liver oil, 75 ounces; red oxide of mercury, 2 ounces; nitric acid, 4½ ounces. Dissolve the red oxide of mercury in the nitric acid, and then slowly add the solution, with constant stirring, to the cod-liver oil, previously heated to a temperature of 212° F. This preparation is a favorite in Cincinnati with oculists, and has been used for over thirty years. It was once made twice the strength of the above, but it was found preferable to double the proportion of oil. The preparation is in the form of a deep-brown liquid or paste, and should be kept, as well as dispensed, in a wide-mouthed bottle instead of a jar.

UNGUENTUM HYDRARGYRI AMMONIATI (*U. S. P.*), *Ointment of ammoniated mercury*, *Ointment of white precipitate*, *Unguentum præcipitati albi*.—"Ammoniated mercury, in very fine powder, ten grammes (10 Gm.) [154 grs.]; benzoinated lard, ninety grammes (90 Gm.) [3 ozs. av., 76 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Rub the ammoniated mercury with the benzoinated lard, gradually added, until they are thoroughly mixed"—(*U. S. P.*). The *British Pharmacopœia* (1898) directs ammoniated mercury, 1 part; paraffin ointment, white, 9 parts. Mix thoroughly. Uses similar to those of *Unguentum Hydrargyri Nitratis* (which see).

UNGUENTUM HYDRARGYRI OXIDI FLAVÆ (U. S. P.)

OINTMENT OF YELLOW MERCURIC OXIDE.

Preparation.—"Yellow mercuric oxide, in very fine powder, ten grammes (10 Gm.) [154 grs.]; ointment, ninety grammes (90 Gm.) [3 ozs. av., 76 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Rub the yellow mercuric oxide with the ointment, gradually added, until they are thoroughly mixed"—(*U. S. P.*). This ointment should be prepared in small amounts on account of its liability to become rancid. (For uses, see *Hydrargyri Oxidum Flavum.*)

Related Ointments.—UNGUENTUM HYDRARGYRI OXIDI RUBRI (*U. S. P.*), *Ointment of red mercuric oxide*, *Unguentum præcipitatum rubrum*, *Ointment of red precipitate*. "Red mercuric oxide, in very fine powder, ten grammes (10 Gm.) [154 grs.]; castor oil, five grammes (5 Gm.) [77 grs.]; ointment, eighty-five grammes (85 Gm.) [3 ozs. av.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Triturate the red mercuric oxide with the castor oil, until a perfectly smooth mixture results; then gradually incorporate the ointment, and mix thoroughly"—*U. S. P.*). The British preparation (*Br. Pharm.*, 1898) is composed of red oxide of mercury, ¼ ounce (Imp.), or 10 grammes; and paraffin ointment (yellow), 2¼ ounces (Imp.), or 90 grammes. As the ointment ages it becomes discolored and rancid, a condition sought to be retarded by the use of the castor oil. This ointment is used similarly to ointment of the yellow oxide in *blepharitis ciliaris*, though less eligible; also employed in the treatment of *indolent syphilitic ulcers*, *acne*, and to abort *boils*. Rarely used in Eclectic practice.

Unguentum Hydrargyri (*U. S. P.*), *Mercurial ointment*, *Blue ointment*, *Unguentum mercuriale*, *Unguentum neapolitanicum*, *Ointment of mercury.*—"Mercury, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]; lard, two hundred and fifty grammes (250 Gm.) [8 ozs. av., 358 grs.]; suet, two hundred and thirty grammes (230 Gm.) [8 ozs. av., 49 grs.]; oleate of mercury, twenty grammes (20 Gm.) [309 grs.]; to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Triturate the oleate of mercury with the mercury, gradually added, in a mortar, until globules of the metal are no longer visible. Then add the lard and suet, previously melted together and partially cooled, and continue the trituration until globules of mercury are no longer visible under a lens magnifying 10 diameters"—(*U. S. P.*). The oleate of mercury is employed to "extinguish" the mercury, which is difficult to accomplish with sweet fats. Formerly a small amount of rancid ointment was used for the same purpose. This ointment is no longer made by the apothecary, but is purchased from the manufacturer, and detailed remarks concerning its manipulation are superfluous. The official ointment contains one-half its weight of mercury, but much of the commercial drug is but one-third mercury. It must be kept in a cool place. Mercurial ointment, to be of any service, must be applied by gentle friction, continued for some time, at each application, in order to promote its absorption. When it is intended to produce the constitutional effects of the mercury, as in *syphilitic diseases*, those parts of the body are selected in which the cuticle is thinnest, as the inside of the thighs and legs, and under the arms. In *liver complaints* the inunctions are made over the region of that organ; and in *buboes*, *swellings of the glands*, etc., it is usually applied immediately over the affected parts. About ½ or 1 drachm, rubbed in night and morning, will be sufficient; and the person who applies the ointment should protect his hands by enveloping them in some article through which the ointment will not pass, as a soft, oiled pig's bladder, turned inside out, India rubber gloves, etc. Or, a strip of muslin 2 or 3 inches wide may be formed into a roll about 1 inch in diameter, one extremity of which may be used to rub over the skin as a substitute for the hand. During the whole course of the inunction the patient should wear the same drawers night and day. The ointment is sometimes used internally, in addition to its external application, and is said to promptly excite salivation. It is often used in a milder form as a dressing to *ulcers*, and in *cutaneous diseases;* being, in such instances, diluted with 2, 3, or 4 times its weight of lard, as may be desired. Not employed in Eclectic practice.

Unguentum Hydrargyri Compositum, *Compound ointment of mercury.*—"Take of ointment of mercury, 6 ounces (av.); yellow wax, olive oil, of each, 3 ounces (av.); camphor, 1½ ounces (av.). Mix the wax and oil by the aid of heat, then incorporate the ointment of mercury, and when the mixture is nearly cold, add the camphor in powder; stir the whole thoroughly together"—(*Br. Pharm.*, 1885). The *British Pharmacopœia* (1898) employs mercury ointment, 10 parts; yellow beeswax, olive oil, of each, 6 parts; and camphor, in flowers, 3 parts.

Unguentum Hydrargyri Iodidi Rubri, *Ointment of red iodide of mercury.*—"Take of iodide of mercury, in fine powder, 16 grains; simple ointment, 1 ounce (av.). Mix thoroughly"—(*Br. Pharm.*, 1885). The *British Pharmacopœia* (1898) directs mercuric iodide, 2 parts; and benzoinated lard, 48 parts. Employed by physicians of the regular school in *syphilitic and scrofulous ulcers*, and *glandular enlargements*, *goitre*, and *hepatic and splenic enlargements.*

Unguentum Hydrargyri Subchloridi, *Ointment of subchloride of mercury*, *Unguentum calomelanos*, *Ointment of calomel.*—"Take of subchloride of mercury, 80 grains; benzoated lard, 1 ounce (av.). Mix thoroughly"—(*Br. Pharm.*, 1885). The proportions of the *British Pharmacopœia* (1898) are mercurous chloride, 1 part; benzoated lard, 9 parts. Employed upon *syphilitic skin eruptions* when of limited extent.

UNGUENTUM IODI (U. S. P.)—IODINE OINTMENT.

Synonym: *Unguentum iodinum.*

Preparation.—"Iodine, four grammes (4 Gm.) [62 grs.]; potassium iodide, one gramme (1 Gm.) [15 grs.]; water, two cubic centimeters (2 Cc.) [32 ♏]; benzoinated lard, ninety-three grammes (93 Gm.) [3 ozs. av., 123 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Rub the iodine and the iodide of potassium, first with the water, and then with the benzoinated lard, gradually added, until they are thoroughly mixed, avoiding the use of a metallic spatula. This preparation should be freshly made when required"—(*U. S. P.*). The presence of the potassium iodide is to insure the divisibility of the iodine. The lard must be gradually added, and the mixture thoroughly rubbed until no longer gritty. The ointment should be of a uniform color. It imparts an orange stain to the skin.

Action and Medical Uses.—This preparation is used as a local application in *bronchocele*, *scrofulous*, and other *chronic glandular enlargements*, and in *opacities of the cornea;* it is undoubtedly absorbed, and thus effects its influence; the discoloration of the skin occasioned by its use gradually disappears. Applied twice a day to *enlarged tonsils*, by means of a camel's-hair pencil, it has caused the enlargement to disappear in the course of 2 months. It is likewise used to promote absorption after *inflammations*, *pleurisy*, and *pericarditis*, and to prevent inflammatory effects in *chilblains.* It is better to prepare it only as it is required for use.

UNGUENTUM IODOFORMI (U. S. P.)—IODOFORM OINTMENT.

Preparation.—"Iodoform, in very fine powder, ten grammes (10 Gm.) [154 grs.]; benzoinated lard, ninety grammes (90 Gm.) [3 ozs. av., 76 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Rub the iodoform with the benzoinated lard, gradually added, until they are thoroughly mixed. This preparation should be freshly made, when required"—(*U. S. P.*).

Action and Medical Uses.—This forms a stimulating, antiseptic, and anæsthetic ointment, used for the general purposes for which iodoform is locally applied (see *Iodoformum*).

UNGUENTUM IPECACUANHÆ.—OINTMENT OF IPECACUANHA.

Preparation.—Take of ipecacuanha, in powder, 2 drachms; olive oil, 2 fluid drachms; lard, ½ ounce. Mix together.

Action and Medical Uses.—Rubbed on the skin for a few minutes, once or twice a day, this ointment produces an eruption. It is used as a counter-irritant in *diseases of the throat*, and in pulmonary affections is applied to the chest. When it is desired to make it more active, 1½ fluid drachms of croton oil may be added to the formula. If rubbed on the surface for 20 or 30 minutes at a time, repeated 3 or 4 times a day, and covered with flannel after each application, it will produce vesicles in 36 hours.

Related Preparation.—UNGUENTUM MEZEREI (N. F.), *Mezereum ointment.* "Fluid extract of mezereum (F. 170), twenty-five cubic centimeters (25 Cc.) [406 ♏]; lard, eighty grammes (80 Gm. [2 ozs. av., 360 grs.]; yellow wax, twelve grammes (12 Gm. [185 grs.]. Melt together with lard and wax with a moderate heat, add the fluid extract, and stir the mixture constantly until the alcohol has evaporated. Then continue to stir until cool"—(*Nat. Form.*). This is an irritant, and is applied to *obstinate ulcers, wounds*, etc., to excite suppuration; sometimes it is used to keep up the discharge from vesicated surfaces.

UNGUENTUM MYRICÆ.—OINTMENT OF BAYBERRY.

Preparation.—Take of bayberry-tallow, white turpentine, each, 2 ounces; olive oil, 1 ounce. Melt together, and strain"—(Beach's *Amer. Prac.*).

Action and Medical Uses.—This forms an excellent application to *scrofulous ulcers* and *indolent ulcers* generally.

UNGUENTUM MYRICÆ COMPOSITUM.—COMPOUND OINTMENT OF BAYBERRY.

Preparation.—Take of bayberry-tallow, sweet gum, each, 1 ounce; suet, 2 ounces. Melt together, and strain.

Action and Medical Uses.—This ointment is very advantageous in *scrofulous ulcers, tinea capitis, porrigo scutulata, itch, salt-rheum*, and several other forms of *cutaneous diseases;* also in *piles* and *fistulous ulcers*. In *fistula* and some cutaneous diseases, the addition of 3 or 4 drachms of zinc sulphate, in powder, will be found beneficial (J. King).

UNGUENTUM PHYTOLACCÆ.—OINTMENT OF POKE.

Preparation.—Take of the leaves of poke, collected just before the ripening of the berries, 4 pounds; lard, 1 pound; spirit, 1 pint; wax, 2 ounces. Mix, and slowly simmer together until the leaves are crisp, and then express through linen. An ointment is sometimes made by mixing 1½ drachms of powdered poke leaves or root, or of the extract of poke, with 1 ounce of lard (see *Stramonium Ointment*).

Action and Medical Uses.—This is used as an application to *ulcers, porrigo, tinea capitis*, and other *cutaneous affections*, and as a discutient to various *tumors* (J. King).

UNGUENTUM PICIS LIQUIDÆ (U. S. P.)—TAR OINTMENT.

Preparation.—"Tar, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]; yellow wax, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; lard, three hundred and seventy-five grammes (375 Gm.) [13 ozs. av., 100 grs.]; to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Melt together the yellow wax and the lard at a moderate heat; then incorporate the tar, strain the mixture through muslin, and stir the ointment constantly until it is cool"—(*U. S. P.*).

Action and Medical Uses.—This is a stimulating ointment. It is used principally in *tinea capitis* and *ringworm of the scalp*, being kept constantly applied to the part by means of a cap. It has also been efficient in some other *cutaneous diseases*, particularly the dry stage of *eczema*. It may be applied to unhealthy *ulcers*.

Related Ointments.—Unguentum Picis Compositum (N. F.), *Compound tar ointment.* "Oil of tar, four grammes (4 Gm.) [62 grs.]; tincture of benzoin (*U. S. P.*), two cubic centimeters (2 Cc.) [32 ♏︎]; oxide of zinc, three grammes (3 Gm.) [46 grs.]; yellow wax, twenty-six grammes (26 Gm.) [401 grs.]; lard, thirty-two grammes (32 Gm.) [1 oz. av., 56 grs.]; cotton-seed oil, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]. Melt the yellow wax and lard with the cotton-seed oil at a gentle heat. Add the tincture of benzoin, and continue heating until all the alcohol has evaporated. Then withdraw the heat, add the oil of tar, and finally the oxide of zinc, incorporating the latter thoroughly, so that on cooling a smooth homogeneous ointment may result"—(*Nat. Form*).

Unguentum Picis Betulæ, *Unguentum rusci, Wolff's tar ointment.*—Birch tar, 4 parts; unguentum, 21 parts. Mix.

UNGUENTUM PIPERIS NIGRI.—OINTMENT OF BLACK PEPPER.

Preparation.—Take of prepared lard, 1 pound; suet, 4 ounces; tar, 1 pint; black pepper, in powder, 4 ounces. Melt the lard and tar together, then add the suet and pepper.

Action and Medical Uses.—This is used in *tinea capitis*, in the same manner as the ointment of tar.

UNGUENTUM PLUMBI ACETATIS.—OINTMENT OF ACETATE OF LEAD.

Preparation.—"Take of lead, in fine powder, 12 grains; benzoated lard, 1 ounce (av.). Mix thoroughly"—(*Br. Pharm.*, 1885). The *British Pharmacopœia* (1898) employs lead acetate, 1 part; and paraffin ointment, white, 24 parts.

Action and Medical Uses.—This forms an application for *cuts, abrasions, acute local inflammations*, and *excoriations*.

UNGUENTUM PLUMBI CARBONATIS (U. S. P.)—OINTMENT OF LEAD CARBONATE.

Preparation.—"Lead carbonate, in very fine powder, ten grammes (10 Gm.) [154 grs.]; benzoinated lard, ninety grammes (90 Gm.) [3 ozs. av., 76 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Rub the lead carbonate with the benzoinated lard, gradually added, until they are thoroughly mixed"—(*U. S. P.*).

Action and Medical Uses.—This ointment is used as a dressing for *abrasions, blistered and inflamed surfaces, burns*, etc.

UNGUENTUM PLUMBI COMPOSITUM.—COMPOUND LEAD OINTMENT.

Synonym: *Mayer's ointment.*

Preparation.—Take of olive oil, 2½ pounds; white turpentine, ½ pound; beeswax, unsalted butter, each, 4 ounces; red lead, 1 pound; honey, 12 ounces; powdered camphor, ½ pound. Melt the olive oil, white turpentine, beeswax, and butter together, and strain; then heat them to nearly the boiling point, and gradually add the red lead, stirring the mixture constantly until it becomes black or brown. Then remove from the fire, and, when it becomes somewhat cool, add to it the honey and camphor, previously mixed together.

Action and Medical Uses.—This forms a very beneficial ointment for all kinds of *ulcers, cuts, wounds*, and several *cutaneous diseases*. It is of a more solid consistence than ointments are generally. It is highly prized by the German population, who have held it for a long time as a secret among themselves. The profession are indebted to Mr. Joseph P. Mayer, of Cincinnati, for a knowledge of it. This ointment was extensively used by the earlier Eclectics, and is still quite popular.

UNGUENTUM PLUMBI IODIDI (U. S. P.)—OINTMENT OF LEAD IODIDE.

Preparation.—"Lead iodide, in very fine powder, ten grammes (10 Gm.) [154 grs.]; benzoinated lard, ninety grammes (90 Gm.) [3 ozs. av., 76 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Rub the lead iodide with the benzoinated lard, gradually added, until they are thoroughly mixed"—(*U. S. P.*).

Action and Medical Uses.—(See *Plumbi Iodidum*.) This ointment is employed chiefly to discuss *glandular enlargements; testicular hypertrophy*, following *gonorrhœa*, is said to be markedly reduced by it.

UNGUENTUM POTASSII CYANIDI.—OINTMENT OF CYANIDE OF POTASSIUM.

Preparation.—Take of cyanide of potassium, 12 grains; oil of almond, 2 drachms; cold cream, 2 ounces. Triturate together.

Action and Medical Uses.—This is used as an application to the sound skin in *neuralgia* (Cazenave).

UNGUENTUM POTASSII IODIDI (U. S. P.)—OINTMENT OF POTASSIUM IODIDE.

Preparation.—"Potassium iodide, twelve grammes (12 Gm.) [185 grs.]; sodium hyposulphite, 1 gramme (1 Gm.) [15 grs.]; water, hot, ten cubic centimeters (10 Cc.) [162 ♏]; benzoinated lard, seventy-seven grammes (77 Gm.) [2 ozs. av., 313 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Dissolve the potassium iodide and the sodium hyposulphite in the hot water, then mix the solution with the benzoinated lard"—(*U. S. P.*). The sodium hyposulphite is added to counteract, or rather to prevent, the liberation of iodine which is likely to take place through changes in the fat, such as were experienced in the earlier official ointment.

Action and Medical Uses.—This ointment is employed as a discutient for *swellings* and *tumors* of a scrofulous character, and for *goitre*. It is less effective than iodine, but has the advantage of not staining the parts and garments.

UNGUENTUM POTASSÆ SULPHURATÆ.—OINTMENT OF SULPHURATED POTASH.

Preparation.—"Take of sulphurated potash, 30 grains; hard paraffin, ¼ ounce (av.); soft paraffin, ¾ ounce (av.). Triturate the sulphurated potash in a glass or porcelain mortar, and gradually add the melted mixture of the hard and soft paraffins, rubbing them together until the ointment is perfectly smooth and free from grittiness. This ointment should be recently prepared"—(*Br. Pharm.*, 1885).

Action and Medical Uses.—This ointment is useful in *ringworm, itch*, and other forms of *cutaneous diseases*. It is, however, unstable, and should be prepared only as needed.

UNGUENTUM SABINÆ.—OINTMENT OF SAVIN.

SYNONYMS: *Ceratum sabinæ*, *Savine cerate*.

Preparation.—"Take of fresh savin tops, bruised, 8 ounces (av.); yellow wax, 3 ounces (av.); benzoated lard, 16 ounces (av.). Melt the lard and wax together on a water-bath, add the savin, and digest for 20 minutes. Then remove the mixture, and express through calico"—(*Br. Pharm.*, 1885). As savin, in fresh condition, is not likely to be obtained in this country, the following formula of the *U. S. P.* (1880) may be employed, though the preparation is unsatisfactory as compared with the above-directed ointment:

CERATUM SABINÆ.—"Fluid extract of savine, 25 parts; resin cerate, 90 parts. Melt the resin cerate by means of a water-bath, add the fluid extract of savine, and continue the heat until the alcohol has evaporated, then remove the heat, and stir constantly until cool"—(*U. S. P.*, 1880).

Action and Medical Uses.—Like ointment of cantharides, this preparation may be employed to maintain a discharge from vesicated surfaces, being preferred over the former on account of its freedom from the liability of producing strangury. It is occasionally used in the same manner upon setons.

UNGUENTUM SCROPHULARIÆ.—OINTMENT OF FIGWORT.

Preparation.—Take of fresh figwort leaves, 2 pounds; lard, 1 pound; tallow, ½ pound. Boil together until the leaves are crisp, and then strain with expression; or, it may be made from the extract, the same as explained under *Unguentum Stramonii.*

Action and Medical Uses.—This ointment is useful in *piles*, *painful tumors*, *ulcers*, and *cutaneous diseases*. Dr. W. Stokes considered it a specific in *gangrenous pemphigus*.

UNGUENTUM STAPHISAGRIÆ.—OINTMENT OF STAVESACRE.

Preparation.—"Take of stavesacre seeds, 4 ounces (av.); benzoinated lard, 8 ounces (av.). Crush the seeds, and macerate them in the lard, kept melted over a water-bath for 2 hours. Strain through calico, and set aside to cool. This ointment contains about 10 per cent of the oil of stavesacre"—(*Br. Pharm.*, 1885). The *British Pharmacopœia* (1898) uses stavesacre seeds, 4 parts; benzoated lard, 17 parts; and yellow beeswax, 2 parts.

Action and Medical Uses.—This ointment is said to be extensively employed in England in *itch*, *prurigo*, and certain other *skin diseases*. Its chief use, however, is to destroy *pediculi*, both of the head and body.

UNGUENTUM STRAMONII (U. S. P.)—STRAMONIUM OINTMENT.

Preparation.—"Extract of stramonium seed, ten grammes (10 Gm.) [154 grs.]; diluted alcohol, five grammes (5 Gm.) [77 grs.]; benzoinated lard, eighty-five grammes (85 Gm.) [3 ozs. av.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Rub the extract with the diluted alcohol until it is uniformly soft, then gradually add the benzoinated lard, and mix thoroughly"—(*U. S. P.*). Or, take of extract of stramonium, 1 drachm; alcohol, 1 fluid ounce; white wax, ½ ounce; lard, 4½ ounces. Dissolve the extract in the alcohol, then add the wax and lard, previously melted together, and continue the heat to evaporate the alcohol; strain while hot, and keep stirring till cold. This ointment may likewise be made as follows: Take of fresh stramonium leaves, cut in pieces, 1 pound; lard, 1 pound; yellow wax, 3 ounces. Boil together until the leaves become crisp, and then strain with expression. Prof. A. J. Howe preferred an ointment of stramonium made like the last mentioned. He used it in cases of hemorrhoids.

Action and Medical Uses.—This forms an anodyne ointment which will be found serviceable in *irritable ulcers, burns, mammary cancer, scalds, irritable cutaneous diseases, painful hemorrhoids*, and as a discutient to *indolent ulcers*. Like belladonna, though in a lesser degree, it relieves *spasm* and *pain*.

UNGUENTUM STRAMONII COMPOSITUM.—COMPOUND OINTMENT OF STRAMONIUM.

Synonym: *Discutient ointment.*

Preparation. Take of the bark of the root of bittersweet, stramonium leaves, cicuta leaves, deadly nightshade, yellow-dock root, each, 2 ounces; lard, 1 pound; Venice turpentine, 2 ounces; spirit, a sufficient quantity. Bruise the roots and leaves, cover them with spirit, and allow them to digest with a moderate heat for 4 hours; then add the lard, and continue the heat until the leaves are crisped. Lastly, strain and express through linen, add the turpentine, and stir constantly till cold (Beach's *Amer. Prac.*).

Action and Medical Uses.—This ointment is useful to discuss *tumors* of various kinds; it must be well rubbed on the parts, 2 or 3 times a day, covering them with cotton held in place by a bandage, after each inunction.

UNGUENTUM STRYCHNINÆ.—OINTMENT OF STRYCHNINE.

Preparation.—"Take of strychnine, 20 grains; oleic acid, 2 drachms (or a sufficient quantity to dissolve the strychnine); simple ointment, 6 drachms. Triturate the strychnine with the oleic acid, and then add the lard.

Action and Medical Uses.—This forms a powerful local application, which may be employed whenever the external use of strychnine is indicated. A small portion to be applied upon the desired part, with friction, 2 or 3 times a day. It must be employed with care, not permitting it to come in contact with abraded or ulcerated surfaces, wounds, etc.

UNGUENTUM SULPHURIS (U. S. P.)—SULPHUR OINTMENT.

Preparation.—"Washed sulphur, three hundred grammes (300 Gm.) [10 ozs. av., 255 grs.]; benzoinated lard, seven hundred grammes (700 Gm.) [1 lb. av., 8 ozs., 303 grs.]; to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Rub the washed sulphur with the benzoinated lard, gradually added, until they are thoroughly mixed"—(*U. S. P.*).

Action and Medical Uses.—Sulphur ointment is considered a certain cure for the *itch*. It must be applied over the whole surface of the body every night, until cured; it usually cures in 4 or 5 days; after which the body should be thoroughly washed with soap and water. It will also be found useful in *tinea capitis, crusta lactea*, and several other *cutaneous diseases*. The last Pharmacopœia has replaced sublimed sulphur with washed sulphur, but it is doubtful if such a change is an improvement; possibly it is a detriment. The antiparasitic virtues of the ointment are undoubtedly due to the presence of certain impurities in the sulphur, especially sulphur dioxide, and these free acids, etc., are lost in the substitution of washed sulphur.

Related Ointments.—Unguentum Sulphuris Alkalinum (N. F.), *Alkaline sulphur ointment* (*U. S. P.*, 1880): "Washed sulphur, twenty grammes (20 Gm.) [309 grs.]; potassium carbonate, ten grammes (10 Gm.) [154 grs.]; water, five cubic centimeters (5 Cc.) [81 ♏]; benzoinated lard (*U. S. P.*), sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.]. Rub the sulphur with the potassium carbonate and the water, gradually add the benzoinated lard, and mix thoroughly"—*Nat. Form.*).

Unguentum Sulphuris Compositum (N. F.), *Compound sulphur ointment, Wilkinson's ointment, Hebra's itch ointment.*—"Precipitated calcium carbonate, ten grammes (10 Gm.) [154 grs.]; sublimed sulphur, fifteen grammes (15 Gm.) [231 grs.]; oil of cade, fifteen grammes (15 Gm.) [231 grs.]; soft soap (*U. S. P.*), thirty grammes (30 Gm.) [1 oz. av., 25 grs.]; lard, thirty grammes (30 Gm.) [1 oz. av., 25 grs.]. Mix the lard with the soft soap and oil of cade. Then gradually incorporate the sublimed sulphur and precipitated calcium carbonate"—*Nat. Form.*). Efficient in treatment of *itch*, especially when it proves very obstinate and unyielding to the milder treatment.

UNGUENTUM SULPHURIS IODIDI.—OINTMENT OF IODIDE OF SULPHUR.

Preparation.—"Take of iodide of sulphur, 30 grains; hard paraffin, ¼ ounce (av.); soft paraffin, ¾ ounce (av.). Triturate the iodide of sulphur in a glass or porcelain mortar, and gradually add the melted mixture of the hard and soft paraffins, rubbing them together until the ointment is perfectly cold and free from grittiness"—(*Br. Pharm.*, 1885). The *British Pharmacopœia* (1898) directs to take of sulphur iodide, 2 parts; glycerin, 2 parts; benzoated lard, 46 parts. Triturate the sulphur iodide and glycerin in a slightly warmed mortar until a smooth paste results; gradually add the benzoated lard; stir until cold"—(*Br. Pharm.*, 1898).

Action and Medical Uses.—This ointment, when fresh, is of considerable value in *chronic, non-inflammatory skin diseases*, particularly in dry forms of *eczema* and *impetigo;* also used in *acne, lupus, porrigo, lepra*, and *psoriasis.* It is a very unstable product, and should not be employed when decomposition has set in.

UNGUENTUM TABACI.—OINTMENT OF TOBACCO.

Preparation.—Take of extract of tobacco, 1 drachm; alcohol, 1 fluid ounce; yellow wax, ½ ounce; lard, 4½ ounces. Dissolve the extract in the alcohol, then add the wax and lard, previously melted together, and continue the heat to evaporate the alcohol; strain while hot, and keep stirring until cold. The extract of tobacco must be prepared in the same manner as the extract of belladonna; or the ointment may be prepared by taking the fresh leaves of tobacco, 2 pounds; lard, ½ pound; spirit, ½ pint; and wax, 1 ounce; and proceeding in the same manner as explained for ointment of poke (*Unguentum Phytolaccæ*).

Action and Medical Uses.—Tobacco ointment forms an anodyne application, useful in various *affections of the skin, piles, scald-head, irritable swellings, painful ulcers*, etc. Some caution is necessary not to use it too freely, lest it produce its constitutional narcotic effects. An ointment made from the dried leaves is of but little value; one made by rubbing 20 drops of the empyreumatic oil of tobacco with 1 ounce of simple ointment, forms an active preparation.

UNGUENTUM TEREBINTHINÆ.—OINTMENT OF TURPENTINE.

Preparation.—"Take of oil of turpentine, 1 fluid ounce; resin, in coarse powder, 54 grains; yellow wax, ½ ounce (av.); prepared lard, ½ ounce (av.). Melt the ingredients together by the heat of a steam or water-bath. Remove the vessel, and stir the mixture constantly while it cools"—(*Br. Pharm.*, 1885).

Action and Medical Uses.—This ointment forms a good application to *recent inflammations* of the surface, and in *erythema, erysipelas*, and *burns.*

UNGUENTUM VERATRI ALBI.—OINTMENT OF WHITE HELLEBORE.

Preparation.—"Take of veratrum album (the root) in powder, 2 ounces; lard, 8 ounces; oil of lemon, 20 minims. Mix them together—(*Lond.*).

Action and Medical Uses.—This ointment, being more agreeable than sulphur ointment, is sometimes employed in *itch* with benefit; but it should be cautiously applied to children. The substitution of poke ointment for the lard will render it still more certain and effective.

UNGUENTUM VERATRINÆ (U. S. P.)—VERATRINE OINTMENT.

SYNONYMS: *Unguentum veratriæ*, *Veratria ointment.*

Preparation.—"Veratrine, four grammes (4 Gm.) [62 grs.]; olive oil, six grammes (6 Gm.) [93 grs.]; benzoinated lard, ninety grammes (90 Gm.) [3 ozs. av., 76 grs.]; to make one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]. Rub the veratrine with the olive oil in a mortar, then gradually add the benzoinated lard and mix thoroughly"—(*U. S. P.*).

Action and Medical Uses.—(See *Veratrina.*) This forms a powerful local stimulant, very useful in *neuralgia*, *amaurosis*, and *paralysis*. It must be employed with care, not permitting it to come in contact with abraded or ulcerated surfaces, wounds, etc.

UNGUENTUM ZINCI OXIDI (U. S. P.)—OINTMENT OF ZINC OXIDE.

SYNONYMS: *Unguentum zinci*, *Ointment of zinc*.

Preparation.—"Zinc oxide, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; benzoinated lard, eight hundred grammes (800 Gm.) [1 lb. av., 12 ozs., 96 grs.]; to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Sift the zinc oxide, through a No. 20 sieve, upon the surface of the benzoinated lard, previously melted, and incorporate it by stirring, which is to be continued until the ointment is cool"—(*U. S. P.*). If perfectly pure oxide of zinc be used, a smooth ointment will result, provided it has been carefully sifted, which is difficult to accomplish. This ointment, with age, becomes somewhat tough. It contains 20 per cent of the zinc compound. Five or 10 grains of benzoic acid, added to an ounce of the ointment, prevents it from becoming rancid. Mr. D. Kemp recommends the following formula, as giving a consistent and durable ointment, without requiring any unusual means to preserve it: Take of prepared lard, pure olive oil, each, 2 ounces; white wax, spermaceti, zinc oxide, each, 1 ounce. Melt the fats, oil, etc., in a water-bath at a low heat; strain into a very warm mortar, and, just before cooling, add the zinc, and continue the stirring very briskly till cold.

Action and Medical Uses.—This forms a mild astringent ointment, useful in *porrigo*, *impetigo*, and other *diseases of the skin*, attended with profuse discharges; after extensive *burns*, *blisters*, *sinapisms*, etc.; to *painful ulcers*, with excessive secretion, and to the eye, when affected with *chronic inflammation*, etc.

Related Ointments.—UNGUENTUM CALAMINÆ (N. F.), *Calamine ointment*, *Unguentum zinci carbonatis (impuri)*, *Unguentum calaminare*, *Turner's cerate*. "Prepared calamine, sixteen and one-half grammes (16.5 Gm.) [255 grs.]; ointment (*U.S.P.*), eighty-three and one-half grammes (83.5 Gm. [2 ozs. av., 414 grs.]. Mix them intimately, by trituration, so as to produce a smooth and homogeneous ointment"—(*Nat. Form.*).

UNGUENTUM ZINCI OLEATI, *Ointment of oleate of zinc.*—"Take of oleate of zinc, 1 ounce (av.); soft paraffin, 1 ounce (av.). Mix by aid of a little heat, and stir until nearly cold"—*Br. Pharm.*, 1885). Used like zinc oxide ointment, particularly in *chronic eczemas*. The *British Pharmacopœia* (1898) gives the following directions for UNGUENTUM ZINCI OLEATI (*Zinc oleate ointment*): Take of "zinc sulphate, 2 ounces (Imp.), or 60 grammes (Metric); hard soap, in shavings, 4 ounces (Imp.), or 120 grammes (Metric); distilled water, boiling, soft paraffin, white, of each, a sufficient quantity. Dissolve the zinc sulphate in 4 fluid ounces (or 120 cubic centimeters) of the distilled water. Mix the solutions; collect the precipitated zinc oleate; wash with hot, distilled water until the washings afford little or no reaction for sulphate; dry on a water-bath, and mix with an equal weight of the soft paraffin, melted; stir until cold"—(*Br. Pharm.*, 1898).

UNGUENTUM ZINCI OXIDI COMPOSITUM.—COMPOUND OINTMENT OF ZINC OXIDE.

Preparation.—Take of olive oil, 2 pounds; spermaceti, 12 ounces; white wax, 4 ounces; oxide of zinc, 7 ounces; benzoic acid, 2 drachms; sulphate of morphine, 48 grains; oil of roses, 20 minims. Rub together, in a mortar, until no specks are seen, the oxide of zinc, benzoic acid, sulphate of morphine, and oil of roses. Melt the olive oil, wax, and spermaceti together, and add the above triturated mass to it, stirring constantly till nearly cold (W. S. Merrell, M. D.).

Action and Medical Uses.—This forms a mild stimulating and astringent preparation, which is exceedingly useful in *acute and chronic ophthalmia*, *opacities of the cornea*, *nebula*, *granulations of the lids*, etc. It is likewise useful in many *cutaneous diseases*, and may be advantageously employed as a dressing to *wounds* and *indolent ulcers*.

Related Ointments.—Mild Zinc Ointment. The *Mild zinc ointment*, which has been so favorably received by the profession, was introduced by Prof. R. S. Newton, M. D. It is similar to the above, varying only in the quantity of certain of the ingredients; thus, he uses white wax, 9 ounces; oxide of zinc, 4 ounces; sulphate of morphine, 2 drachms, instead of the quantities named in the above formula. In other respects, the formula is the same. It forms an excellent soothing and anodyne application in cases of painful and irritable *ulcers, burns, scalds*, and wherever such an agent is indicated.

Ophthalmic Balsam.—The Compound Ointment of Zinc, a favorite with many Eclectic physicians, is somewhat similar to a preparation which has been extensively sold under the name of "*Pettit's Ophthalmic Balsam* or *Eye Salve*," and the formula of which is as follows: Take of white precipitate, 3 ounces; oxide of zinc, 4 ounces; benzoic acid, 2 drachms; sulphate of morphine, 48 grains; oil of rosemary, 20 drops. Rub these thoroughly together, in a mortar, until they are well incorporated, and then add them gradually to a warm compound made by melting together olive oil, 2 pounds; spermaceti, 12 ounces; white wax, 4 ounces; stirring constantly until cold.

Ophthalmic Ointment.—A preparation of a similar character, known as *Brown* or *Ophthalmic Ointment*, has enjoyed considerable reputation in the East, in the treatment of ophthalmic diseases. It is composed of red precipitate, 2½ drachms; oxide of zinc, 1 drachm; fresh butter, 3 ounces; white wax, ½ ounce; camphor, dissolved in olive oil, 1 drachm. Mix. It is a French preparation.

UNGUENTUM ZINCI SULPHATIS.—OINTMENT OF SULPHATE OF ZINC.

Preparation.—Take of sulphate of zinc, 20 grains; fresh butter, 2 drachms. Triturate together.

Action and Medical Uses.—This ointment is very beneficial in *eruptions of the skin, fungous growths, gangrenous and indolent ulcers, fistula, hemorrhoids, ulcerations of the cornea*, etc. If it acts too severely, it may be rendered milder by the addition of butter in necessary quantity.

UREA.—UREA.

Formula: CH_4N_2O, or $CO(NH_2)_2$. Molecular Weight: 59.95.

Synonym: *Carbamide.*

Source, History, and Preparation.—Urea is a regular constituent of the human urine, in which it was discovered, in 1773, by Rouelle. It amounts to from 2 to 4 per cent, and varies in proportion with the nitrogen ingested in the body with the food. Urea occurs in the urine of all mammals, especially of the flesh-eaters (carnivora), in smaller quantities in the urine of birds, in sweat, blood, the vitreous humor of the eye (30 per cent of the total solids; Watts' *Dict. of Chem.*, Vol. IV, 1894, p. 829), and other animal fluids. It was synthetically prepared, in 1828, by Wöhler, by evaporating a solution of ammonium isocyanate ($CO:N.NH_4$), resulting in a rearrangement of the molecule—*i. e.*, the formation of *urea* or *carbamide* ($CO:[NH_2]_2$). This was the first organic synthesis effected. Urea may also be prepared by several other synthetic processes, *e. g.*, the interaction of carbonyl chloride ($COCl_2$) and ammonia. It is generally obtained, however, from urine. This is evaporated to a thin syrup; to the cooled fluid, an equal volume of strong nitric acid is added. The brownish, scaly nitrate which falls out, is recrystallized from diluted nitric acid, the crystals dissolved in water, the solution evaporated to dryness with barium carbonate, and the urea abstracted from the residue by means of alcohol. Or, the urea may be precipitated from the concentrated urine by means of oxalic acid, and the oxalate decomposed by calcium carbonate. Another quite practical method consists in first preparing potassium cyanate (CNOK), by fusing potassium ferrocyanide with potassium bichromate, evaporating an aqueous solution of the cyanate with ammonium sulphate to dryness, and extracting the urea with alcohol (see C. A. Bell, *Amer. Jour. Pharm.*, 1875, p. 559).

Description.—Urea forms colorless, odorless, and permanent, quadrangular prisms, having a saline and cooling taste. It is dissolved by its own weight of cold water, and is easily soluble in alcohol, but only slightly soluble in pure ether. Its aqueous solution (in pure water) keeps for a considerable time; putrescent matter, however, quickly causes its decomposition into carbon dioxide and ammonia. Only fresh urine contains it. It melts at 132° C. (269.6° F.), and decomposes by higher heat. It is monobasic, and forms crystallizable salts with acids, of which the oxalate and the nitrate are the most easily obtained. Boiling with diluted acids and alkalies decomposes urea into carbonic acid and ammonia, as follows: $CO(NH_2)_2+H_2O=CO_2+2NH_3$. Chlorine water, hypobromite of sodium, etc., liberate nitrogen and carbonic acid: $CO(NH_2)_2+6Cl+H_2O=CO_2+6HCl+N$ By absorbing the carbonic acid gas in solution of caustic soda, the nitrogen may be collected and measured, and the quantity of urea in urine may thus be determined. Another method is that originally proposed by Liebig, and is based upon the quantitative precipitation of urea by mercuric nitrate. (For details regarding this and other methods, see, among other manuals, Roscoe and Schorlemmer's *Chemistry*, Vol. I, p. 650; also see gasometric method of G. Campari, *Amer. Jour. Pharm.*, 1887, p. 494.)

Action, Medical Uses, and Dosage.—Experimentation upon animals proves this agent to exert a diuretic effect, an increased amount of urea being also voided. In man, however, even as large doses as 75 grains are said not to provoke an increased flow of urine. Notwithstanding, the drug has been employed as a hydragogue-diuretic in some forms of *dropsy*, notably that occurring after *scarlet fever*. It should be remembered, however, that this form of dropsy often tends to spontaneous recovery without the use of drugs. The nitrate, particularly, is used for this purpose. Dose, 2 to 3 grains, every 2 or 3 hours.

Compounds and Related Products.—Acids, metallic oxides, and several neutral salts, *e. g.*, sodium chloride, produce with urea crystallizable compounds. Hydrochloric acid produces deliquescent *Urea hydrochlorate*. Oxalic acid yields *Urea oxalate* ($[CH_4N_2O]_2.H_2C_2O_4$), in scaly crystals, containing over 57 per cent of urea. It is soluble in hot, much less soluble in cold water. *Urea nitrate* ($CH_4N_2O.HNO_3$) forms in scales and prisms, containing nearly 49 per cent of urea. Water and alcohol sparingly dissolve it; it is even less soluble in nitric acid.

FORMAMIDE (CH_3NO, or $CHO.NH_2$).—An oily, colorless fluid, insoluble in ether, but soluble in all proportions in water and alcohol. It is produced by heating ammonium formate ($CHOONH_4$) to a temperature of above 230° C. (446° F.).

HIPPURIC ACID ($C_9H_9NO_3$, or $C_6H_5.CO.NH.CH_2.COOH$), *Benzoylglycocoll.*—Rhombic prisms, fusing at 187° C. (368.6° F.). When heated to near 240° C. (464° F.), it splits into benzoic acid, hydrocyanic acid, and benzo-nitrile ($C_6H_5.CN$). When hippuric acid is acted upon by alkalies or acids, benzoic acid and glycocoll result. It sometimes occurs in the urine of man, especially after the internal administration of such aromatic bodies as toluol, benzoic, and cinnamic acids. In the urine of the herbivora it is quite abundant. It was proposed by Garrod as a remedy for the *uric acid diathesis*, and, in the form of the sodium salt, is now recommended to be given with lithium and potassium compounds for this condition. Dose, 10 grains, 3 times a day.

URETHANUM.—URETHANE.

FORMULA: $C_3H_7NO_2$, or $C_2H_5NH_2CO_2=CO.NH_2.OC_2H_5$. MOLECULAR WEIGHT: 88.94.

SYNONYMS: *Ethyl urethane, Ethyl carbamate.*

Source, History, and Preparation.—Urethanes are the esters of *carbamic acid* ($NH_2.COOH$), the ammonium salt of which (*ammonium carbamate*, $NH_2.COONH_4$) is a constituent of commercial ammonium carbonate (which see). In medicine, the term urethane is confined to the ethyl ester of carbamic acid ($NH_2.COOC_2H_5$). The acid itself is not known in the free state. The ammonium salt may be formed by the action of gaseous ammonia (2 molecules) upon carbonic acid (1 molecule). *Urethane* may be obtained by several methods, *e. g.*, by the union of cyanic acid and ethyl alcohol: $CONH+C_2H_5OH=NH_2.COOC_2H_5$; or by heating, in a sealed tube, a mixture of urea nitrate and ethyl alcohol to a temperature of 120° to 130° C. (248° to 266° F.) for several hours. Urethane is dissolved out from the crystalline mass by means of ether. The reaction is as follows: $NH_2CONH_2.NO_3H+C_2H_5OH=NH_2COOC_2H_5+NO_3NH_4$. It is also produced by the action of ammonia upon ethyl carbonate: $C_2H_5O.COOC_2H_5+NH_3=C_2H_5OH+NH_2.COOC_2H_5$. Urethane was discovered, in 1833, by Dumas.

Description and Tests.—Urethane occurs in non-deliquescent, colorless, and odorless, tabular, or columnar crystals, saline and somewhat cooling to the taste. At 15.5° C. (60° F.), it is soluble in alcohol (0.6 part), liquid carbolic acid (0.8 part), ether (1 part), chloroform (1.5 parts), glycerin (3 parts), castor oil (15 parts), and olive oil (20 parts) (Vulpius). It melts between 47° and 50° C. (116.6° and

122° F.), and boils between 170° and 180° C. (338° and 356° F.), without decomposition; at a lower temperature, it sublimes. When heated upon a platinum foil, it completely volatilizes. When warmed with alkalies, urethane is decomposed into carbonic dioxide, ammonia, and alcohol: $NH_2.COOC_2H_5+H_2O=CO_2+NH_3+C_2H_5OH$. By the action of ammonia upon urethane, urea is formed as follows: $NH_2.COOC_2H_5+NH_3=NH_2.CO.NH_2+C_2H_5OH$. The absence of urea in urethane is established when 5 Cc. of nitric acid, oxalic acid, or mercuric nitrate, fails to produce a white precipitate with a solution of 2 Gm. of urethane in 2 Cc. of cold water.

Action, Medical Uses, and Dosage.—The widely-varying statements concerning the action of this remedy do not inspire confidence in it as a remedial agent. While some assert that, in doses of as high as 70 grains, it produces no ill-results, others, and, notably, Friedlander, speak of its causing vomiting and depression in so small a dose as $\frac{1}{50}$ grain. It was introduced as a hypnotic, and even this property is denied it by many. It appears, however, to have induced sleep in several cases of *insanity*, especially in *melancholia*. It is apt to disagree with the stomach. It more nearly resembles paraldehyde, it is said, as a hypnotic, though less certain of results, and it has the advantage over the latter in being odorless and pleasant to the taste, although commercial specimens have been known to possess an unpleasant odor (see G. Vulpius, *Pharm. Centralhalle*, 1892, p. 223). Upon pain it appears to have no effect, nor does it seem to be of any value in the insomnia of delirium tremens and like conditions. Urethane is reputed to have cured *tetanus* after failure with other remedies; *tetany* is said to have been relieved by it, and, in *chorea*, it has been successfully employed to produce sleep and quietude. The average dose of urethane is from 10 to 15 grains, in capsule or in sweetened aromatic solution. Its effects are best produced by its administration by way of the stomach; hypodermatically, the medicine is less effective, and is generally so administered in about 4-grain doses.

Related Compound.—EUPHORIN, *Phenyl urethane*, *Phenyl carbamate* or *Ethyl carbanilic ether* ($C_6H_5NH.COOC_2H_5$). A crystalline, white powder, feebly aromatic in odor, and leaving a faint, clove-like taste. It is obtained by the interaction of chloro-ethyl carbonate ($Cl.COOC_2H_5$) and aniline, as follows: $Cl.COOC_2H_5+2C_6H_5NH_2=C_6H_5NH.COOC_2H_5+C_6H_5NH_2.HCl$ (aniline hydrochloride). The product is recrystallized from diluted alcohol. It fuses between 49° and 50° C. (120.2° and 122° F.). It is soluble in alcohol, wines, and ether. Cold water sparingly dissolves it. Cold, strong sulphuric acid dissolves it without browning. This agent is reputed destructive to bacteria, and, as an antiseptic, is used like iodoform and similar bodies, particularly where discharges are fetid and purulent. Internally, it has been employed as antipyretic, analgesic, and antirheumatic. It is said to act nicely in *thrush*. The dose ranges from 7 to 15 grains. These are best given in broken amounts, the whole being taken in 24 hours.

URTICA.—NETTLE.

The leaves and root of *Urtica dioica*, Linné.

Nat. Ord.—Urticaceæ.

COMMON NAMES: *Nettle*, *Stinging nettle*, *Great stinging nettle*.

Botanical Source.—This plant is a perennial, herbaceous, dull-green plant, armed with minute rigid hairs or prickles, which transmit a venomous fluid when pressed. The stem is obtusely 4-angled, branching, 2 to 4 feet high, arising from a creeping and branching root, with fleshy shoots and many fibers. The leaves are opposite, petiolate, cordate, lance-ovate, spreading, conspicuously acuminate, coarsely and acutely serrate, the point entire, armed with stings, and are 3 or 4 inches long, and about half as wide. The flowers are small, green, monœcious or diœcious, in branching, clustered, axillary, interrupted spikes, longer than the petioles (W.—L.).

History and Chemical Composition.—This is a well-known plant, common to Europe and the United States, growing in waste places, by woodsides, in hedges, and in gardens, flowering from June to September. A decoction of the plant, strongly salted, will quickly coagulate milk without imparting to it any unpleasant flavor. The leaves and root are generally used, and yield their virtues to water. A fabric, known as nettle-cloth, has been woven from the bast fibers of nettle. The young shoots have been boiled and eaten as a remedy for scurvy. The irritation caused by rubbing the sharp hairs of the nettle on the skin, is believed to be caused by the free *formic acid* which they contain (Gorup Besanez, *Amer. Jour. Pharm.*, 1850, p. 181). According to G. Haberlandt (1886), the poisonous action of the hairs of the stinging nettle is not due to formic acid, but to an unorganized ferment or enzyme. Mr. B. Shoemaker (*Amer. Jour. Pharm.*, 1866, p. 493), who has found starch, gum, albumen, lignin, sugar, and two resins, in the root, believes the diuretic properties of the root to be due to a warm, penetrating, volatile oil. The leaves contain tannic and gallic acids, gum, wax, etc. (Saladin, 1830). L. Reuter (*Amer. Jour. Pharm.*, 1890, p. 11, from *Pharm. Centralh.*, 1890) found the leaves of *U. urens* and *U. dioica* and the seeds of *U. pilulifera* to contain a non-nitrogenous glucosid, giving precipitates with some alkaloidal reagents. The juice of the fresh plant is said to evolve nitrous fumes upon being heated. This is probably due to the action of formic acid upon nitrates (E. Giustianini, *Jahresb. der Pharm.*, 1896, p. 239).

Action, Medical Uses, and Dosage.—Common nettle is astringent, tonic, and diuretic. A decoction is valuable in *diarrhœa* and *dysentery*, with profuse discharges, and in *hemorrhoids*, various *hemorrhages*, and *scorbutic affections*, and has been recommended in *febrile affections*, *gravel*, and other *nephritic complaints*. A strong syrup made of the root, combined with suitable quantities of wild-cherry bark and blackberry root, forms an excellent remedy for all *summer complaints of children*, and *bowel affections of adults*. In *cholera infantum* and other summer disorders of children, with profuse watery or mucous discharges, the following treatment gives excellent results: ℞ Specific urtica, ʒss; water, ℥iii. Mix. Dose, a teaspoonful, every 1 or 2 hours. It is especially applicable in *chronic diseases of the colon*, with increased secretion of mucus. The leaves of the fresh plant stimulate, inflame, and even raise blisters on those portions of the skin with which they come in contact, and have, in consequence, been used as a powerful rubefacient. *Paralysis* is said to have been cured by whipping the affected limbs with them. Applied to *bleeding surfaces*, they are an excellent styptic. The seeds and flowers. given in wine, in doses not to exceed 1 drachm, have been reputed equal to cinchona in *tertian and quartan agues*—larger doses will, it is said, induce a lethargic sleep. The seeds, in doses of 14 or 16, and repeated 3 times daily, are highly recommended as a remedy for *goitre*, and to reduce excessive *corpulence;* they are also considered anthelmintic. The seeds may also be prepared in strong tincture with full strength alcohol, the dose of which, for goitre, would be from a fraction of a drop to 10 drops. Dr. J. D. McCann (*Ec. Med. Gleaner*, 1893, p. 62) praises this agent as a remedy for *eczematous affections*, and relates a case of stubborn *eczema of the face, neck, and ears* that was readily and completely cured by the following local application: ℞ Specific urtica, flʒii; rose water, fl℥i. Mix. Apply every 3 or 4 hours. Several other cases have also yielded to it. A child with "a crust-covered head, with here and there a bleeding surface," that had long resisted treatment, yielded in a short time to softening applications of olive oil, thorough ablutions with soap and water, drying the parts, and applying the solution as above recommended. Some physicians prescribe the remedy internally at the same time that they are using it locally. It is also a remedy for *chronic cystitis*, with mucous discharges. *Warts*, rubbed with the freshly expressed juice of this plant, 3 or 4 times a day, continuing the application daily for 10 or 12 days, disappear without any pain being produced (M. Jaroschevitz). Dose of the powdered root or leaves, from 20 to 40 grains; of the decoction, from 2 to 4 fluid ounces; of specific urtica, $\frac{1}{10}$ to 10 drops.

Specific Indications and Uses.—Chronic diarrhœa and dysentery, with large mucous evacuations; profuse secretion of gastric juice, with eructations and emesis; choleraic discharges; summer bowel diseases of children, with copious watery and mucous passages; chronic eczematous eruptions.

Related Species.—*Urtica urens*, Linné, or *Dwarf nettle*, possesses similar properties, and has been found very efficient in *uterine hemorrhage*. It also allays *urethral and cystic irritation*. It is also reputed galactagogue. It has a branching, hispid, stinging stem, 1 or 2 feet high, with broadly elliptic, acutely serrate leaves, about 5-veined, on short petioles, 1 or 2 inches long, and about two-thirds as broad. Flowers in drooping, pedunculate, nearly simple clusters, 2 in each axil, and shorter than the petioles. This is an annual, introduced from Europe (W.).

Pilea pumila, Gray (*Urtica pumila*), *Cool-weed*, *Rich-weed*, or *Stingless nettle*, has a peculiar, grateful, strong smell, indicating active properties. The herb contains a crystallizable glucosid, and an aromatic, vanilla-like substance (F. R. Weiser, *Amer. Jour. Pharm.*, 1888, p. 390). It is stated that the leaves, bruised, give immediate relief in *inflammations, painful swellings, ecchymoses, erysipelas,* and the topical *poison of rhus;* and that an ointment made from it is beneficial in *inflammatory rheumatism.* This is the *Pilea pumila* of Lindley, and has a smooth, shining, ascending, weak and succulent, often branched, and translucent stem, 4 to 18 inches high, and, together with the whole plant, destitute of stings. Leaves on long petioles, opposite, rhombic-ovate, crenate-serrate, membranaceous, glabrous, pointed, 3-nerved, about 2 inches long, and two-thirds as broad. Flowers monœcious, triandrous, in axillary, corymbed heads, shorter than the petioles. Sepals of the fertile flowers lanceolate, and a little unequal. This plant is worthy of further investigation (W.).

Laportea canadensis, Gaudichaud (*Urtica canadensis*, Linné), has strong bast fibers and stinging hairs, and is adapted to use in making cordage. Other plants yielding cordage-fibers are the RAMIE (*Boehmeria nivea*, Hooker and Arnott), used in manufacturing *Chinese grass-cloth.* The variety *candicans* of Weddell, yields the fiber known as *rhea.* The fibers of these plants are often woven with silk, or substituted therefor. *Urtica cannabina*, Linné, a Siberian species, is also cultivated for its fibers.

Urtica stimulans, Linné; *Urtica crenulata*, Roxburgh; and *Urtica urentissima*, Blume, all of India, are extremely irritating plants, more so than common stinging nettle.

Lamium album (*Urtica iners*, or *Urtica mortua; Nat. Ord.*—Labiatæ), *Henbit.* Florain isolated from this plant a principle which he named *lamine.* The plant has been used, domestically, in *bronchitis, hemorrhages, leucorrhœa,* and *scrofulous disorders.*

Urtica pilulifera, Linné.—India, central Asia, and south Europe. The fruit of this species is regarded in the East as a galactagogue, and diuretic virtues are ascribed to the root. The seeds contain a non-nitrogenous glucosid (Reuter; see p. 2033).

USTILAGO.—CORN-SMUT.

A parasitic fungus, *Ustilago segetum*, Bull (*Ustilago Maydis* [*Maidis*], Léveillé; *Ustilago carbo*, Tulasne), developed upon the fruit of *Zea Mays*, Linné.

Nat. Ord.—Fungi—Ustilagineæ.

COMMON NAMES: *Corn-smut, Corn-ergot, Corn-brand.*

Source, Formation, and History.—*Ustilago* is a parasitic fungus infesting the fruit of the common corn plant (*Zea Mays*, Linné). The "smutted" ear of corn appears blackened and shrivelled, the fungus, called *Ustilago*, from its burnt or charred appearance, exhibiting a smooth, gelatiniform membrane, containing a soot-like powder of minute, dark, spherical spores. Ustilago attacks many plants, as the ears of wheat, oats, and barley, and also various grasses, figs, violets, anemones, etc. The particular species infesting the ears of corn, is the *Ustilago segetum*, Bull. The condition produced is known popularly as the "*smut of corn,*" or "*brand of corn.*" The attack actually begins with the germination of the corn plant, for the hyphæ of the fungus-spores enter the seedling when very young, and grow up *within* the plant, but does not manifest itself until the fruit begins to ripen, when the ears take on the characteristic sooty or smutty appearance, each bad grain being filled to bursting with the powdery spores. Only very young seed ings can be infested by this parasite, for, as the tissues of the plant become harder, the germinal tube, sent out from the sporidium, can not effect an entrance into the tissues. The spores of *Ustilago* are largely conveyed to the plants through the distribution of barn-yard manures, in which the fungus appears to thrive and rapidly multiply. This parasitic disease was thought to be similar to that of ergot (see *Ergota*), but since 1860–66, the matter has been better studied, and the life-history of the fungus well worked out. (For an interesting and popular exposition of the fungous diseases of vegetation, see *Diseases of Plants*, by H. Marshall Ward.)

Fig. 249.

Ustilago segetum.

Description and Chemical Composition.—Ustilago is easily recognized as the large, black, or blackish excrescences (smut of corn) which form on the end of defective ears of corn, and give a dry, black powder, resembling lampblack. The masses are covered with a smooth, gelatin-like membrane, showing a slate-black color, due to the presence of the black spores within. The masses are quite large, sometimes 6 or more inches thick, globose or irregular, showing a lobular or obtusely-branched structure. It has a disagreeable taste, and a heavy, unpleasant odor. Moisture impairs its virtues, which, under the best of keeping, are not retained for more than 1 year.

Mr. John H. Hahn (*Amer. Jour. Pharm.*, 1881, p. 496) obtained from corn-smut, by extraction with ether, 2.5 per cent of a dark-brown fixed oil of acid reaction, insoluble in alcohol, and having the odor of the drug. A variety of substances was isolated from corn-smut by C. J. Rademaker and J. L. Fischer (*ibid.*, 1887, p. 445, from *Medical Herald*, 1887). The authors found fixed oil (6.5 per cent), resin (8 per cent), and wax (5.5 per cent), soluble in petroleum benzin; *trimethylamine* (1.5 per cent), crystallizable *sclerotic* or *maisenic acid* (2 per cent), wax (6.25 per cent), and resin (4.5 per cent), soluble in ether; *sclerotic acid* (0.5 per cent), and resin (3.5 per cent), soluble in alcohol; sugar (3.75 per cent), pectin (2.25 per cent), salts (4.5 per cent), and extractive (9.5 per cent), soluble in water, and a crystallizable alkaloid, *ustilagine*. It is white, bitter, soluble in ether, alcohol, and water, of alkaline reaction, forming crystallizable salts, soluble in water. The above sclerotic acid is probably not identical with that of Dragendorff (see *Ergota*).

Action, Medical Uses, and Dosage.—Ustilago appears to possess decided activity, its effects having been compared with those of ergot and nux vomica combined. Upon the lower animals it acts as a spinal excitant, producing tonic convulsions, and destroying life, either by tetanus or exhaustion. Full doses dilate the pupils. Ecbolic properties are conceded to it, and, by many, it is preferred to ergot for *obstetrical uses*, inasmuch as it appears to be less powerful, and to produce clonic instead of tonic uterine contractions. According to Ellingwood, with whom it is a favorite remedy, it produces perfectly regular intermittent and safe contractions. The following statements (since confirmed by other investigators) have been made concerning this agent: "Its action on the uterus is as powerful as the ergot of rye, and perhaps more" (Lindley). "Its use is attended with shedding of the hair, both of man and beast, and sometimes even of teeth. Mules fed on it lose their hoofs, and fowls lay eggs without any shells" (Rowlin). "It is doubtless by its abortifacient power that it causes the eggs of fowls to be extruded before there has been time for a shell to be formed. By what power does it cause the shedding of the hair of man and brute animals, and the casting off of the hoofs of mules long fed upon it?" (Prof. Tully). "In a cowhouse, where cows were fed on Indian corn infested with this parasite, 11 of their number aborted in 8 days. After their food was changed none of the others aborted" (*Annal. Med. Netr. Belge*, and *Rép. de Ph.*). The better to be convinced of the poisonous nature of this fungus, the author, after having dried and pulverized the drug, administered 6 drachms to two bitch dogs with young, which soon caused them to abort" (Dr. H. W. Burt, *Amer. Homœop. Obs.*, 1868, p. 305).

Ustilago was introduced into practice chiefly through the efforts of the Homœopaths. Inasmuch as it acts promptly upon the gravid uterus, exciting contraction, it may be employed in *labor*, under the same circumstances, and observing the same precautions as named under ergot (see *Ergota*). It likewise controls *postpartum hemorrhages* and *passive hemorrhages from the lungs and bowels*. In minute doses, Prof. Scudder (*Spec. Med.*, p. 261) points out that it may be used "to relieve *false pains*, and unpleasant sensations in the pelvic region, during the latter months of pregnancy." Ustilago, in fractional doses (tincture of ustilago, gtt. x, to water, fl℥iv; dose, a teaspoonful, every 2, 3, or 4 hours), is of value in many disorders in which ergot or belladonna are useful, and sometimes acts better than either. The conditions are those of enfeebled spinal and sympathetic innervation, and sluggish capillary and venous circulation, with a tendency to passive hemorrhages. It serves a useful purpose in *impaired cerebral circulation*, with dizziness, unsteadiness of motion, or lack of command over the intellectual faculties, dull headache in top of head, disordered vision, etc. It is especially applicable in *disorders of the spinal cord and cerebellum*, resulting from *masturbation* and *seminal pollutions.* In the diseases peculiar to women, it has been successfully prescribed when the abdomen was lax and pendulous, the perineum full and relaxed, and the uterus weak, flabby, and increased in size. Thus it has proved useful in the following disorders, and in the reflex disturbances arising from them: *Ovarian irritation, ovaritis, amenorrhœa, dysmenorrhœa, premature menstruation,* and other *menstrual derangements, metrorrhagia,* from *uterine subinvolution, turn of life, uterine catarrh,* and *agalactia.* It also arrests prolonged *lochial discharge,* and gives a healthy tone to the uterine walls. The dose in these conditions should range from 5 to 30 drops of specific ustilago. Ustilago is said to affect the skin and its appendages, therefore it has been suggested in doses of 1 to 5 drops of specific ustilago, in *alopecia, scalp diseases,* with dryness, *urticaria,* with large, pale welts, and in early *dental decay.* Dose of ustilago, 1 to 20 grains; of specific ustilago, 1 to 60 drops; of the fluid extract, 1 to 60 drops; of the tincture, 1 to 60 drops.

Specific Indications and Uses.—Enfeebled spinal and sympathetic innervation; feeble capillary and venous circulation; impaired cerebral circulation, with dizziness and unsteadiness; sleeplessness from atony; uterine derangements, with excessive sanguineous or other discharges, lax or flabby uterine, vaginal, and perineal tissues, with uterine pain; pain in top of head; uterine inertia during labor; postpartum and passive hemorrhages.

UVÆ.—RAISINS.

The dried fruits of *Vitis vinifera,* Linné.

Nat. Ord.—Vitaceæ.

SYNONYM: *Uva passa* (*U. S. P.*, 1870).

ILLUSTRATION: Bentley and Trimen, *Med. Plants,* 66.

Botanical Source.—*Vitis vinifera,* or *European wine grape.* This is a climbing shrub, which has been known in nearly all parts of the globe from a very early period. There are many varieties of it, which will generally be found to agree in most respects with the following description of De Candolle: Leaves lobed, sinuated, toothed, smooth or downy, flat or crisp, pale or deep-green; branches prostrate, climbing, or erect, tender, or hard; racemes or branches loose or compact, ovate or cylindrical; fruit or berries red, yellow, or purple, watery or fleshy, globose-ovate or oblong, sweet, musky, or austere. Calyx somewhat 5-toothed; petals 5, cohering at the point, separating at the base, and dropping off like a calyptra. Stamens 5. Style none. Berry 2-celled and 4-seeded; the cells or seeds are often abortive.

History and Chemical Composition.—The grape-vine grows wild in the south of Asia and in Greece, and was, probably, first cultivated in the East at an exceedingly remote period. Scripture informs us that Noah, after leaving the ark, "planted a vineyard and drank of the wine." At present, it is cultivated in the warm, temperate climates of Europe and America; in this country, notably in California, Ohio, New York, and Virginia. *Vitis vinifera,* grown in the United States, yields the Californian grapes known as the *Mission, Riesling, Gutedel,* etc., while several wild species of this country have been successfully cultivated. Thus, the grapes known as *Concord, Catawba, Isabella, Delaware,* are varieties of *Vitis Labrusca,* Linné (*Fox* or *Plum grape*); the *Taylor* and *Clinton* grapes come from *V. riparia,* Michaux (*Frost grape*); the *Muscadine,* or *Scuppernong,* from *V. vulpina,* Linné; and *Herbemont,* and others from *V. aestivalis,* Michaux (*Summer grape*). (On the early cultivation of the grape near Cincinnati, and diseases of the vine, see E. S. Wayne, *Amer. Jour. Pharm.*, 1855, pp. 494–499; also see an interesting article on mildew and grape culture, by Henry S. Mauger, *ibid.*, 1887, pp. 433–437.) The leaves and the tendrils (*pampini vitis*) of the grape-vine are somewhat astringent, and were formerly employed in diarrhœa, hemorrhages, and other morbid discharges. According to A. Hilger and L. Gross (*Amer. Jour. Pharm.*, 1887, p. 267), the young *shoots* and *leaves* contain potassium bitartrate, calcium tartrate, tartaric and malic acids, quercetin, tannin, starch, gum, dextrose, saccharose, inosit, oxalic and glycolic acids, an ether-soluble substance, ammonium salts, and calcium sulphate and phosphate; in Autumn, malic acid and inosit are absent. The *tendrils* contain much pectin, also sugar, potassium bitartrate, calcium oxalate, and traces of tannin and resin. The *sap*, exuding from cut vines, was found by Hilger and Gross (*loc. cit.*) to contain sugar, inosit, a mucilaginous body, succinic acid, tartrates and citrates, while the aqueous liquid, exuding in spring from the young twigs, contains carbon dioxide, potassium nitrate, ammonium salts, calcium sulphate, phosphate, and tartrate, magnesium phosphate, sugar, inosit, succinic and oxalic acids (Husemann and Hilger, *Pflanzenstoffe*, Vol. II, 1884, p. 888). The juice of the unripe fruit (*agresta*) is called *omphacium*, and contains malic, citric, tartaric, and racemic acids, with bitartrate of potassium, sulphates of potassium and calcium, a little tannic acid, etc. The juice of the ripe fruit is called *must;* when fermented, it is called *wine* (see *Vinum*).

GRAPES.—Ripe grapes are a most delicious and refreshing fruit, the juice of which is especially adapted to patients with *fevers*, and which, in large quantities, proves aperient and diuretic, but, eaten moderately, will be found beneficial to those disposed to *diarrhœa* or *dysentery;* they are useful in many instances of *acidity of the stomach*. The skin and seeds of the grape are indigestible, and apt to occasion serious intestinal disease, and should, therefore, never be swallowed. Dr. Cullen considered ripe, sweet grapes the safest and most nutritive of all fruits. According to J. König (*Die Menschl. Nahrungs- und Genussmittel*, 3d ed., 1893), ripe grapes contain on an average: Water (78.17 per cent), nitrogenous matter (0.59 per cent), free acid (0.79 per cent, or from 0.5 to 1.4 per cent), sugar (14.36 per cent, or from 9.3 to 18.7 per cent), other nitrogen-free substances (1.96 per cent); seeds and skins (3.6 per cent), and ash (0.53 per cent). Hilger and Gross (*loc. cit.*) name the following constituents of the grape: Tartaric and malic acids, free and combined with potassium and calcium, tannic, succinic, glyoxylic, and glycolic acids, inosit, dextrose, lævulose, albuminoids, and traces of quercitrin and quercetin. The skins of grapes contain much tannin, and the red grapes contain a blue coloring matter (*œnocyanin*), which is believed to be identical with the coloring matter of huckleberries. Acids, *e. g.*, tartaric acid, turn it red; ammonia blue (see A. Andrée, *Amer. Jour. Pharm.*, 1880, p. 205, from *Archiv der Pharm.*, 1880). It is supposed to originate from the tannin of the grape (*œnotannin*) by oxidation. The source of the sugar formed during the ripening process of the grape, is not clearly established. It is not derived, however, from the acid of the grape, as was formerly believed. (For researches on the maturing of the grape, see C. Neubauer [1868], E. Mach and C. Portele [1879], and J. König, *loc. cit.*) The stems of grapes contain much tannic acid. The seeds, likewise, are rich in tannic acid, and contain from 10 to 18 per cent of a fatty oil, consisting of the glycerides of palmitic, stearic, oleic, and *erucic* acids ($C_{22}H_{42}O_2$) (A. Fitz, 1871).

RAISINS.—Grapes, when properly dried, are denominated raisins (*Uvæ passæ*), of which there are several kinds known in commerce. The finest are the *Spanish* or *Malaga* raisins (*Uvæ Malacenses*, or *Uvæ passæ majores*), of which there are three kinds—*Muscatels*, *Sun* or *Bloom raisins*, and the *Lexia raisins*. *Corinthian raisins* (*Uvæ Corinthiaceæ*), or *Dried currants* (*Uvæ passæ minores*), are obtained from a very small grape, called the *Black Corinth*, and are produced in Greece, at Zante, Patras, etc. Raisins naturally contain more saccharine matter than fresh grapes, as may be seen by the saccharine efflorescence which is often noticeable upon their surfaces. The amount of sugar in raisins varies from 53 to 61 per cent (J. König, *loc. cit.*). Malaga raisins consist of dried bunches, while Valencia raisins are free from stems. Malaga raisins are large, fleshy, purplish-brown, sweet, and of fine flavor. A yellow-brown raisin, of a musky odor, and less pleasant in taste, is imported from Syria, and known as *Smyrna raisins*. A seedless kind, from Asia Minor, is called *Sultana* or *Seedless raisins*. Since about 1873, large quantities of raisins are being prepared in California from native grapes, chiefly from *Feher Zagos*, *Muscat*, and *Muscatel*, also from seedless *Sultana*. The grapes, at the proper point of ripeness, are exposed, in bunches on trays, to the heat of the sun for 6 or 8 days, and then placed in sweating boxes for about 2 weeks. The bunches are then sorted and packed. By careful manipulation, the raisins will neither be too dry, nor will they mold. They are put on the market either with the grapes attached to the stems, or stemless. (For an interesting description of this flourishing industry, see *Amer. Jour. Pharm.*, 1890, p. 465; also see *ibid.*, 1899, p. 5.)

Action and Medical Uses.—Raisins are used in medicine principally for imparting a flavor to various infusions, decoctions, etc. When eaten freely, they are apt to cause flatulency and other unpleasant symptoms, on account of their difficult digestibility. An excellent, pure, and sparkling wine may be made as follows: Take 12 pounds of good raisins, cut each raisin in two, and put them into a 5-gallon demijohn, nearly filled with clean, soft water; let it stand uncorked for about 14 days, then filter, bottle, and cork well. Upon the residue, after the wine is poured off, put as much water as before, let it stand a sufficient time, and the result will be a good white wine vinegar. Grapes are diuretic, probably owing to the grape-sugar present.

UVA URSI (U. S. P.)—UVA URSI.

"The leaves of *Arctostaphylos Uva ursi* (Linné), Sprengel"– (*U. S. P.*) (*Arbutus Uva ursi*, Linné; *Arctostaphylos officinalis*, Wimmer).

Nat. Ord.—Ericaceæ.

COMMON NAMES: *Bearberry*, *Upland cranberry*.

ILLUSTRATION: Bentley and Trimen, *Med. Plants*, 163.

Botanical Source.—This plant is a small, perennial shrub, having a long, fibrous root. Its stems are woody, trailing, and rooting, the young shoots only turning upward; the bark deciduous and smooth. The leaves are alternate, obovate, acute at base, short petioled, coriaceous, evergreen, glabrous, shining above, paler beneath, entire, in young ones pubescent, the margin rounded, but scarcely reflexed. The flowers are terminal and clustered. Peduncles short, red, reflexed, and furnished at base with a short, acute bract, with 2 minute ones at the sides. Sepals 5, roundish, reddish, and persistent. Corolla ovate or urceolate, white with a reddish tinge, transparent at base, contracted at the mouth, and hairy inside, with 5 short, reflexed segments. Stamens 10, very slightly adhering to the base of the corolla; filaments hairy; anthers reddish, each with 2 horns and 2 pores. Ovary round; style straight, longer than the stamens; stigma simple. Disk a black indented ring. The fruit is small, globular, succulent, drupaceous, depressed, almost scarlet-colored, with an insipid, mealy pulp, and 5 angular seeds (L.).

Fig. 250.

Arctostaphylos Uva ursi.

History and Description.—Uva ursi is a perennial evergreen, common in the northern part of Europe and America, growing on sterile, gravelly ridges, and dry, sandy soils. It flowers from June to September, and ripens its berries during the winter. The leaves are the parts used; the green leaves alone should be selected, picked from the twigs in the fall, and dried by exposure to a moderate heat. They are frequently adulterated with whortleberry or cowberry leaves. These adulterations may be detected by observing that the uva ursi leaf is reticulated beneath, while the whortleberry leaf is merely dotted. The leaves of pipsissewa are longer, cuneate-lanceolate, and sharply serrated. Uva ursi leaves are odorless, except when in powder, which is of a light-brown color, with a shade of greenish-yellow, and has nearly the smell of good grass hay, and to the taste is at first smartly astringent and bitterish, which sensations gradually soften into a liquorice flavor. The leaves yield their properties to water or alcohol, forming, with the latter, a green tincture, which is rendered turbid by water, causing a deposit of green resin. As officially described, uva ursi leaves are "very short-stalked, obovate or oblong-spatulate, coriaceous, from 15 to 20 Mm. ($\frac{3}{5}$ to $\frac{4}{5}$ inch) long, and 5 to 8 Mm. ($\frac{1}{5}$ to $\frac{1}{3}$ inch) broad, obtuse, slightly revolute on the margin, upper surface with depressed veins; lower surface distinctly reticulate; odor faint, hay-like; taste strongly astringent, and somewhat bitter"—(*U. S. P.*).

Chemical Composition.—The leaves of uva ursi contain large quantities of *gallic acid*. The active principle is the crystallizable glucosid, *arbutin*, announced by Kawalier, in 1852. Previously, J. C. C. Hughes (*Amer. Jour. Pharm.*, 1847, p. 88 attributed the diuretic power of the leaves to a crystallizable substance, which he called *ursin*. This substance was subsequently shown by Jungmann (*ibid.*, 1871, p. 205) to have been arbutin mixed with some gallic acid. Diluted acids, as well as the ferment *emulsin*, decompose arbutin into sugar, *hydroquinone* ($C_6H_6O_2$) (*arcturin* of Kawalier), and *methyl-hydroquinone* ($C_6H_5[CH_3]O_2$), which substances may occur in the herb together with arbutin. Upon destructive distillation of an extract of uva ursi leaves, *hydroquinone* can be isolated from the distillate (Uloth, 1859). Other constituents of the leaves are the bitter glucosid *ericolin*, and its decomposition product *ericinol* (Rochleder and Schwarz, 1852, and R. Thal, *Pharm. Zeitschr. für Russland*, 1883, p. 209; also see *Rhododendron*, *Ledum*, etc.); the crystallizable substance *urson*, insoluble in water (H. Trommsdorff, 1854); tannic and malic acids, a small quantity of volatile oil, fatty matter, wax, gum, sugar, coloring matter, etc. (Jungmann, *loc. cit.*). A yellow coloring matter, allied to quercetin, of the formula $C_{15}H_{10}O_7$, was isolated by A. G. Perkin (see *Amer. Jour. Pharm.*, 1898, p. 584). It forms phloroglucin and protocatechuic acid upon fusion with alkali. The ash of the leaves of uva ursi amounts to about 3 per cent. The leaves are free from the poisonous andromedotoxin, which occurs in certain other *Ericaceæ*.

ARBUTIN ($C_{25}H_{34}O_{14}$, Hlasiwetz and Habermann, 1883) also occurs in other Ericaceæ (see *Pyrola*, *Kalmia*, *Gaultheria*, etc.) From the leaves of uva ursi it is obtained by adding solution of subacetate of lead to a decoction of the leaves, removing the lead from the filtrate by sulphide of hydrogen, and evaporating to crystallization. The crystals are purified by treatment with a mixture of ether (8 parts) and alcohol (1 part), and are subsequently crystallized from water. It forms colorless, long, silky needles of bitter taste, neutral reaction, very hygroscopic, easily soluble in hot water and alcohol, hardly soluble in ether. The aqueous solution produces a blue color with ferric chloride, and does not reduce Fehling's solution, nor is it precipitated by the lead acetates. Acids and emulsin decompose it as stated before. In aqueous solution, rendered alkaline by ammonia or caustic potash, arbutin acquires a deep azure-blue color with phosphomolybdic acid (Jungmann, *loc. cit.*).

Action, Medical Uses, and Dosage.—The effects of this medicine depend entirely on its stimulant, astringent, and tonic powers, though, in the smaller doses, it tends to relieve *chronic irritation of the bladder*. As an astringent, it is applicable to all the purposes for which astringents are used, as in *chronic diarrhœa and dysentery*, *menorrhagia*, *diabetes*, *enuresis*, etc. In *chronic affections of the kidneys and urinary passages*, it is frequently useful; in *vesical catarrh*, *chronic gonorrhœa*, *strangury*, *leucorrhœa*, and *excessive mucous and bloody discharges* with the urine. Its tannic acid becomes oxidized and converted into gallic and pyrogallic acids, and humus-like substances, which communicate a dark color to the urine. The keynote to its use is relaxation of the urinary membranes, as is evidenced by catarrhal discharges and a feeling of weight and dragging in the loins and perineum. There is always a feeble circulation and lack of innervation in the urinary tract when uva ursi is indicated. It undoubtedly lessens lithic acid deposits in the urine. In *gonorrhœa*, with bloody and mucous discharges, and pain in the vesical region, it speedily allays all these unpleasant symptoms. *Cystic spasm* is relieved by it, and, when *calculi* are present, it obtunds the cystic membranes to such an extent that the offending material is comfortably borne. It is also a remedy for *passive hemorrhage*, small in amount, and in *chronic affections of the larynx, bronchiæ, and pulmonary tissues*, with excretion and cough. In large doses, uva ursi may cause emeto-catharsis. Arbutin, while undoubtedly diuretic, does not fully represent uva ursi, and the latter is said not to exert a diuretic action in health. Arbutin, in its passage through the system, is decomposed, and gives rise to hydroquinone, to which body has been attributed the retardation of putrescent changes in the urine of persons taking uva ursi. Arbutin may be given to the extent of 10 or 15 grains a day, usually mixed with sugar. Dose of powdered uva ursi, 10 to 60 grains; of the decoction, 1 to 3 fluid ounces, made by boiling 1 ounce of uva ursi with 1½ pints of distilled water down to 1 pint; of the extract, 5 to 15 grains; of the tincture, 5 to 30 drops.

Specific Indications and Uses.—Relaxation of the urinary tract, with pain and mucous or bloody secretions; feeling of weight and dragging in the loins and perineum, when not due to prostatic enlargement; chronic vesical irritation, with pain, tenesmus, and catarrhal discharges.

Related Species and Sophistications.—The leaves of the following North American plants have been used as substitutes or adulterants of uva ursi: *Vaccinium uliginosum*, Linné, *Bog-bilberry*; *Vaccinium Vitis-Idæa*, Linné, *Cowberry*, or *Red whortleberry* (containing *vacciniin* [*arbutin*]; see E. Claassen, *Amer. Jour. Pharm.*, 1870, p. 297; and F. Oelze, *Jahresb. der Pharm.*, 1890, p. 73); *Buxus sempervirens*, Linné, *Box; Leiophyllum buxifolium*, Elliott; *Oxydendron arboreum*, De Candolle, *Sourwood*, or *Sorrel tree;* and *Epigæa repens*, or *Trailing arbutus*, containing *ericolin* and, probably, *arbutin*. Other species related to uva ursi are:

Arctostaphylos glauca, Lindley, *Manzanita.*—California. This shrub-like tree grows in the dry, rocky districts of the Sierras, on the western slopes. The leaves are the parts used, being employed like uva ursi. They are about 2 inches long, leathery, entire, ovate-oblong, and of a light-green hue. J. H. Flint (*Amer. Jour. Pharm.*, 1873, p. 197) found in them nearly 10 per cent of tannin and some *arbutin*, which gave Jungmann's test (see *Uva Ursi*).

Arbutus xalapensis, Kunth, Mexico and western Texas, and *Arctostaphylos tomentosa*, Douglass, of Mexico, both known as *Madrona*, are used like uva ursi; as are also the *Arctostaphylos mucrocifera*, De Candolle, and the *Arctostaphylos polifolia*.

UVULARIA.—BELLWORT.

The root of *Uvularia perfoliata*, Linné.

Nat. Ord.—Liliaceæ.

COMMON NAMES: *Bellwort, Mealy bellwort.*

Botanical Source.—Bellwort has a perennial, creeping root-stalk, and a stem 8 to 14 inches high, dividing at the top into 2 branches. The leaves are clasping-perfoliate, elliptical, rounded at base, acute at apex, 2 or 3 inches long, by one-third as broad, smooth, and glaucous underneath. The flowers are solitary, pale-yellow, about 1 inch long, pendulous from the end of one of the branches; perianth subcampanulate and tuberculate-scabrous within; segments linear-lanceolate, about 1 inch long and twisted; anthers cuspidate, ¾ inch long. Capsule or pod obovate-truncate, and divergently 3-lobed at top; lobes with convex sides (W.—G.).

History.—Bellwort is a smooth, handsome plant, common to the United States, growing in moist copses, woods, etc., and flowering in May. The root is the part employed, which, when recent, is acrid and mucilaginous. It imparts its properties to water.

Action, Medical Uses, and Dosage.—Bellwort is a tonic, demulcent, and nervine, and may be used in decoction or powder, as a substitute for cypripedium. The decoction has proved beneficial in *sore mouth* and *affections of the throat*, also *inflammation of the gums*. A poultice of it is useful in *wounds* and *ulcers*. Boiled in milk, and the decoction drank freely, with a poultice of the root applied to the wound, it has considerable reputation as an alexipharmic in bites of *venomous snakes*. A poultice of the green or dried root, in powder, and mixed with hot new milk, is very highly recommended in all stages of *erysipelatous inflammation*, to be renewed when dry; the same application has been used beneficially in *acute ophthalmia*. An ointment made by simmering the powdered roots and green tops in lard for an hour, over a slow fire, and straining by pressure, is useful in *herpetic affections, sore ears, mouths*, etc., of children, and also in mild cases of *erysipelas*.

VACCINIUM.—BLUE WHORTLEBERRY.

The fruit and root of *Gaylussacia frondosa*, Torrey and Gray (*Vaccinium frondosum*), and of *Gaylussacia resinosa*, Torrey and Gray (*Vaccinium resinosum*).

Nat. Ord.—Ericaceæ.

COMMON NAMES: (1) *Blue whortleberry, Blue dangles, High blueberry, Blue huckleberry;* (2) *Black whortleberry, Black huckleberry.*

Botanical Source.—*Gaylussacia frondosa* is a shrub 3 to 6 feet high, with a grayish bark, and round, smooth, slender and divergent branches. Its leaves are deciduous, obovate-oblong, obtuse, entire, pale, glaucous beneath, covered with minute resinous dots, and the margin being slightly revolute. The flowers are small, nearly globose, reddish-white, in loose, slender, lateral, bracteate racemes; the bracts are oblong or linear, rather deciduous, and shorter than the pedicels; the pedicels are from 5 to 10 lines long, slender, drooping and bracteate near the middle. The corolla is ovoid-campanulate, with acute divisions, inclosing the stamens. The fruit is large, globose, dark-blue, covered with a glaucous bloom, sweet and edible (W.).

Gaylussacia resinosa is a bushy shrub 1 to 3 feet in height. Its branches are cinereous brown and villose when young. The leaves are deciduous, oblong-ovate, or oblong-lanceolate, rather obtuse, entire, petiolate, 1 or 2 inches long, about one third as wide, and thickly covered with shining resinous dots beneath. The flowers are reddish, tinged with green, or yellowish-purple, in lateral, secund, dense, corymbose racemes, small and drooping; the pedicels are about the length of the flowers, and sub-bracteolated; the bracts and bractlets are reddish, small, and deciduous. The corolla is ovoid-conic, at length subcampanulate, 5-angled, contracted at the mouth, longer than the stamens, shorter than the style. The fruit is globose, black, without bloom, sweet and edible (W.).

History and Chemical Composition.—These plants are common to the northern states, growing in woods and pastures, flowering in May and June, and ripening their fruit in August. The fruit, or berries, together with the bark of the root, are the parts used. They yield their virtues to water. To our knowledge, no analysis has yet been made of them. The fruit of the related European plant, *Vaccinium myrtillus*, Linné, contains malic and citric acids, sugar, pectin, coloring matter, iron-bluing tannin, ericolin and kinic acid (see Dragendorff's *Heilpflanzen*, 1898; and Wittstein's *Pharmacognosie*, 1882).

Action, Medical Uses, and Dosage.—Diuretic and astringent. The fruit is very useful, eaten alone, with milk or sugar, in *scurvy*, *dysentery*, and *derangements of the urinary organs*. The berries and roots, bruised and steeped in gin, form an excellent diuretic, which has proved of much benefit in *dropsy* and *gravel*. A decoction of the leaves or bark of the root is astringent, and may be used in *diarrhœa*, or as a local application to *ulcers*, *leucorrhœa*, and *ulcerations of the mouth and throat*.

Related Species.—The different varieties of whortleberry possess similar properties, as the *Gaylussacia dumosa*, Torrey and Gray (*Vaccinium dumosum*), or *Bush whortleberry*; *V. corymbosum*, Linné, or *Giant whortleberry*; *V. Pennsylvanicum*, Lamarck, *Common low blueberry*, or *Black-blue whortleberry*; *V. Vitis-Idæa*, Linné, *Cowberry* or *Bilberry*, and several others. The last-named contains a bitter principle, *vacciniin*, identical with *arbutin* (Edo Claassen; see under *Uva Ursi*). Several species are found growing in the mountainous regions of some of the southern states. Torrey and Gray have removed the *V. frondosa*, *V. resinosum*, and *V. dumosum* from the genus *Vaccinium*, and placed them in a new one called *Gaylussacia*, in honor of the distinguished chemist, Gay-Lussac. Both the berries and root-bark of *V. arboreum*, Michaux, or *Farkleberry*, are very astringent, more so than the other varieties above named, and may be used in all cases where this class of agents is indicated, as in *diarrhœa*, *chronic dysentery*, etc., taken internally; and the infusion will be found valuable as a local application in *sore throat*, *aphthous ulcerations*, some forms of *chronic ophthalmia*, *leucorrhœa*, etc. The leaves of *Vaccinium Vitis-Idæa*, and of *Vaccinium uliginosum*, Linné, have been confounded with those of *Uva ursi*.

Vaccinium macrocarpon, Aiton (*Oxycoccus macrocarpus*), *Cranberry*.—This well-known fruit is frequently applied in domestic practice to *inflammatory swellings*, such as *erysipelas*. Edo Claassen (*Amer. Jour. Pharm.*, 1886, p. 324) finds in the fruit a bitter, non-crystallizable glucosid, which he names *oxycoccin*, resembling *arbutin*. Cranberries are a source of citric acid; L. W. Moody (*ibid.*, 1878, p. 567) found 2.27 per cent. Cranberries in poultice have proved useful in *erysipelatous inflammations*, *tonsilitis*, *scarlatinal sore throat*, and *swelling of the cervical glands*, as well as in *indolent and malignant ulcers*. A split cranberry, held in position by a daub of flour or starch-paste, will quickly relieve the pain and inflammation attending *boils* upon the tip of the nose. This procedure, recently recommended by a distinguished physician, has given good results in our hands.

VALERIANA.—VALERIAN.

"The rhizome and roots of *Valeriana officinalis*, Linné"—(*U. S. P.*).

Nat. Ord.—Valerianeæ.

Common Names and Synonyms: *Valerian*, *Great wild valerian*, *Valerian root*; *Valerianæ rhizoma* (*Br.*), *Radix valerianæ minoris*.

Illustration: Bentley and Trimen, *Med. Plants*, 146.

Botanical Source.—The official valerian, sometimes known as *Great wild valerian*, is a large herb, with a perennial, tuberous, somewhat creeping, fetid root, most aromatic when growing in dry pastures, with numerous long, dark-brown rootlets, and a smooth, hollow, furrowed stem about 4 feet in height. The leaves are all pinnate and opposite; leaflets in from 7 to 10 pairs, lanceolate, coarsely serrated, those of the radical leaves broadest, approaching to ovate, and borne on long foot-stalks. The flowers are flesh-colored, small, fragrant, in terminal cymose, contracted panicles; bracts, ovate-lanceolate, acuminate, herbaceous, membranous at the edge, appressed, and rather longer than the ovary, calyx superior, rolled inward in the form of a rounded, thickened rim, ultimately becoming a sort of pappus to the seed; corolla funnel-shaped and smooth; tube gibbous at the base on that side of the flower turned away from the axis, and hairy internally; limb spreading, divided into 5, nearly equal, concave and linear, with rounded segments. Stamens 3, exserted, subulate, white from the middle of the corolla tube; anthers yellow and oblong; ovary inferior, narrow-oblong, compressed, 1-celled, with a single pendulous ovule; style filiform; stigma divided into 3 filiform lobes. The fruit is light-brown, linear-ovate, compressed with a slight elevated ridge on one side, terminated by the 12 filiform, plumose, recurved segments of the calyx-limb (L.—Wo.).

History and Description.—Valerian is a European plant growing in wet places, or even in dry pastures, flowering in June and July. The plant thrives best in a light, dry soil; that growing in low, wet situations is not so active, therapeutically. Botanists have given distinctive variety names to these two kinds, which differ in habit of growth. Valerian is also cultivated in this country, especially in Vermont and New Hampshire, and is fully equal, if not superior, to that of English growth. The valerian of American growth has almost entirely superseded the foreign in this country. The medicinal part of the plant is the root, which should be gathered soon after the leaves have fallen, and carefully dried. The *U. S. P.* describes the drug to be a "rhizome from 2 to 4 Cm. ($\frac{4}{5}$ to 1$\frac{3}{5}$ inches) long, and 1 to 2 Cm. ($\frac{2}{5}$ to $\frac{4}{5}$ inch) thick, upright, subglobular or obconical, truncate at both ends, brown or yellowish-brown, internally whitish or pale-brownish, with a narrow circle of white wood under the thin bark. Roots numerous, slender, brittle, brown, with a thick bark, and slender, ligneous cord. Odor peculiar, becoming stronger and unpleasant on keeping; taste, camphoraceous and somewhat bitter"—(*U. S. P.*). The odor of the dry root is fetid. characteristic, and highly attractive to cats, and, it is said, to rats also. The root imparts its properties readily to water, alcohol, and ammoniated alcohol.

Chemical Composition.—The active properties of valerian are largely due to its volatile oil (about 1 per cent), the characteristic constituent of which is *iso-valerianic acid* (see *Acidum Valerianicum*), combined with *borneol*, in the freshly distilled oil (see *Oleum Valerianæ*). Other constituents are malic acid, resin, sugar, starch, iron-greening tannin (about 1.5 per cent), etc. An alkaloid, *chatinine*, was isolated from valerian by Waliszewski (*Amer. Jour. Pharm.*, 1891, p. 285). In Mexican valerian, R. McLaughlin (*ibid*, 1893, p. 329) found 3.33 per cent of volatile oil, 4.3 per cent of oleoresin, a crystalline, ether-soluble glucosid, wax, fat, etc.

Admixtures and Adulterations.—M. O. Reveil has detected the roots of *Scabiosa succissa*, Linné, and *S. arvensis*, Linné, to the extent of 22 per cent in some valerian. These roots are inodorous, but soon acquire the odor of valerian by contact (*Amer. Jour. Pharm.*, 1855, p. 21). The roots of *Valeriana Phu*, Linné, and *Valeriana dioica*, Linné, are occasionally intermixed with true valerian root. They are weaker in odor and taste. Several *Ranunculaceæ* have been added in Germany with fraudulent intent (Ebermayer). R. Bentley (*Amer. Jour. Pharm.*, 1877, p. 201) calls detailed attention to the dangerous admixture of *Veratrum album;* Charbonnier (1887) detected *Cynanchum Vincetoxicum;* and Bernbeck (1880) *Sium latifolium*, as admixtures.

Action, Medical Uses, and Dosage.—Valerian excites the cerebro-spinal system. Large doses cause headache, mental excitement, visual illusions, giddiness, restlessness, agitation, and even spasmodic movements, and frequently nausea. In medicinal doses it acts as a stimulant-tonic, antispasmodic and calmative, and has been used in *chorea*, *hysteria*, and in the low forms of *fever*, where a nervous stimulant is required. Although sometimes very effectual in curing, it as frequently fails in producing more than temporary benefit. These failures are probably due to the fact that the medicine is often administered without due regard to the indications, and especially the condition of the nerve centers. The cases requiring it are those evidencing enfeebled cerebral circulation; there is despondency and marked mental depression, often amounting to *hypochondria*. In properly selected cases it relieves irritability and pain, and favors rest and sleep. In such cases it is frequently useful in *hemicrania* and other forms of *nervous headache*. Its chief value is in *chorea*, with enfeebled cerebral circulation. ℞ Valerian, macrotys, āā ℥ij; dilute alcohol, Oj; macerate for 2 weeks. Dose, 1 teaspoonful, 3 times a day (Locke). Valerian is adapted to the milder *spasmodic affections*. Prof. Webster states that "it is better calculated to steady that hyperæsthetic state which carries a patient to the very verge of convulsive action than to relax it when it has once taken place"—(*Dynam. Therap.*, 214). Valerian is one of many agents which have been used for the relief of *epilepsy*. The extract of valerian is worthless, but the fluid extract has been found to possess all the medicinal virtues of the root. The powder is apt to irritate the stomach and bowels, its dose is from ½ drachm to 2 drachms, every 3 or 4 hours; the infusion, which is a preferable form, may be given in doses of 1 or 2 fluid ounces; the fluid extract, in doses of from 20 to 60 drops in a little water; the tincture, in doses of 1 or 2 fluid drachms; and the volatile oil, from 2 to 6 drops; ammoniated tincture, 1 to 2 fluid drachms; specific valerian, 2 to 30 drops.

Specific Indications and Uses.—A cerebral stimulant. Hysteria, chorea, hemicrania, all with mental depression and despondency; cerebral anemia; mild spasmodic movements.

Related Species and Drugs.—*Valeriana Phu*, Linné. West Asia and south Europe yields the root above-mentioned as an adulterant. It is known as *Radix valerianæ majoris*. Its odor and taste resemble those of valerian, but are not nearly so strong.

Valeriana celtica, Linné.—Europe. This Alpine plant yields the rhizome known as *Nardus spica celtica*, which has a valerian taste and powerful odor.

Valeriana toluccana, De Candolle; *Valeriana Mexicana*, De Candolle.—Mexico. Used like valerian; yields large amounts of valerianic acid.

Nardostachys Jatamansi, De Candolle (*Valeriana Jatamansi*, Roxburgh).—Mountains of north India. Yields true *spikenard* (*Nardus Indica*, or *Spica Narda*), *Jatamansi*. Its taste is bitter and spicy, and its odor strong and resembling Virginia snakeroot. It has long been used by the Hindus as a medicine and perfume. In 45-grain doses it is employed in colds and coughs as an expectorant, and there is a popular belief in India that it promotes "the growth and blackness of the hair" (*Dymock*). It is chiefly used in making washes and ointments for the hair. Sir W. O. Shaughnessy states that "it is a perfect representative for valerian" (Dymock, *Mat. Med. of West. India*). It yields a brownish volatile oil.

Valeriana Hardwickii, Wallach.—Himalayas. This drug is the *Taggar* of India, and its medicinal properties are similar to those of *jatamansi*. Contains 1 per cent of volatile oil, with valerianic acid, and 3.13 per cent of tannin (J. Lindenberg, *Pharm. Zschr. f. Russland*, 1886, p. 523).

Patrinia scabiosæfolia, Link.—Japan. *Kesso*, or *Japanese valerian*, at first sight very much resembles valerian, and as to taste and odor is almost identical (*Pharmacographia*). It lacks the upright rhizome of the true drug. It was introduced in 1879 into English markets.

Amyl Valerianate.—One part of this ester, dissolved in a mixture of 19 parts of alcohol and 2 per cent of a spirit of amyl acetate (1 in 20) has been praised by Dr. Wade, of Birmingham, in cases to which valerian is applicable. The dose of the above mixture ranges from 6 to 8 drops.

VANILLA (U. S. P.)—VANILLA.

"The fruit of *Vanilla planifolia*, Andrews"—(*U. S. P.*).

Nat. Ord.—Orchideæ.

Common Name: *Vanilla*.

Illustration: Bentley and Trimen, *Med. Plants*, 272.

History and Botanical Source.—The plant which produces vanilla bean is an orchid, native of the tropical forests of Mexico, but now grown in many other parts of the globe, as in Brazil, Honduras, Java, Africa, and the West Indies, though only on the island of Guadaloupe on a commercial scale. Vanilla has probably been in use among the Mexicans from times immemorial, as a flavor to their chocolate, and was made known to the western world by the Spaniards. Hernandez, the Spanish historian, describes it under the botanical name *Aracus aromaticus*, also mentioning its Mexican name, *Tlilxochitl*. Clusius, in 1602, calls it *Lobus oblongus aromaticus*. The generic name of the plant was established, in 1752, by Plumier, and the present name of the species yielding the true Mexican vanilla of commerce, by Andrews, in 1808. (As to priority of synonyms, see George M. Beringer, *Amer. Jour. Pharm.*, 1895, p. 611.) While the *Index Kewensis* enumerates 34 species of vanilla; only very few contribute to the world's supply of the vanillas of commerce—for example, *V. planifolia*, Andrews (Mexico, also cultivated in Réunion, Java, etc.); *V. pompona*, Schiede (southeast Mexico, Panama, Colombia, Venezuela, Surinam, Cayenne, Guadaloupe, etc.); and *V. Gardneri*, Rolfe (Brazil) (R. A. Rolfe, *Kew Bulletin*, 1895, p. 169; see Beringer, *loc. cit.*).

Fig. 251.

Vanilla planifolia.

Vanilla planifolia, Andrews, the official source of the bean, is a climbing vine, with a thick, succulent stem, and entire, thick, smooth, bright-green, pointed leaves, 4 to 9 inches long, and 1½ to 2½ inches broad. Opposite the leaves, it is furnished with numerous aerial roots, with which it clings to its support. The flowers are produced in axillary bunches of 8 or 10; they are of a pale-yellow color, about 2 inches in diameter, have the usual orchidaceous structure, but are more regular in appearance than most orchids. The fruit is a pendant pod, 5 to 10 inches long, and an inch or more in circumference when fresh, and contains myriads of minute seeds. These pods, when properly cured and dried, are the vanilla of commerce. Regarding the mode of sustenance of the vanilla vine, two statements have been made—one, that it is a parasite, deriving its nourishment from the tree to which it clings; the other, that it is an *epiphyte* (as many orchids are), *i. e.*, living entirely on moisture and nourishment derived from the air. Neither opinion is exact. After the vanilla plant has established itself, it will continue to grow even if its connection with the ground is severed, and will throw out new roots, which reach and penetrate the ground. Hence it is, to some extent, epiphytic. But should it fail to establish its connection with the ground, it will finally wither and die. It is in no sense a parasite.

Cultivation and Treatment.—Vanilla is almost exclusively propagated from cuttings, although it can be reared from seeds, but not without considerably delaying the year of the harvest. A warm and moist climate, sandy, moist (not marshy) soil, a mixture of shade and sunshine, the shade predominating, is essential to its successful cultivation. The temperature should average from 75° to 80° F., but should not fall below 65° F. in winter, and the plants should be protected from the salty air of the ocean breezes. If a virgin forest is to be transformed into a vanilla plantation, all superfluous shade must be removed, while, when an open field is to be cultivated, shade trees must first be planted. After about 4 weeks, the cuttings will have taken root, and, in the third year, they begin to bear fruit, and continue to bear for a period of from 30 to 40 years, although with decreasing tendency after the tenth year. In Mexico, the vanilla is permitted to climb the highest trees, while, in Réunion, the expanding vines are so guided as to permit of easy access.

Like most orchids, vanilla depends on insects for fertilization, but in Reunion, where these are absent, artificial fecundation must be resorted to. This is done by slipping aside the labellum, a dividing film, which separates the anther from the stigma, and pressing them lightly together. Care must be taken not to produce, in this way, too many fruits on one stalk, because, in this case, the plants would perish before the pods could ripen. The vine blossoms from March to June, the pod, however, does not ripen until the following January or February. Unfortunately, vanilla in Mexico is picked before it ripens—namely, as early as October or November, chiefly because the crop is in danger of being stolen. This pernicious habit was noticed as early as 1811 by Humboldt.

The value of vanilla depends greatly on the success of the curing process, which requires much skill and experience on the part of the operator. During this manipulation, the flavor of the bean is developed by a peculiar sweating process, a mode of fermentation, which causes the bean to shrivel and to assume a fine chestnut-brown color. This process is carried out differently in different vanilla-producing countries. Ripe vanillas can be cured much more easily than those that are unripe, and the flavor is more permanent. First-grade ripe pods, when stored, become covered with crystals of vanillin in a few months, while the pods, when gathered green, do not form crystals, and are difficult to preserve (Charles E. Hires). The beans are finally sorted into different commercial grades, made into bundles, packed, and conveyed to the shipping ports. (For much interesting information regarding the cultivation and treatment of vanilla, see J. C. Sawer, *Odorographia*, Vol. 1, 1892, pp. 143–173, London; and Charles E. Hires, "A Talk on Vanillas," in *Amer. Jour. Pharm.*, 1893, pp. 571-584; also see a summary on vanilla, with indication of literature, by J. U. Lloyd, *West. Drug.*, Dec., 1897.

Description and Commercial Varieties. The most valued of the vanillas of commerce is the MEXICAN VANILLA. It is the official kind, and is described by the *U. S. P.* as "from 15 to 25 Cm. (6 to 10 inches) long, and about 8 Mm. (⅓ inch) thick, linear, narrowed, and bent or hooked at the base, rather oblique at the apex, wrinkled, somewhat warty, dark-brown, glossy leathery, 1-celled, and containing a blackish-brown pulp, with numerous minute seeds, and more or less acicular crystals; odor and taste peculiar, fragrant"—(*U. S. P.*). Mr. Beringer (On Some Commercial Vanillas, *Amer. Jour. Pharm.*, 1892, pp. 289–294) remarks that the pods of this variety feel firmly plump, and there is a roughness to the touch, which becomes more pronounced as it gets older and dryer. While fresh, the surface is somewhat viscid; the crystals begin to form at the ends, and gradually extend over the surface.

BOURBON VANILLA, from the island of Réunion, is darker than the Mexican bean, and feels smooth and waxy. The odor, while not unpleasant, rather resembles that of tonka bean than Mexican vanilla. Good Bourbon vanilla is likewise covered with crystals ("frosted").

SEYCHELLES AND MAURITIUS VANILLA are sold as inferior Bourbon vanilla in the American market. They are of small size (about 6 inches), pale, smooth, non-waxy, and but faintly odorous.

SOUTH AMERICAN VANILLAS are reddish-brown in color, very pulpy, resinous, and scarcely frosted. Their odor is unpleasant, resembling that of fermented molasses.

TAHITI VANILLA is similar to the former. Its market is the Pacific coast and the western states.

WEST INDIAN VANILLONS, derived from *V. pompona*, Schiede, are exported from Martinique and Guadaloupe, and are collected also from wild vanillas in Mexico. They are only 4 to 5 inches in length, of a twisted appearance, owing to their being tied with twine during the process of curing. The odor is different from vanilla, and, as stated by Beringer (*loc. cit.*) may be compared to a cross between a fermented sugar and heliotrope odor. They are used in the tobacco industry, and, in perfumery, for sachet powders.

Chemical Composition.—The fragrance of vanilla is due to crystallizable *vanillin*, and a small quantity of a balsam, both of which are developed during the curing process. The presence of an odorous resin tends to impair the quality of the bean, according to its quantity. (For a complete analysis of vanilla beans, see W. von Leutner, *Jahresb. der Pharm.*, 1872, p. 36, from *Pharm. Zschr. f. Russland*, 1871.) The "frost" which forms upon vanilla beans, upon storing, was formerly believed to be benzoic acid, until Gobley, in 1859, pointed out its distinction from the latter, and named it *vanillin*. He obtained it by treating an alcoholic extract of vanilla with ether, and recrystallizing the ether extract from hot water with the use of animal charcoal.

VANILLIN ($C_8H_8O_3$) occurs in long, colorless needles, melting at 81° C. (177.8° F.), subliming at a higher temperature, and boiling in an atmosphere of carbon dioxide gas, without decomposition, at 285° C. (545° F.). It is little soluble in cold water (198 parts), much more soluble in boiling water (11 parts), and crystallizing upon cooling. It is easily soluble in ether, alcohol, and chloroform, very little soluble in low-boiling petroleum ether. The researches of Tiemann and Haarmann (1874–76) have shown vanillin to be *methyl-proto-catechuic aldehyde*, or, more exactly, *meta-methoxy-para-oxy-benzoic aldehyde* (C_6H_3[OH].[OCH_3].CHO). Thus it is closely related to *piperonal* (C_6H_4[OCH].[OCH_3].CHO), of heliotrope odor (see *Piperonal*). These authors prepared vanillin synthetically from *coniferin* ($C_{16}H_{22}O_8 + 2H_2O$), a glucosid occurring in the cambium sap of coniferous trees; when treated with the ferment emulsin, it becomes hydrolyzed into dextrose and *coniferyl alcohol*, or *oxy-eugenol* ($C_{10}H_{12}O_3$), which, upon oxidation, yields vanillin. The latter is now prepared synthetically by oxidation of *eugenol* (see *Oil of Cloves*, and diagram, by Prof. V. Coblentz, *Journal of Pharmacology*, 1898, p. 37). Or, it may be obtained from other similarly constituted compounds, *e. g.*, *creosol, guaiacol, caffeic acid*, etc. Owing to its being an aldehyde, vanillin enters quantitatively into a crystallizable, ether-insoluble compound with sodium bisulphite (SO_3HNa), from which vanillin may be regenerated by treatment with diluted acid (Tiemann and Haarmann). Another interesting aldehydic compound of vanillin is that with ammonia, which permits the quantitative separation of vanillin from coumarin, the aromatic principle of the tonka bean. "If vanillin be dissolved in pure, dry ether, and dry ammonia gas be passed through the solution, the aldehyde-ammonia compound of vanillin will be precipitated in almost quantitative proportions. * * * Coumarin, on the other hand, remains wholly (and unchanged) in the ether solution'' (Wm. H. Hess and A. B. Prescott, *Pharm. Review*, 1899, p. 7). By oxidation, vanillin forms odorless, volatile *vanillic acid*, melting at 212° C. (413.6° F.). An alcoholic solution of vanillin produces greenish-blue with ferric chloride; an aqueous solution produces a permanent blue with the same reagent. It dissolves in sulphuric acid with yellow color.

The quality of commercial vanilla beans does not necessarily depend on the quantity of vanillin they contain; thus Tiemann and Haarmann found, in Mexican vanilla, 1.32 to 1.69 per cent, while Bourbon yielded from 0.75 to 2.9 per cent, and Java vanilla from 1.56 to 2.75 per cent of vanillin. Denner (1887) obtained 4.3 per cent from vanilla cultivated at Marburg (Flückiger, *Pharmacognosie des Pflanzenreichs*, 3d ed., 1891). West Indian vanillons contained 0.4 to 0.7 per cent of vanillin, together with a liquid aldehyde, probably benzoic aldehyde; when both are in prolonged contact with each other, an odor resembling heliotrope will be developed.

Benzoic acid, dusted over vanilla beans, with fraudulent intent, may be recognized, according to Messrs. Schimmel & Co. (1888), by abstracting the crystals with sodium carbonate, adding sulphuric acid and metallic magnesium or zinc; if the crystals are benzoic acid, the odor of oil of bitter almonds (benzoic aldehyde) will then be developed. Vanillin is also a constituent of many other vegetable products, such as Siam benzoin (Balsam of Peru, see H. Thoms, *Archiv der Pharm.*, 1899), the sugar beet, asparagus, several kinds of wood, the husks of oats, etc.

Action, Medical Uses, and Dosage.—Aromatic stimulant. Vanilla is said to exhilarate the brain, prevent sleep, increase muscular energy, and stimulate the sexual propensities. Useful, in infusion, in *hysteria*, *rheumatism*, and low forms of *fever*. It is also considered an aphrodisiac, powerfully exciting the generative system. Much used in perfumery, and to flavor tinctures, syrups, ointments, confectionery, etc. Dose, of the powder, from 8 to 10 grains; of the infusion, made in the proportion of ½ ounce to 1 pint of boiling water, ½ fluid ounce, 3 or 4 times a day. To pulverize it, the pods must be cut in small pieces, mixed with sugar, 4 parts, and pounded in an iron mortar, then sifted; the residue to be powdered with more sugar, and so on.

Related Plants.—A plant of the distinct genus SOBRALIA, collected by Prof. Rusby in the Andes, produces a pod which develops the odor of vanilla upon maturity (see *Jour. of Pharmacol.*, 1898, p. 29); likewise, the flowers of a certain orchid, growing in Switzerland, yield considerable quantities of vanillin.

The *Vanilla plant*, or *Southern vanilla*, is the *Liatris odoratissima*, Michaux. The odorous principle of its leaves is *coumarin* (see Charles Falkenhainer, *Amer. Jour. Pharm.*, 1899, p. 133; also see *Liatris*).

A similar odoriferous plant is *Angræcum fragrans*, Du Petit-Thouars, known in Mauritius and Réunion as *faham*. Its odoriferous principle is coumarin; its odor is that of vanilla, tonka, and melilot combined.

VAPORES.—INHALATIONS.

This class of preparations has been official in the *British Pharmacopœias*, but is not recognized in the present *British Pharmacopœia*, 1898. The preceding *British Pharmacopœia* gave directions for the following inhalations: (1) VAPOR ACIDI HYDROCYANICI—*Inhalation of hydrocyanic acid;* (2) VAPOR CHLORI—*Inhalation of chlorine;* (3) VAPOR CONINÆ—*Inhalation of conine;* (4) VAPOR CREASOTI—*Inhalation of creosote;* (5) VAPOR IODI—*Inhalation of Iodine;* and (6) VAPOR OLEO PINI SYLVESTRIS—*Inhalation of fir-wool oil.*

VERATRINA.—VERATRINE.

"A mixture of alkaloids obtained from the seed of *Asagræa officinalis* (Schlechtendal et Chamisso), Lindley (*Nat. Ord.*—Liliaceæ)"—(*U. S. P.*).

SYNONYM: *Veratria.*

Preparation.—The *British Pharmacopœia* (1898) directs the preparation of veratrine as follows: Take of "cevadilla of commerce, 2 pounds (Imp.), or 1 kilogramme (Metric); distilled water; alcohol (90 per cent); solution of ammonia, hydrochloric acid, of each, a sufficient quantity. Macerate the cevadilla with half its weight of boiling distilled water, in a covered vessel, for 24 hours; remove the cevadilla; squeeze it; dry it thoroughly in a warm place; then beat it in a mortar, and separate the seeds from the capsules. Reduce the seed to powder; moisten the powder with the alcohol; pack firmly in a percolator; pass the alcohol through the marc until the percolate ceases to be colored; concentrate the alcoholic solution by distillation, so long as no deposit forms, and pour the residue, while hot, into 12 times its volume of cold distilled water; filter through calico; wash what remains on the filter with distilled water, until the filtrate ceases to precipitate with the solution of ammonia. To the filtrate add solution of ammonia in slight excess; let the precipitate completely subside; pour off the supernatant liquid; collect the precipitate on a filter; wash it with distilled water until the filtrate passes colorless; distribute the moist precipitate through 12 fluid ounces (or 400 cubic centimeters) of distilled water; add gradually, with diligent stirring, sufficient hydrochloric acid to make the liquid feebly but persistently acid; add 60 grains (or 4 grammes) of the purified animal charcoal of commerce; digest with moderate heat for 20 minutes; filter; allow the liquid to cool; add solution of ammonia in slight excess, and when the precipitate has completely subsided pour off the supernatant liquid; collect the precipitate on a filter and wash it with cold distilled water until free from chloride; dry the precipitate, first by imbibition with filtering paper, and then by the application of warmth"—(*Br. Pharm.*, 1898). (For other processes, see this *Dispensatory*, preceding edition.)

Description and Tests.—The *U. S. P.* directs "a white or grayish-white, amorphous or semi-crystalline powder, odorless, but causing intense irritation and sneezing when even a minute quantity reaches the nasal mucous membrane; having an acrid taste, and leaving a sensation of tingling and numbness on the tongue; permanent in the air. Very slightly soluble in cold or hot water; soluble in 3 parts of alcohol at 15° C. (59° F.), and very soluble in boiling alcohol; also soluble in 6 parts of ether, and in 2 parts of chloroform. When heated to 175° C. (347° F.), veratrine melts, forming a light-brown liquid. Upon ignition, it is consumed, leaving no residue. An alcoholic solution of veratrine has an alkaline reaction upon litmus paper. With nitric acid, veratrine forms a yellow solution. On triturating veratrine with concentrated sulphuric acid, in a glass mortar, the yellow or orange-red solution exhibits, by reflected light, a greenish fluorescence, which becomes more intense upon the addition of more acid, while the liquid is deep red by transmitted light. On heating a small portion of veratrine with a few Cc. of hydrochloric acid, the liquid will acquire a deep-red color"—(*U. S. P.*). Veratrine is also dissolved by glycerin (1 in 96 , and olive oi (1 in 56). Bromine water immediately produces a purple color when added to a fresh sulphuric acid solution of veratrine.

Chemical Composition. Veratrine from sabadilla seeds is a mixture of alkaloids and their derivatives (see details, under *Sabadilla*). Care must be taken to distinguish between the different alkaloids bearing the same name, *veratrine*. The *veratridine* of Bosetti (*Amer. Jour. Pharm.*, 1883, p. 263; also see *Sabadilla*) is identical with the veratrine of Weigelin and E. Schmidt.

G. B. Frankforter and L. B. Pease (*Amer. Jour. Pharm.*, 1899, p. 130 found commercial specimens of veratrine to consist chiefly of an alkaloid identical with the *cevadine* of Wright and Luff; this substance was found associated with from 0.8 to 3.8 per cent of an alkaloid insoluble in ether.

Action, Medical Uses, and Dosage.—Locally, veratrine (or its salts) is an irritant. When applied in alcoholic solution, ointment or oleate, it excites a singular sense of heat and tingling, or prickling pain, which, however, does not last long, but is followed by a coolness and more or less numbness; there is seldom redness or vesication unless the preparation is strong and applied with brisk friction. Taken into the nostrils, even in minute quantity, it occasions severe coryza and excessive sneezing. Muscular twitching has resulted from its application in ointment to the face, and sometimes it gives rise to headache, nausea, griping, slight diarrhœa, and depression of the action of the heart. When swallowed it is a violent, irritant poison, causing great acrimony in the parts over which it passes, salivation, peculiar prickling numbness of tongue and mucous membranes, violent vomiting, profuse and sometimes bloody, and bilious diarrhœa (sometimes constipation); weak, irregular and quick pulse; cardiac depression; pallor of face and great faintness; cold sweats; muscular twitching and aching pain along the spine; contracted abdomen and pupils; and occasional extreme pruritis and tinglings which may persist for weeks. In medicinal doses it produces a feeling of warmth in the stomach and bowels, which extends to the chest and extremities. In poisoning by this agent, the stomach should be thoroughly evacuated, and tannin solutions freely given and pumped out. Stimulation should be resorted to to overcome the depression; for this purpose alcoholics, aromatic spirit of ammonia, ammonium carbonate, artificial respiration, etc., may be employed. Veratrine has been recommended internally in *nervous palpitation*, *palsy*, *epileptic convulsions*, *pertussis*, *gouty*, *rheumatic and neuralgic affections*, *dropsy*, etc.; but its efficacy in these affections, except in *sciatica* and *other forms of serere neuralgia*, is not well established. Besides, it is too dangerous a remedy for internal administration, and is seldom, if ever, so employed by Eclectic physicians. The dose is from $\frac{1}{12}$ to $\frac{1}{6}$ grain, 3 times a day, in pill form. One grain of veratrine may be mixed with 12 grains each of liquorice powder and extract of hyoscyamus, and made into 12 pills; one of these may be given every 3 or 4 hours. It is best used in the form of a salt, as the acetate, tartrate, citrate, or sulphate. Veratrine is more frequently used as a local application than as an internal remedy, and even then is considered by many a very dangerous agent. When so used it is chiefly to allay the pains of *superficial functional neuralgias*, for which it is less effective than aconitine, though the latter should be used only in extreme cases, and very cautiously at that. Veratrine is formed into an ointment, liniment, or tincture, in the proportion of from 5 to 40 grains of veratrine to 1 ounce of lard, or oil, etc., a small portion of which is to be rubbed on the affected part for 10 or 20 minutes each time, repeating the application twice a day. Not over 3 or 4 grains must be used in a day, and in ordinary cases only 1 or 2 grains. If the skin is tender or irritated, still less must be used; and if there be a cut or abrasion, it must not be used at all. It is also applied externally in the above-named forms of disease. The doses of veratrine recommended are: For internal use, $\frac{1}{120}$ to $\frac{1}{4}$ grain; endermically, $\frac{1}{8}$ to $\frac{1}{4}$ grain; hypodermatically, $\frac{1}{6}$ grain. The latter occasions much pain, and may produce a local abscess (see *Mixtures* and *Ointments*).

VERATRUM ALBUM.—WHITE HELLEBORE.

The rhizome and rootlets of *Veratrum album*, Linné.

Nat. Ord.—Liliaceæ (Melanthaceæ).

Common Name and Synonyms: *White veratrum; Rhizoma veratri, Radix hellebori albi.*

Illustration: Bentley and Trimen, *Med. Plants*, 285.

Botanical Source.—Veratrum album is a perennial herb, with a fleshy, oblong, somewhat horizontal, premorse rhizome, about the thickness of a finger, blackish or brownish-white externally, whitish or pale yellowish-white internally, having numerous fleshy, brownish-white fibers or true roots. The stem is straight, round, striated, and from 1 to 4 feet high. The leaves are alternate, plaited, broad-ovate, and acutish. The flowers are yellowish-white, green at the back, 8 lines in diameter, and produced in a terminal panicle; segments spreading, serrulate, and somewhat wavy. In other respects it resembles the *Veratrum viride* (L.).

History and Description.—White hellebore inhabits Europe, especially the Alpine and Pyrenean districts. Under the name *Veratrum californicum*, Durand, this plant is said to have been found in Colorado and other western states. The part used is the rhizome, though the whole plant is highly noxious. The dried root, as it occurs in pharmacy, consists of a single, double, or many-headed rhizome, cylindrical, or in the form of a truncated cone, from 2 to 4 inches by 1 inch, rough, corrugated, grayish or blackish-brown externally, having a faint, unpleasant odor, and a sweetish, bitter, and then intensely disagreeable, and permanently acrid taste. Diluted alcohol is its best solvent. Its powder is somewhat of an ash color.

Fig. 252.

Veratrum album.

Chemical Composition.—Much confusion, as to the active principles of the root of white hellebore, existed prior to the researches of Wright and Luff (*Jour. Chem. Soc.*, 1878, pp. 338–359, and 1879, pp. 405–426; also see *Amer. Jour. Pharm.*, 1878, p. 489, and 1879, p. 367). Contrary to previous statements by Pelletier and Caventou (1819), Weigand (1842), Weppen (1873), and, in accordance with the views of Dragendorff (1872 and Tobien (1877), these authors established the absence of *cevadine*, the active principle of sabadilla seed (see *Veratrina* and *Veratrum Viride*). They believe the poisonous properties of white hellebore to be due to an amorphous alkaloid, *veratralbine* ($C_{26}H_{43}NO_5$). In addition, the authors found three crystallizable alkaloids, *jervine* ($C_{26}H_{37}NO_4$), discovered by E. Simon, in 1837, and called by him *barytine*, because, like barium salts, it formed an almost insoluble sulphate; *pseudo-jervine* ($C_{29}H_{43}NO_7$); and *rubijervine* ($C_{26}H_{43}NO_3$).

The painstaking researches of G. Salzberger (*Archiv der Pharm.*, 1890, pp. 462–483) have thrown further light on this subject. The author discovered a crystallizable base (*protoveratrine*, $C_{32}H_{51}NO_{11}$) of enormous poisonous activity, and extremely sensitive to alkalies. It is permanent in the air, insoluble in water, benzol, petroleum ether, quite soluble in chloroform, and in boiling (96 per cent) alcohol, little soluble in cold ether, easily soluble in dilute acids, except acetic acid. Its alcoholic solution turns red litmus paper blue, and a trace of its powder excites violent sneezing. The crystals dissolve in concentrated sulphuric acid with greenish color, which turns blue, and, later, violet. Warming with concentrated sulphuric acid produces vapors of isobutyric acid, and the liquid turns dark cherry-red. About 0.03 per cent was obtained from the root. In addition, the author found the following crystallizable alkaloids, all being nearly insoluble in ether, and indications of other alkaloids existing in the root: *Protoveratridine* ($C_{26}H_{45}NO_8$), 0.005 per cent, almost insoluble in alcohol and ether, physiologically inert, and probably a decomposition product of protoveratrine; *jervine* (0.1 per cent crude alkaloid), *pseudo-jervine*, and *rubijervine* (0.005 per cent), which he found of the composition and the general properties assigned to them by Wright and Luff. *Jervine* is feebly toxic, and is the most abundant of the veratrum alkaloids. Its salts, with sulphuric, hydrochloric, and nitric acids are very little soluble in water. The two other bases are physiologically inert. Wright and Luff's *veratralbin* is considered by Salzberger as not sufficiently characterized chemically. The root also contains a green, fatty oil and a volatile oil of a delicious and permanent anise flavor.

Action, Medical Uses, and Dosage.—White hellebore is a violent irritant poison, occasioning, when snuffed up into the nostrils, severe coryza. When swallowed, it causes sore mouth, swelling of the tongue, gastric heat, and burning, severe vomiting, and often profuse diarrhœa. Vertigo, weakness, and tremors of the extremities, feeble pulse, loss of voice, dilatation of pupils, spasms of the ocular muscles, blindness, cold sweating, and mental disturbances are also produced. When it proves fatal, narcotic symptoms are superadded, such as prolonged stupor and convulsions. Gastro-intestinal inflammation has also been produced by it. When not fatal, distressing præcordial oppression persists for some time, and there are produced nervous and spasmodic symptoms and prolonged debility. It was formerly administered as an emetic and purgative in *insanity*, as a diaphoretic in *some diseases of the skin*, and as a sternutatory, in combination with some other powder to modify its action, in *headache*, *amaurosis*, and *ophthalmia*. Poisoning by white hellebore may be treated by coffee as a drink and in injection, with stimulants to overcome the depressed condition of the heart and arteries, and opiates and demulcents to relieve internal inflammation. At present it is rarely used, except in the form of decoction or ointment, as an external application to kill *lice*, and cure the *itch*, *pruritis*, and some other *cutaneous affections;* but, used thus, it is not always free from danger. It has been used for the cure of *gout*, as a substitute for the *Eau Médicinale of Husson;* 3 parts of the wine of white hellebore added to 1 part of laudanum, was given in doses of from ½ to 2 fluid drachms. Minute doses of a tincture of Veratrum album are efficient in bowel disorders, with gushing, watery evacuations, there being more or less cramp-like or spasmodic action in the muscular fibers of the intestines and abdominal walls. It has thus been employed in *cholera infantum*, *cholera morbus*, in both of which it also checks the vomiting, and in *Asiatic cholera.* For these uses the 3x dilution may be added to water in the proportion of 30 drops of the tincture to 4 fluid ounces of water, the dose of which, in severe cases, is a teaspoonful every 15 minutes. For its earlier uses, the dose of the powder is from 1 to 8 grains, gradually and cautiously increased, commencing with 1 grain; of the vinous tincture, from 20 to 60 minims. Its use always requires great care.

Specific Indications and Uses.—Gushing watery discharges from the bowels, with spasmodic or cramp-like action of the intestines and abdominal parieties; cold face; sunken eyes; body covered with cold sweat.

Related Species.—*Veratrum album* var. *Lobelianum*, Bernhardt (*Veratrum album* var. *viridiflorum* of Mertens and Koch), is a European plant closely related to white and American hellebore. Its chief difference consists in its having bracts of a greater length, and a simpler inflorescence, the blossoms of which are pale-green. Tobien (1877) found *jervine* and *veratroidine* in both the rhizome and young leaves of this species.

VERATRUM VIRIDE (U. S. P.)—VERATRUM VIRIDE.

"The rhizome and roots of *Veratrum viride*, Solander"—(*U. S. P.*) (*Veratrum album* var. *viride*, Baker; *Melanthium virens*, Thunberg).

Nat. Ord.—Liliaceæ.

Common Names and Synonyms: *American hellebore*, *Swamp hellebore*, *Indian poke*, *Itch weed*, *Green hellebore*, *Green veratrum; Veratri viridis rhizoma* or *radix.*

Illustration: Bentley and Trimen, *Med. Plants*, 286.

Botanical Source.—This plant has a perennial, thick and fleshy rhizome, its upper portion tunicated, its lower half solid, and sending forth a multitude of large, whitish roots. The stem is from 3 to 5 feet high, roundish, solid, striated, pubescent throughout the greater part of its length, and closely invested with the sheathing bases of leaves. The lower leaves are large, from 6 to 12 inches long, half as wide, oval, acuminate, pubescent, strongly plaited and nerved, the lower part of their edges meeting round the stem; the upper leaves are gradually narrower; the uppermost, or bracts, are linear and lanceolate; all alternate. The flowers are numerous, green, in compound racemes axillary from the upper leaves, and terminal; the whole forming a sort of panicle. Peduncles roundish and downy. Bracts are boat-shaped, acuminate, and downy. Pedicels many times shorter than the bracts. The perianth is divided into 6 green, oval, acute, nerved segments, of which the alternate ones are longest; all the segments are contracted at the base into a sort of claw with a thickened or cartilaginous edge. The stamens 6, with recurved filaments and roundish 2-lobed anthers. Carpels 3, cohering, with acute, recurved styles as long as the stamens. A part of the flowers are barren, and have only the rudiments of styles, so that the plant is strictly polygamous. The seed-vessel is composed of 3 capsules, united together, separating at top and opening on their inner side. Seeds flat, winged, and imbricated (L.).

History and Description.—This plant is so closely related to *Veratrum album*, the European species, that some botanists have regarded the two species as identical. Others have declared it a variety of the latter, while still others seem to regard it as distinct. Though very closely related, it differs somewhat in its constituents, probably sufficiently so as to retain it as a distinct species. American hellebore is indigenous to the United States and Canada, growing in swamps, low grounds, and moist meadows, usually associated with Skunk-cabbage (*Symplocarpus fœtidus*, Nuttall), and flowering in June and July. The medicinal virtues of the drug seem to reside in the rhizome alone. In this connection Mr. Frederick V. Coville, botanist to the *United States Department of Agriculture*, in a letter to J. U. Lloyd (Jan., 1899), writes: "I have never been able to understand clearly the poisonous character of this plant. Various of the older authors in the East have stated that the stems and leaves were poisonous. In the mountains of Oregon, however, where the plant grows in abundance, it is considered one of the very best of sheep foods, and passes under the name of *Wild Indian corn*. The sheep fatten on it in the spring and early summer. Either the western plant is a distinct species or variety, which I doubt, or the leaves and stems are not poisonous." At least the *dried* leaf-stalks which sometimes occur attached to the rhizome were found inert by Prof. Maisch, but contained a saponaceous principle (*Amer. Jour. Pharm.*, 1864, p. 98). The official part is the rhizome, which should be gathered in autumn, after the decay of the leaves. As it rapidly loses its virtues, it should be renewed annually, and kept in well-closed vessels. When fresh, it has a very strong, unpleasant odor; when dried, it is nearly inodorous, and has a sweetish-bitter taste, succeeded by a persistent acridity. Its physical and therapeutical properties strongly resemble those of the White hellebore (*Veratrum album*). The drug is officially described as follows: "Rhizome upright, obconical, simple or divided, from 3 to 8 Cm. ($1\frac{1}{5}$ to $3\frac{1}{5}$ inches) long, and 2 to 4 or 5 Cm. ($\frac{4}{5}$ to $1\frac{3}{5}$ or 2 inches) thick; externally, blackish-gray; internally, grayish-white; showing numerous short, irregular wood bundles. Roots emanating from all sides of the rhizome, numerous, shrivelled, light yellowish-brown, about 10 to 20 Cm. (4 to 8 inches) long, and 2 Mm. ($\frac{1}{12}$ inch) thick. Inodorous, but strongly sternutatory when powdered; taste, bitterish and very acrid"—(*U. S. P.*).

Fig. 253.

Veratrum viride.

Chemical Composition.—Thomas R. Mitchell (*Amer. Jour. Pharm.*, Vol. IX, 1837, p. 181) found the rhizome of Veratrum viride to contain gum, resin, starch, red coloring matter, wax, sugar, a bitter principle probably analogous to veratrine, and gallic acid. The alkaloidal constituents were subsequently studied by several investigators, with somewhat contradictory results. (For a summary of these researches see J. U. Lloyd, in *The Western Druggist*, Oct., 1897.) In 1879 Messrs. Wright and Luff found the alkaloids of Veratrum viride to consist to about one-half of *cevadine*, the sternutatory, ether-soluble alkaloid of sabadilla seeds; the other half consisted of the ether-insoluble alkaloids *jervine*, *pseudojervine*, and *rubijervine*, with a small quantity of *veratrine* and a trace of *veratralbine* (compare *Veratrum Album* and *Sabadilla*). The total quantity of alkaloids isolated by Wright and Luff was only 0.08 per cent. S. C. Pehkschen obtained from the rhizome 0.08 per cent of crude total alkaloids (*Amer. Jour. Pharm.*, 1891, pp. 196–200, from *Pharm. Zschr. f. Russland*); they consisted chiefly of *jervine*, with a small quantity of *veratroidine*, an ether-soluble alkaloid obtained by Charles Bullock in 1865 (see *Amer. Jour. Pharm.*, 1875, p. 449; also see A. Tobien, *ibid.*, 1878, p. 122).

Action, Medical Uses, and Dosage.—American hellebore exerts an influence upon the system quite similar to that of White hellebore (*Veratrum album*, which see). Veratrine does not represent the action of this plant, which contains but a small proportion of this body. Applied to the skin, veratrum is rubefacient, and to the nose, excites sneezing. Small doses of veratrum appear, at first, not to affect the frequency of the pulse, but to lower its force; it afterward slows the pulse, it becoming moderately full and soft, and remaining so, unless the patient, during this stage of depression, attempts to rise or makes any exertion when the pulse becomes very rapid, small, thready, and sometimes almost imperceptible. During the stage of depression, there is marked muscular weakness and relaxation, and nausea and vomiting take place, the contents of the stomach being evacuated first, and then those of the gall-bladder. Occasionally, a watery diarrhœa is caused by veratrum, sometimes amounting to hypercatharsis, but, as a rule, purging is not produced. The nausea produced by veratrum is intense, and the vomiting severe and often persistent, making it, therefore, an unsafe emetic. The most characteristic action of veratrum is its effects upon the movements of the heart and upon vascular tonus. The pulse-rate has been lowered to 35 beats a minute with this agent, a corresponding depression of force accompanying this action. When such depression is reached, it is seldom that emesis can be prevented. In large doses, it is a very dangerous agent, yet, singularly, fatalities from its use are rare. Toxic doses produce an exceedingly weak heart-action, almost indistinguishable, running pulse, reduced temperature, cold, clammy sweat, extreme retching, and incessant vomiting, dizziness, faintness, failure of sight, pupillary dilatation, complete muscular prostration, slow, shallow breathing, sleepiness, coma, and unconsciousness, with sometimes stertorous breathing. The prompt emesis induced by this agent, undoubtedly prevents lethal effects. The exact action of the alkaloidal constituents is yet undetermined, as well as the effect each produces in the sum total of the effects of the root. According to Wood, the drug is a spinal and arterial depressant having no direct action upon the spinal centers; the direct action of jervine upon the heart-muscle, and the stimulation of the inhibitory nerves by veratroidine lower the pulse-rate; the force of the heart-beat is lowered by the direct action of jervine upon the heart-muscle, while the same constituent, according to dose, produces a more or less complete vaso-motor paralysis. The depression of the spinal-motor centers is attributed to jervine. The emetic action of veratrum is said to be due to the combined action of veratroidine and the resin. Death from veratrum is caused by asphyxia. All vaso-motor depressants and all agents which diminish the vital force, favor the action of veratrum. Nausea is always the signal for suspension of the administration of the drug. In poisoning by veratrum, withdrawal of the drug and free stimulation will quickly overcome the depression. Large draughts of warm water may be given to encourage and assist emesis until the stomach has been thoroughly washed out. This should be followed by undiluted whiskey or brandy, to check the vomiting. Opium or morphine may be given by mouth or otherwise, ammonia and alcoholics may be used by enema or hypodermatically, and strychnine or digitalis may be given by the latter method. External heat, sinapisms, friction, etc., must be utilized, and, under no circumstances, must the patient be allowed to rise from the recumbent position, not even to raise the head to vomit.

Therapeutically, veratrum is a remedy of great value and power, though quite transient in its effects. Small doses do good work when indicated, but they must follow each other at short intervals, so that a continuous action may be kept up. Owing to its tendency to induce gastric irritability, with nausea, large doses are not tolerated, and small doses are contraindicated when the tongue becomes long and pointed and reddened at the tip, and nausea and other unpleasant gastric phenomena are present. Veratrum increases secretion from the lungs, kidneys, and liver, but depresses the circulatory system. It is not adapted to asthenic troubles, but proves an admirable remedy in *sthenic conditions*, with the full, bounding pulse. Early in the nineteenth century, Prof. Tully called attention to the value of veratrum in *gout*, *rheumatism*, etc., declaring it equal, if not superior, to colchicum. Dr. Osgood (1835) affirmed it to be an excellent agent in all diseases in which it is required to diminish the activity of the heart and arteries, and his observations have been subsequently confirmed. It not only lessens excited cardiac action, but lessens temperature and restores suppressed secretions. (For Norwood's account of the action of veratrum, see *American Dispensatory*, 17th and preceding editions.)

Veratrum is a positive arterial sedative in *sthenic inflammations* and *fevers*, when not contraindicated by gastric irritability. The popularity of veratrum, as a specific agent, is due most largely to the writings of Prof. J. M. Scudder, M. D., who believed that veratrum was preferable to aconite in *sthenic diseases*, *high grades of fever*, *pulmonary and other active inflammations* (see *Aconitum*). He declared it the remedy when there is a frequent, but free, action of the heart, where there is active capillary circulation, and in *serous inflammations*, when there is a full and hard pulse, a full and bounding pulse, or a corded or wiry pulse. In *determination of blood to the brain*, and in *active delirium*, he employed veratrum in conjunction with gelsemium. He also found it of service where it was desirable to increase the action of the excretory organs. He says of veratrum: "It lessens the frequency of the pulse in both large and small doses. In large doses, the sedative action is a real depression of life, and the circulation is really impaired. Such an action may be temporarily borne in sthenic fevers and inflammation, and may be attended with good results. Yet, as it can not be continued for any considerable length of time, and can only be resorted to in high grades of action, it is better to depend upon small doses, which improve innervation through the sympathetic, remove obstructions to the free circulation of blood, also irritability of the circulatory system, the power of which it increases. Veratrum, in small doses, gradually lessens the frequency and hardness of the pulse, and promotes a uniform and equal circulation."

Prof. Scudder further says of veratrum (*Specific Medication*, pp. 262–63): "In small doses, veratrum is a stimulant to all the vegetative processes. Acting through the sympathetic or ganglionic system of nerves, it removes obstruction to the capillary circulation, gives tone to the vascular system, and strength to the heart. As the obstacles to a free circulation are removed, and the vessels through which the blood is distributed and returned, regain their normal condition, there is less necessity for increased action upon part of the heart, and, as the power of the heart is increased, there is less necessity for frequent contraction. I give this as a theory of the action of veratrum, but whether true or not, there is no question with regard to the facts as above stated."

Veratrum is a remedy for active febrile and inflammatory diseases of the respiratory tract of the sthenic type. In these disorders, it moderates the flow of blood, increases secretion, allays nervous irritation, brings down the temperature, and subdues inflammation. The hard, full, bounding pulse is the guide here as elsewhere. Prof. Webster speaks of it as being specially indicated in the early stage of "inflammation of the area of distribution of the bronchial arteries." A gargle of veratrum is useful in *inflamed sore throat*. All *sthenic inflammations of the throat* are controlled by it. It is an excellent agent in *acute tonsilitis*, when indicated, and often painting the tincture alone upon the tonsils will check the disease. Very small amounts, however, should be used in this manner, and then only in the robust. Veratrum, when indicated by the full, bounding pulse, is an excellent sedative in *acute pneumonia* in the first stage, but only in markedly sthenic cases. The dose should be small and frequently repeated, until the temperature and circulation respond, when the pain will be lessened, nervous excitation allayed, secretion re-established, and cough controlled. It is equally of value in *pleurisy* (usually with bryonia), and in *acute bronchitis*, when specifically used. Veratrum is a valuable expectorant, and is of marked value in *chronic pulmonary affections*, to control the circulation, and thereby regulate the temperature, besides acting as a powerful and efficient alterative. In *phthisis*, especially in the early stage, it controls the violent circulation and temperature, facilitates expectoration, and exerts a beneficial influence over the sympathetic system, controlling restlessness and excitement, and quieting cough. It is very frequently of service in *chronic bronchitis*, and in *chronic pneumonia*. It is valuable in *hæmoptysis*, when the circulation is strong and violent. Prof. Howe regarded it as one of the best alteratives that could be used in chronic lung troubles, being especially valuable in *pulmonary consumption* for this, and for the control of the inflammatory condition.

When indicated, veratrum is a remedy of great power in *peritonitis*, especially *puerperal peritonitis* and *pelvic peritonitis*, from septic absorption. Here the inflammation must be speedily checked, and quite large doses may be required—2 drops of specific veratrum may be given every ½ hour (if it does not provoke nausea), and continued until sedation is effected, when the remedy may be continued in fractional doses. Veratrum has won laurels in *peritoneal inflammations*. It is also a remedy of importance in properly-selected cases of *nephritis*, *cystitis*, *hepatitis*, *ovaritis*, and *orchitis*. For inflammations, arising from blows or kicks upon the abdomen, it is the best-known remedy. It is often useful in active forms of *acute gonorrhœa*, and may prevent *chordee*, and, in *acute inflammatory rheumatism*, it may be given to control pain and promote elimination. Veratrum has been justly praised as a remedy for *erysipelas*. It may be used both topically and internally. It is best adapted to that form showing tumefaction and redness, simulating ordinary inflammations. It has been successfully used, internally and locally, for the relief of *poisoning by Rhus Toxicodendron*. *Boils, carbuncles, inflamed pimples, felons, ulcers*, with heat and tumefaction, *cellular inflammations*, and *labial herpes* are well treated by painting specific veratrum upon them.

Prof. A. J. Howe stated that, "as an alterative, Veratrum viride takes a high rank. It improves the appetite, and favors assimilation by exciting to action the lacteals and lymphatic system generally. In *scrofula, constitutional syphilis, cancer*, and *tetter*, it can be employed as an internal remedy to great advantage. It tends to correct the menstrual function, restraining a too frequent and profuse flow, and exciting to greater activity a scanty and tardy menstruation." Veratrum is a useful agent in some nervous disorders. "It relieves irritation of the nervous system, by lessening the momentum of blood to and through the nerve centers" (Scudder). When *convulsive disorders* depend upon an excited circulation, it proves a powerful remedy. Few remedies have been more praised than veratrum in *puerperal eclampsia*. There is marked cerebral engorgement, and the indications for veratrum must be present, as in other disorders, for one to get good results from this agent. The dose must be quite large, and be regulated according to the sedation produced. It is of value in other forms of convulsions, especially in children, when active cerebral hyperemia is a feature. It is of special value in undue *excitement of the spinal nervous system*, in *spinal irritation, spinal convulsions, cerebro-spinal meningitis*, and *acute mania*, all with excited circulation. When *neuralgia* and *headache* are due to irritation of the nerve centers, with hyperemia, it proves a useful drug; usually, however, it is of little value in headache, unless accompanied with elevation of temperature. It will restore quiet and allow sleep in *delirium tremens*, when the pulse is full and bounding, and the eyes red and bloodshot, with evidence of inflammation" (Locke).

Beginning with small doses, and progressively increasing to 12 drops of the tincture, and again reducing the dose, veratrum has been accredited with favorably influencing *exophthalmic goitre*. Veratrum has been given with digitalis in the early stage of *dropsy*, where there is rapid heart-action, and a sedative is required. It is a good remedy in *aneurism*, to retard the velocity of the blood-current, and to reduce the vaso-motor tonus. *Heart disorders* are often relieved by it. Thus it controls *palpitation*, with violent circulation, and especially the irritable heart, produced by the use of tobacco. Palpitation, due to *cardiac hypertrophy*, is quieted by it, when valvular incompetence is not a factor. "In these cases, the pulse is full, strong, and intense, the carotids pulsate forcibly, the eyes are bloodshot, and there is cough, headache, and weight in the upper epigastrium, while the heart may beat so violently as to shake the bed, and sleep is entirely prevented. This remedy relieves the excitement, the heart-action becomes normal, the cough improves, and the patient is in every way better" (Locke). The dose for this purpose is 1 drop, in water, 5 or 6 times a day.

Prof. Foltz (*Dynam. Therap.*) always employs veratrum after cataract operations, and uses, locally, for *mastoid disease*, the following: R Aconite, veratrum, āā, flʒii to flʒiv; aqua, fl℥iv. Mix. The dose of tincture of veratrum is from 1 to 10 drops (gradually increased until some effect is produced), every 2, 3, or 4 hours; of the extract, or inspissated juice (both of which are seldom used), ¼ grain, carefully increased as required; of the powdered root (seldom used), from 4 to 10 grains; of the fluid extract, from a fraction of a minim to 5 minims; of specific veratrum, from a fraction of a minim to 5 minims.

Specific Indications and Uses.—Pulse frequent and full; tissues full, not shrunken; surface flushed with blood; pulse rapid, bounding; pulse rapid, full, corded, or wiry; marked arterial throbbing; increased arterial tension, with bloodshot eyes; sthenic fevers and inflammations; erysipelas, appearing like ordinary inflammation; red stripe along center of tongue; irritation of nerve centers, due to an excited circulation; convulsions from active, cerebral hyperemia.

VERBASCUM.—MULLEIN.

The leaves and tops of *Verbascum Thapsus*, Linné (*Verbascum Schraderi*, G. Meyer). *Nat. Ord.*—Scrophulariaceæ.

Botanical Source.—Mullein is a biennial plant, with a straight, tall, stout, woolly, generally simple stem, occasionally with 1 or 2 branches above, winged by the decurrent bases of the leaves, and from 3 to 5 feet high. Its leaves are alternate, oblong, acute, decurrent, indented at the margin, rough, and densely tomentose on both sides. The flowers are of a golden-yellow color, rotate, nearly sessile, in a dense, spiked, club-shaped raceme; calyx 5-parted and downy; corolla 5-lobed, rotate, lobes broad, rounded, and somewhat unequal; stamens 5, the two lower smooth, the rest downy. Capsule or pod ovoid-globose, 2-valved, and many-seeded (W.—G.).

Fig. 254.

Verbascum Thapsus.

History, Description, and Chemical Composition.—Mullein is common to the United States, growing in recent clearings, along the sides of roads, in uncultivated fields, etc., flowering from June to August. Some botanists consider it to have been introduced from Europe. The leaves and flowers are the parts used. They have a faint, rather pleasant odor, resembling that of a mild narcotic, and a somewhat bitterish, albuminous taste, and yield their virtues to boiling water. The leaves of *V. Thapsus* contain a trace of volatile oil, wax, some tannin, resin soluble in ether (0.78 per cent), resin insoluble in ether (1 per cent), sugar, etc., and an amorphous, non-glucosidal, bitter principle, soluble in water, ether, alcohol, and chloroform (A. Latin, *Amer. Jour. Pharm.*, 1890, p. 71). The flowers, according to E. L. Janson (*ibid.*, p. 600), besides mucilage, dextrose, etc., contain glucosidal coloring matters, mixed with resins; the seeds, which have a somewhat acrid taste, yielded 20.75 per cent of a green, fatty oil; their acrid principle is soluble in alcohol, water, and petroleum ether. The corolla of *Verbascum phlomoides*, Linné, and *Verbascum thapsiforme*, Schrader (*Verbascum Thapsus*, G. Meyer), are the official species of the *German Pharmacopœia*.

Action, Medical Uses, and Dosage.—Mullein is demulcent, diuretic, anodyne, and antispasmodic. It is likewise said to possess marked antiperiodic virtues. Besides, it is mildly nervine, controlling irritation, and favoring sleep. Upon the upper portion of the respiratory tract its influence is pronounced, particularly where the larynx and trachea are involved. The infusion is useful in *coughs, protracted colds, catarrh, hemoptysis, diarrhœa, dysentery*, and *piles*. It is applicable to dry, hoarse coughs, which occur chiefly at night, as well as to cough associated with an abundant catarrhal discharge. Its diuretic properties are rather weak, yet it is very useful in allaying the acridity of urine, which is present in many diseases. It may be boiled in milk, sweetened, and rendered more palatable by the addition of aromatics, for internal use, especially bowel complaints. A fomentation of the leaves also forms an excellent local application for *inflamed piles, ulcers*, and *tumors*. The leaves and pith of the stalk form a valuable cataplasm in *white swellings*, and when infused in hot vinegar or water it makes an excellent poultice to be applied to the throat in *tonsilitis, malignant sore throat*, and *mumps*. The seeds, it is said, will rapidly pass through the intestines, and have been successfully used in *intestinal obstructions*. They are narcotic, and have been used in *asthma, infantile convulsions*, and to poison fish. The infusion may be drank freely. The flowers, placed in a well-corked bottle, and exposed to the action of the sun, are said to yield an excellent relaxing oil. This oil is also valuable in some cases of *deafness*, used locally for its effect upon the membrana tympani, and upon the secretion of cerumen. The same oil, in doses of 1 to 10 drops, is said to give excellent results in *nocturnal enuresis* and in *vesical irritation*, caused by alkaline urine; it is also reputed a good agent to control painful micturition, in *lithæmia, chronic cystitis*, and *urinary calculus*. The leaves, dried and smoked like tobacco, are often useful in *asthma* and *laryngeal affections*. The dose of specific verbascum is from 1 to 30 drops.

Specific Indications and Uses.—To quiet nervous irritation, bronchial irritation and cough, and urinary irritation with painful micturition.

VERBENA.—VERVAIN.

The root of *Verbena hastata*, Linné.

Nat. Ord.—Verbenaceæ.

COMMON NAMES: *Common vervain, Wild hyssop, Simpler's joy, Vervain.*

Botanical Source.—Vervain, sometimes known by the names of *Wild hyssop*, or *Simpler's joy*, is an erect, tall, elegant, and perennial plant, with an obtusely 4-angled stem, 3 or 4 feet high, having opposite, paniculate branches above. The leaves are opposite, petiolate, lanceolate, acuminate, rough, and incisely serrate; the lower ones are often lobed, or somewhat hastate. The flowers are small, purplish-blue, sessile, tetrandrous, in long, erect, slender, imbricated, terminal and axillary, panicled spikes. Calyx 5-toothed; corolla funnel-form; limb 5-cleft, and nearly equal; seeds 4 (W.—G.).

History and Description.—Vervain is indigenous to the United States, growing along roadsides, and in dry, grassy fields, flowering from June to September. The root is the part used; it is woody and fibrous, faintly odorous, and of a bitter, somewhat astringent, nauseous taste, and imparts its properties to water. Sometimes the leaves are used instead of the root, but they are less active.

Action, Medical Uses, and Dosage.—Vervain is tonic, emetic, expectorant, and sudorific. In small doses a tincture of verbena relieves gastric irritation. As an emetic and sudorific it has proved beneficial in *intermittent fever*, given in warm infusion or in powder. In all cases of *colds* and *obstructed menstruation* it may be used as a sudorific. Taken cold, the infusion forms a good tonic in some cases of *debility*, *anorexia*, and during *convalescence from acute diseases*. It has been reputed valuable in *scrofula*, *visceral obstructions*, *gravel*, and *worms*. The following application has been recommended as effectual in promoting the absorption of the blood effused in *bruises*, and in allaying the attendant pain: Take of vervain, senna, and white pepper, of each, equal parts. Make a cataplasm by mixing with the white of eggs. Dose of the powdered root, from 20 to 40 grains; of the infusion, from 2 to 4 fluid ounces, 3 or 4 times a day, or oftener if it is desired to cause emesis.

Related Species.—There are several species of Verbena, as the *V. urticæfolia*, Linné, or *Nettle-leaved vervain*, with white flowers; the *V. officinalis* var. *spuria*, Linné, with blue flowers, and others, the roots of which possess similar properties, but in a milder degree than the *V. hastata*. The root of *V. urticæfolia*, boiled in milk and water, with the inner bark of *Quercus alba*, and the decoction drank freely, is said to be efficacious in cases of *poisoning by Rhus Toxicodendron*. The root of *V. urticæfolia*, Linné, according to R. M. McFarland (*Amer. Jour. Pharm.*, 1892, p. 401), contains a glucosid having the nauseous, bitter taste of the drug; it is insoluble in ether and petroleum ether, soluble in alcohol and chloroform. Resins and an acid crystalline principle, mucilage, sugar, etc., were also present. The *V. officinalis*, Linné, is a European plant, possessing similar properties with the above, but less active. (Regarding useful plants of Verbenaceæ, see Prof. Maisch, *Amer. Jour. Pharm.*, 1885, pp. 330–335.)

Agnus Castus (*Vitex Agnus Castus*, Linné) (*Nat. Ord.*—Verbenaceæ), *Chaste tree*.—Mediterranean Europe. A small plant of disagreeable odor, bearing terminal spikes of blue or purple flowers, and having berries somewhat like peppercorns, also possessing a pungent taste. Landerer (1835) found the fruit to contain a volatile principle, an acrid oil, and a crystalline, bitter substance named *viticin* and *castin* (see *Amer. Jour. Pharm.*, 1885, p. 332). A tincture of the fresh berries is employed. This agent is reported galactagogue and emmenagogue, and is also said to repress the sexual passions, for which purpose the ancient Athenian women employed it. It has been suggested in small doses in *impotence* and *sexual melancholia*. It is probably a remedy for *sexual irritability*, with nervousness, or melancholia, or mild dementia. A tincture of the root of *Castus indicus* has been employed as an antidote to *venomous bites* and *stings*, and in drop doses has been given for giddiness and salivation.

VERBESINA.—VERBESINA.

The leaves and tops of *Verbesina virginica*, Linne.

Nat. Ord.—Compositæ.

COMMON NAMES: *Crown beard*, *Gravel weed*.

Botanical Source.—This is a tall, perennial plant, found growing in open situations in the southern part of the United States. It has a pubescent, branched stem, which is winged by the decurrent leaves, and grows from 3 to 6 feet high. The alternate leaves are ovate, downy beneath, and irregularly toothed or lobed. They taper at the base to a winged leaf-stalk, and the lower ones are decurrent on the stem. The flower-heads are numerous, and borne in dense, compound terminal corymbs. They have pale-yellow disks, and a few white, oval, fertile rays. The fruit is a flattened, narrowly-winged achenium, bearing a couple of erect awns. The genus Verbesina is an extensive family of American plants, found mostly in Mexico and South America. Three species are indigenous to the United States, *V. virginica*, Linné; *V. Siegesbeckia*, Michaux; and *V. sinuata*, Elliott: all natives of the southern states. Of their chemical constituents nothing is known.

Action, Medical Uses, and Dosage.—This article was introduced into our materia medica in 1880. According to Dr. J. C. Kendrick, of Texas, who has made extensive use of it in his practice, a strong decoction proves a certain diuretic; he has found it almost a specific in *gravel* and in *vesical tenesmus*. He believes that it exerts a solvent effect upon *calculi in the bladder*, but it will require repeated and careful trials before such a belief can be accepted; nevertheless, it certainly deserves to be tested in the cases he has named. The decoction may be used freely.

Related Species.—*Verbesina sinuata*, Elliott. This plant has been found to possess antisyphilitic properties. The root is made into an infusion, which must be drank freely and as largely as the stomach will bear. It is somewhat spicy and agreeable to the taste, and is reputed efficient in both the primary and constitutional forms of the disease.

VERNONIA.—IRON WEED.

The root of *Vernonia fasciculata*, Michaux.

Nat. Ord.—Compositæ.

Botanical Source.—This is an indigenous, perennial, coarse, purplish-green weed, with a tall, striate or grooved, tomentose stem, from 3 to 10 feet in height. The leaves are 4 to 8 inches long by 1 or 2 inches broad, narrow lanceolate, tapering to each end, serrulate, alternate, and smooth above; the lower ones are petiolate. The flower-heads are numerous, in a compact or loose, somewhat fastigiate cyme. The corolla is showy, dark-purple, tubular, and twice as long as the involucre. The involucre is smooth, and ovoid-campanulate; scales appressed, all but the lowest rounded and obtuse, and without appendages (W.—G.).

History.—Iron weed is a very common plant in the western states, growing in the woods and prairies, and along river streams, and flowering from July to September. The root, which is the part used, is bitter, and imparts its properties to water or alcohol.

Action, Medical Uses, and Dosage.—Iron weed is a bitter tonic, deobstruent, and alterative. In powder or decoction, the root is beneficial in *amenorrhœa*, *dysmenorrhœa*, *leucorrhœa*, and *menorrhagia*. In *intermittent*, *remittent and bilious fevers*, the decoction or a saturated tincture has been recommended. Said to have been useful in *scrofula*, and some *cutaneous diseases*. Dose of the decoction, 1 to 2 fluid ounces; of the tincture, 1 to 2 fluid drachms. The leaves or powdered root in the form of poultice make an excellent discutient application to *tumors*.

Related Species.—*Vernonia Noveboracense*, Willdenow, growing in the eastern, western and middle states, and its variety, *V. præalta*, bearing purple flowers, and the *V. tomentosa*, with some other species possess similar medicinal properties (see *Vernonia anthelmintica*, under *Spigelia*). The root of *V. nigritiana*, Oliver, of west Africa, is used in Senegambia, under the name of *batiatior*, as a febrifuge. It contains the glucosid *vernonin* (Heckel and Schlagdenhauffen, *Amer. Jour. Pharm.*, 1889, p. 40).

VERONICA.—SPEEDWELL.

The tops and leaves of *Veronica officinalis*, Linne.

Nat. Ord.—Scrophulariaceæ.

Botanical Source.—This is a roughish-pubescent plant, the stem of which is prostrate, rooting at the base, and from 6 to 12 inches long, with ascending branches. The leaves opposite, vary from ovate to obovate, generally elliptical, short-petioled, obtuse, serrate, mostly narrowed to the base, and 1 inch or 1½ inches long. The flowers are pale-blue, in long, axillary, erect, dense, many-flowered, pedunculate racemes, the pedicles being shorter than the calyx. Calyx 4-parted; corolla rotate. The pods or capsules are puberulent, obovate-triangular, emarginate, strongly flattened, and several-seeded (W.).

History, Description, and Chemical Composition.—Speedwell is a native of Europe, and now very common in North America, growing on dry hills, and in woods and open fields, flowering from April to August. The leaves and tops are employed; they have a faint odor, and a slightly bitter and aromatic taste; water extracts its virtues. J. B. Enz (Wittstein's *Vierteljahrsschrift*, 1858, p. 182; also see F. F. Mayer, *Amer. Jour. Pharm.*, 1863, p. 299) found the fresh juice and extract from the herb to contain a bitter principle soluble in water and alcohol, but scarcely in ether; precipitable by salts of lead, but not by tannin; an acrid principle and a red coloring matter, all contained in the precipitate with neutral acetate of lead, together with malic, tartaric, and citric acids; also, acetic and lactic acids, and a tannin striking a green color with iron; a crystallizable, apparently fatty acid, soluble in alcohol and ether; a soft, dark-green, bitter resin, and mannit. Prof. Mayer found in the dry herb an alkaloid, and obtained a very small yield of a saponaceous principle.

Action, Medical Uses, and Dosage.—Speedwell is an expectorant, alterative, tonic, and diuretic. It was formerly administered in *coughs*, *catarrhs*, *renal*, and *skin diseases*, *jaundice*, etc. Likewise reputed beneficial in *scrofula*, and other diseases where alteratives are indicated, especially the *V. peregrina;* to be given internally, and used as a wash.

Related Species.—*Veronica Beccabunga*, Linné, or *Brook-lime*, is found in most of the eastern and northern states, growing in small streams and near water-courses; this, together with the *Veronica Americana*, Schweinitz; *V. Anagallis*, Linné; *V. scutellata*, Linné; *V. agrestis*, Linné, *Neckweed;* and *V. peregrina*, Linné, possess somewhat similar properties. They all impart their virtues to water. *V. parviflora*, Vahl, indigenous to New Zealand, yields a drug called *koroniko*, which J. Jardine (*Amer. Jour. Pharm.*, 1883, p. 576) praises as being useful in *chronic dysentery*. *Veronica Beccabunga* is antiscorbutic, diuretic, febrifuge, and emmenagogue, and is said to be beneficial in cases of *amenorrhœa*, *scurvy*, *dyspepsia*, *fevers*, and *coughs*. It relieves irritation in several *chronic skin diseases*. The decoction of the plants may be used freely. Brook-lime has no odor, but a saline, bitterish, feebly pungent taste.

VIBURNUM OPULUS (U. S. P.)—VIBURNUM OPULUS.

"The bark of *Viburnum Opulus*, Linné"—(*U.S.P.*) (*Viburnum Oxycoccus*, Pursh).
Nat. Ord.—Caprifoliaceæ.

COMMON NAMES: *High cranberry*, *Viburnum* (*Pharm.*, 1880), *Cramp bark*.

Botanical Source.—This is the *Viburnum Oxycoccus* of Pursh. It is a nearly smooth and upright shrub or small tree, rising 5 to 12 feet in height. The stems are several from the same root, and branched above. The leaves are 3-lobed, 3-veined, broadly wedge-shaped or truncate at base, and broader than long; the lobes divaricate, acuminate, crenately-toothed on the sides, and entire in the sinuses; the petioles have 2 or more glands at the base, and are channelled above. The flowers are white or reddish-white, in rayed, pedunculated cymes; marginal flowers large and sterile; inner flowers much smaller and fertile. Fruit ovoid, red, very acid, ripens late, and remains upon the bush after the leaves have fallen. It resembles the common cranberry, and is sometimes substituted for it. The *V. roseum*, *Snowball*, or *Guelder-rose tree*, is a cultivated European variety, with the whole cyme turned into large sterile flowers (W.—G.). This variety is now largely cultivated in American gardens for its beauty.

History and Description.—This is a handsome, indigenous shrub, growing in low, rich lands, woods, and borders of fields, in the northern part of the United States and Canada, flowering in June, and presenting at this time a very showy appearance. The flowers are succeeded by red and very acid berries, resembling low cranberries, and which remain through the winter. The bark is the official part. As demanded by the *U. S. P.*, it is in "flattish or curved bands, or occasionally in quills, sometimes 30 Cm. (12 inches) long, and from 1 to 1.5 Mm. ($\frac{1}{25}$ to $\frac{1}{16}$ inch) thick; outer surface ash-gray, marked with scattered, somewhat transversely elongated warts of a brownish color, due to abrasion, and more or less marked with blackish dots, and chiefly in a longitudinal direction with black, irregular lines or thin ridges; underneath the easily-removed corky layer of a pale-brownish or somewhat reddish-brown color; the inner surface dingy-white or brownish; fracture tough, the tissue separating in layers; inodorous; taste somewhat astringent and bitter"—(*U. S. P.*). It has been frequently put up by the Shakers, and is then sold somewhat flattened from pressure. It yields its properties to water or diluted alcohol. *Viburine* is the name that was once given to a secret nostrum, purporting to be obtained from this plant. (For the histology of this species and *V. prunifolium*, see L. E. Sayre, *Amer. Jour. Pharm.*, 1895, p. 386, and 1896, p. 225; also see R. H. Denniston, *Pharm. Archives*, 1898, p. 137.)

Chemical Composition.—The berries of *V. Opulus* contain *valerianic acid* (Dumas; *phocenic acid* of Chevreul, identical with the volatile acid from the fat of the dolphin), and a red coloring matter (Leo, 1834). The bark of this species also contains valerianic acid, identified by Monro (1845), and previously believed to differ from it (*viburnic acid* of Krämer, 1834). In addition, H. Krämer found iron-bluing tannin, and a peculiar, bitter, neutral principle (*viburnin*), an amorphous, white powder, soluble in ether and alcohol, slightly soluble in water (see review of "The Useful Species of Viburnum," by Prof. Maisch, *Amer. Jour. Pharm.*, 1878, p. 49).

Action, Medical Uses, and Dosage.—High cranberry bark is a powerful antispasmodic, and, in consequence of this property, it is more generally known among American practitioners by the name of *Cramp bark*. It is very effective in relaxing *cramps* and *spasms* of all kinds, as *asthma*, *hysteria*, *cramps of the limbs* or other parts in females, especially during pregnancy, and it is said to be highly beneficial to those who are subject to *convulsions during pregnancy*, or at the time of parturition, preventing the attacks entirely, if used daily for the last 2 months of gestation. Like Viburnum prunifolium, it is a remedy for the prevention of *abortion*, and to prepare the way for the process of parturition. It allays uterine irritation with a tendency to terminate in *hysteria*, while in the neuralgic and spasmodic forms of *dysmenorrhœa*, it is a favorite remedy with many physicians. It has been used in *spasmodic contraction of the bladder*, and in *spasmodic stricture*. The doses employed are from a fraction of a drop to 20 drops of specific viburnum. The action of this agent closely resembles that of the black haw, and there is reason to believe that they are often used interchangedly for similar purposes (see *Viburnum Prunifolium*). The following forms an excellent preparation for the relief of spasmodic attacks, viz.: Take of cramp bark, 2 ounces; scullcap, skunk-cabbage, of each, 1 ounce; cloves, ½ ounce; capsicum, 2 drachms. Have all in powder, coarsely bruised, and add to them 2 quarts of good sherry or native wine. Dose, 1 or 2 fluid ounces, 2 or 3 times a day. Dose, of the decoction or vinous tincture of cramp bark, 2 fluid ounces, 2 or 3 times a day; specific viburnum, $\frac{1}{16}$ to 30 drops. "It may be proper to remark here that I have found a poultice of low cranberries very efficient in *indolent and malignant ulcers;* and, applied round the throat in the inflammation and swelling attending *scarlatina maligna*, and other diseases, it gives prompt and marked relief. Probably the high cranberries will effect the same results" (J. King). (See *Vaccinium Macrocarpum* and *Cataplasma Oxycocci*.)

Specific Indications and Uses.—Cramps; uterine pain, with spasmodic action; pain in thighs and back; bearing down, expulsive pains; neuralgic or spasmodic dysmenorrhœa. As an antiabortive.

VIBURNUM PRUNIFOLIUM (U. S. P.)—BLACK HAW.

"The bark of *Viburnum prunifolium*, Linné"—(*U. S. P.*).

Nat. Ord.—Caprifoliaceæ.

COMMON NAMES: *Black haw*, *Sloe*, *Stag bush*, *Sloe-leaved viburnum*.

Botanical Source.—This shrub or tree, also known by the name of *Sloe*, is indigenous to this country, growing to the height of from 10 to 20 feet. Its branches are spreading, some of them often stinted and naked, giving the plant an unthrifty aspect. The leaves are about 2 inches long, nearly as wide, roundish-ovate, smooth, shining above, obtuse at both ends, acutely serrate, with uncinate teeth, and situated on short petioles, slightly margined with straight, narrow wings. The flowers are white, in large, terminal, sessile cymes. The fruit consists of ovoid-oblong, sweet, edible, blackish berries (W.—G.). It contains a single stony nut. There is a variety in the south called the Possum haw (*V. prunifolium* var. *ferrugineum*), differing from the black haw in having lance-oval leaves, rusty beneath, and tasteless fruit.

History and Description.—*Viburnum prunifolium* belongs to the honey-suckle family—an extensive family, numbering about 80 species, distributed over North and South America, Europe, and Asia. About 12 species are indigenous to the United States, forming, in the northern states, a considerable portion of the undergrowth of woods. The *V. prunifolium*, the most valuable of the genus Viburnum, is popularly known as the Black haw, the Sloe-leaved viburnum, and the Sloe. It grows from Connecticut to Illinois, and in the south, where it is most abundant. It thrives in dry woods and thickets, and on rocky hillsides in fertile soil, reaching a height of from 10 to 20 feet. The branches are spreading, somewhat stunted, and often give to the shrub an unthrifty appearance. It flowers from March to June, and presents, at this time, a very handsome appearance. It is usually found in woods and thickets. The bark of the roots, stem, and branches are medicinal, but that of the root is preferred by Eclectics. It is fawn-colored externally, with a feeble odor, and a very bitter, slightly aromatic taste. As described by the *U. S. P.*, viburnum occurs "in thin pieces or quills, glossy purplish-brown, with scattered warts, and minute black dots; when collected from old wood, grayish-brown; the thin, corky layer easily removed from the green layer; inner surface whitish, smooth; fracture short; inodorous, somewhat astringent, and bitter"—(*U. S. P.*). Water or alcohol extracts its properties. The leaves of the black haw have been used for tea. The bark is readily pulverized when dry, and affords a reddish-colored powder, tinged with gray. (As to its distinction from *V. Opulus*, see literature indicated under the latter; also see *Chemical Composition*, below.)

Chemical Composition.—According to analysis by Herman Van Allen (*Amer. Jour. Pharm.*, 1880, pp. 439–443), the bark of *V. prunifolium* contains a brown, bitter resin; a greenish-yellow, bitter resin, identical with Krämer's *viburnin* (see *V. Opulus*); a volatile acid, answering to all the tests of *valerianic acid;* tannic, oxalic, citric, and malic acids, sulphates and chlorides of calcium, magnesium, potassium, and iron. Prof. L. E. Sayre (*Amer. Jour. Pharm.*, 1895, p. 392) reports on the quantity of chloroformic extract obtainable from *V. Opulus* (5.98 per cent) and *V. prunifolium* (9.46 per cent), and their solubilities toward water, petroleum spirit, and alcohol (80 per cent), successively employed. Water extracted only about 0.1 per cent in both cases; petroleum spirit removed from the former 1.66 per cent, from the latter, 7.8 per cent; alcohol then extracted 2.44 per cent of resin from the former, and only 0.75 per cent from the latter.

Action, Medical Uses, and Dosage.—Of the physiological action of this agent little is known. To the taste it is bitter, and slightly aromatic. Large doses sometimes produce nausea and vomiting, and by some observers is said to produce contraction of the uterine muscular tissue. That it has a decided affinity for the female reproductive organs is well established. By Dr. D. L. Phares, of Mississippi, who brought the remedy forward, it was described as having nervine, antispasmodic, tonic, astringent, and diuretic properties. To these Prof. King adds alterative. Decoctions of the drug were formerly used as a gargle in *aphthæ*, as a wash in *indolent ulcers*, and in various *ophthalmic disorders*. By its astringency it has proved of value in *diarrhœa* and *dysentery*. It has been recommended in *jaundice*, but we have a better agent in chionanthus. *Palpitation of the heart* is said to have been relieved by it. Such cases are sympathetic disturbances, generally near the menstrual period. Its principal use at the present day is in disorders of the female organs of reproduction. As a uterine tonic it is unquestionably of great utility. It restores normal innervation, improves the circulation, and corrects impaired nutrition of these organs. In the *hyperæsthetic*, or *irritable condition of the uterus* incident to highly nervous women, or as the result of overwork, it will be found an admirable agent. It is called for in weakened conditions of the body, with feeble performance of the uterine functions. In *dysmenorrhœa*, with deficient menses, *uterine colic*, and in those cases where there are severe lumbar and bearing-down pains, it will prove an efficient drug. Helonias is also an excellent agent in the latter condition. It is specifically indicated in cramp-like menstrual pains—pains decidedly expulsive and intermittent in character—and in the various painful contractions of the pelvic muscles, so common to disorders of women. *Uterine congestion* and *chronic uterine inflammation* are often greatly relieved by specific black haw. It acts promptly in *spasmodic dysmenorrhœa*, especially with excessive flow. *Menorrhagia* due to malaria is promptly met with Viburnum prunifolium. It is a good remedy for *uterine hemorrhage*, attending the menopause. In *amenorrhœa* in pale, bloodless subjects, the menses are restored by it. *Cramps of limbs* attending pregnancy yield to both black haw and cramp bark. It is considered almost specific for *cramp in the legs*, not dependent on pregnancy, especially when occurring at night. The condition for which black haw is most valued is that of *threatened abortion*. It is the most prompt drug in the materia medica to check abortion, provided the membranes have not ruptured. In all cases of *habitual abortion* it should be given in small doses for a considerable length of time. The abundant testimony as to its value in this condition alone gives it a high place among drugs. By its quieting effects upon the irritable womb, women who have previously been unable to go to full term have been aided by this drug to pass through the pregnancy without mishaps which would otherwise have proven disastrous to both child and mother. Small doses of the specific black haw should be administered throughout the dangerous period, and may be continued with good results until parturition. Dr. Phares, who introduced it as an antiabortive, states that it will prevent abortion, whether habitual or otherwise—whether threatened from accidental cause or criminal drugging. He considered it to completely neutralize the effect of the cotton bark when this is used for the purpose of causing abortion. It was for a long time customary for planters to compel their female slaves "to drink an infusion of black haw daily whilst pregnant to prevent abortion, from taking the cotton-root" (Scudder, *Spec. Med.*, 266). It has been used to control *postpartum hemorrhage*, but is less effective than ergot and cinnamon. It assists in reducing the size of the womb in *subinvolution* of that organ. Viburnum is of some value in nervous disorders, and has been advised in *chorea*, *hysteria*, *hystero-epilepsy*, *petit mal*, and *paralysis agitans*. It is of service only when these troubles are associated with menstrual wrongs. Viburnum Opulus resembles this agent very closely in its effects, and may be used in the above-named conditions, for which the black haw is useful.

Black haw is said to be of value in *sterility*. Some cases of *spermatorrhœa* are benefited by it. *False pains* of pregnancy are readily controlled, and for *after-pains* it is nearly as valuable as macrotys, or actæa. Black haw promptly allays *ovarian irritation*. The late Prof. Howe considered it one of the very best uterine tonics, and incorporated it with wild cherry and aromatics in his Black Haw Cordial. This he recommended to allay the pangs of *dysmenorrhœa;* to arrest *leucorrhœa*, and to alleviate pelvic discomfort; and as a remedy of value in *chlorosis* and the *debility of the second climacteric*. Prof. Howe compounded the cordial to meet the wants of the alcoholic tippler. It allays the gnawing sensations in the stomach, and relieves the faucial discomfort met with in the inebriate. Specific black haw, in drop doses, is a valuable drug in *obstinate singultus*. The black haw is steadily growing in favor with all schools of medicine. The usual prescription is: ℞ Specific black haw, ʒss to ʒi, aqua ℥iv. Mix. Sig. Teaspoonful every 1 to 4 hours, according to case under treatment. The infusion may be given in ½-fluid-ounce doses, several times a day; or the tincture in doses of 1 fluid drachm, 4 or 5 times a day. The powder may be given in ½ or 1-drachm doses; specific black haw, $\frac{1}{10}$ to 30 drops; Howe's black haw cordial, 1 to 2 fluid drachms.

Specific Indications and Uses.—Uterine irritability, and hyperæsthesia; threatened abortion; uterine colic; dysmenorrhœa, with deficient menses; severe lumbar and bearing-down pains; cramp-like, expulsive menstrual pain; intermittent, painful contractions of the pelvic tissues; after-pains and false pains of pregnancy; obstinate hiccough.

Related Species and Pharmaceutical Preparations.—Several species of Viburnum have been used for medicines, but at present the number is narrowed down to two—*V. prunifolium* and *V. Opulus*. The American Indians, and subsequently the Dutch, employed the *V. acerifolium*, Linné (*Maple-leaved arrow-wood*, *Dockmackie*), as a local application to *tumors*. The bark of the *V. dentatum*, Linné (*Tily* of the Indians), was used by the aborigines as a diuretic.

Viburnum dentatum, *Arrow-wood* or *Mealy-tree*, called by the former name on account of its long, straight, slender branches, or young shoots, is a somewhat smooth shrub, 6 to 12 feet in height, growing in low grounds, damp woods and thickets, throughout the United States, with roundish-ovate, dentate-serrate, furrow-plaited leaves, on long, slender petioles. The leaves are 2 or 3 inches in diameter; upper pair oval, the veins beneath prominent, parallel, pubescent in their axils; flowers white, in pedunculate cymes, appear in June; fruit small, ovoid-globose, dark-blue berries (W.—G.). The bark of this tree is ash-colored, and is employed as a diuretic and detergent, and was once extolled as an internal and external agent to cure *cancer;* the infusion to be used freely. It may also be used in extract, pills, or plaster.

V. Lentago (*Sweet viburnum, Nanny berry, Sheep berry*) was formerly esteemed a valuable antiperiodic. *Viburnum Lantana*, Linné, of Europe, has properties analogous to those of our *V. Opulus*. J. B. Enz (1863) found the red berries of *V. Lantana* to contain iron-greening tannin, valerianic acid, acetic and tartaric acids, a bitter principle, an acrid principle, fatty oil, red coloring matter, resin, sugar, gum, etc.

Viburnum obovatum, Walter, a southern states shrub closely allied to *V. prunifolium*, is used by the people in *malarial conditions.* Its leaves are more persistently bitter than its bark (see *V. Opulus*).

HELONIAS CORDIAL.—This agent is prepared by the Wm. S. Merrell Chemical Co., Cincinnati, Ohio, and represents the active constituents of Helonias dioica, Viburnum Opulus, Caulophyllum thalictroides, and Mitchella repens. It is useful in a large range of *functional disorders of the female reproductive organs*, and reflex troubles arising therefrom.

CELERINA.—This preparation is a nerve tonic, stimulant, and antispasmodic. It represents the combined virtues of celery, kola, coca, viburnum, and aromatics. Celerina is a specialty of the Rio Chemical Co., St. Louis, Mo. It is employed in various nervous affections with *loss of nerve power* in any organ, and as a remedy for the *exhaustion following alcoholic excesses.* Dose, 1 to 2 fluid drachms, 3 times a day.

ALETRIS CORDIAL.—A specialty of the Rio Chemical Co., of St. Louis, Mo., is a preparation of Aletris farinosa, and aromatics. It is designed as a uterine tonic and restorative, and may be employed in *leucorrhœa, amenorrhœa, dysmenorrhœa, sterility,* and in those cases where there is a disposition to *miscarriage.* The dose is 1 fluid drachm, 3 or 4 times a day.

VIBURNUM CORDIAL (Howe).—Recent bark of root of black haw, 20 ounces; recent bark of root of wild cherry, 40 ounces; Ceylon cinnamon, 10 ounces; cloves, 5 ounces; sugar, 7½ pounds; brandy, 2 gallons; water, 1½ gallons. Mix the crushed drugs with the mixed brandy and water; add the sugar, and stir together for 14 days. Then express and filter. (For uses of Howe's Viburnum cordial, see page 2061.)

VINA MEDICATA.—MEDICATED WINES.

By medicated wines we mean vinous tinctures of those medicinal agents which are capable of yielding their virtues to wine, either pure or diluted. As a rule vinous tinctures are much inferior to alcoholic, on account of their tendency to decomposition, and the uncertainty of their strength, and should therefore be made without heat, in limited quantities at a time, and kept cool in well-closed bottles. Wines owe their solvent properties largely to the alcohol which they contain, as well as to the acid (chiefly acid tartrate of potassium) which they usually hold in greater or less proportion; and in the selection of them for medicinal purposes, the purest qualities only should be chosen. *Native wine* forms an elegant medicated wine, when the article is to be used immediately; but if the compound be allowed to stand for any time fermentation and decomposition take place; hence the necessity for the official *stronger wine.* Medicated wines, like tinctures, may be prepared by maceration, or by percolation, or by dissolving the substance in wine.

I. BY MACERATION.—The powdered article or articles are placed in wine, and are allowed to macerate in a closed glass bottle, usually for 14 days, with occasional agitation; after which the articles are expressed if necessary, and filtered through paper or a fine muslin cloth.

II. BY PERCOLATION.—The powdered article or articles are first covered with wine, and allowed to stand until they are moistened throughout, which generally requires from 24 to 36 hours; the whole is then transferred to a percolator, and wine gradually poured on and allowed to percolate or filter until the requisite amount has passed.

The following wine is official, but is not employed in Eclectic practice:

VINUM ANTIMONII (*U. S. P.*), *Wine of antimony, Antimonial wine.*—"Antimony and potassium tartrate, four grammes (4 Gm.) [62 grs.]; boiling distilled water, sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; alcohol, one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏]; white wine, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the alcohol with eight hundred cubic centimeters (800 Cc.) [27 fl℥, 24 ♏] of white wine; dissolve the antimony and potassium tartrate in the boiling distilled water, and add the solution to the mixture. When the liquid is cold filter it through paper, and add enough white wine, through the filter, to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

VINUM.—WINE.

Vinum Album (*U. S. P.*), *White wine.*—"An alcoholic liquid, made by fermenting the juice of fresh grapes, the fruit of *Vitis vinifera* (*Nat. Ord.*—Vitaceæ), freed from seeds, stems, and skins. When white wine is prescribed without further specification, it is recommended that a dry white wine of domestic production (such as California Riesling, Ohio Catawba, etc.) be employed. White wine should be preserved in well-closed casks, filled as full as possible, or in well-stoppered bottles, in a cool place"—(*U. S. P.*).

Vinum Rubrum (*U. S. P.*), *Red wine.*—"An alcoholic liquid, made by fermenting the juice of fresh colored grapes, the fruit of *Vitis vinifera* (*Nat. Ord.*—Vitaceæ), in the presence of their skins. When red wine is prescribed without further specification, it is recommended that a dry red wine of domestic production (such as a native Claret, Burgundy, etc.) be employed. Red wine should be preserved in well-closed casks, filled as full as possible, or in well-stoppered bottles, in a cool place"—(*U. S. P.*).

Source and Preparation.—Wines, in general, include the fermented juices of all sweet fruits, such as grapes, apples, pears, blackberries, currants, gooseberries, etc. In the special and commonly accepted sense, wine is the alcoholic liquid, produced by spontaneous fermentation of the juice of the grape. The grapes are harvested after they have reached their full maturity. The quality of the wine may be judged beforehand, by the ratio of acid to sugar in the grape; in good seasons, this ratio is about 1 to 30 and higher, in medium years, 1 to 16, in poor years, 1 to 12, below which the ratio seldom falls. If the ratio is 1 to 10, the wine will be sour.

In making *White Wine* (see article on "Ohio Wines," by James O. Howells, in *Amer. Jour. Pharm.*, 1885, p. 324), unripe or decayed grapes are rejected, and the *must* is obtained by passing the grapes between horizontal wooden rollers, placed above large vats. The must represents the liquid portion of the grape (see *Uva*), and the yield is from 60 to 70 per cent. Must contains from 18 to 24 and as high as 30 per cent of sugar, and from 0.4 to 1 per cent of acid, consisting chiefly of potassium bitartrate, with free tartaric and malic acids. The must is allowed to stand in the vats for about 18 to 36 hours, in order to induce slight fermentation, which facilitates the settling of the marc. The must is then drawn off, and the remaining mass expressed in large wine-presses. The must is put into large casks, which are kept nearly full, and a uniform temperature of about 15° C. (59° F.), or less, is maintained. Spontaneous fermentation then proceeds, induced by the access of spores from the air or the grapes to which they adhere. The dextrose of the must is converted into alcohol and carbonic acid, with a small percentage of glycerin and succinic acid (see *Alcohol*). At the temperature indicated, fermentation is moderate, and the yeast and lees settle to the bottom of the cask (*bottom* or *low fermentation*), while, at higher temperatures (15° to 25° C., or 59° to 77° F.), the yeast rises to the surface, and the fermentation is quite rapid (*surface* or *high fermentation*). The former is practiced in Germany, France, and some parts of the United States, while Spanish, Italian wines, etc., are fermented by the second method, and yield a product richer in alcohol, but nearly devoid of the fragrance, or *bouquet*, possessed by the other class of wines. The bottom fermentation lasts from 2 to 4 weeks. The product, called *young wine*, must be transferred to fresh casks ("racking off"), without delay, in order to prevent the formation of acetic acid. The second stage, a *still fermentation* (*after-fermentation*), sets in, lasting for several months, during which time potassium bitartrate (*cream of tartar, argol*) is thrown out in proportion as the quantity of alcohol, in which it is insoluble, increases. Thus it is seen that, in making wine from the grape, a large part of its acidity is automatically thrown out. The aroma (bouquet) of the wine is developed during the third stage of fermentation, which lasts for several years, then the wine is *bottle-ripe*. Meanwhile, it must be repeatedly racked off, in order to separate the lees, which are liable to cause undesirable changes in the wine if in too prolonged contact with it. In order to obtain a clear, limpid wine, it is usually treated with isinglass or gelatin (*fining*).

Red Wines (*e. g.*, American Claret, Burgundy, Bordeaux, etc.) are made from red grapes in the same manner, except that the must is allowed to ferment in contact with the marc, whereby the coloring matter of the skins is dissolved by the alcohol as it forms. This also increases the amount of tannin in the wine, hence the acerbity of some red wines. Precautions must be taken by mechanical means to prevent the marc from rising to the surface, which would induce souring. When the first fermentation is finished, the marc is pressed off, and the wine is put into casks to undergo after-fermentation.

Sweet Wines (*e. g.*, Sherry, Port, Sweet Catawba, Lachrymæ Christi, Tokay, etc.) are made by adding concentrated grape juice or pure cane sugar to the must, whereby a certain percentage remains unfermented, or fermentation of the natural must is checked at a certain stage by the addition of alcohol; or lastly, sugar may be added to the completely fermented wine. Sweet wines are usually made stronger in alcohol than dry wines, in order to prevent subsequent fermentation of their sugar contents.

Effervescing Wines (*Champagnes*) are made from carefully selected wines that have already passed through the first and second fermentation. The clear wines are put into strong bottles, with the addition of a definite quantity of "liqueur," consisting of pure cane-sugar solution and cognac, etc., securely corked and arranged horizontally on wooden racks, where they are exposed to the temperature of summer heat, which induces fermentation of the added sugar. Gradually the bottles are inclined neck downward. The wine becomes clear and limpid, and the yeast and lees settle on the cork. Finally, by quick manipulation, the cork is taken out, the yeast ejected by the pressure of the gas, the loss of wine replaced by "liqueur," and the bottles are again securely corked and stored. The pressure in the bottles is from 4 to 6 atmospheres. Champagne wines are now frequently imitated by impregnating wines with carbonic acid gas.

Diseases and Improvement of Wines.—Wine is subject to various accidents during its manufacture and storage. Of these, the formation of acetic acid or *souring* has been noted above. It takes place quite readily in wines that are weak in alcohol and in tannin. The *ropiness*, *bitterness*, and other defects of wines are mostly due to the access of foreign ferments. In order to guard against these, it is a common practice in the cellar treatment of wines to fumigate the casks with sulphur dioxide from burning strips of sulphur prior to filling them with wine. Another and very efficient method of preserving wine consists in *Pasteurizing*, *i. e.*, the wine contained in bottles or casks is exposed to a temperature of about 60° C. (140° F.), and subsequently kept out of contact with air. The addition of burnt gypsum (plaster of Paris) to the must (*plastering*) is said to bring about a more rapid fermentation, a brighter color and better keeping qualities. The practice is in use especially in southern Europe, and is objectionable, because it converts the potassium bitartrate of the wine into acid potassium sulphate ($KHSO_4$), which remains in solution while neutral calcium tartrate is precipitated. The former salt, if present in large quantities, is not a harmless ingredient (see pharmacopœial limitation, below).

It is often desirable that a poor quality of wine be improved, especially when due to an unfavorable season. Several methods are in use, some of which are rational and ought to be considered perfectly legitimate. Among the more important processes are:

Chaptalizing (named after Prof. Chaptal, of Montpellier). This consists in adding sugar, and neutralizing an excess of tartaric acid by the addition of a calculated amount of calcium carbonate in the form of marble dust or the pure precipitated carbonate. By this method, no calcium enters the wine, unless it contains acetic acid. In the absence of the latter, the method is quite applicable, especially when the excess of acidity is due to free tartaric acid, the amount of which, however, must be accurately determined. Liebig proposed to remove excess of tartaric acid by the addition of a calculated quantity of neutral potassium tartrate, the purpose being to convert the undesirable excess of the free tartaric acid into the little soluble bitartrate. When the free acid is malic acid, this process is not applicable.

Petiotizing (Pétiot, a Burgundy landowner) consists in subjecting the pressed-out marc to a second and probably third fermentation in contact with water and sugar. Advantage is taken of the fact that the first fermentation does not remove all the coloring matter, tannin and bitartrate from the marc. A great number of the French Bordeaux wines of the market are made by this profitable method.

Gallizing (named after its advocate, Dr. Ludwig Gall) aims to correct the composition of a poor quality of must by the addition of sufficient water and sugar to bring it to a normal composition. Dr. Gall considers a normal must to contain 24 per cent of sugar, 0.6 per cent of acid, and 75.4 per cent of water. Analysis of the must will establish the quantities of sugar and water needed for correction. Any excessive addition of water and sugar is indicated by the deficiency in extractive matter (see analysis, page 2066).

Scheelizing (named after Scheele) consists in adding a certain amount of glycerin to the wine in order to correct the taste of very acid, thin wines.

Description, Chemical Composition, and Tests.—There is considerable diversity in the different wines in regard to their flavor and the relative proportions of their constituents, owing to differences in the grape, the climate, soil and management. Wines may be generally classed according to their color into *white* and *red* wines; according to their saccharine contents into *dry* and *sweet* wines, the former being practically free from sugar; according to the quantity of alcohol they contain, we have *light* and *strong* or *generous* wines; another well-known distinction is that between *still* and *sparkling* wines (*Champagnes*). Certain famous wines are named according to the country or district of their origin, *e. g.*, Port, Sherry, Madeira, etc.

American Wines.—In the '50s, the chief American grape used in wine-making was the *Catawba grape*, introduced to the notice of wine-growers by Major Adlum, of Washington, D. C. It was then much cultivated in the vicinity of Cincinnati (see Wm. Procter, Jr., *Amer. Jour. Pharm.*, 1854, p. 411; and E. S. Wayne, *ibid.*, 1855, p. 494). Now we have many American pure wines from native grapes (see *Uvæ*), produced in the wine districts of Virginia, the Lake Erie regions and especially California, the output of the latter state alone in 1893 having been 20,000,000 of gallons. The *U. S. P.* directs the preferment of American-grown wines. *Catawba wines* are rather acid, and, with other American wines, compare favorably in strength, bouquet and appearance with the best wines of central and southern Europe. *American Claret* is a dry, red wine of moderate alcoholic strength. Its French equivalent is *Red Bordeaux wine.* As to foreign wines, suffice it to allude to a few of the more largely employed wines of southern Europe; also see interesting article on "Wines on the Rhine," by Charles A. Lee, in *Amer. Jour. Pharm.*, 1863, p. 324.

Sherry Wine (*Vinum Xericum* of the *Br. Pharm.*, 1898). The original Sherry comes from the vicinity of the Spanish city, Xeres de la Frontera. It is of a pale yellowish-brown or deep-amber color, feebly acid and of an agreeable aroma. According to König (*Die Menschl. Nahrungs- und Genussmittel*, 3d ed., 1894), the alcoholic strength of commercial Sherry varies from 18 to 25 per cent by volume, and its extractive matter from 3 to 5 per cent. Its specific gravity ranges from 0.978 to 0.995. The *British Pharmacopœia* (1898) requires it to contain "not less than 16 per cent of ethyl hydroxide by volume." The *German Pharmacopœia* directs that the southern wines (Sherry, Port, Madeira, Marsala) "should contain in one liter not less than 140 Cc. and not more than 200 Cc. of alcohol." The same authority gives the following directions: "The quantity of sulphuric acid in one liter of wine should not exceed the quantity contained in 2 grammes of potassium sulphate." This is intended to limit excessive plastering, which is practised with many southern wines, especially all genuine Sherry wines (J. König, *loc. cit.*). Imitations of Sherry are numerous, and are often made from cheap wines, with the addition of sugar, raisins, cloves, St. John's bread, etc. The *British Pharmacopœia* (1898) gives directions for the testing of Sherry for salicylic acid. On the Sherry wine industry in Spain, see interesting article in *Western Druggist*, 1897, p. 462, from U. S. Consular reports.

Madeira Wine.—This wine is grown in the Canary Islands, and is obtained by adding to the must a certain quantity of alcohol, which shortens the time of the fermentation. At a later stage, alcohol is again added. The wine has from 18 to 20 per cent alcohol, and from 4 to 6 per cent extract (J. König, *loc cit.*). A special kind of *Dry Madeira* is less sweet and more astringent. Commercial Madeira is also much adulterated.

Malaga Wine (*Vinum Malacense*) is made in the Spanish province of Malaga. It is a sweet wine, of light or dark color, and contains from 13 to 19 per cent of alcohol, by volume, and from 14 to 21 per cent of extract (J. König, *loc. cit.*). Its composition and appearance is regulated in the place of its manufacture by the addition of alcoholized must (for sugar), and an alcoholic extract of the dark grape (for color). A very dark Malaga is made from *arrope*, *i. e.*, a sugar-coloring made from concentrated must by aid of heat. It is an article of commerce in Spain.

Port Wine (*Vinum Portense*) comes from the valley of the river Douro, and enters commerce through Oporto, hence its name. The juice ferments in contact with the fresh grapes, and the wine is finally drawn off; then alcohol is added. In bad seasons all sugar is consumed in the fermentation; then an addition of concentrated must (*jeropiga*), or sugar, is made, The port wine of commerce contains from 15 to 24 per cent of alcohol by volume, and from 3 to 8 per cent of extract. It has been the practice in Portugal to color the wine with the juice of elderberries It acquires its best flavor by age, and deposits a large quantity of coloring matter during its storage in bottles. Port wine of commerce is very seldom genuine. The American port wines are made from grapes grown from vines that were originally imported from Portugal. They resemble true port wine in flavor and appearance, but contain less alcohol (about 14 to 16 per cent by volume).

Marsala Wine is made near the city of Marsala in Sicily. The must is allowed to ferment to a certain degree; then alcohol is added to interrupt fermentation.

For further details regarding the manufacture and treatment of wines, see for example, Prof. S. P. Sadtler's *Handbook of Indust. Org. Chem.*, 2d ed., 1895, and the special literature on the subject indicated therein on page 246.

The Chemical Composition of the different wines is very variable. Their constituents are as follows: Water (80 to 90 per cent), alcohol (5 to 15 per cent by weight, or 6.2 to 18.8 per cent by volume), glycerin (0.2 to 0.8 per cent), volatile acids (*e. g.*, acetic, œnanthic, etc.) being one-fourth of the total acidity; carbonic acid gas in young wines; aldehydes; œnanthic ether of vinous odor consist of caprinic and caprylic esters; unknown volatile substances constituting the "bouquet" of wines; dextrose (grape sugar) in small quantities, except in sweet wines; bitartrate of potassium, tartaric, malic and phosphoric acids, partly free, partly combined with potash, lime, soda, aluminum, magnesium, iron, and manganese; phosphate of calcium constituting from 20 to 60 per cent of the weight of the ash; sulphates, and traces of chlorides; coloring matters; pectin and gum (imparting "body" to the wine); tannin, amounting to from 0.1 to 0.2 per cent in red wines, while mere traces (about 0.01 per cent) occur in white wines (adapted from C. A. Crampton's report in *Foods and Food Adulterants*, Part III, *Bull. No.* 13, *United States Department of Agriculture*, 1887). The quantitative composition of some representative wines is given in the subjoined table.

The Analysis of Wine takes into account the determination of specific gravity (is usually below 1, but in most sweet wines above 1), alcohol, extractive or total solids (fixed for the *U. S. P.* wines between the limits of 1.6 to 3.5 per cent for red, and 1.5 to 3.0 for white wines); acidity (limited for the *U. S. P.* wines between 0.5 and 0.9 per cent in both kinds, calculated as tartaric acid); sugar, glycerin, tannic acid, and ash, and the search for special adulterants, such as artificial coloring matters (see *Amer. Jour. Pharm.*, 1887, p. 200, *ibid.*, 1892, p. 626, and *Proc. Amer. Pharm. Assoc.*, 1897, p. 536); preservatives, such as salicylic acid, etc. E. Claassen tests wine for salicylic acid by acidulating it with dilute sulphuric acid, and shaking with a mixture of equal volumes of ether and benzin. Evaporation of the ethereal layer leaves a residue producing a violet color with dilute solution of ferric chloride (*Digest of Criticisms on the U. S. P.*, Part I, 1892).

While we can not here enter into the interesting but extensive field of wine analysis, we may state that a uniform method of wine analysis has been elaborated by a German commission (see Dr. Max Barth, *Die Weinanalyse*, Leipzig, 1884; also see extensive comment by C. A. Crampton, *loc. cit.*), and has become official in Germany by an act of 1892. The method is more or less followed also in the United States. (In this connection, see Nessler and Barth, on the "Analysis of Wine," in *Amer. Jour. Pharm.*, 1882, pp. 444–454.) The *U. S. P.* makes the following requirements for white and red wines:

I. Vinum Album (*U. S. P.*), *White wine.*—"A pale amber-colored or straw-colored liquid, having a pleasant odor free from yeastiness, and a fruity, agreeable, slightly spirituous taste without excessive sweetness or acidity. The specific gravity, at 15.6° C. (60° F.), should not be less than 0.990, nor more than 1.010. If a portion of white wine be evaporated, the residue, when dried during 12 hours on a water-bath, should not amount to less than 1.5 nor more than 3 per cent. To neutralize 50 Cc. of white wine should require not less than 3 nor more than 5.2 Cc. of normal potassium hydrate V.S. (limit of free acid), phenolphtalein being used as indicator. If 10 Cc. of white wine be diluted with an equal volume of water, and treated with 5 drops of ferric chloride T.S., only a faint, greenish-brown color may make its appearance (absence of more than traces of tannic acid). Tested by the following method, white wine should be found to contain not less than 10 nor more than 14 per cent, by weight (equivalent to 12.4 to 17.3 per cent, by volume), of absolute alcohol: Take the specific gravity (to 4 decimals) of a sufficient portion of the white wine, carefully measured, at the temperature of 15.6° C. (60° F.), evaporate the white wine in a tared capsule to one-third of its original weight, cool, and add water until the liquid measures its original volume at 15.6° C. (60° F.), then take the specific gravity (to 4 decimals) again. The difference between the two specific gravities, deducted from 1.0000, corresponds to the specific gravity of an alcohol containing the same percentage of absolute alcohol, by weight or volume, as the wine under examination, the corresponding percentage being ascertained by referring to the alcoholometric tables"—(*U. S. P.*).

II. Vinum Rubrum (*U. S. P.*), *Red wine.*—"A deep-red liquid, having a pleasant odor, free from yeastiness, and a fruity, moderately astringent, pleasant, and slightly acidulous taste, without excessive sweetness or acidity. The specific gravity, at 15.6° C. (60° F.), should not be less than 0.989, nor more than 1.010. If a portion of red wine be evaporated, the residue, when dried during 12 hours on a water-bath, should not amount to less than 1.6 per cent, nor more than 3.5 per cent. To neutralize 50 Cc. of red wine should require not less than 3 nor more than 5.2 Cc. of normal potassium hydrate V.S. (limit of free acid), eosin or fluorescein being used as indicator. If 10 Cc. of red wine be diluted with an equal volume of water, and treated with 5 drops of ferric chloride T.S., the liquid should acquire a brownish-green color (due to tannic acid). With lead acetate T.S., red wine forms a heavy precipitate, which may vary in color from bluish-green to green. If 2 Cc. of red wine be mixed, in a test-tube, with 2 drops of chloroform and 4 Cc. of normal potassium hydrate V.S., and the mixture carefully heated, the disagreeable odor of isonitril should not become perceptible (absence of various aniline colors). If 50 Cc. of red wine be treated with a slight excess of ammonia water, the liquid should acquire a green or brownish-green color; if it be then well shaken with 25 Cc. of ether, the greater portion of the ethereal layer removed, and evaporated in a porcelain capsule with an excess of acetic acid and a few fibers of uncolored silk, the latter should not acquire a crimson or violet color (absence of fuchsine). If 25 Cc. of red wine, heated to about 45° C. (113° F.), be well agitated with 25 Gm. of manganese dioxide, the liquid filtered off, and acidulated with hydrochloric acid, it should not acquire a red color (absence of sulphofuchsine). Tested by the following method, red wine should be found to contain not less than 10 nor more than 14 per cent, by weight (equivalent to 12.4 to 17.3 per cent, by volume), of absolute alcohol: Take the specific gravity (to 4 decimals) of a sufficient portion of the red wine, accurately measured, at the temperature of 15.6° (60° F.), evaporate the wine, in a tared capsule, to one-third of its original weight, cool, and add water until the liquid measures its original volume at 15.6° C. (60° F.), then take the specific gravity (to 4 decimals) again. The difference between the two specific gravities, deducted from 1.0000, corresponds to the specific gravity of an alcohol containing the same percentage of absolute alcohol, by weight or volume, as the wine under examination, the corresponding percentage being ascertained by referring to the alcoholometric tables"—(*U. S. P.*).

The distillation method, for the determination of alcohol in wines, is carried out as follows: 100 Cc. of the sample are rinsed into a flask with about 50 Cc. of water; the flask is connected with a Liebig's condenser, exactly 100 Cc. are distilled off, measured at the same temperature as the original bulk was measured;

then the specific gravity is taken, either by means of an alcoholometer, or, preferably, by means of a picnometer. The alcoholic strength of the distillate may then be read from alcohol tables, *e.g.*, Hehner's table (see C. A. Crampton, *loc. cit.*, p. 285).

The following table, by J. König (*loc. cit.*), gives the average composition of some European sweet wines of commerce:

WINES.	Specific Gravity.	Alcohol (by weight). Per cent.	Extract.	Sugar.	Acid—Tartaric.	Glycerin.	Nitrogenous substance.	Mineral matters.	P_2O_6.	SO_3.	K_2O.
Tokay..........	1.0870	9.44	23.63	19.44	0.57	0.62	0.37	0.32	0.054	0.054	0.116
Port	1.0081	16.69	8.05	5.82	0.40	......	......	0.23	0.031	0.023	0.102
Madeira........	1.0003	15.40	5.52	3.23	0.43	......	.....	0.35	0.060	0.075	0.149
Malaga.........	1.0694	11.95	21.73	17.11	0.55	0.46	......	0.41	0.049	0.043	0.187
Marsala........	1.0022	15.85	5.27	3.53	0.49	0.51	0.23	0.38	0.029	0.114	0.142
Sherry..........	0.9932	17.45	3.98	2.12	0.45	0.52	0.17	0.38	0.031	0.128	0.206
Pure, genuine Sherry........	....	15.61	2.63	2.60	0.39	0.49	......	0.49	0.027	0.209	0.228

(For a great number of tabulated analyses of all grades of American wines, by Henry B. Parsons [1880] and C. A. Crampton [1887], including the experimental results obtained by Prof. E. W. Hilgard, in the Viticultural Laboratory of the University of California, see Mr. C. A. Crampton's report, *loc. cit.*)

Action, Medical Uses, and Dosage.—In moderate quantities, wine operates as a stimulant to the nervous and vascular systems, and the secreting organs. It quickens the action of the heart and arteries, diffuses an agreeable warmth over the body, promotes the different secretions, communicates a feeling of increased muscular force, excites the mental powers, and banishes unpleasant ideas. In a state of health, its use can be in no way beneficial, but on the contrary, its habitual employment in many cases proves injurious by exhausting the vital powers and inducing disease. The actual amount of injury it may inflict will, of course, vary with the quantity and quality of the wine taken, and according to the greater or less predisposition to disease which may exist in the system. Maladies of the digestive organs, and of the cerebro-spinal system, gout, gravel and dropsy, are those most likely to be induced or aggravated by it. Intoxication in its varied forms is the effect of excessive quantities of wine. Wine, however, possesses a tonic influence not observed after the use of ardent spirit, and differs from it, likewise, in not inducing disease of the liver. Dr. McCulloch observes: "It is well known that diseases of the liver are the most common and the most formidable of those produced by the use of ardent spirit; it is equally certain that no such disorders follow the intemperate use of pure wine, however long indulged in. To the concealed and unwitting consumption of spirit, therefore, as contained in the wines commonly drunk in this country, is to be attributed the excessive prevalence of those hepatic affections which are comparatively little known to our Continental neighbors" (the French).

As a medicinal agent, wine is employed principally as a cordial, stimulant, and tonic; some, however, possess acid and astringent properties. Wine is useful in low forms of *fever* to support the vital powers, promote sleep, and relieve delirium and subsultus tendinum; it is also useful as a stimulating tonic in convalescence from fevers, and from various chronic diseases. It is often given with the best effects in cases of *extensive ulceration*, *copious suppuration*, *gangrene of the extremities*, and after *profuse hemorrhages*, *severe operations*, or *extensive injuries*. Whenever it causes dryness of the tongue, thirst, quick pulse, restlessness or delirium, its use should be immediately dispensed with, as well as in active inflammations. In *tetanus*, its free use has at times produced an apparent alleviation of the disease (P). The best wines for practical use are, *Port*, *Sherry*, or *Madeira*, among the stronger wines; and among the weaker, *Claret*, *Hock*, *Moselle*, and *Champagne*. *Port* is a red or dark-purple, somewhat astringent wine, and may be used as a stimulant tonic in cases of *debility*; it is apt, however, to cause constipation, and usually disagrees with weak stomachs. *Sherry* is a dark yellowish-brown white wine, having a pleasant and peculiar flavor, and containing a very small amount of free acid; it is best adapted for *gouty patients*, and those disposed to *acid stomach*, or *uric acid deposits*. *Madeira* is somewhat of the color of Sherry, is feebly acid, and more stimulating than Sherry; it is better adapted for old persons and *weak, broken-down constitutions*, and for invalids. *Teneriffe* is similar to Madeira wine, but less stimulating. Among the weaker wines, none are equal to the *Claret* or *Bordeaux* wine; this wine is acid and slightly astringent, and is the least injurious among the wines. It may be used, as well as the Rhine and Moselle wines where the *urine deposits phosphates*, in *low fevers*, etc., but should not be used in gout, and uric acid deposits *Champagne* is more apt to cause headache than any other wine, yet it is a good excitant and diuretic, useful in *hypochondria*, *low stage of fevers*, *excessive debility*, and in *excessive vomiting* during *pregnancy* or at other times. *Catawba* wines are rather acid, and may be used as a substitute for Madeira and Claret. The dose of wine varies from a teaspoonful to a wineglassful, to be repeated every 1, 2, or 4 hours, according to the circumstances of the case; it may be given alone, or mixed with water and sweetened, and if not contra-indicated, some nutmeg may be grated upon it. Wine may also be added to soups, gruels, milk, etc., and to nutritive and stimulating enemas. Wine is sometimes employed in the preparation of medicated wines, but from its liability to undergo decomposition, it is much more objectionable as a solvent than diluted alcohol. In obstinate cases of *conjunctivitis*, of 1 or 2 years' standing, apparently unyielding to all treatment, I have found permanent cures to be rapidly effected by allowing the patient a free use of the ripe Catawba grape; the children thus cured were of a strumous disposition. In some cases, it was astonishing to witness the rapidity with which the cure progressed (J. King).

Related Wines.—Raisin Wines. This class of wines is now frequently made in France, owing to the destruction of large tracts of vineyards by diseases of the vine and other accidents (see *Amer. Jour. Pharm.*, 1898, p. 48). M. Palangié (*Amer. Jour. Pharm.*, 1889, p. 245, from *Jour. de Pharm. et Chim.*) recommends the following: Take Corinth raisins, 25 kilogrammes; sugar, 4 kilogrammes; fresh grapes, 1 kilogramme; tartaric acid, 25 Gm. Exhaust the raisins with 3 waters; press and unite all the liquors in a cask. Dissolve the sugar and tartaric acid in water, and boil for a few minutes; add this to the other liquors, with water to make 1 hectoliter; then add the grapes, previously bruised, and keep the mixture at a temperature of 25° C. (77° F.). In 48 hours from the beginning of fermentation, the air in the cask must be renewed, and this must be repeated daily until fermentation ceases. The wine should stand for a month before bottling. The taste of these wines is tart and sweetish; their flavor recalls that of raisins.

Malton Wines.—These alcoholic preparations, invented by Dr. Sauer in 1895, are made from infusion of barley malt, and are distinguished from ordinary wines by containing *lactic* instead of tartaric acid; much scientific skill is required in their preparation. The process is carried out in three phases: (1) Producing solution of maltose (17 to 20 per cent) by making an infusion of malted barley; (2) producing lactic acid by the addition of a pure culture of lactic ferments at 50° C. (122° F.), until a percentage of 0.6 to 0.8 of acid is obtained, when the souring is interrupted by exposure to a temperature of 75° C. (167° F.); (3) cooling the "wort" rapidly to 25° C. (77° F.), and adding specially cultivated yeast from genuine southern wines, as Sherry, Port, etc.; then allow to ferment by "high fermentation," from time to time adding maltose in the form of vacuum-concentrated wort. The unusual yield of 18 per cent of alcohol by volume is easily obtained by this process. Fermentation lasts from 3 to 5 weeks; then draw off and treat as any other wine. These wines, though retaining a slight taste of extract of malt, are said to have the pronounced character of the genuine wines from the pure yeast of which they are made (see report on these wines, by W. Möslinger, in *Forschungsberichte über Lebensmittel*, 1896, p. 313).

Hoochinoo.—The spirituous beverage of the Alaskans, about corresponding in alcoholic strength with Sherry wine (Marshall).

VINUM ALBUM FORTIUS (N. F.)—STRONGER WHITE WINE.

Preparation.—"White wine, eight hundred and seventy-five grammes (875 Gm.) [1 lb. av., 14 ozs., 378 grs.]; alcohol, one hundred and twenty-five grammes (125 Gm. [4 ozs. av., 179 grs.]. Mix them. When tested for alcohol, stronger white wine should contain not less than twenty (20) per cent, nor more than twenty-five (25) per cent of absolute alcohol, by weight" (*Nat. Form.*).

Pharmaceutical Uses.—This preparation was official in the *U. S. P.*, 1880, and was used in the preparation of medicated wines, where a fortified white wine was demanded. In the present Pharmacopœia (1890), however, the official formulas separately direct the addition of a definite amount of alcohol to the wine when fortification of the latter is necessary.

VINUM ALOES (N. F.)—WINE OF ALOES.

Preparation.—"Purified aloes (*U. S. P.*), sixty grammes (60 Gm.) [2 ozs. av., 51 grs.]; cardamom, ten grammes (10 Gm.) [154 grs.]; ginger, ten grammes (10 Gm.) [154 grs.]; stronger white wine (F. 440), a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Mix the aloes, cardamom, and ginger, and reduce them to a moderately coarse (No. 40) powder. Macerate the powder with nine hundred grammes (900 Gm.) [1 lb. av., 15 ozs., 327 grs.] of stronger white wine for 7 days, with occasional agitation, and filter through paper, adding, through the filter, enough stronger white wine to make the filtered liquid weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—(See *Aloe.*) A preparation of repulsive taste, employed to overcome *constipation*, when associated with *flatulence* or *menstrual tardiness*. Dose, as a laxative, about 4 fluid drachms.

VINUM AROMATICUM.—AROMATIC WINE.

Preparation.—Take of lavender, origanum, peppermint, rosemary, sage, wormwood, of each, 1 part; stronger white wine, a sufficient quantity to make 100 parts. "Mix the solid ingredients, and reduce them to a coarse (No. 20) powder. Moisten the powder with 4 parts of stronger white wine, pack it moderately in a conical glass percolator, and gradually pour enough stronger white wine upon it to make the filtered liquid weigh 100 parts"—(*U. S. P.*, 1880).

Action and Medical Uses.—This preparation was one of a class of vulneraries once in vogue as applications to *wounds*, *ulcers*, *chancres*, etc. It has been dismissed from the Pharmacopœia.

VINUM AURANTII (N. F.)—WINE OF ORANGE.

Preparation.—"Oil of bitter orange, one cubic centimeter (1 Cc.) [16 ♏]; alcohol, ten cubic centimeters (10 Cc.) [162 ♏]; purified talcum (F. 395), fifteen grammes (15 Gm.) [231 grs.]; sherry wine, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Triturate the purified talcum, first with the alcohol, in which the oil of bitter orange had previously been dissolved, and afterward with seven hundred and fifty cubic centimeters (750 Cc.) [25 fl℥, 173 ♏] of sherry wine, gradually added. Filter the mixture through a wetted filter, returning the first portions of the filtrate until it runs through clear, and lastly, pass enough sherry wine through the filter to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*Nat. Form.*).

Pharmaceutical Uses.—This preparation is employed as a flavoring substance and excipient in some of the official preparations.

Related Preparation.—VINUM AURANTII COMPOSITUM (N. F.), *Compound wine of orange*, *Elixir aurantiorum compositum* (*Ger. Pharm.*), *Compound elixir of orange*. "Bitter orange peel, two hundred grammes (200 Gm.) [7 ozs. av., 24 grs.]; absinthium, sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.]; menyanthes, leaves, sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.]; cascarilla, sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.]; cinnamon (cassia), forty grammes (40 Gm.) [1 oz. av., 180 grs.]; gentian, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; potassium carbonate, ten grammes (10 Gm.) [154 grs.]; sherry wine, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Reduce the six first-named drugs to a moderately coarse (No. 40) powder, mix with this the potassium carbonate, moisten the mixture with sherry wine, and let it macerate during 24 hours. Then pack it in a percolator, and percolate with sherry wine, in the usual manner, until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of product are obtained. *Note.*—The *German Pharmacopœia* directs to macerate the orange peel, cinnamon, and potassium carbonate with the sherry wine, and then to add the other drugs in the form of extracts. The proportions above given produce a product practically identical with that of the *German Pharmacopœia*"—(*Nat. Form.*). This preparation may be employed as a gastric tonic.

VINUM CARNIS (N. F.)—WINE OF BEEF.

SYNONYM: *Beef and wine.*

Preparation.—"Extract of beef, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; hot water, sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏]; sherry wine, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Pour hot the water upon the extract of beef contained in a mortar or other suitable vessel, and triturate until a smooth mixture results. Then gradually add, while stirring, nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of sherry wine. Transfer the mixture to a bottle, set this aside for a few days in a cool place, if convenient, then filter, and pass enough sherry wine through the filter to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents 2 grains of extract of beef. *Note.*—The extract of beef suitable for this or similar preparations is that which is prepared by Liebig's method"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—This agent is designed for a tonic and nutritive preparation. The dose is from 1 to 4 fluid drachms.

VINUM CARNIS ET FERRI (N. F.)—WINE OF BEEF AND IRON.

SYNONYM: *Beef, wine, and iron.*

Preparation.—"Extract of beef, thirty-five grammes (35 Gm.) 1 oz. av., 103 grs.]; tincture of citro-chloride of iron (F. 407), thirty-five cubic centimeters (35 Cc.) [1 fl℥. 88 ♏]; hot water, sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏]; sherry wine, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Pour the hot water upon the extract of beef contained in a mortar or other suitable vessel, and triturate until a smooth mixture results. Then gradually add, while stirring, eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of sherry wine. Next add the tincture and enough sherry wine to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Transfer the mixture to a bottle, set this aside for a few days in a cold place, if convenient, filter, and pass enough sherry wine through the filter to restore the original volume. Each fluid drachm represents 2 grains of extract of beef, and 2 minims of tincture of citro-chloride of iron"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—Tonic, nutrient, and restorative. Dose, 1 to 4 fluid drachms.

VINUM CARNIS, FERRI, ET CINCHONÆ (N. F.)—WINE OF BEEF, IRON, AND CINCHONA.

SYNONYM: *Beef, wine, iron, and cinchona.*

Preparation.—"Extract of beef, thirty-five grammes (35 Gm.) [1 oz. av., 103 grs.]; tincture of citro-chloride of iron (F. 407), thirty-five cubic centimeters (35 Cc.) [1 fl℥. 88 ♏]; quinine sulphate, two grammes (2 Gm.) [31 grs.]; cinchonidine sulphate, one gramme (1 Gm.) [15 grs.]; citric acid, seventy-five centigrammes (0.75 Gm.) [12 grs.]; hot water, sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏]; angelica wine, a sufficient quantity to make one thousand cubic centimeters (1000 Cc. [33 fl℥, 391 ♏]. Dissolve the citric acid and the quinine and cinchonidine sulphates in the hot water, and pour the solution upon the extract of beef contained in a mortar, or other suitable vessel. Triturate the liquid with the extract, until they form a smooth mixture, then gradually add, while stirring, eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏] of angelica wine, and afterward the tincture of citro-chloride of iron. Transfer the mixture to a bottle, set this aside for a few days in a cool place, if convenient, filter, and pass enough angelica wine through the filter to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents about 2 grains of extract of beef, 2 minims of tincture of citro-chloride of iron, and small quantities of cinchona alkaloids. *Note.*—Angelica wine is a variety of sweet California wine"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—Tonic, nutritive, and restorative. Dose, 1 to 4 fluid drachms.

VINUM CINCHONÆ AROMATICUM.—AROMATIC WINE OF CINCHONA.

Preparation.—Take of powdered red Peruvian bark, 4 ounces; coriander, bruised, 1 drachm; cinnamon bark, in powder, 2 drachms; diluted alcohol, a sufficient quantity. Macerate the articles in alcohol (about 1 pint), then place in a percolator, and exhaust with diluted alcohol. Evaporate to expel the alcohol, and filter to separate the resin, which will give about ½ pint of liquid. To this add sherry or Madeira wine, sufficient to make the whole amount to ½ gallon; white sugar, ½ pound; tartaric acid, 1 drachm.

Action, Medical Uses, and Dosage.—This is a pleasant aromatic tonic, and may be used, in doses of from 1 to 4 fluid ounces, 3 or 4 times a day, in all cases where a tonic and gentle stimulating action is desired. Catawba wine may be substituted for the sherry or Madeira, when the compound is to be immediately administered.

VINUM COLCHICI RADICIS (U. S. P.)—WINE OF COLCHICUM ROOT.

Preparation.—"Colchicum root, in No. 30 powder, four hundred grammes (400 Gm.) [14 ozs. av., 48 grs.]; alcohol, one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏]; white wine, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the alcohol with eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of white wine. Moisten the powder with one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏] of the menstruum, pack it moderately in a conical glass percolator, and gradually pour upon it, first, the remainder of the menstruum, and afterward enough white wine to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—The want of uniformity of strength in the colchicum bulb brought to this country, requires it to be used in large amount, as compared with its menstruum, in order to secure an efficient vinous solution of it. Wine of colchicum root has been used in *gout*, *gouty rheumatism*, and *neuralgia*. Its effects will be much more decided in many instances, by associating it with a solution of sulphate of morphine, and exhibiting it in conjunction with magnesia or magnesium sulphate. Overdoses may occasion serious results. The dose is from 5 to 60 minims, every 3 or 4 hours, or oftener when the symptoms are urgent, continuing its use until its peculiar effects have manifested themselves.

VINUM COLCHICI SEMINIS (U. S. P.)—WINE OF COLCHICUM SEED.

Preparation.—Colchicum seed, in No. 30 powder, one hundred and fifty grammes (150 Gm.) [5 ozs. av., 127 grs.]; alcohol, one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏]; white wine, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the alcohol with eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of white wine. Macerate the powder with nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the mixture during 7 days, in a closed vessel, with occasional agitation. Then filter through paper, adding, through the filter, first, the remainder of the menstruum, and afterward enough white wine to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*).

It is very necessary that the seeds be ground fine in order that the colchicine may be more thoroughly exhausted, or after having macerated the seeds in the wine a few days they may be taken out and crushed while wet (Maisch). This is the preparation usually called in this country *Wine of Colchicum*.

Action, Medical Uses, and Dosage.—Colchicum seed are not so apt to deteriorate as the bulb, and preserve their activity unchanged for a much longer period; consequently they do not require to be used so largely, in proportion to their menstruum, as the bulb. This medicated wine may be employed for the same purposes as the wine of the bulb, or the tincture of the seed. In overdoses it is capable of producing death. The dose varies from ½ to 1 fluid drachm. The seeds should always be bruised to obtain their full medicinal activity

VINUM ERGOTÆ (U. S. P.)—WINE OF ERGOT.

Preparation.—"Ergot, recently ground, and in No. 30 powder, one hundred and fifty grammes (150 Gm. [5 ozs. av., 127 grs.]; alcohol, one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏]; white wine, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the alcohol with eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of white wine. Moisten the powder with forty cubic centimeters (40 Cc.) [1 fl℥, 169 ♏] of the mixture, pack it moderately in a conical glass percolator, and gradually pour upon it, first, the remainder of the menstruum, and afterward enough white wine to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*U. S. P.*). The official wine contains about 15 per cent of ergot. In preparing it the drug should be finely ground, not bruised.

Action, Medical Uses, and Dosage.—This may be used during labor, as a parturient, in doses of 2 or 3 fluid drachms; in other instances it may be given in doses of 1 or 2 fluid drachms, 3 or 4 times a day, and gradually increased if desirable. It is less used than other preparations of ergot.

VINUM ERYTHROXYLI (N. F.)—WINE OF ERYTHROXYLON.

SYNONYM: *Wine of coca.*

Preparation.—"Fluid extract of erythroxylon (*U. S. P.*), sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; alcohol, sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; sugar, sixty-five grammes (65 Gm.) [2 ozs. av., 128 grs.]; claret wine, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the sugar in about six hundred cubic centimeters (600 Cc.) [20 fl℥, 138 ♏] of claret wine, add the alcohol and fluid extract, and enough claret wine to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Let the mixture stand a few days in a cold place, if convenient, then filter, and pass enough claret wine through the filter to restore the original volume. Each fluid ounce represents 30 grains of erythroxylon (coca). *Note.*—In place of claret wine, any other palatable wine may be used, according to the demand or preference of the prescriber or consumer"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—(See *Coca.*) Dose, 1 to 2 fluid drachms.

Related Preparation.—VINUM ERYTHROXYLI AROMATICUM (N. F.), *Aromatic wine of erythroxylon, Aromatic wine of coca.* "Fluid extract of erythroxylon (*U. S. P.*) sixty-five cubic centimeters (65 Cc.) [2 fl℥, 95 ♏]; compound elixir of taraxacum (F. 111), ten cubic centimeters (10 Cc.) [162 ♏]; syrup of coffee (F. 367) twenty-five cubic centimeters (25 Cc.) [406 ♏]; port wine, one hundred and sixty-five cubic centimeters (165 Cc.) [5 fl℥, 278 ♏]; aromatic elixir (*U. S. P.*), three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏]; sherry wine, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the five first-named ingredients with four hundred cubic centimeters (400 Cc.) [13 fl℥, 252 ♏] of sherry wine. Let the mixture stand several days in a cold place, if convenient, then filter, and pass enough sherry wine through the filter to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid ounce represents 30 grains of erythroxylon coca)"—(*Nat. Form.*). Dose, 1 to 2 fluid drachms.

VINUM FERRI.—WINE OF IRON.

SYNONYMS: *Vinum chalybeatum, Vinum martiatum.*

Preparation.—"Take of iron, in wire, 1 ounce (Imp.), or 50 grammes (Metric); sherry, 1 pint (Imp.), or 1000 cubic centimeters (Metric); set aside for 30 days in a closed vessel, the iron wire being almost but not quite immersed in the sherry wine, and the vessel frequently shaken, and the stopper occasionally removed;

then filter"—(*Br. Pharm.*, 1898). The natural salt of the wine—acid potassium tartrate—slowly acts upon the iron, dissolving it, while hydrogen is evolved. A double salt, iron and potassium tartrate is formed, of course in variable amount, depending upon the amount of the acid tartrate contained in the wine. On account of its variability, this wine has been discarded by the *U. S. P.*

Action, Medical Uses, and Dosage.—A mild chalybeate. Dose, 1 to 4 fluid drachms.

VINUM FERRI AMARUM (U. S. P.)—BITTER WINE OF IRON.

SYNONYM: *Vinum chinæ ferratum.*

Preparation.—"Soluble iron and quinine citrate, fifty grammes (50 Gm.) [1 oz. av., 334 grs.]; tincture of sweet orange peel, one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏]; syrup, three hundred cubic centimeters (300 Cc.) [10 fl℥, 69 ♏]; white wine, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the soluble iron and quinine citrate in five hundred cubic centimeters (500 Cc.) [16 fl℥, 435 ♏] of white wine. Add to this the tincture of sweet orange peel and the syrup, and lastly, enough white wine to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Set the mixture aside for several days, then filter, and pass enough white wine through the filter to restore the original volume"—(*U. S. P.*). Each fluid drachm contains nearly 3 grains of iron and quinine citrate.

Action, Medical Uses, and Dosage.—A chalybeate tonic for *debilitated and anemic individuals.* Dose, 1 or 2 fluid drachms.

VINUM FERRI CITRATIS (U. S. P.)—WINE OF FERRIC CITRATE.

Preparation.—"Iron and ammonium citrate, forty grammes (40 Gm.) [1 oz. av., 180 grs.]; tincture of sweet orange peel, one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏]; syrup, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; white wine, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the iron and ammonium citrate in seven hundred cubic centimeters (700 Cc.) [23 fl℥, 321 ♏] of white wine. Add to this the tincture of sweet orange peel and the syrup, and lastly, enough white wine to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Set the mixture aside for several days, then filter, and pass enough white wine through the filter to restore the original volume"—(*U. S. P.*). Each fluid drachm contains about 2¼ grains of iron and ammonium citrate.

Action, Medical Uses, and Dosage.—This preparation is intended as a means of obtaining a uniform vinous solution of ferric citrate. It is a mild chalybeate, and may be given in doses of from 1 to 4 fluid drachms.

VINUM FRAXINI AMERICANÆ (N. F.)—WINE OF WHITE ASH.

Preparation.—"Fraxinus (bark), in No. 40 powder, five hundred grammes (500 Gm.) [1 lb. av., 1 oz., 279 grs.]; stronger white wine (F. 440), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Moisten the powdered fraxinus with one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of stronger white wine, macerate it during 3 days in a well-covered vessel; then pack it in a percolator, and gradually pour on stronger white wine until one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of percolate are obtained. Keep the product in well-stoppered bottles, which should be completely filled and stored in a cool place. Each fluid drachm represents 30 grains of fraxinus (bark). *Note*—Fraxinus bark is the inner bark of the trunk or root of *Fraxinus Americana*, Linné (white ash)"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—(See *Fraxinus.*) Dose, 1 to 2 fluid drachms.

VINUM HELLEBORI COMPOSITUM.—COMPOUND WINE OF HELLEBORE.

Preparation.—Take of black hellebore (in coarse powder), logwood chips or raspings, helonias root (in powder), each, 2 ounces; sherry wine, 1½ pints, or a sufficient quantity. Form into a medicated wine by maceration or percolation, as explained under *Vina Medicata*, and make 1½ pints of the preparation.

Action, Medical Uses, and Dosage.—This preparation is tonic and cathartic, exerting a direct influence on the female reproductive organs. It has proved serviceable in *menstrual derangements*, as *amenorrhœa*, *dysmenorrhœa*, and some *painful uterine affections*. The dose varies from ½ to 1 or 2 fluid ounces, every 3 or 4 hours.

VINUM HYDRASTIS COMPOSITUM.—COMPOUND WINE OF GOLDEN SEAL.

SYNONYM: *Wine bitters.*

Preparation.—Take of golden-seal root, tulip-tree bark, bitter root, each, in fine powder, 1 drachm; prickly ash berries, sassafras bark, capsicum, each, in fine powder, ½ drachm; sherry wine, 3 pints, or a sufficient quantity. Form into a medicated wine by maceration or percolation, as explained under *Vina Medicata*, and make 3 pints of the preparation.

Action, Medical Uses, and Dosage.—This is useful in *dyspepsia*, and in all cases where tonics are required, with gentle stimulation. The dose varies from ½ to 1 or 2 fluid ounces, every 3 or 4 hours.

VINUM IPECACUANHÆ (U. S. P.)—WINE OF IPECAC.

Preparation.—"Fluid extract of ipecac, one hundred cubic centimeters (100 Cc.) [3 fl℥, 183 ♏]; alcohol, one hundred cubic centimeters (100 Cc.) [3 fl℥. 183 ♏]; white wine, eight hundred cubic centimeters (800 Cc.) [27 fl℥, 25 ♏]: to make one thousand cubic centimeters (1000 Cc.) [33 fl℥. 391 ♏]. Mix them. Set the mixture aside for a few days, then filter"—(*U. S. P.*). This wine contains in each fluid drachm the active constituents of about 5 grains of ipecac.

Action, Medical Uses, and Dosage.—(See *Ipecacuanha.*) This wine contains all the medicinal qualities of the drug, and, as an emetic, is sometimes preferred in infantile cases. An adult may take 1 fluid ounce for a dose, when vomiting is required; a child 1 or 2 years old may take 1 fluid drachm, repeating it every 10 or 20 minutes, until it vomits. From 10 to 30 minims have an expectorant and diaphoretic effect, if repeated at regular intervals of every 1 or 2 hours.

VINUM OPII (U. S. P.)—WINE OF OPIUM.

SYNONYMS: *Laudanum liqidum Sydenhami, Sydenham's laudanum.*

Preparation.—"Powdered opium, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; cassia cinnamon, in No. 60 powder, ten grammes (10 Gm.) [154 grs.]; cloves, in No. 30 powder, ten grammes (10 Gm.) [154 grs.]; alcohol, one hundred and fifty cubic centimeters (150 Cc.) [5 fl℥, 35 ♏]; white wine, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the alcohol with eight hundred and fifty cubic centimeters (850 Cc.) [28 fl℥, 356 ♏] of white wine. To the mixed powders add nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of the menstruum, and macerate during 7 days, with occasional agitation. Then transfer the mixture to a filter, and, when the liquid has drained off, gradually pass through the filter, first, the remainder of the menstruum, and afterward enough white wine to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. If 100 Cc. of wine of opium be assayed by the process given under *Tinctura Opii*, it should yield from 1.3 to 1.5 Gm. of crystallized morphine"—(*U. S. P.*). This is a pleasant vinous tincture of opium, containing in each 10 minims the activities of 1 grain of opium. With age it deposits insoluble extractive, and sometimes a little narcotine. This preparation is one of the forms of *Sydenham's laudanum* (*Tinctura Opii Crocata*, or *Saffronized tincture of opium*), the true form of which is a vinous tincture, made according to the *Parisian Codex*, by macerating, for 2 weeks, 2 ounces of opium, 1 ounce of saffron, and 1 drachm, each, of bruised cinnamon and cloves in 1 pint of sherry wine; then filter. A fluid drachm of this laudanum is equivalent to 3 grains of opium.

Action, Medical Uses, and Dosage.—This is one of the most eligible of the liquid preparations of opium, having a more agreeable taste and smell, and being much less liable to nauseate than tincture of opium. It is occasionally used in *conjunctivitis*, to constringe diluted vessels and relieve pain. The dose is from 5 to 16 minims.

VINUM PEPSINI (N. F.)—WINE OF PEPSIN.

Preparation.—"Pepsin (*U. S. P.*), seventeen and one-half grammes (17.5 Gm.) [270 grs.]; glycerin, fifty cubic centimeters (50 Cc.) [1 fl℥, 331 ♏]; hydrochloric acid (*U. S. P.*), four cubic centimeters (4 Cc.) [65 ♏]; water, sixty cubic centimeters (60 Cc.) [2 fl℥, 14 ♏]; purified talcum (F. 395), sixteen grammes (16 Gm.) [247 grs.]; stronger white wine (F. 440), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the water, glycerin, and hydrochloric acid, and agitate the pepsin with the mixture until it is completely disintegrated and apparently dissolved. Then add enough stronger white wine to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]; mix the liquid intimately with the purified talcum, allow it to stand for a week, if convenient, frequently shaking, then filter, and pass enough stronger white wine through the filter to restore the original volume. Each fluid drachm represents 1 grain of pepsin (*U. S. P.*)"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—(See *Pepsinum.*) A preparation of pepsin of questionable utility. Dose, 1 to 4 fluid drachms.

VINUM PHYTOLACCÆ COMPOSITUM.—COMPOUND WINE OF POKE.

SYNONYM: *Rheumatic liquid.*

Preparation.—Take of inspissated juice of poke berries, white turpentine, each, 4 ounces; sherry or native wine, 2 gallons. Macerate for 14 days, with occasional agitation, and filter (Beach's *Amer. Prac.*).

Action, Medical Uses, and Dosage.—This is an excellent preparation for *chronic rheumatism*, *chronic gonorrhœa*, *syphilitic pains*, etc. The dose is from ½ to 1 fluid ounce, 2 or 3 times a day.

VINUM PICIS (N. F.)—WINE OF TAR.

Preparation.—"Tar, one hundred grammes (100 Gm.) [3 ozs. av., 231 grs.]; water, two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏], pumice, in moderately fine powder, one hundred and twenty-five grammes (125 Gm.) [4 ozs. av., 179 grs.]; stronger white wine (F. 440), a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Upon the tar, contained in a suitable vessel, pour two hundred and fifty cubic centimeters (250 Cc.) [8 fl℥, 218 ♏] of cold water, and triturate the mixture thoroughly; then pour off the water and throw it away. Mix the remaining tar thoroughly with the powdered pumice, and add one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏] of stronger white wine. Stir frequently during 4 hours, then transfer the mixture to a wetted filter, and, after the liquid has passed, pour on enough stronger white wine to make the filtrate measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—(See *Tar.*) When used internally, the dose may range from 1 to 2 fluid drachms. Externally, it is useful in certain *skin affections*, requiring the effects of tar and stimulation.

VINUM PRUNI VIRGINIANÆ (N. F.)—WINE OF WILD CHERRY.

Preparation.—"Wild cherry, in No. 40 powder, two hundred and fifty grammes (250 Gm.) [8 ozs. av., 358 grs.]; sugar, one hundred and sixty-five grammes (165 Gm.) [5 ozs. av., 359 grs.]; water, two hundred cubic centimeters (200 Cc.) [6 fl℥, 366 ♏]; alcohol, seventy-five cubic centimeters (75 Cc.) [2 fl℥, 257 ♏]; purified talcum (F. 395), fifteen grammes (15 Gm.) [231 grs.]; angelica wine, a sufficient quantity to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Dissolve the sugar in the water. Moisten the wild cherry with a sufficient quantity of this solution, and allow it to macerate during 1 hour. Then transfer it to a percolator, pour upon it the remainder of the solution, and afterward enough angelica wine, until nine hundred cubic centimeters (900 Cc.) [30 fl℥, 208 ♏] of percolate are obtained. Add to this the alcohol, mix the purified talcum intimately with the liquid, then filter, returning the first portions of the filtrate until it runs through clear, and finally pass enough angelica wine through the filter to make the product measure one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents 15 grains of wild cherry"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—(See *Prunus Virginiana.*) A good tonic and sedative. Dose, 1 to 4 fluid drachms.

VINUM PRUNI VIRGINIANÆ FERRATUM (N. F.)—FERRATED WINE OF WILD CHERRY.

Preparation.—"Tincture of citro-chloride of iron (F. 407), eighty-five cubic centimeters (85 Cc.) [2 fl℥, 420 ♏]; wine of wild cherry (F. 452), enough to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Mix the tincture with enough wine of wild cherry to make one thousand cubic centimeters (1000 Cc.) [33 fl℥, 391 ♏]. Each fluid drachm represents 5 minims of tincture of citro-chloride of iron and 13¾ grains of wild cherry"—(*Nat. Form.*).

Action, Medical Uses, and Dosage.—This preparation combines the tonic properties of the iron with the sedative and tonic virtues of wild cherry. The dose may range from 1 to 2 fluid drachms.

VINUM QUININÆ.—WINE OF QUININE.

Preparation.—"Take of sulphate of quinine, 20 grains; citric acid, 30 grains; orange wine, 1 pint (Imp.). Dissolve, first the citric acid, and then the sulphate of quinine, in the wine; allow the solution to remain for 3 days in a closed vessel, shaking it occasionally, and afterward filter. Each fluid ounce contains 1 grain of sulphate of quinine"—(*Br. Pharm.*, 1885). The *Vinum Quininæ* of the present *British Pharmacopœia* (1898) is prepared from the hydrochloride, as follows: Take of "quinine hydrochloride, 20 grains (Imp.), or 2 grammes (Metric); orange wine, 1 pint (Imp.), or 875 cubic centimeters. Dissolve; set aside; filter, if necessary"—(*Br. Pharm.*, 1898).

Action, Medical Uses, and Dosage.—A convenient form for administering quinine citrate. Dose, 2 fluid drachms to 1 fluid ounce.

VINUM RHEI (N. F.)—WINE OF RHUBARB.

Preparation.—"Rhubarb, in No. 30 powder, one hundred grammes (100 Gm). [3 ozs. av., 231 grs.]; calamus, in No. 30 powder, ten grammes (10 Gm.) [154 grs.]; stronger white wine (F. 440), a sufficient quantity to make one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]. Moisten the mixed powders with fifty grammes (50 Gm.) [1 oz. av., 334 grs.] of stronger white wine, pack the mixture in a conical glass percolator, and gradually pour enough stronger white wine upon it to make the filtered liquid weigh one thousand grammes (1000 Gm.) [2 lbs. av., 3 ozs., 120 grs.]"—(*Nat. Form.*). This is based on the *U. S. P.* (1880) formula.

Action, Medical Uses, and Dosage.—(See *Rhei* and *Calamus.*) Laxative and carminative. Dose, 1 to 4 or more fluid drachms.

VINUM SAMBUCI.—WINE OF ELDER.

SYNONYM: *Hydragogue tincture.*

Preparation.—Take of elder bark, parsley root, each, in coarse powder, 1 ounce; sherry wine, 1 pint, or a sufficient quantity. Form into a medicated wine by maceration or percolation, as explained under *Vina Medicata*, and make one pint of the preparation.

Action, Medical Uses, and Dosage.—Wine of elder is useful in *dropsical diseases*, especially *ascites*, and *dropsy* supervening upon *scarlatina* or other *exanthematous diseases.* Dose, 2 fluid ounces, 3 or 4 times a day.

VINUM SYMPHYTI COMPOSITUM.—COMPOUND WINE OF COMFREY.

Preparation.—Take of comfrey root, Solomon's-seal root, helonias root, each, in coarse powder, 1 ounce; chamomile flowers, calumba root, gentian root, cardamom seeds, sassafras bark, each, in coarse powder, ½ ounce; sherry wine, 4 pints; boiling water, a sufficient quantity. Place the herbs in a vessel, cover with boiling water, and let the compound macerate for 24 hours, keeping it closely covered; then add the sherry wine. Macerate for 14 days; express and filter. Malaga wine, which is sometimes used in this preparation, is inferior to sherry wine, and more liable to decomposition. The addition of sugar to this wine of comfrey is apt to disagree with many persons, and thus destroy its efficiency. This preparation is sometimes called *Restorative Wine Bitters*, but is much superior to the article formerly known by this name.

Action, Medical Uses, and Dosage.—This is a most valuable tonic in all diseases peculiar to females, especially *leucorrhœa*, *amenorrhœa*, *weakness of the back*, etc. The dose is from ½ to 2 fluid ounces, 3 or 4 times a day.

VIOLA.—VIOLET.

The whole plant of *Viola pedata*, Linne; *Viola odorata*, Linné, and other species of *Viola.*

Nat. Ord.—Violaceæ.

COMMON NAMES: (1) *Blue violet*, *Bird's-foot violet;* (2) *Sweet violet*, *Sweet-scented violet.*

Botanical Source.—*Viola pedata*, *Blue violet*, or, as it is sometimes called, *Bird's-foot violet*, is an indigenous, stemless plant, glabrous, with the leaves and scapes all from perennial, fleshy, premorse, subterranean root-stocks. The leaves are pedately 5 to 9-parted; the lobes, linear-lanceolate, obtuse, and nearly entire. The petioles are armed with long, ciliate stipules at base. Flowers large, very showy, 1 inch broad, pale or deep lilac-purple, and fragrant. The peduncles are somewhat 4-sided, and much longer than the leaves. Segments of the calyx are linear, acute-ciliate, and emarginate behind. Petals veinless, entire and beardless. Spur or beak obscure. Stigma large, flattened at the sides, obliquely truncate, and pierced at the top (W.—G.). *Viola odorata* is a small, creeping plant, with flagelliform runners; its leaves are roundish-cordate; sepals 5, ovate and obtuse; petals 5; spur very blunt. Its flowers are fragrant, deep-purple, often white, occasionally lilac, and borne on radical, furrowed, quadrangular peduncles. The bracts are inserted above the middle of the scape. Capsules turgid, hairy, bursting with elasticity, many-seeded, and 3-valved. Seeds turbinate and pale (L.—De Candolle).

History and Description.—The *Blue violet* is common to the United States, growing from Maine to Florida, and west to Missouri, in dry woods and pastures, and sandy places, flowering in May and June. Occasionally a second flowering occurs in August and September. The herb and root are used, and impart their virtues to water. The taste of the flowers is sweet and mucilaginous; of the rhizome, bitter, mucilaginous, and sub-acrid. The *Viola odorata*, or *Sweet violet*, of Europe, is much cultivated in this country on account of its beautiful flowers, which appear in April and May. The flowers of this species are made into a syrup which is official in the *French Codex*. Of fresh violet petals (the deep-blue ones only, deprived of the calyx), take 10 parts, and boiling water, 20 parts. Infuse, and add to 21 parts of infusion 38 parts of sugar. Both of these plants possess similar properties; the flowers are commonly employed, but the whole plant is medicinal. The flowers should be gathered as soon as they are fully expanded, the sepals removed, and then carefully dried. According to P. L. Simmonds (*Amer. Jour. Pharm.*, 1891, p. 201), the whole plant of *Viola odorata* is sold in a dry state in all the bazars of Bengal, and is given in infusion as a diaphoretic in fevers. In large doses it nauseates and often produces vomiting. The Romans had a wine of violet flowers, and it is said they are still used in the preparation of sherbets.

Chemical Composition.—The root, leaves and seeds of these odoriferous plants are emetic in larger doses. Boullay (1828) found the whole plant of *V. odorata* to contain an acrid and poisonous principle which he called *violine*. It resembles emetine in its action, is a pale-yellow or white powder of bitter and acrid taste, more soluble in water than emetine, insoluble in ether, quite soluble in alcohol, and forming an insoluble compound with tannin solution. It also exists in other plants of this family, particularly in the rhizomes of the perennial, and especially the stemless species of violet. It is not present, however, in the pansy (see below). The root also contains starch, yellow coloring matter, gum, traces of volatile oil, etc. The flowers contain a blue coloring matter, turning green with alkalies. As to the odoriferous principle of the violet, it has not yet been definitely established whether it is identical with the synthetical violet perfume from orris root. (Regarding the latter, see Henry Kraemer, *Amer. Jour. Pharm.*, 1895, pp. 346–356.) K. Mandelin (*Dissert.*, 1881; see *Amer. Jour. Pharm.*, 1882, p. 11) found the leaves of *V. odorata* to contain a substance which, after boiling, yielded salicylic acid (also see *Related Species*, below). Boiling water extracts the virtues of these plants.

Action, Medical Uses, and Dosage.—The flowers and seeds of *V. odorata* act as laxatives in doses of 3 or 4 drachms, rubbed up with sugar and water; the root in ½ or 1-drachm doses is emeto-cathartic, but it is uncertain in its action. The odorous emanations from the flowers have caused faintness and giddiness, and in one case were supposed to have brought on apoplexy. The seeds have been recommended in *uric acid gravel*. *Blue violet* is mucilaginous, emollient, and slightly laxative; also antisyphilitic and useful, when combined with *Corydalis formosa*, in *syphilis*. Has been used in *pectoral, nephritic and cutaneous affections*, especially *crusta lactea*. The plant should be used when fresh, as drying destroys its active properties. Prof. Scudder says of it that "it stimulates waste and secretion, relieves nervous irritability, and improves nutrition"—(*Spec. Med.*). The *V. tricolor*, or pansy, may be used as a substitute. The roots of these plants are bitterish and slightly acrid, and in doses of from 8 to 10 grains are tonic; from 25 to 30 grains, purgative; and from 40 to 60 grains, emetic.

Related Species.—*Viola tricolor*, Linné (*Herba jaceæ*); *Heartsease, Johnny jump-up, Pansy*. The wild-growing species of pansy is official in the *German Pharmacopœia*, and its variety *arvensis* in the *French Codex*. Its corolla has the 3 colors—blue, yellow, and purple. According to Boullay (1828), no emetic *violine* (see above) is present, but a yellow coloring principle and an abundance of mucilage was found. The yellow principle has since been shown by Mandelin (*Pharm. Zeitschrift für Russland*, 1883, p. 329) to be a glucosid *violaquercitrin* ($C_{42}H_{42}O_{24}$). From hot solution it forms fine yellow acicular crystals, soluble in alkalies and reprecipitated by acids; when boiled with diluted acids it is split into quercetin, glucose, and a fluorescent body. Previously (1881), Mandelin obtained free salicylic acid from the dried herb varying from 0.06 to 0.14 per cent. It occurs in several other species of Viola. Griffith and Conrad (1884) found 0.13 per cent in the leaves, 0.08 per cent in the stems, and 0.05 per cent in the root; the flowers contained but a trace. The fresh leaf-buds, when rubbed between the fingers, exhibit a distinct odor of methyl salicylate (see monograph on *Viola tricolor*, by Henry Kraemer, *Dissert.*, Marburg, 1897). The immoderate use of Viola tricolor is said to derange the gastro-intestinal functions, and to induce diuresis, sweating, and a pustular skin eruption. It imparts to the urine a feline odor. Its chief use is as a remedy for the *moist eczematous eruptions* which are prone to occur on the scalp and face of children. From 5 to 10 drops of a strong tincture may be added to 4 fluid ounces of water, the dose of the mixture being a teaspoonful every 4 hours. In Europe it is used as a blood purifier, and in *catarrhal affections of the bronchiæ and intestines.*

Viola sagittata, Aiton, var. *ovata*, or *Rattlesnake violet*, has been highly recommended in the *bites of rattlesnakes*, the infusion to be freely administered; and the infusion used internally, with a fomentation of the leaves locally applied, has proved efficient in *obstinate chronic ophthalmia;* a similar course is reputed very valuable in *scrofulous diseases.* Probably all the species possess analogous properties; they are undoubtedly more active agents than are generally supposed, and deserve further investigation.

Viola cucullata, Aiton, is our *Common blue violet*, abundant everywhere, and a very variable species.

Anchietæa salutaris, St. Hilaire (*Noisettia pyrifolia*, Martius).—A Brazilian shrub, the root of which is emeto-cathartic. Sugar, starch, gum, tannin, resin, and a pale-yellow, crystalline basic *anchietine* (0.40 per cent) were found in the root by Peckolt in 1859 (*Archiv der Pharm.*, Vol. CXLVII, p. 271). The base has a nauseous, persistently pungent taste, is freely soluble in alcohol, sparingly in boiling water; insoluble in ether; forms a characteristic hydrochloride, and produces violet, subsequently turning to black, with sulphuric acid. From the fact that this root will salivate, it has been used in powder and alcoholic tinctures for the relief of *cutaneous disorders* and *syphilis.*

Ionidium Marcucci, Bancroft (*Ionidium parviflorum*, Ventenat), South America, near Mount Chimborazo.—The *cuichunchulli* of the Indians, much used in South America in *cutaneous disorders*, and said to be peculiarly efficient in *elephantiasis.* Small doses of the root are diaphoretic, sialagogue, and diuretic, while large doses prove emetic and purgative.

Ionidium Ipecacuanha, Ventenat.—A Brazilian root, used as a substitute for ipecacuanha (see *Ipecacuanha*). It contains an emetic alkaloid not identical with emetine or violine (see J. B. Barnes, *Pharm. Jour. Trans.*, Vol. XV, 1884–85, p. 515).

VISCUM.—MISTLETOE.

The leaves and branches of *Viscum flavescens*, Pursh (*Phoradendron flavescens*, Nuttall).

Nat. Ord.—Loranthaceæ.

COMMON NAMES: *Mistletoe, American mistletoe.*

Botanical Source and History.—This is the *Viscum verticillatum* of Nuttall, and *Viscum album* of Walter. It is a yellowish-green, succulent parasite, growing on the branches and trunks of old trees, especially apple trees, elms, oaks, hickories, etc. The stems are jointed, 1 or 1½ feet in length, rather thick, with many round, spreading, opposite, and sometimes verticillate, terete branches. The leaves are opposite, cuneate-obovate, 3-veined, obtuse, smooth, entire, contracted at the base into a short petiole, and 9 to 16 lines long by 4 to 9 broad. The flowers are small, greenish-white; the sterile ones mostly 3-parted, in axillary, solitary spikes, and about as long as the leaves. The fruit is globose, yellowish-white, smooth, semitransparent, with a viscous pulp, is borne in clusters, and contains 1 fleshy seed. It remains throughout the winter (W.—G.).

Fig. 255.

Viscum flavescens.

Viscum album, Linné, is the European species employed. It differs in the shape of its leaves, which are lance-shaped or spatulate. It grows upon apple, plum, pear and other fruit trees, as well as upon birches, beeches, poplars, etc.

Description.—This parasitic shrub is found growing on various trees; but that which is found on the oak is preferred. The bark and leaves have an unpleasant odor, and a mawkish, bitterish taste. The proper time for collection is in November, when it should be gradually dried, pulverized, and kept in a well-stoppered bottle. It should never be kept more than a year, as age impairs its active qualities. The mistletoe growing on the water or black elm (*Ulmus nemoralis*), and on the water oak (*Quercus aquatica*), is reputed to possess the most energetic medicinal virtues.

Chemical Composition.—All parts of the plant contain *viscin;* also called *bird-glue;* curiously miscalled *birdlime* (from the German *Vogelleim*), deriving its name from the fact that it has been used in Germany in catching small birds. It is very adhesive, soft, and elastic, having a greenish or brownish color; insoluble in water and fixed oils, slightly soluble in alcohol, very soluble in ether. According to Henry, the berries contain viscin, green wax, gum, bassorin, brown extractive, salts, etc. P. Reinsch (*Neues Jahrbuch f. d. Pharm.*, Vol. XIV, 1860, pp.

129–153) obtained crude *viscin* from the berries and the bark. The former yield a purer product, but are difficult to obtain in quantity, as they invariably grow on high trees. The scrapings from the bark are first kneaded with gradually increased quantities of water, which removes gum, albumen, sugar, chlorophyll, tannin, and salts; the residual mass is treated with alcohol, which removes yellow wax; the residual crude viscin is then dissolved by ether, which, upon evaporation, leaves a residue which, when washed with alcohol and water, and heated for some time to 120° C. (248° F.), constitutes pure *viscin*, a clear, tasteless, and odorless mass of the consistency of honey, and capable of being drawn out into threads. In the above treatment, ether leaves undissolved a mixture of plant fibers and a yellowish-brown, exceedingly sticky mass, which is soluble in oil of turpentine. Reinsch calls it *viscaoutchin*.

Action, Medical Uses, and Dosage.—Narcotic, antispasmodic, diaphoretic, and tonic. This plant possesses toxic properties. Vomiting, catharsis, with tenesmus and sometimes bloody stools, pupillary contraction, muscular spasm, prostration, coma, convulsions, and death have been reported from eating the leaves and berries. Viscum has been beneficially employed in *epilepsy*, *hysteria*, *insanity*, *paralysis*, and other *nervous diseases*. In using this agent, it is always necessary to regulate the condition of the stomach and bowels, and the menstrual discharge, and other faulty secretions, and remove *worms*, if any are present, previous to its exhibition. It is asserted of some value as an oxytocic, and to restrain *postpartum and other uterine hemorrhages*. It produces intermittent contractions, and by some physicians, especially Dr. Ellingwood, is declared to be safer, in many respects, than ergot. It is useful in *amenorrhœa* and *dysmenorrhœa*. It is also reputed a heart tonic. According to Dr. Tascher, it is a remedy for *cardiac hypertrophy* and *dropsy*, associated with enlarged heart. Cardiac hypertrophy, valvular insufficiency, feeble pulse, œdema, dyspnœa, and inability to lie down, were the symptoms of the cases favorably influenced by 20 to 30-drop doses of the fluid extract. Dr. Ellingwood advises it with strychnine to support the weak, irregular, and rapid heart-action, with tendency to collapse, in *typhoid fever*. It may be given in doses of from 30 to 60 grains, and gradually increased to 3 or 4 drachms, 3 or 4 times a day, and if it produces sleep or other narcotic effects, the doses must be diminished; fluid extract, 10 to 40 drops; specific mistletoe, 1 to 15 minims. Preparations of the fresh plant should be used, as the drug loses its properties when old. The powder is best given in an infusion of valerian.

Specific Indications and Uses.—Determination of blood to brain, flushed face, and oft-recurring headache; tearing, rending rheumatic or neuralgic pains, coming on in paroxysms; weak, irregular heart-action, with dyspnœa, cardiac hypertrophy, and valvular insufficiency.

Related Species.—*Loranthus europæus*, Linné. East and south Europe. This is a larger shrub, and thicker than the mistletoe. Its berries are light-yellow, and its bark grayish or deep-brown. Oak and chestnut trees support it. It is the plant alluded to by older writers as the *Viscum quercinum*.

VITELLUS (U. S. P.)—YOLK OF EGG.

"The yolk of the egg of *Gallus Bankiva* var. *domestica*, Temminck (*U. S. P.*) (*Phasianus Gallus*, Linné).

Class: Aves. *Order*: Gallinæ.

Synonym: *Ovi vitellus.*

Source.—The *Common hen*, or Dunghill-fowl, *Gallus Bankiva* (*Phasanius Gallus*), supposed to have been originally the *jungle-fowl* of India, is now domesticated almost everywhere. Its egg is the part used in medicine; less frequently the eggs of ducks and geese are in domestic use.

Description and Chemical Composition.—According to J. König (*Die Menschl. Nahrungs-und Genussmittel*, 3d ed., Vol. II, 1894, p. 201), the average weight of a hen's egg is about 53 grammes, the limits being from 30 to 70 grammes. It consists of the *egg-shell* with its lining membrane (11.5 per cent), the *egg-white* or *albumen* (58.5 per cent), and the *yolk* (30 per cent).

I. Testa Ovi (*Putamen ovi, Egg-shell*) is composed chiefly of calcium carbonate (89 to 97 per cent), calcium and magnesium phosphate (0.5 to 5 per cent), magnesium carbonate (0 to 2 per cent), and organic substance (2 to 5 per cent). The carbonate of calcium renders the shell absorbent and antacid. The albuminous membrane (*Pellicula ovi, Membrana putaminis*) which lines the inner surface of the shell, is a keratin-(horn) like substance, soluble in alkalies, from which solution it is precipitated by acids. At the broad end of the egg it forms an air space, the *Follicula aëris*.

II. Albumen Ovi (the *White* or *Glaire of egg, Ovalbumen*) is an almost colorless, transparent, odorless, liquid mass, consisting of a thin, alkaline fluid, rendered viscous on account of being enclosed in cells forming a network of delicate membranes. This fluid contains on an average 85.75 per cent of water, 12.67 per cent of nitrogenous matter, 0.25 per cent of fat, and 0.59 per cent of salts, which consist for the most part (about 92 per cent) of the chlorides of potassium and sodium. The yolk of the egg (see below) has a markedly different composition. The albumen of the white of egg (ovalbumen) corresponds to the formula $C_{144}H_{122}N_{18}S_2O_{44}$ (see J. König, *loc. cit.*), containing 1.6 per cent of sulphur. This element is partly liberated in the form of hydrogen sulphide when the egg decomposes. Ovalbumen, however, is not a simple compound; its chief constituent is *ovalbumin*, probably a mixture also; it is soluble in water, and coagulates by exposure to a temperature of 60° to 70° C. (140° to 158° F.). It is precipitated from aqueous solution by the addition of alcohol, hydrochloric acid, excess of sodium sulphate and ammonium sulphate, not by sodium chloride, and forms precipitates with tannic acid, creasote, mercuric chloride, salts of copper, chlorides of gold and tin, the acetates of lead, potassium ferrocyanide in acetic acid solution, etc. It is not precipitated by concentrated solution of magnesium sulphate at 20° C. (68° F.), and may be separated by means of this behavior from *ovoglobulin*, another nitrogenous constituent of the egg-white, forming about 0.67 per cent of the latter. *Ovomucoid* is a mucous substance rich in nitrogen (12.65 per cent) and sulphur (2.2 per cent), also contained in ovalbumen. (For further details regarding these albuminous compounds and their reactions, see Hammarsten and Mandel, *Physiological Chemistry*, 2d ed.. 1898, pp. 410–416, or similar publications.)

The reactions of ovalbumen differ somewhat from those afforded by *seralbumen*, or the albumen contained in the serum of the blood; unlike seralbumen, ovalbumen in aqueous solution is precipitated by ether and concentrated hydrochloric acid, and both differ somewhat from the albumen in the urine accompanying Bright's disease. To test a specimen of urine for albumen, apply the exceedingly sensitive *Heller's test*, as follows: Place 3 Cc. of strong nitric acid into a test-tube, add 1 Cc. of water, cool, and carefully filter into this liquid the urine, employing two layers of filtering paper, and taking care that the urine runs down the sides of the test-tube and forms a layer above the nitric acid. If albumen is present, a white ring is formed at the zone of contact. This test in case of a positive result may be supplemented by the *heat test:* Slightly acidulate the urine if alkaline with acetic acid, filter, if necessary, through a double filter into a test-tube, add about one-tenth its volume of a saturated solution of sodium chloride, and heat the upper part of the liquid over a small flame; if a cloudiness appears, which is not dissolved after cooling by the addition of nitric acid (phosphates), the turbidity will be due to albumen.

When the white of eggs is placed in thin layers on glass, and dried in the air, it becomes solid without losing its transparency or property of dissolving in water, and may be preserved in this manner for a long time; these dried fragments (*albumen ovi siccum*) will be found to answer as a substitute for the original white, when formed into a solution with water. They are insoluble in ether or alcohol. White of egg kept in its original condition speedily decomposes.

III. Vitellus Ovi, the *Yolk of egg*, is enclosed within a fine membrane, and consists of minute cells holding albuminous matter with yellow oil. It becomes solid (coagulates) by heat. Triturated with water, yolk of egg produces a thick, opaque solution, much used in pharmacy for suspending oily and resinous substances in the former fluid. Heat solidifies it, and its oil (*oil of eggs*) may then be obtained by expression; or, the oil may be prepared by boiling the yolk hard, then digesting it with ether or alcohol, filtering and distilling off the solvent, when the oil remains. When extracted by means of ether, it contains chiefly triolein (about 83 per cent), solid fats (about 16 per cent), cholesterin (1.6 per cent), lecithin (0.2 per cent), and coloring matters (M. Kitt, *Pharm. Centralhalle*, 1897, p. 340, from *Chem. Zeitg.*). J. König (*loc. cit.*) gives the following average composition of the yolk of eggs: Water, 51.8 per cent; *vitellin*, 15.8 per cent; *nuclein*, 1.5 per cent; palmitin, stearin and olein, 20.3 per cent; the crystallizable alcohol, *cholesterin* ($C_{26}H_{44}O$), 0.4 per cent; glycero-phosphoric acid, 1.2 per cent; *lecithin*, 7.2 per cent; *cerebrin*, 0.3 per cent; coloring matters (*luteines*) 0.5 per cent; salts, 1.0 per cent, consisting chiefly of phosphates of calcium, potassium and sodium. *Vitellin* (of Gobley) is a peculiar albuminous body, resembling the albumins of the globulin group (see Hammarsten and Mandel, *loc. cit.*); like these, it is insoluble in water, but is soluble in a 10 per cent sodium chloride solution, from which it is precipitated by dilution with water. It coagulates at a temperature of 70° to 75° C. (158° to 167° F.). *Lecithin*, a rather complex waxy compound occurring also in the brain, nerves, muscles, blood, etc., was first obtained by Gobley from the ether extract of the yolk. Its molecule combines the radicals of glycerin, phosphoric acid, oleic acid, palmitic acid and the base *choline* ($C_5H_{14}NO_2$) (see under *Trimethylamine*). When boiled with baryta water, it is split into the above-named fatty acids, glycero-phosphoric acid and choline.

Eggs may be preserved for some time by coating them with wax, gum, fat, paraffin, linseed oil (recommended by Violette), or similar substances, which render the shell impervious to water and air. Packing the eggs in salt or milk of lime, placing the pointed end downward, has been common practice. (Also see J. König, *loc cit.*, and *Amer. Jour. Pharm.*, 1899, pp. 7 and 24.)

Action and Medical Uses.—Eggs have been much employed in medical practice. The shells, when reduced to a very fine powder, may be used in *acid conditions of the digestive organs*, in the same doses as prepared chalk. The albumen or white is useful as a demulcent in *diseases of the intestinal mucous membrane*, and is a valuable agent in the treatment of *poisoning by bichloride of tin*, the *soluble salts of copper*, and *bichloride of mercury;* its efficiency in these cases is owing to its combining with the oxide or chloride of the metal, forming comparatively harmless compounds. In cases of redness or *excoriation* from pressure, it forms a good local application, when used in the form of a liniment, made by agitating it briskly with its own volume of alcohol. It is also employed as a clarifying agent for wines, and some other liquids. Its efficacy depends on its coagulation, by which it entangles in its meshes the impurities with which it either rises to the surface or precipitates. When the liquid to be clarified does not spontaneously coagulate the albumen, it is necessary to apply heat (P.). The white is also used for diffusing throughout water substances which are not dissolved by it. Mixed with a small quantity of alum, a coagulum (*alum curd*) is formed which has been found efficient as a local application in some *inflammations of the eye*, after the more severe symptoms have been subdued. It is likewise valuable in this form for the treatment of *erysipelas*, *scalds*, and *burns*, and *poisoning by rhus* when located near the eyes. The yolk is a mild nutrient, and generally does not offend the stomach; added to an infusion of ginger, and thoroughly beaten up with it, it has been found serviceable in *dyspepsia*. It answers the purpose much better than the white in the preparation of mixtures, emulsions, etc. Its powers as an antidote to poison are the same as those of the white. Contrary to the generally accepted notion, the hard-boiled yolk is easy of digestion. The oil obtained from the hard-boiled yolk has been found serviceable in *cracked nipples*. A non-collegiate practitioner in this country acquired some celebrity in the treatment of *dyspepsia*, loss of appetite, *constipation*, *hemorrhoids*, etc.; the agent he employed was a powder composed of equal parts of the inner skin of chickens' gizzards (*ingluvies pulli*), dried and pulverized, sulphur, and resin, of which from 5 to 10 grains were to be taken 3 or 4 times a day (see *Ingluvin*).

An artificial serum has been used to moisten the hands with during the manipulation of the abdominal contents while operating for removal of the ovaries, etc., and for other purposes; it is composed of common salt, 1 drachm; white of egg (albumen) 1½ drachms; pure water, 1 pint. Mix. During an operation in which this fluid is employed it should be constantly maintained at a blood-warm temperature. White of egg forms a good cement for mounting certain specimens for microscopic investigation.

WINTERA.—WINTER'S BARK.

The bark of *Drimys Winteri*, Forster (*Wintera aromatica*, Murray).

Nat. Ord.—Magnoliaceæ.

COMMON NAMES AND SYNONYMS: *Winter's bark*, *Winter's cinnamon*, *Cortex winteri*, *Cortex magellanicus*, *Cortex winteranus*.

Botanical Source.—This is a very large (or very small, according to locality of growth) evergreen, aromatic tree, varying in size from 6 to 50 feet high. The bark of the trunk is gray and wrinkled; that of the branches smooth and green. Branches rather erect, and scarred by the traces of fallen leaves. The leaves are alternate, oblong, obtuse, with a midrib, but otherwise veinless, glabrous, and finely dotted beneath. The flowers are small, on axillary or somewhat terminal peduncles, which are approximated, usually 1-flowered and simple; occasionally divided a little above the base into long pedicels. Sepals 2 or 3; petals 6, and oblong; fruits 4 or 6, obovate, baccate, and many-seeded (L.).

History.—This tree inhabits the southern parts of South America, Chili, Peru, Terra del Fuego, etc., and takes its name from its discoverer, Capt. Winter, who commanded the *Elizabeth* in Capt. Drake's voyage through the Straits of Magellan in 1578. Winter employed it to cure scurvy. Owing to the difficulty of obtaining the true bark, and the ease with which other barks, notably canella bark, could be substituted for it, the true bark was lost sight of for many years; hence the conflicting descriptions in the literature of the drug. Forster (1773) first correctly established its botanical identity. As a remedy for gastric debility and diarrhœa, it is largely employed in South America.

Description.—The authors of *Pharmacographia* thus describe true Winter's bark, as found by them upon many examinations: "The bark is in quills, or channelled pieces, often crooked, twisted or bent backward, generally only a few inches in length. It is most extremely thick ($\frac{1}{10}$ to $\frac{3}{10}$ inch), and appears to have shrunk very much in drying; bark $\frac{1}{4}$ inch thick, having sometimes rolled itself into a tube only 3 times as much in external diameter. Young pieces have an ashy-gray suberous coat beset with lichens. In older bark the outer coat is sometimes whitish and silvery, but often more of a dark rusty-brown, which is the color of the internal substance, as well as of the surface of the wood. The inner side of the bark is strongly characterized by very rough striæ, or, as seen under a lens, by small, short, and sharp longitudinal ridges, with occasional fissures indicative of great contraction of the inner layer in drying. In a piece broken or cut transversely, it is easy to perceive that the ridges in question are the ends of rays of the white fiber which diverge toward the circumference in radiate order, a dark-rusty parenchyme intervening between them. No such feature is observable in either *Canella* or *Cinnamodendron*. Winter's bark has a short, almost earthy fracture; an intolerably pungent, burning taste, and an odor which can only be described as terebinthinous"—(*Pharmacographia*, 2d ed., p. 19).

Chemical Composition.—Winter's bark was examined in 1820 by M. Henry, who found in it a reddish-brown, inodorous, acrid resin (10 per cent), a pale-yellow volatile oil (1.2 per cent), tannic acid, oxide of iron, starch, coloring matter, and various salts. The volatile oil appears to be a mixture of several bodies; P. N. Arata and F. Canzoneri found the oil from a genuine specimen to contain a sesquiterpene which they named *winterene* ($C_{15}H_{24}$) (*Amer. Jour. Pharm.*, 1890, p. 354).

Action, Medical Uses, and Dosage.—Stimulant, aromatic, stomachic, and tonic, and may be substituted in all cases for the canella, cascarilla, and cinnamon barks. It was highly recommended by its discoverer as an antiscorbutic. Thirty grains is the dose of the powdered bark. It is seldom used in this country. A vinous tincture (bark, ℥i to sherry wine, ℥viij) may be employed in drachm doses.

Related Drugs and Substitutes.—Another tree inhabiting Chili, *Drimys Mexicana*, Sessé (*Drimys Chilensis*, of De Candolle), has a bark possessing analogous virtues. This species and *Drimys granatensis*, Linné filius, are regarded as mere varieties of the *Drimys Winteri*. The second is now adopted by the *French Codex* as the source of the drug of commerce, which this authority states has the same properties as the original drug from the Straits of Magellan, and even excels the original drug in keeping qualities.

Cinnamodendron corticosum, Miers, of Jamaica, has been sold extensively as Winter's bark, and at one time wholly replaced the true article. *Canella alba*, Linné, at one time was erroneously believed to be the source of the commercial drug (D. Hanbury, 1862; see his *Science Papers*).

The barks of *Drimys lanceolata* and *Drimys axillaris*, Forster, both of Australia, are aromatic and pungent, and the fruit of the first-named is said to be employed as a condiment.

MALAMBO BARK is the name of a substitute for Winter's bark which appeared on the American market about 1856. It was identified by Prof. E. S. Wayne (see *Amer. Jour. Pharm.*, 1857, pp. 1-8, and D. Hanbury, *ibid.*, p. 212).

XANTHIUM.—SPINY CLOT-BUR.

The whole plant of *Xanthium spinosum*, Linné.

Nat. Ord.—Compositæ.

COMMON NAME: *Spiny clot-bur.*

Botanical Source.—Xanthium spinosum is a weed known as "*Spiny clot-bur*," and is naturalized in the United States, in many places near the seacoast, the seed having been introduced in ballast. The stem is an annual, from 1 to 3 feet high, much branched, and armed with numerous spines. The spines are of a light straw color, and are divided, about a quarter of an inch from the base, into three slender, sharp, diverging branches. The leaves are lanceolate, acute, tapering to a short leaf-stalk at the base; they are entire or have 2 teeth, or often lobes, near the base. The under surface is covered with a close, white tomentum. The flowers are small, monœcious, the sterile being borne near the apex, the fertile at the base, of the branchlets. The fruit is a rough, oblong bur, armed at the apex with a short beak, and densely covered with equal hooked prickles.

Chemical Composition.—In 1876 (*Jahresb. der Pharm.*, p. 117) Dragendorff communicated the result of an analysis of the plant made by him in 1866. He obtained small quantities of a probably evanescent alkaloid soluble in alcohol and water. The herb contains considerable quantities of potassium nitrate. Yvon (*ibid.*) believes the alkaloidal reactions to be due to a non-alkaloidal resin soluble in ether and alcohol. About 10 per cent of starch is present.

Action, Medical Uses, and Dosage.—This plant was recommended as a specific in the treatment of *hydrophobia* by Dr. Grzyvala; the assertion being made that in one hundred cases and upward of persons who had been bitten by rabid dogs, the administration of this article effected recovery without a single failure. The dose was 10 grains of the plant, in powder, repeated several times a day. Experiments by other physicians have failed to sustain this assertion, and for this purpose the plant has passed into disrepute. It, however, is reputed sialagogue, sudorific, and somewhat diuretic, resembling to a considerable extent the action of pilocarpus, besides being antiperiodic. Prof. Scudder (*Spec. Med.*, p. 266) writes of it, that it "may be employed as a prophylactic against *ague*, as an antiperiodic when the patient is subject to profuse sweatings, and to prevent the recurrence of *chills* when they have been broken. It may be employed in any disease where there is nervous excitement attended by sweating." Clot-bur has a soothing action upon the urinary tract, and has recently proved a good remedy for *passive hematuria*. Some have reported success with it in *postpartum hemorrhage*, but it is not likely to supplant other well-known remedies for this purpose. Dr. George W. Homsher, of Camden, Ohio, attributes a specific action to this agent in *irritable conditions of the bladder*, particularly *chronic cystitis*. In cases benefited by it there is an excess of mucus and a uric acid diathesis, the bladder walls are thickened, urination is tenesmic and frequent, and gravel or minute calculi may pass continually. It is frequently used with red onion. Prof. Bloyer has used this combination with success in similar conditions, with bloody urine. Clot-bur was long ago employed in the treatment of *gonorrhœa*. Dose of the powder, 5 to 10 grains; of the tincture (fresh plant in flower, ℥viij to strong alcohol, Oj), $\frac{1}{4}$ to 10 drops; specific xanthium spinosum, $\frac{1}{10}$ to 10 drops.

Specific Indications and Uses.—Ague, with profuse sweatings; prophylactic against ague, and to prevent a recurrence of chills; nervous excitation, with copious sweating. Bloody urine; urine heavily loaded with mucus and gravelly deposit; urination painfully tenesmic and frequent.

Related Species.—*Xanthium strumarium*, Linné, *Cockle-bur, Clot-bur.* A common weed growing in wastes throughout Europe, north Asia and North America. Our indigenous plant has two varieties, the *echinatum*, Gray, and *canadense*, Miller. The fruit has been analyzed by Zander (*Amer. Jour. Pharm.*, 1881, p. 271), who isolated 1.27 per cent of a yellow, non-crystalline glucosid, *xanthostrumarin*, soluble in alcohol, chloroform, ether, benzene, and water. With the group reagents for alkaloids it forms precipitates, except with gelatin and tannin. Among other constituents were found albuminoids, 36.64; fatty matter, 38.6; ash, 5.18; sugar and resin. A peculiar principle, differing perhaps from xanthostrumarin of Zander, and about 14.5 parts of fixed oil were obtained by Chatham in 1884 (*ibid.*, p. 134).

XANTHORRHIZA.—SHRUB YELLOW ROOT.

The rhizome and roots of *Xanthorrhiza* (*Zanthorhiza*) *apiifolia*, L'Heritier (*Xanthoriza simplicissima*, H. Marshall; *Marbosia tinctoria*, Wm. Bartram; *Xanthorrhiza tinctoria*, Woodhouse).

Nat. Ord.—Ranunculaceæ.

Common Names: *Shrub yellow root*, *Southern yellow root*, *American shrub yellow root*, *Parsley-leaved yellow root*, *Yellow wort*, and *Yellow root.*

Illustration: Lloyd's *Drugs and Med. of N. A.*, Pl. 25; Bentley and Trimen, *Med. Plants*, 9.

Botanical Source.—This is a small, deciduous, indigenous shrub, 1 to 3 feet in height, with a thick, horizontal, deep-yellow rhizome, throwing up numerous suckers. The stem is short, woody, leafy above, with a light-gray (Lloyd) bark, and a bright-yellow wood. The leaves are pinnate, of about 3 pairs with an odd one, glabrous, about 8 inches long, including the long petioles; they are 2 or 3 inches long, ovate or rhomboidal, sessile, incisely-lobed, and dentate, sometimes divided almost to the base on one side, pale-green, smooth above and slightly pubescent beneath. The flowers are small, dull purplish-brown, in axillary, compound, drooping racemes, appearing with the leaves. Calyx of 5 sepals, regular, spreading, and deciduous; corolla of 5 obovate, concave, 2-lobed petals, smaller than the sepals, and raised on a claw. Ovaries from 5 to 9. Follicles or capsules inflated, compressed, spreading, 1½ inches long, 1-celled, 2-valved, and opening at the apex; seeds, oval and flattened (L.—W.—G.).

Fig. 256.

Xanthorrhiza apiifolia.

History and Description.—This plant is found along river banks in the mountains of Pennsylvania to Florida, being chiefly confined to the mountains. It is also found in some of the western and southwestern states, flowering in March and April. The root is the medicinal part; it varies in length from 4 to 12 inches, is about 6 lines in diameter, is bright-yellow (light-brown when dried), and exceedingly bitter. Water extracts its virtues, and sulphate of iron is not incompatible with its infusion. The bark of the stem is equally as efficient as the root. The Indians were well acquainted with it as a dye; it dyes silk a bright-yellow, and wool a dark-brown or dun color. The plant is generally known in the south as yellow root, a name borne farther north by hydrastis.

Chemical Composition.—The root contains berberine, to which undoubtedly its tonic properties are due. The presence of this principle was suspected in the drug by Wm. S. Merrell; it was isolated by G. Dyson Perrins (*Pharm. Jour. and Trans.*, May, 1862), who obtained but a very small amount of it. J. U. Lloyd obtained, on a large scale, 1.1 per cent of berberine monosulphate. Gum and bitter resin were early pointed out by Dr. Woodhouse (see Lloyd's *Drugs and Med. of N. A.*, Vol. I, p. 297). Mr. Samuel S. Jones (*Amer. Jour. Pharm.*, 1886, p. 161) made a complete quantitative analysis of the root. In addition to starch, dextrin, sugars, etc., he found several resins, and 0.28 per cent of total alkaloids. In the mother liquor from berberine sulphate, the author found an amorphous alkaloid not identical with berberine.

Action, Medical Uses, and Dosage.—Yellow root is a pure, bitter tonic, considered by the late Prof. Barton to be superior to calumba. It may be used for all purposes in which the other simple tonic bitters are applicable. Of xanthorrhiza, Prof. J. U. Lloyd (*Drugs and Med. of N. A.*, Vol. I, p. 289) very justly remarks that "although we find xanthorrhiza most favorably introduced by the leaders of medicine of the early part of the century, and although it has been official in the Pharmacopœia since its first issue (1820) until discarded in 1880, it has failed to obtain a foothold. It has never been a favorite with either botanic or Eclectic physicians, and it is hardly recognized by them. In this connection we must revert to the fact that, although known to the Eclectics, and possessing berberine in nearly as great proportion as hydrastis, they persistently refused to use it in place of that drug, asserting that its action was not at all similar. The investigations of Profs. Bartholow, Sattler, Shoemaker, and others (see *Hydrastis*, in *Drugs and Med. of N. A.*), now show that these conclusions were rational, as at least one of the very active principles of hydrastis is entirely absent from xanthorrhiza." Dose of the powder, 20 to 40 grains, 3 times a day; of the decoction, 1 or 2 tablespoonfuls; of the tincture, which is its most eligible form, from 1 to 3 fluid drachms. It contains a bitter resin, which would probably form an excellent tonic.

XANTHOXYLUM (U. S. P.)—XANTHOXYLUM.

The bark of *Xanthoxylum americanum*, Miller (*X. fraxineum*, Willdenow; *X. fraxinifolium*, Marshall; *X. ramiflorum*, Michaux; *X. tricarpum*, Hooker; *X. Clava-Herculis*, Lamarck; *Thylax fraxineum*, Rafinesque), and of *Xanthoxylum Clava-Herculis*, Linné (*X. fraxinifolium*, Walter; *X. aromaticum*, Willdenow; *X. carolinianum*, Lamarck; *X. tricarpum*, Michaux; *X. Catesbianum*, or *Pseudopetalon glandulosum*, or *P. tricarpum*, *Kampmannia fraxinifolia*, Rafinesque; *Fagara fraxinifolia*, Lamarck). The berries are also employed, but are not official.

Nat. Ord.—Rutaceæ.

COMMON NAMES: (1) *Prickly ash*, *Toothache tree* (or *bush*), *Northern prickly ash*, *Yellow wood*, *Angelica tree*, *Suterberry;* (2) *Southern prickly ash*, *Toothache tree*, *Angelica tree*, *Suterberry*.

ILLUSTRATIONS: (1) Bigelow, *Amer. Med. Bot.*, Vol. III, 156; (2) Willdenow, *Sp. Plant.*, Vol. IV, 214.

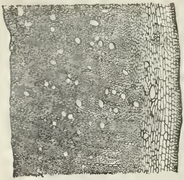
Botanical Source.—*Xanthoxylum americanum* is an indigenous shrub, 10 or 12 feet in height, with alternate branches, which are armed with strong, conical, brown prickles, with a broad base, scattered irregularly, though most frequently in pairs at the insertion of the young branches. The leaves are alternate and pinnate; the leaflets about 5 pairs, with an odd one, nearly sessile, ovate, acute, with slight vesicular serratures, and somewhat downy underneath; the common petiole round, usually prickly on the back, though sometimes unarmed. The flowers are borne in small, dense, sessile umbels, near the origin of the young branches; they are small, greenish, diœcious or polygamous, appear before the leaves, and have a somewhat aromatic odor. In the sterile flower the calyx is 5-leaved, with oblong, obtuse, erect segments, 5 stamens with subulate filaments, and sagittate, 4-celled anthers; the ovary is abortive. In the hermaphrodite or perfect flower, the calyx and stamens are like the last, ovaries 3 to 4, pediceled, with erect, converging styles nearly as long as the stamens. Fertile or female flowers grow upon a separate tree, are apetalous, with a smaller and

Fig. 257.

Xanthoxylum americanum.

more compressed calyx, and 5 pediceled ovaries, with styles converging into close contact at top, and a little twisted; stigmas obtuse. Each fertile flower is succeeded by as many capsules as it had ovaries. Capsules stipitate, oval, covered with excavated dots, varying from green to red; 2-valved and 1-seeded; seeds oval and blackish (L.—W.—G.).

Fig. 258.

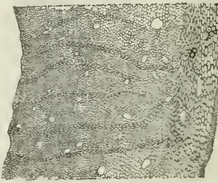


Xanthoxylum americanum, L. (Northern prickly ash).

Xanthoxylum Clava-Herculis ranges from a shrub to a small-sized tree, yet sometimes attaining a height of 45 feet. The bark is beset with verrucose prickles. The petioles and branches are armed with larger prickles. The leaves are odd-pinnate; the leaflets from 5 to 17 in number, ovate-lanceolate, unequilateral, the terminal one only being equilateral, shining and smooth on the upper surface, and having crenate-serrulate margins. The flowers are plentiful, of a greenish hue, appear before the leaves, and have but 3 pistils.

History.—Northern prickly ash, a well-known shrub of the rue family, furnishes a drug that ranked among the most important during the early investigations of our indigenous remedies by the "Eclectic Fathers." It was an especial favorite with Prof. John King. The shrub is common in thickets, rocky woods, and along river banks from Virginia northward to Canada, and westward to the Mississippi, though scarce east of the Hudson valley. It grows to the height of 5 to 10 feet. The flowers, which appear in April and May before the leaves have expanded, are axillary, small, and of a greenish color. On account of its pinnate leaves and spiny, prickly stems, it is best known to the common people as Prickly ash. To distinguish it from a southern species (*Xanthoxylum Clava-Herculis*), which is known as Southern prickly ash, it is sometimes called Northern prickly ash. Its reputed efficacy in toothache has given it the name of Toothache tree. In common with some other plants, it is also known as Yellow wood, a name giving the literal meaning of Xanthoxylum (Greek: *xanthos*, yellow; *xylon*, wood). All parts of the shrub are aromatic and pungent, and the leaves and berries have a decided odor of lemons. Water and alcohol extract its virtues. The therapeutic principle of the berries resides in the capsule surrounding the seeds. This principle has been found to be a volatile oil. The whole plant possesses medicinal virtues; the fragrance of the fruit and leaves is due to a volatile oil. Both the bark and fruit (berries) are employed medicinally.

Fig. 259.



Xanthoxylum Clava-Herculis, L. (Southern prickly ash).

Description.— Bark. The two official barks are thus described: "*Xanthoxylum americanum* (Northern prickly ash) is in curved or quilled fragments, about 1 Mm. ($\frac{1}{25}$ inch) thick; outer surface brownish-gray, with whitish patches, and minute, black dots, faintly furrowed, with some brown, glossy, straight, 2-edged spines, linear at the base, and about 5 Mm. ($\frac{1}{5}$ inch) long; inner surface whitish, smooth; fracture short, non-fibrous, green in the outer and yellowish in the inner layer; inodorous; taste bitterish, very pungent. *Xanthoxylum Clava-Herculis* (Southern prickly ash) resembles the preceding, but is about 2 Mm. ($\frac{1}{12}$ inch) thick, and is marked by many conical, corky projections, sometimes 2 Cm. ($\frac{4}{5}$ inch) high, and by stout, brown spines, rising from a corky base. Xanthoxylum should not be confounded with the bark of *Aralia spinosa*, Linné (*Nat. Ord.*—Araliaceæ), which is nearly smooth externally, and beset with slender prickles in transverse rows"—(*U. S. P.*).

Berries.—The fruit, or berries, as met with in commerce, consist of open, bivalved, oval capsules, about 3 lines in length and 2 in diameter, brownish, and covered with excavated dots externally, whitish-yellow, and smooth internally, and usually with a portion of the stalk appended; they inclose an oval, shining, black, wrinkled seed, which, in the dried state, is hollow, and grayish-yellow or light brownish-yellow internally, inodorous, very brittle, and having the peculiar taste of the capsule in a very faint degree. This seed is more often absent than present in the capsule, from whose opening it escapes, and may be generally found separated from it, but mixed up with the mass. The medicinal virtues of the fruit reside in the capsules, which have a faintly aromatic, peculiar odor, and a warm, pungent, peculiar, aromatic, and pleasant taste, both of which properties are more energetic in the recent than in the dried fruit. They depend upon a volatile oil for their properties, which they yield to alcohol or ether.

Chemical Composition.—The bark of *Xanthoxylum fraxineum*, Willdenow, (Northern prickly ash) was first investigated by Dr. Edward Staples (*Amer. Jour. Pharm.*, 1829, p. 163), who isolated therefrom a crystallizable principle, which he called *xanthoxylin*. From the same source, E. T. Moffit (*ibid.*, 1886, p. 417) and, previously, J. U. Lloyd (*ibid.*, 1876, p. 226, and 1890, p. 229) obtained a similar substance. It forms colorless, tasteless needles, insoluble in cold water, very slightly soluble in boiling water, quite soluble in boiling alcohol; it is physiologically inert (Lloyd). A similar principle was derived from the bark of *X. carolinianum* (Southern prickly ash) by George H. Colton (*ibid.*, 1880, p. 191). E. G. Eberhardt (*ibid.*, 1890, p. 231) showed the non-identity of the principles derived from different species, while those obtained by various authors, from the same species, were shown to be identical. Probably the *xanthoxyloïne* of Witte (*Dissert.*, 1876; see *Jahresb. der Pharm.*, 1877, p. 178) is identical with the xanthoxylin of Staples, Lloyd, and Moffit. Witte found it to have the formula $C_{14}H_{14}O_{2}$, and to melt between 131° and 131.5° C. (267.8° and 268.7° F.). Eberhardt observed a melting point of 129.5° C. (265.1° F.) with Lloyd's recrystallized specimen. According to Moffit (*loc. cit.*), the bark also contains a bitter, yellowish alkaloid, soluble in alcohol, water, and chloroform, insoluble in benzin and ether. It is probably related to berberine; a similar alkaloid, insoluble in chloroform, was found by Colton (*loc. cit.*) in northern bark. Additional constituents are fixed oil, an acrid resin, some sugar, tannin, gum, albuminoids, coloring matter, forming a precipitate with basic lead acetate, ash (about 12 per cent), but no starch (Moffit). In the Caribbean Xanthoxylum (*Xanthoxylum carribæum*, Lamarck) Chevallier and Pelletan (1826) found the alkaloid *xanthopicrite*, which Perrins (1862) showed to be identical with *berberine*. In recent years Prof. Schaer (*Beiträge zur Geschichte des Berberins*, Zürich, 1893) again demonstrated the presence of berberine in certain South American Xanthoxylum barks.

Action, Medical Uses, and Dosage.—Physiologically, prickly ash acts upon the secretions, the nervous and circulatory systems. The bark, when chewed, imparts an aromatic, sweetish taste, followed by bitterness and persistent acridity. Its sialagogue properties are remarkable, inducing a copious flow of saliva, together with a great quantity of mucus from the buccal glands. This is brought about both by its local and systemic action. In the stomach it creates a sense of warmth, and the flow of both gastric and intestinal juices is augmented. There is increased biliary and pancreatic activity. Under its action the kidneys become more active, and an increased urinary product results. Cardiac action is increased, the pulse becomes slightly accelerated, and the integumentary glands give out an abundant secretion. Therapeutically, the bark is sialagogue, alterative, diaphoretic, and especially stimulant to the mucous surfaces. It is also emmenagogue and carminative, and the berries are said to possess antiseptic properties. To increase its diaphoretic power, it should be administered with plenty of hot water, at the same time subjecting the patient to a warm foot-bath. Prof. King cautions us that there is a material difference, in their influence on the system, between the tincture of the bark, or that of the berries, which should always be kept in view. The properties of the bark, as given by him, are stimulant, tonic, alterative, and sialagogue; of the berries, stimulant, carminative, and antispasmodic, acting especially on mucous tissues. Prickly ash has been deservedly valued in domestic practice as a remedy for *chronic rheumatism*, and was once quite popular as a masticatory for the relief of *toothache*. It undoubtedly has some value in rheumatic complaints, and may be combined with phytolacca when the indications for that drug are present. Its value in chronic rheumatism is very likely due to its eliminative power. It is best adapted to debilitated patients, and to cases of transient and fugitive forms of rheumatism, particularly *lumbago*, *torticollis*, *myalgia*, and *muscular rheumatism*. It may be used externally and administered internally, and in many cases will assist the action of macrotys. Its use in *odontalgia* will be confined to those cases where there is dull, grumbling pain due to peridental inflammation, the parts being dry and shining, and the buccal secretions scanty. Owing to its eliminative powers, it has been quite extensively used in constitutional *syphilis* and *scrofula*, and as a remedy for the former ranks with guaiac, stillingia, sarsaparilla, and mezereon. It is one of the constituents of "Trifolium Compound," and other alterative mixtures. Prof. King states that "combined with equal parts of pulverized blue flag and mandrake, it will bring on salivation, and is useful on this account in the treatment of *scrofulous*, *syphilitic*, and other diseases where there is a want of susceptibility to the influence of other alterative agents; the mixture must be given in small doses, and repeated at short intervals. Externally, it forms an excellent stimulating application to *indolent and malignant ulcers*." Xanthoxylum is serviceable in many disorders of the mouth and throat, as well as of the entire alimentary tract. It has some reputation as a local stimulant for *paralysis of the tongue*, though its value here is overrated. In like manner it has been employed in *neuralgia*, and *paralytic conditions of the vocal apparatus and organs of deglutition*. That it will relieve an unpleasant dryness of the mouth and fauces is well established. It is a remedy of value in *pharyngitis*, especially the chronic variety, the mucous surfaces presenting a glazed, shining, dry condition, with thin, adherent scales of dried mucus. In both *pharyngitis* and *post-nasal catarrh* a decoction locally, and specific xanthoxylum (bark) internally, will be found to aid a cure in those cases having dryness of mucous membranes as a distinctive feature. Prickly ash is unmistakably an admirable gastro-intestinal tonic. It will find a place in the treatment of *atonic dyspepsia* and *gastric catarrh*. Many chronic affections of the mucous tissues are benefited by it, the cases being those of enfeeblement and relaxation, with hypersecretion. *Constipation* due to deficient intestinal secretion has been overcome by its use alone. It is more especially indicated when accompanied by a flatulent distension of the abdomen. As an agent for *flatulence*, the preparation from the berries will give the best results. Lack of secretion in any part of the intestinal tract calls for a preparation of prickly ash bark. Both the bark and the berries may be required in some instances. *Icterus*, the result of *biliary catarrh*, is specifically influenced by xanthoxylum, as well as that form resulting from malarial impression. In *spasm of the bowels*, *colic*, *cholera infantum*, and *cholera morbus*, specific xanthoxylum (berries) will be found valuable in atonic cases. It is useful to restore the bowels to their normal state after severe attacks of *dysentery*, and has been of particular service as a remedy for *epidemic dysentery*. Prof. John King introduced the saturated tincture of the berries to the profession in Cincinnati, in 1849, as a remedy for *Asiatic cholera*. In his article on prickly ash berries in the *College Journal* for 1856 (p. 86), he writes: "I have used this tincture for some years past, and had the pleasure to introduce it to the profession in this city during the year 1849, both in the treatment of *tympanitic distension of the bowels* during *peritoneal inflammation* and in *Asiatic cholera*. In *tympanites* it may be administered by mouth and by injection; internally, from $\frac{1}{2}$ to 1 fluid drachm may be given in a little sweetened water, repeating the dose every $\frac{1}{2}$ or 1 hour. At the same time, $\frac{1}{2}$ fluid ounce may be added to the same quantity of water and used as an injection, repeating it every 15 or 30 minutes, according to its influence and the severity of the symptoms, and should there be pain 10 to 20 drops of laudanum may be added to every third or fourth injection. The action is usually prompt and permanent, and, as far as my experience has gone, I prefer it, in a majority of cases, to oil of turpentine and other remedies advised in this condition. In Asiatic cholera during 1849–50 it was much employed by our physicians in Cincinnati, and with great success—it acted like electricity, so sudden and diffusive was its influence over the system. In this disease the tincture was given in teaspoonful doses, and repeated, according to circumstances, every 5, 10 or 20 minutes, at the same time administering an injection, prepared as above, after each discharge from the bowels, and causing it to be retained by the bowels as long as possible." Prof. King likewise valued it in *atonic diarrhœa* and in *typhoid conditions* requiring a stimulant, believing it to have an advantage over all other drugs for that purpose. In the tympanitic conditions incident to *cholera infantum* and other forms of *diarrhœa*, he combined equal parts of olive oil and tincture of prickly ash berries and had the little patient's abdomen freely rubbed with it, in a downward direction only, for 1 or 2 hours, until the flatulent state was over, claiming thereby to have saved many a little one who would otherwise have gone to an early grave. To prevent a return of the tympanitic distension he used the tincture by mouth and per rectum. Combined with diuretics and tonics, prickly ash has been employed in *dropsy* and in *malarial manifestations*, and is in good repute as a remedy for *functional dysmenorrhœa*. For the latter purpose about 20 drops of specific xanthoxylum (bark) should be administered at a dose, and repeated as often as necessary. Both the bark and berries give good results in *neuralgic dysmenorrhœa* with marked pain and hypersensitiveness. Xanthoxylum is a valuable nerve stimulant, and may be administered for some length of time without ill effects. It is valuable in all cases of prostration, and has been recommended in "*hemiplegia*, *locomotor ataxia*, and all depressed conditions of the vital forces." *Pains* down the anterior portions of the thighs, as well as *after-pains*, accompanied with dorsal or sacral pain, are relieved by it. It relieves neuralgic pains in anemic and delicate persons. Owing to its action on blood stasis, overcoming capillary engorgement, it has been found useful in determining the rash to the surface in the *eruptive diseases*, and is especially serviceable in cases of retrocession of the eruption. It is a remedy that is neglected, but should be borne in mind during the prevalence of summer diseases. The dose of specific xanthoxylum (berries) is from 5 to 30 drops; of specific xanthoxylum (bark), from 2 to 20 drops; of the powder, from 10 to 30 grains, 3 times a day. The *oil of xanthoxylum* may be used for the same purpose as the berries, in doses of from 2 to 10 drops, in mucilage, or on sugar; and its tincture, made according to the formula below (see *Preparation*), may be administered in the same doses as the tincture of the berries.

Specific Indications and Uses.—Xanthoxylum is specifically indicated (in the smaller doses) in hypersecretion from debility and relaxation of mucous tissues; atonicity of the nervous system (larger doses); in capillary engorgement in the exanthemata, sluggish circulation, tympanites in bowel complaints, intestinal and gastric torpor (with deficient secretion), dryness of the mucous membrane of mouth and fauces (with glazed, glossy surfaces), flatulent colic, Asiatic cholera, uterine cramps, and neuralgia. For the painful bowel disorders, the preparations of the berries are to be preferred.

Preparation.—An *ethereal oil* has been made from the bark, by filtering its ethereal tincture, and then evaporating or distilling off the ether. The oil is dark greenish-black in bulk, yellowish-green in thin layers; very fluid, possessing an odor of ether, and the peculiar taste of the bark in an eminent degree. It is soluble in alcohol, ether, and alkaline solutions, and will probably be found to possess the active principle of the bark in a concentrated form.

Related Species.—*Xanthoxylum floridanum*, Nuttall (probably identical with Lamarck's *X. caribæum*), *Yellow thorn*, *Yellow Hercules' club*, *Satin wood*. Florida and West Indies. Yields a paralyzing and lethal alkaloid.

Xanthoxylum piperitum, De Candolle, of Japan, *X. alatum*, Roxburgh, of north India, and other species, yield aromatic, pungent berries, employed as condiments. They are also used as bitters and aromatics (Dymock). Stenhouse (1854 and 1857) distilled the fruits with water, and obtained an essential oil. The yield is over 3 per cent, and chiefly contains the aldehyde, *citral* (Schimmel & Co., October, 1890). The oil separates into crystals of a stearopten, called, by Stenhouse, *xanthoxylin* ($C_{20}H_{24}O_8$), and a colorless liquid, *xanthoxylene* ($C_{10}H_{16}$), which boils at near 162° C. (324° F.). It is a hydrocarbon, perhaps identical with pinene or camphene.

Xanthoxylum senegalense, *Artar root*.—Giacosa and Soave (*Amer. Jour. Pharm.*, 1890, p. 500) have examined this root, and find, besides a fixed oil and a crystalline neutral compound, two alkaloids—amorphous *artarine* (0.4 per cent), agreeing in composition with *methyl hydroberberine* ($C_{21}H_{23}NO_4$); the second, a blood-red alkaloid is present in smaller quantity, and forms acicular crystals, readily soluble in water. One of the alkaloids is a cardiac stimulant, resembling veratrine in its action.

Xanthoxylum pterota, Kunth.—Southern United States, south to Brazil. Yields pungent leaves and bark, and has a hard, dense-yellow wood.

Xanthoxylum Naranjillo is said to resemble jaborandi, as a sialagogue, diuretic, and diaphoretic.

Xanthoxylum Rhetsa, De Candolle (aromatic stimulant), *X. zeylanicum* (aromatic bitter), *X. Budrunga* (stimulant, digestive, and stomachic), and *X. hastile* (an aromatic stimulant) are employed more or less in India (Dymock, *Mat. Med. of Western India*).

ZEA (U. S. P.)—ZEA.

"The styles and stigmas of *Zea Mays*, Linné"—(*U. S. P.*).

Nat. Ord.—Gramineæ.

COMMON NAME: *Corn-silk.*

Botanical Source.—Indian corn is a monœcious, paniceous grass, annual, with a fibrous root, and an erect, leafy stem, channelled on one side, 5 to 10, and, in some varieties, 15 to 20 feet high. The male flowers are terminal and racemose; the female axillary and densely spiked. Stamens 3. Ovary sessile and ovate. Style 1, long and capillary. Stigma ciliated. Caryopsides roundish or reniform, arranged on a large cylindrical receptacle or rachis, popularly called the cob, generally in 8 rows. The ordinary color of the ripe grains or caryopsides is yellow, but they are frequently met with white, parti-colored, red, purple, or even black (W.—P.).

History.—Corn is a native of the warm latitudes of America, and its varieties are exceedingly numerous. It is extensively cultivated in the United States, and also in various parts of the world, and is much used in these countries as one of the principal articles of diet. It is very nourishing and digestible, and is used in many forms in this country, as bread, mush, puddings, cakes, etc. It is incapable of being made into light or raised bread, on account of its small quantity of gluten. *Roasting-ears*, or *hot corn*, as it is called in this country, consists of the young ears, which are gathered just previous to becoming ripe and hard, and boiled in water. They form an agreeable and nutritious food, but should not be used by those disposed to looseness or other intestinal derangements. The parts used in medicine are *corn-meal* and the styles and stigmas, the latter two constituting the official *Zea*, which is thus described:

Description.—*Zea*, or *Stigmata maydis*, is "thread-like, about 15 Cm. (6 inches) long, and 0.5 Mm. ($\frac{1}{50}$ inch) broad, yellowish or greenish, soft-silky, finely hairy, and delicately veined longitudinally; inodorous; taste sweetish"—(*U. S. P.*).

Chemical Composition.—GRAIN OF MAIZE contains moisture (13.3 per cent), starch (50 to 67 per cent, and more), nitrogenous matters (about 10 per cent), fatty or oily substance (3.8 to 9 per cent), and mineral matters (about 1.5 per cent), consisting chiefly of potassium phosphate. The *oil of maize* occurs mainly in the embryo, and can not be obtained from the corn by mere pressure. The grains are allowed to sprout to a certain extent; the germ containing over 15 per cent of the oil, is separated by machinery from the starchy part, and is then softened by steam and subjected to hydraulic pressure, which separates the oil and yields a press-cake, rich in albuminoids, and retaining 4 to 5 per cent of oil. Or, the oil is yielded as a by-product in the manufacture of corn-starch (see J. M. Maisch, *Amer. Jour. Pharm.*, 1885, p. 404, and J. U. Lloyd, *ibid.*, 1888, p. 325; also see C. E. Bowers, *ibid.*, 1889, p. 503). Oil of maize has been used as a lubricant, and in the manufacture of soap. It is a bland, non-drying, yellowish oil, having a specific gravity of 0.92. It is readily saponifiable, and does not easily become rancid upon exposure to the air. Prof. Lloyd recommends its use especially in the making of ammonia liniment.

CORN-SILK (*Zea*).—C. J. Rademaker and John L. Fischer (*Amer. Jour. Pharm.*, 1886, p. 369) found corn-silk to contain 5.25 per cent of a light-yellow fixed oil, resin, a crystallizable acid (*maizenic acid* of Vautier), soluble in water, ether, and alcohol, insoluble in petroleum spirit; and sugar, gum, albuminoids, etc. No volatile oil could be found. J. M. Hillan (*ibid.*, 1884, p. 571), by distillation with alkali, obtained a basic distillate, yielding a crystalline acetate, which formed precipitates with solution of iodine and with Mayer's solution. The same author found 83.3 per cent of moisture, and in the dried corn-silk 12.5 per cent of ash. Sugar was observed in green but not in the dried corn-silk. (For pharmaceutical preparations from corn-silk, see Geo. W. Kennedy, *Amer. Jour. Pharm.*, 1883, p. 242.)

Action, Medical Uses, and Dosage.—Corn-silk is diuretic and slightly anodyne, and, for the former purpose, has been found useful in many urinary troubles, associated with renal and cardiac disorders. In southern France, the inhabitants use it as a domestic remedy for *calculi*, *gravel*, and *strangury*. It has been found of value by physicians in the treatment of *cystic irritation*, due to phosphatic and uric acid concretions, and in both *acute and chronic inflammations of the bladder*, whether traumatic or idiopathic. *Dropsy*, when due to cardiac or renal origin, and particularly after such urinary disorders as those above mentioned, and *pyelitis, catarrh of the bladder*, and *urinal retention* appear to be benefited by the diuretic action of this drug, which action is said to be quite positive. Besides its diuretic effects, the drug seems to be a cardiac stimulant as well. In fact, its diuretic action is largely due to its tonic action upon the heart and blood vessels. It is especially of value in the *bladder disorders of children*, in *gonorrhœa*, and in cases where decomposition of the urine is prone to take place within the bladder. The active virtues are attributed to the maizenic acid, which may be given in ⅙-grain doses. However, the infusion of the fresh "silk" (silk ℥ii to boiling water Oj) is the most active preparation, and should be freely administered. The fluid extract, which is said to well represent the drug, may be given in doses of ½ to 2 fluid drachms, every 2 to 4 hours.

Corn-meal forms a very palatable and nutritious gruel for the sick, and, in the form of mush, is an excellent diet for convalescents, as well as a good emollient poultice for *ulcers, swellings, rheumatic pains*, etc. An infusion of parched corn is useful in allaying the *nausea* and *vomiting* attendant upon many diseases. It may be drank freely. (For the parasitic fungus growing on corn [*Ustilago Maydis*], see *Ustilago*.)

ZINCI ACETAS (U. S. P).—ZINC ACETATE.

Formula: $Zn(C_2H_3O_2)_2+2H_2O$. Molecular Weight: 218.74.

"Zinc acetate should be kept in well-stoppered bottles"—(*U. S. P.*).

Preparation.—"Take of carbonate of zinc, 2 ounces (av.); acetic acid, 5 fluid ounces, or a sufficiency; distilled water, 6 fluid ounces. Add the carbonate of zinc in successive portions to 3 ounces of the acetic acid previously mixed with the water in a flask; heat gently, add by degrees the remainder of the acid till the carbonate is dissolved; boil for a few minutes, filter while hot and set it aside for 2 days to crystallize. Decant the mother liquor; evaporate to one-half, and again set it aside for 2 days to crystallize. Place the crystals in a funnel to drain, then spread them on filtering paper on a porous tile, and dry them by exposure to the air at ordinary temperatures"—(*Br. Pharm.*, 1885). The following reaction takes place: $ZnCO_3+2C_2H_4O_2=Zn(C_2H_3O_2)_2+H_2O+CO_2$. If evaporation is conducted at the boiling temperature, acetic acid is liable to be lost, and an insoluble basic acetate is formed. This is obviated by adding a slight excess of acetic acid. If concentration is carried too far, the salt will crystallize with less than 2 molecules of water. Zinc acetate may also be prepared by the interaction of zinc sulphate and lead acetate, double decomposition taking place as follows: $ZnSO_4+Pb(C_2H_3O_2)_2=Zn(C_2H_3O_2)_2+PbSO_4$. If the solution contains a slight excess of lead, this may be removed by digesting it with pure metallic zinc. If the zinc acetate solution contains ferric salt, this may be precipitated by means of freshly prepared zinc hydroxide or carbonate (compare Wm. Procter, Jr., *Amer. Jour. Pharm.*, 1846, p. 241).

Description and Tests.—As officially described, zinc acetate forms "soft, white, 6-sided, monoclinic plates, of a pearly luster, having a faintly acetous odor, and an astringent, metallic taste. Exposed to the air, the salt gradually effloresces, and loses some of its acid. Soluble, at 15° C. (59° F.), in 2.7 parts of water, and in 36 parts of alcohol; in 1.5 parts of boiling water, and in somewhat less than 3 parts of boiling alcohol. Protracted boiling with water renders the salt less soluble, acid being lost and a basic salt formed. When heated, the salt is partially fused, losing water and acid. At a higher temperature it is decomposed, evolving acetone and other combustible vapors, and leaving a residue of zinc oxide. The aqueous solution reddens litmus paper. In the aqueous solution (1 in 20) of the salt, hydrogen sulphide T.S., as well as ammonium sulphide T.S., produces a pure white precipitate; potassium ferrocyanide T.S. also causes a white precipitate. Potassium hydrate T.S., or ammonium carbonate T.S., when added to a small quantity, produces a white precipitate, which dissolves upon the addition of an excess of the reagent. The addition of a little ferric chloride T.S. produces a red color"—(*U. S. P.*). The red color is due to the formation of ferric acetate. The presence of the acetic acid radical may also be shown by means of sulphuric acid, which liberates acetic acid. The precipitate of zinc hydroxide ($Zn[OH]_2$) caused in solution of zinc acetate by potassium hydrate, is soluble in excess of the alkali, with the formation of a double compound (ZnO_2K_2). If cadmium or magnesium are present, the hydroxides of these metals will not dissolve in an excess of the precipitant. "The aqueous solution (1 in 20), acidulated with hydrochloric acid, should not be colored or rendered turbid by an equal volume of hydrogen sulphide T.S. (absence of arsenic, cadmium, lead, copper, etc.)"—(*U. S. P.*). Arsenic and cadmium would produce a yellow color, while lead, copper, bismuth, etc., would impart a black or at least a dark tint to the white zinc sulphide. "If the aqueous solution be completely precipitated by hydrogen sulphide T.S. (without having been acidulated), the filtrate should, after evaporation, leave no fixed residue (absence of aluminum, iron, alkalies, alkaline earths, etc.). The aqueous solution should remain perfectly clear after the addition of either barium chloride T.S. (absence of sulphate), or silver nitrate T.S. (absence of chloride)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—As an internal medicine acetate of zinc, in doses of 1 or 2 grains, gradually increased, is said to be tonic and antispasmodic, and has been used in the same cases in which the oxide or sulphate of zinc is employed. In large doses it causes vomiting and purging. Zinc acetate will control *passive hemorrhages*. It is principally used in solution as an astringent application in *chronic ophthalmia*, *leucorrhœa*, *gleet*, and *chronic gonorrhœa*. Two or more grains of the acetate may be dissolved in 1 fluid ounce of pure water and used as a wash, or by injection. Seldom employed.

ZINCI BROMIDUM (U. S. P.)—ZINC BROMIDE.

FORMULA: $ZnBr_2$. MOLECULAR WEIGHT: 224.62.

SYNONYM: *Zincum bromatum.*

"Zinc bromide should be kept in small, glass-stoppered bottles"—(*U. S. P.*).

Preparation.—This salt may be prepared either by the direct union of zinc and bromine, or by the double decomposition of crystallized zinc sulphate (240 parts) and potassium bromide (100 parts). In the latter process (see L. Lyons, *Amer. Jour. Pharm.*, 1880, p. 75), just sufficient water to dissolve the salts is employed, and the solutions are added to each other while hot. After cooling, twice the bulk of alcohol is added, and the potassium sulphate removed by filtration through asbestos. Lastly, the solution is evaporated to dryness. Theoretically, the following reaction takes place: $ZnSO_4+7H_2O+2KBr=ZnBr_2+K_2SO_4+7H_2O$. In order to prevent the formation of an alcohol-soluble double compound ($ZnBr_2.BrK$), an excess of zinc sulphate must be employed, which is the case in the above proportions. It is best prepared, however, by digesting granulated zinc in hydrobromic acid, whereby hydrogen gas is evolved, and filtering the solution through asbestos, evaporating carefully, rendering slightly acid with hydrobromic acid, and finally drying the salt by evaporation over a water-bath. This salt does not readily crystallize from water.

Description and Tests.—"A white, granular powder, odorless, and having a sharp, saline and metallic taste. Very deliquescent. Readily soluble in water and alcohol. When heated to 394° C. (741.2° F.), the salt fuses, and, with careful increase of heat, may be sublimed in the form of needle-shaped prisms. The aqueous solution gives a slightly acid reaction with litmus paper. A 5 per cent aqueous solution of the salt yields a pure white precipitate with hydrogen sulphide T.S., ammonium sulphide T.S., or potassium ferrocyanide T.S. Silver nitrate T.S. produces a yellowish-white precipitate, insoluble in ammonia water. If a few drops of copper sulphate T.S. be mixed with 5 Cc. of the aqueous solution (1 in 20) of zinc bromide, and then some sulphuric acid be carefully poured into the mixture so as to form a separate layer, a deep brownish-red color will appear at the line of contact, and will disappear when the mixture is shaken. If to the aqueous solution (1 in 20) a little starch T.S. be added, and then some chlorine water, drop by drop, the liquid should assume a pure-yellow color, free from any shade of blue (absence of iodine). After acidulation with hydrochloric acid, the aqueous solution should not be colored or rendered turbid by the addition of an equal volume of hydrogen sulphide T.S. (absence of arsenic, cadmium, lead, copper, etc.). On adding ammonium carbonate T.S. to the aqueous solution of zinc bromide, a white precipitate is produced, which should completely redissolve in an excess of the reagent (absence of iron, aluminum, calcium, etc.). If from this solution in ammonium carbonate T.S. all the zinc be precipitated by ammonium sulphide T.S., the filtrate should leave no fixed residue on evaporation (absence of alkalies, magnesium, etc.). If 0.3 Gm. of the dry salt be dissolved in 10 Cc. of water, and 2 drops of potassium chromate T.S. be added, it should require 26.7 Cc. of decinormal silver nitrate V.S. to produce a permanent red color (corresponding to not less than 99.95 per cent of the pure salt)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—This agent was introduced to fulfil the indications of zinc and bromine, but has failed to become an established remedy. It has, however, been asserted to have proved useful in *epilepsy*, but it is not well borne by the patient. Dose, 1 to 5 grains.

ZINCI CARBONAS PRÆCIPITATUS (U. S. P.)—PRECIPITATED ZINC CARBONATE.

Synonyms: *Zinci carbonas præcipitata* (*U. S. P.*, 1870), *Carbonate of zinc*, *Zinci carbonas* (*Br.*), *Zincum carbonicum*.

Source.—Zinc carbonate occurs native, both in Europe and this country, as *zinc-spar* or *calamine* ($ZnCO_3$), and, together with zinc silicate, as *siliceous calamine*. Both, when ground, constitute the *Lapis calaminaris* of commerce. It should be free from barium sulphate. Quite recently, a spurious calamine was recorded (E. H. Gane, *Bull. Pharm.*, 1900, p. 123, from *Amer. Druggist*), consisting entirely of barium sulphate, and being colored with ferric oxide. Calamine has also been employed medicinally in the form of the calcined ore, and then consists chiefly of an impure oxide of zinc (see *Zinci Oxidum*). The zinc carbonate now employed medicinally is that obtained by precipitation.

Preparation.—Precipitated carbonate of zinc is prepared by adding to a hot solution of pure, iron-free zinc sulphate (10 parts) a hot solution of crystallized sodium carbonate (10.5 parts), with constant stirring. A precipitate of basic carbonate of zinc, of variable composition is formed, *e. g.*, $2ZnCO_3+3Zn(OH)_2$, while some carbonic acid is liberated, according to the following equation: $5ZnSO_4+5Na_2CO_3+3H_2O=2ZnCO_3+3Zn(OH)_2+3CO_2+5Na_2SO_4$. After effervescence has ceased, boil for 15 minutes, then let the precipitate subside, withdraw the supernatant liquid, and wash the precipitate with fresh portions of boiling water, until the washings are no longer precipitated by chloride of barium. Allow the precipitate to drain on a calico strainer, and dry at a moderate temperature. Ammonium carbonate can not be used in the preparation of this substance, because it is soluble in excess of the precipitant.

Description and Tests.—Precipitated carbonate of zinc is "an impalpable, white powder, of somewhat variable chemical composition, without odor or taste. Permanent in the air. Insoluble in water or alcohol; soluble in diluted acids with copious effervescence; also soluble in ammonia water, and in ammonium carbonate T.S. When strongly heated, the salt loses water and carbon dioxide, and leaves a residue of zinc oxide, which is yellow while hot, but becomes white on cooling. When a small portion of the salt is moistened with a drop of cobaltous nitrate T.S., and heated before the blowpipe, it will assume a vivid-green color"—(*U. S. P.*). This compound, called *Rinmann's green*, is characteristic for zinc. The reaction is analogous to that for aluminum compounds, which form a blue mass, called *Thénard's blue*. The *U. S. P.* further directs for precipitated zinc carbonate: "For making tests of identity and purity, add 10 Cc. of diluted sulphuric acid and 10 Cc. of water to 1.25 Gm. of the salt, and, after effervescence has ceased, remove the undissolved excess by filtration. In a portion of the filtrate a pure white precipitate is produced by potassium ferrocyanide T.S., or by ammonium sulphide T.S. In another portion of the filtrate, acidulated with hydrochloric acid, no color or turbidity should be produced by the addition of an equal volume of hydrogen sulphide T.S. (absence of arsenic, cadmium, lead, copper, etc.). Another portion of the filtrate should yield with ammonium carbonate T.S. a white precipitate, which should redissolve completely in an excess of the reagent (absence of iron, aluminum, calcium, etc.). No insoluble residue should be left, if 0.5 Gm. of zinc carbonate be dissolved in 10 Cc. of diluted sulphuric acid (absence of lead). If 1 Gm. of the salt be placed in a flask with 10 Cc. of boiling water, and 2 drops of phenolphtalein T.S. be added, not more than 1 Cc. of decinormal oxalic acid V.S. should be required to discharge the red color (limit of alkali)"—(*U. S. P.*).

Action and Medical Uses.—Prepared calamine is used as a dusting powder for children, and as a mild desiccant and astringent application in *chafings*, *intertrigo*, *excoriated nipples*, *ophthalmia tarsi*, *simple ulcerations*, etc. The precipitated carbonate of zinc is used for similar purposes.

ZINCI CHLORIDUM (U. S. P.)—ZINC CHLORIDE.

FORMULA: $ZnCl_2$. MOLECULAR WEIGHT: 135.84.

"Zinc chloride should be kept in small, glass-stoppered bottles"—(*U. S. P.*).

Preparation.—Chloride of zinc may be obtained by heating zinc in a current of chlorine gas; or by sublimation of a mixture of zinc sulphate and calcium chloride. It is usually prepared by dissolving metallic zinc, or zinc oxide, or zinc carbonate in solution of hydrochloric acid, and evaporating to dryness. If metallic zinc is employed, the following reaction takes place: $Zn+2HCl=ZnCl_2+H_2$. If the zinc contains iron, the latter is removed from the solution by first converting the ferrous chloride into ferric chloride by the use of chlorine water, and then precipitating the iron by means of zinc carbonate, a corresponding quantity of zinc going into solution; if lead is present, this is likewise precipitated. (For detailed directions, see *Br. Pharm.*, 1885.) The solution of zinc chloride should not be filtered through paper, as this would dissolve and cause a dark color to be imparted to the finished product; either glass wool or asbestos should be employed. Upon evaporating the solution, care must be taken that no decomposition takes place with escape of hydrochloric acid and formation of an insoluble basic salt. In this case the addition of a little hydrochloric acid will restore the normal salt. Pencils of chloride of zinc may be made by incorporating with the salt its own or twice its weight of well-dried wheat flour, rolling the mass into cylinders, and, after drying these in an oven, coating them with white wax in order to protect them from moisture (see *Amer. Jour. Pharm.*, 1883, p. 309, and 1878, p. 345).

Description.—The *U. S. P.* describes chloride of zinc as "a white, granular powder, or porcelain-like masses, irregular, or molded into pencils, odorless, of such intensely caustic properties as to make tasting dangerous, unless the salt be dissolved in much water, when it has an astringent, metallic taste. Very deliquescent. Soluble in about 0.3 part of water at 15° C. (59° F.), forming a clear solution, which, on protracted boiling, deposits a basic salt; very soluble in alcohol. When heated to 115° C. (239° F.), zinc chloride fuses to a clear liquid. At a higher temperature it is partly volatilized in dense, white fumes, and partly decomposed, leaving a residue of zinc oxide. The aqueous solution reddens blue litmus paper"—(*U. S. P.*). The dense, white fumes evolved upon heating chloride of zinc consist of a mixture of zinc chloride and chlorine; the residue consists of zinc oxychloride of variable composition, until finally zinc oxide remains. A concentrated solution of zinc chloride when mixed with oxide of zinc forms a plastic mass, which hardens soon afterward, a basic chloride, *e. g.*, $ZnCl.OH$, being formed. With ammonium chloride, zinc chloride forms a compound which is useful in soldering metals. It acts by removing the film of metallic oxide, which is converted into soluble metallic chloride. A solution of chloride of zinc (200 grains to the Imperial pint) was patented (1840) by Sir William Burnett, to prevent dry rot in wood, and as a disinfectant and antiseptic. This compound has also been known by the names of *muriate*, *hydrochlorate*, or *butter of zinc*, and *Burnett's Antiseptic Fluid* (see *Amer. Jour. Pharm.*, 1847, p. 269, and 1866, p. 363).

Tests.—The aqueous solution with a little acetic acid should give no violet color (iron) with tannic acid. Tannic acid gives in the pure solution a dirty white precipitate of tannate of zinc which is dissolved by acetic acid. If hydrogen sulphide is passed into the solution of zinc chloride acidified with hydrochloric acid, and causes a yellow precipitate soluble in concentrated hydrochloric acid, cadmium is present. "A 5 per cent aqueous solution of the salt yields with potassium ferrocyanide T.S. a pure white precipitate, and with ammonium carbonate T.S. a white precipitate which redissolves in an excess of the reagent"—(*U. S. P.*). An insoluble white residue would point to calcium, also to cadmium; in the latter case, solution of hydrogen sulphide would color the precipitate a bright yellow (cadmium sulphide, CdS). With a 5 per cent aqueous solution of zinc chloride "silver nitrate T.S. produces a white precipitate insoluble in nitric acid. The aqueous solution (1 in 20) should be clear, or at most only very slightly opalescent; and, if it be mixed with an equal volume of alcohol, a single drop of hydrochloric acid should suffice to render 10 Cc. of the mixture perfectly clear (limit of oxychloride). If to the aqueous solution, acidulated with hydrochloric acid, an equal volume of hydrogen sulphide T.S. be added, it should not become colored or turbid (absence of arsenic, cadmium, lead, copper, etc.)"—(*U. S. P.*). (Compare *Zinci Acetas.*) "If ammonium carbonate T.S. be added to the solution, the precipitate should be of a pure white color, and redissolve completely in an excess of the reagent (absence of iron, aluminum, calcium, etc.). If from this solution in ammonium carbonate T.S. the zinc be completely precipitated by ammonium sulphide T.S., the filtrate should leave no fixed residue on evaporation (absence of alkalies, magnesium, etc.)"—(*U. S. P.*). If a residue remains after ignition of the evaporation-residue, the presence of magnesium may be ascertained by dissolving the residue in hydrochloric acid, adding aqua ammoniæ, ammonium chloride, filtering, if necessary, and adding ammonium phosphate solution. A crystalline precipitate would indicate magnesium. The *U. S. P.* further directs for zinc chloride that "the aqueous solution should not be rendered turbid by the addition of barium chloride T.S. (absence of sulphate)"—(*U. S. P.*). This test was introduced on account of the manufacture of some commercial zinc chloride from zinc sulphate (see *Preparation*, preceding page; also *Digest of Criticisms on the U. S. P.*, Part I., 1897). "If 0.3 Gm. of dry zinc chloride be dissolved in 10 Cc. of water, and 2 drops of potassium chromate T.S. be added, it should require 44.1 Cc. of decinormal silver nitrate V.S. to produce a permanent red color (corresponding to not less than 99.84 per cent of the pure salt"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Large doses of chloride of zinc act as an irritant poison, producing a burning sensation in the stomach, nausea, vomiting, anxiety, short breathing, small quick pulse, cold sweats, fainting, and convulsions; in small doses it has been given in *scrofula*, *chorea*, *epilepsy*, and other *nervous diseases*. It is seldom now employed as an internal medicine. Its principal use is as an external agent; from 1 to 5 grains dissolved in 1 fluid ounce of water may be used as an application to *syphilitic and scrofulous ulcers*, to the vaginal walls in *leucorrhœa*, to the *os uteri in ulceration*, as a urethral injection in *gonorrhœa* and *gleet*, and to the eye in the relaxed and congested conditions of the arteries in inflammations of that organ. A solution of 1 grain to 4 fluid ounces of water may be used as an injection in *chronic cystitis*. Its local action on living tissues, when not diluted, is that of a caustic or escharotic, depending partly on its affinity for albumen and gelatin, with which it forms difficultly soluble compounds; so that when placed in contact with living parts into whose composition these organic compounds enter, the chloride exercising its affinity, destroys the life of the part, unites with the albuminous and gelatinous matters present, decomposes the carbonate and hydrosulphide of ammonium found in the secretion from *malignant ulcerations*, and forms a white eschar, which separates in from 10 to 12 days. Its action is accompanied with a violent burning pain for several hours, or until it has destroyed the parts. Beside corroding the parts with which it is in immediate contact, it exercises an influence over the vital actions of neighboring parts, and produces no constitutional symptoms from its absorption. Perhaps no escharotic has been more generally employed for the destruction of *malignant growths* than zinc chloride usually, however, combined with other agents. It is adapted to cases of *epithelioma* and *carcinoma* that can not be removed by the knife, or in which the patient will not submit to such a surgical procedure. It is also a good application for the destruction of *chancre* and *chancroid*. When used for the destruction of malignant growths the chloride must be thoroughly applied, crowding the paste prepared with it and mucilage, or other of the combinations below named, well into every part of the tumor, and persisting in the application until every vestige of the growth is destroyed. This procedure causes intense pain, but less severe than that produced by arsenic, besides which it does not produce poisonous effects through its absorption. It does not cause hemorrhage even when applied in the region of large blood vessels, a sort of mummefying action being exerted on the latter, causing them to shrivel and become hard, thin, and cord-like. In recent times it has become quite popular with physicians to treat *malignant and other affections of the uterine cavity* with applications of zinc chloride. In such instances it is customary to curette well the interior of the organ, after which is applied a preparation containing the chloride, usually mixed with the oxide and common flour, made into a tampon with gauze, and introduced into the cavity, from which it may be withdrawn by means of an attached string. This is left *in situ* for a few hours, care being taken that it does not come into contact with the vesico-vaginal or recto-vaginal septum. After removal of the tampon the parts are dressed with iodoform or other medicated gauze. Chloride of zinc is a safe escharotic, inasmuch as its action does not extend further than the area of application. When applied so as to act deeply it causes the tissues to become hard and tough, and in the course of a week or two the uniform eschar separates, leaving a granulating surface which heals rapidly. For *cancers* and *malignant ulcers* the following have been used: (1) Take 1 part of chloride of zinc, and mix it with 2, 3, or 4 parts of flour, forming a paste with as little water as possible; a stronger preparation is made by mixing together 2 parts chloride of zinc, and 1 part chloride of antimony, with flour in quantity proportioned to the desired strength (Dr. Canquoin). This paste must be continued after the removal of the eschar formed, until all the morbid tissue has been removed. (2) Take of chloride of bromine 3 parts, chloride of zinc 2 parts, chloride of antimony 1 part, chloride of gold 1 part, powder of liquorice sufficient to make into a paste (Landolfi). (For manner of using, see *College Journal of Medical Science*, Cincinnati, Ohio, 1856, p. 98; and Braithwaite's *Retrospect*, Part XXXIII, 1856, p. 48.) A *cauterizing paste*, used in the London hospitals, is composed of chloride of zinc, 12 parts; chloride of antimony, 8 parts; pulverized starch, 4 parts; glycerin, a sufficient quantity to form a paste. This has been successful as a local application to *cancer*. When to be used as an escharotic, chloride of zinc may be formed into cylinders, which will be much more manageable than the salt alone, by the following plan of M. Sommié: Soften gutta percha with boiling alcohol, then incorporate it in a warm porcelain mortar with an equal portion of chloride of zinc, in a fine state of division. Then rapidly roll out the mass on a porphyry slab in the manner of making pastilles, and form it into cylinders of the size of a quill, and of various lengths; keep these in wide-mouthed bottles with a little powdered chalk. Cooke's method of applying this salt was to saturate lint with the deliquesced chloride, which, after being dried, could be kept in a paper or wooden box, and when desired for use could be cut to any size desired. This method is applicable to *gangrenous ulcerations*. For cutting it, however, a good steel instrument should not be used, as the salt has a destructive action on metals. The dose internally, of chloride of zinc, is 1 or 2 grains, dissolved in sufficient water. Very weak solutions of chloride of zinc, 2 to 4 grains to the fluid ounce of water, have been used successfully, by injections, in obstinate *gonorrhœa* and *gleet*. Solutions of carbonate of sodium, or carbonate of potassium, or of soap, may be freely given in cases of poisoning by chloride of zinc; these change it into an insoluble carbonate.

Related Compound.—Escatol. This name was used by the late Prof. A. J. Howe, M. D., for a compound of salicylic acid, chloride of zinc, and petrolatum. He prescribed several strengths, the variation being in the proportion of the ingredients: "It may be applied to an *ulcer* in the nose successfully, and the agent will not attack the sound mucous membrane. I will mention a few morbid states where the escharotic exerts a curative power. A few daily applications cured a *bleeding wart* in a man's beard, and *seed-warts* on the hands. It destroyed *moles* on a woman's chin after 2 weeks' use. It removed *scaly ulcers of a lupoid nature* on an old man's face. It caused an obstinate *eczema* on a lady's neck to get well. It cured a *rodent ulcer of the nipple*. It destroyed a patch of '*ringworm*' on a man's thorax, and a sluggish *ulceration of the leg*, which may have been epitheliomatous. It will destroy *polypus of the nose* without other agency, whether operative or therapeutic. I employ the escharotic (escatol) upon *fistulous surfaces* after they have been incised, and on all sluggish *traumatisms*, to arouse a healing action. It is one of the few things I have learned tentatively. I keep a jar of it in stock, and deal it out in small boxes to patients. I apply it to *fissures of the anus*, and *wounds* made in the excisions of *cancerous growths*. *Syphilitic ulcerations of the mouth, fauces and pharynx*, and, *of the velum*, yield to daily dressings with this escharotic unguent" Prof. A. J. Howe, M.D.).

ZINCI IODIDUM (U. S. P.)—ZINC IODIDE.

FORMULA: ZnI_2. MOLECULAR WEIGHT: 318.16.

"Zinc iodide should be kept in small, glass-stoppered bottles"—(*U. S. P.*)

Preparation.—This salt may be prepared by placing 2 parts of iodine and 1 part of granulated zinc in water, warming carefully until the solution is colorless, evaporating to dryness, and, if crystals are desired, fusing the residuum, which forms beautiful prismatic crystals of anhydrous iodide of zinc on cooling. Iodide of zinc may also be obtained by placing 2 parts of zinc and 17 parts of iodine into a flask, and heating; in this way the salt sublimes in the form of white acicular crystals. Or it may be obtained by dissolving zinc carbonate or oxide in solution of hydriodic acid.

Description and Tests.—"Iodide of zinc is a white, granular powder, odorless, and having a sharp, saline and metallic taste. Very deliquescent, and liable to absorb oxygen from the air, and to become brown from liberated iodine. Readily soluble in water, alcohol or ether. When heated to about 446° C. (834.8° F.) the salt fuses to a colorless liquid, and at a higher temperature sublimes, forming quadratic needles, while a small part is decomposed, and leaves a residue of zinc oxide. The aqueous solution reddens blue litmus paper. A 5 per cent aqueous solution of the salt yields a pure white precipitate with potassium ferrocyanide T.S., or with ammonium sulphide T.S. With silver nitrate T.S. it yields a pale-yellow precipitate, insoluble in ammonia water; with mercuric chloride T.S. a scarlet-red precipitate, soluble in potassium iodide T.S. The aqueous solution, acidulated with hydrochloric acid, should not be colored or rendered turbid by hydrogen sulphide T.S. (absence of arsenic, cadmium, lead, copper, etc.), nor by barium chloride T.S. (absence of sulphate). If ammonium carbonate T.S. be added to the aqueous solution, a pure white precipitate will form, which should redissolve completely in an excess of the reagent (absence of iron, aluminum, calcium, etc.). If from the solution in ammonium carbonate T.S. all the zinc be precipitated by ammonium sulphide T.S., the filtrate should leave no fixed residue on evaporation (absence of alkalies, magnesium, etc.). If 0.5 Gm. of dry zinc iodide be dissolved in 10 Cc. of water, and 2 drops of potassium chromate T.S. be added, not more than 31.4 Cc. nor less than 31.0 Cc. of decinormal silver nitrate V.S. should be required to produce a permanent red color (31.4 Cc. corresponding to 100 [99.9] per cent, and 31.0 Cc. to 98.62 per cent, of pure zinc iodide)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Internally, iodide of zinc has been used as a tonic in *spasmodic affections* occurring in patients of a *strumous diathesis*. It is usually administered in syrup, which preserves it from the action of the air. The syrup may be prepared in the same manner as that of iodide of iron. Dr. A. T. Thompson recommended iodine, 4 drachms; powdered zinc, 2 drachms; to be agitated in 4 fluid ounces of distilled water, until the solution is colorless; then filter, and add 12 fluid ounces of syrup. The dose is from 10 to 40 drops, 3 times a day, in water. Mr. A. B. Taylor recommended another formula for preparing this medicinal syrup (see *Amer. Jour. Pharm.*, 1852, p. 33). Externally, an ointment (1 part of the iodide to 8 parts of lard) has been recommended as an application to *tumors* by friction: 1 or 2 grains, dissolved in 1 fluid ounce of water, has been used with benefit in *gonorrhœa* (injecting 1 or 2 teaspoonfuls into the urethra, 2 or 3 times a day. Twenty or 30 grains, dissolved in 1 fluid ounce of water, has been found useful in *enlargement of the tonsils;* it must be applied by means of a small probang, or camel's-hair pencil, and after several days the deliquesced iodide should be used instead, applying it by means of a camel's-hair pencil (J. J. Ross).

ZINCI OXIDUM (U. S. P.)—ZINC OXIDE.

FORMULA: ZnO. MOLECULAR WEIGHT: 81.06.

SYNONYMS: *Flores zinci*, *Flowers of zinc*, *Lana philosophica*, *Philosopher's wool*, *Pompholyx*, *Nix alba*, *Nihilum album*, *Zinc white.*

"Zinc oxide should be kept in well-stoppered bottles"—(*U. S. P.*).

Preparation.—Zinc oxide may be prepared either in the dry or in the wet way. When metallic zinc is exposed to a white heat with access of air, it burns with a brilliant light, forming white flakes of zinc oxide, which, when obtained in this way, have been called *Lana philosophica*, *Flowers of zinc*, *Zinc white*, etc. Zinc white is official in the *German Pharmacopœia*, under the name *Zincum Oxidatum Crudum*. It is directed that it should not be used internally. Oxide of zinc is found in an impure form in the chimneys of zinc and brass furnaces (see *Tutty*, following page). Zinc oxide, intended for internal application, is mostly obtained in the wet way. Basic zinc carbonate (see *Zinci Carbonas Præcipitatus*) is first prepared, and then ignited in a crucible, a flask, or a flat porcelain dish, whereby it loses water and carbonic acid gas (see directions in *U. S. P.*, 1870, and *Br. Pharm.*, 1885; also Wittstein, *Amer. Jour. Pharm.*, 1852, p. 361; and Charles Caspari, *ibid.*, 1859, p. 435). The powder thus obtained should be impalpable; too high a heat is liable to render it gritty. It may also become gritty upon prolonged keeping; in this case, recalcining is said to restore its fineness (Speidel, 1875).

Description.—Pure oxide of zinc is "an amorphous, white powder, without odor or taste. It gradually absorbs carbon dioxide from the air. Insoluble in water or alcohol. Soluble, without effervescence, in diluted acids; also in ammonia water, and in ammonium carbonate T.S. When heated, it assumes a yellow color, which disappears again on cooling. If a small portion of the salt be moistened with a drop of cobaltous nitrate T.S., and heated before the blowpipe, it will assume a vivid-green color"—(*U. S. P.*). (Compare *Zinci Carbonas Præcipitatus.*) Heated on charcoal before the blowpipe, zinc oxide is reduced, and the metal is completely burned and volatilized; a small portion of the oxide condensing, forms a yellow ring on the cold charcoal, becoming white on cooling. Zinc oxide, as such, is permanent toward heat.

Tests.—If the oxide be digested with water, the solution, when filtered and evaporated, should leave no residue; should any occur and effervesce with diluted acids, it is due to carbonate of sodium. If the oxide, when treated with diluted sulphuric acid, evolves hydrogen sulphide gas, recognizable by its blackening a strip of paper saturated with solution of lead acetate, zinc sulphide is present (see Schneegans, *Pharm. Jour. Trans.*, Vol. II, 1896, p. 50). If the oxide effervesces with diluted acids, it contains either carbonate of zinc, calcium, or magnesium. To determine whether either of the latter is present, the nitric acid solution is supersaturated with ammonia water, precipitated with hydrosulphide of ammonium, filtered, the excess of hydrosulphide of ammonium driven off by boiling, and oxalate of ammonium added; a precipitate indicates calcium; after filtering this, any precipitate caused by phosphate of ammonium is due to magnesium.

The *U. S. P.* directs the following tests: "For making tests of identity and purity, digest 1 Gm. of zinc oxide, during 1 hour, with occasional agitation, in a mixture of 10 Cc. of diluted sulphuric acid and 10 Cc. of water; then remove the undissolved zinc oxide by filtration. In a portion of the filtrate a pure white precipitate is produced by potassium ferrocyanide T.S., or by ammonium sulphide T.S. In another portion of the filtrate, acidulated with hydrochloric acid, no color or turbidity should be produced by an equal volume of hydrogen sulphide T.S. (absence of arsenic, cadmium, lead, copper, etc.). Another portion of the filtrate should yield with ammonium carbonate T.S., a pure white precipitate, which should redissolve completely in an excess of the reagent (absence of iron, aluminum, calcium, etc.). If from this solution in ammonium carbonate T.S., the zinc be completely precipitated by ammonium sulphide T.S., the filtrate should, on evaporation, leave no fixed residue (absence of alkalies, magnesium, etc.). In another portion of the filtrate, silver nitrate T.S. should not produce a turbidity (absence of chloride). If zinc oxide be agitated for some time with water, and a drop of phenolphtalein T.S. be added, no red color should appear (absence of alkaline carbonate, etc.). If 10 Cc. of diluted sulphuric acid be added to 0.5 Gm. of zinc oxide, no effervescence should occur (absence of carbonate), and a perfectly clear solution should result (absence of lead, silicate, etc.). If zinc oxide be dissolved in diluted hydrochloric acid, the solution should remain perfectly clear after the addition of barium chloride T.S. (absence of sulphate)"—(*U. S. P.*). To insure the absence of metallic zinc, the *British Pharmacopœia* (1898) directs that zinc oxide "should be entirely soluble when rubbed and, if necessary, warmed with solution of ammonia, mixed with strong solution of ammonia (absence of metallic zinc)"—(*Br. Pharm.*, 1898). A test for arsenic is recommended as follows: On mixing 1 Gm. of the oxide with 3 Cc. of solution of stannous chloride, no brown coloration should appear within 1 hour (*Digest of Criticisms on the U. S. P.*, Part I, 1897; from *Apoth. Ztg.*, 1894). (For examinations of commercial specimens of zinc oxide, see *Amer. Jour. Pharm.*, 1881, p. 534; *ibid.*, 1888, p. 608, and 1894, p. 492.)

Action, Medical Uses, and Dosage.—Oxide of zinc, in large doses, produces irritation, vomiting, and sometimes purging. Continued small doses may occasion nausea and other gastric unpleasantness, with eructations and vomiting, heat in the stomach, elevated temperature, thirst, mental confusion, disordered hearing and sight, convulsions, and disturbed circulation; larger doses cause diarrhœa, œdema, and a general marasmic state. In small doses of from 2 to 10 grains, it has been used in *epilepsy*, *chorea*, *catalepsy*, *pertussis*, *hysteria*, *neuralgia*, *gastrodynia*, etc., as a tonic, antispasmodic, and sedative. Long used, it acts as a slow poison, causing *tabes sicca*. It is seldom used internally, as its effects are very uncertain, and its efficacy in *epilepsy* has been very much overrated. It has been used with varying success in *diarrhœa* and *dysentery*, and it appears to exert a considerable influence for good in *chronic alcoholism*, with tremors, vertigo, insomnia, tinnitus, and hallucinations. Three or four 1-grain doses of the oxide, taken during the evening, give beneficial results in *colliquative sweating*. The indications for the internal administration of zinc oxide, in gastric disorders, are *nervous dyspepsia*, with full abdomen and broad tongue. It is also useful in *gastric ulcers*, and in *chronic gastritis*, with free secretion of mucus. Here the dose should range from ½ to 1 grain. Applied to *ulcerated or other secreting surfaces*, it acts as a desiccant and astringent, and has been found useful as an application to *excoriations*, *moist skin*, *eruptions*, *balanitis*, *chaps and cracks of the nipples*, *simple ulcerations*, *burns* and *scalds*, *ophthalmic and cutaneous affections*, etc. In *eczema*, *impetigo*, and *ophthalmia tarsi* it has been found especially useful. An impure oxide of zinc, known by the name of *Tutty*, is occasionally used for similar purposes, but it is inferior to the pure oxide.

Specific Indications and Uses.—Nervous dyspepsia, with broad tongue and full abdomen; gastric ulcer; chronic gastritis, with hypersecretion of mucus; night-sweats.

Related Preparation.—TUTTY, *Impure zinc oxide*, *Tutia*, *Cadmia fornacum*. When lead ores, containing zinc as an impurity, undergo smelting, this oxide is formed, and collects in the chimney of the furnace in the form of heavy, hard, and brittle incrustations. It is grayish externally, yellowish internally, and consists of zinc oxide with some carbonate, and small quantities of metallic zinc. A spurious tutty, more friable, of an earthy odor, and readily disintegrating in water, has been prepared from copper filings and blue clay. Tutty was formerly used in fine powder, or in ointment, as a topical desiccant.

ZINCI PHOSPHIDUM (U. S. P.)—ZINC PHOSPHIDE.

FORMULA: Zn_3P_2. MOLECULAR WEIGHT: 257.22.

SYNONYM: *Phosphuret of zinc*.

"Zinc phosphide should be kept in small, glass-stoppered vials"—(*U. S. P.*).

Preparation.—This compound may be obtained either by adding dry phosphorus (26 parts), little by little, to fused zinc (74 parts), a direct union taking place; or, according to Currie and Vigier, vapors of phosphorus are conducted over fused zinc in an atmosphere of dry hydrogen. Great danger, however, attends this process, as a violent explosion may occur. Proust prepared the compound by conducting a mixture of nitrogen and hydrogen phosphide gas over zinc, contained in a redhot porcelain tube, the apparatus being previously filled with nitrogen gas. Metallic zinc is often present in the product, and may be separated by powdering and sifting the preparation; the zinc phosphide is easily differentiated by its appearance, which is that of reduced iron.

Description and Tests.—"A gritty powder of a dark-gray color, or crystalline fragments of a dark, metallic luster, and having a faint odor and taste of phosphorus. In contact with the air it slowly emits phosphorous vapor. Insoluble in water or alcohol; soluble in diluted hydrochloric or sulphuric acid, with evolution of hydrogen phosphide. When strongly heated, with exclusion of air, it melts, and finally sublimes. When heated in air, it becomes oxidized to zinc phosphate. If 0.5 Gm. of zinc phosphide be dissolved in 15 Cc. of diluted hydrochloric acid, heat being applied to expel all of the hydrogen phosphide gas, a clear solution should result, leaving no residue (absence of insoluble impurities). A portion of this solution should yield a pure white precipitate with potassium ferrocyanide T.S. (absence of iron or copper), or with ammonium sulphide T.S. (absence of lead or copper). If another portion of this solution be mixed with an equal volume of hydrogen sulphide T.S., no color or turbidity should appear (absence of arsenic, cadmium, lead, copper, etc.)"—(*U. S. P.*).

Action, Medical Uses, and Dosage.—Zinc phosphide was introduced as a remedy for *nervous affections*, but has failed to fulfil all that its introducers claimed for it. It is, however, a useful agent in debilitated conditions, with impaired nutrition of the brain and spinal cord. Thus it has proved beneficial in *paralysis agitans*, *progressive locomotor ataxia*, *spinal irritation*, *cerebral exhaustion from brain-fag*, or *anemia*, and in *aphasia* and *cerebral degeneration*, or "*softening of the brain.*" In cerebral exhaustion, pallor, depression, and insomnia are the indications for its selection; it is also, according to Goss, a remedy for *vertigo*, with pain in the cerebellar, medullary, and cervico-spinal tracts. The dose may range from 1 grain of the 3 x or 2 x triturations to $\frac{1}{10}$ grain of the phosphide, 4 times a day. If the drug causes diarrhœa or vomiting it should be withdrawn. *Zinc hypophosphite*, in doses of 1 grain in syrup, has been recommended as being less irritant than the phosphide.

Specific Indications and Uses.—Cerebral anemia; brain-fag, with pallor, depression, and sleeplessness; pain in cerebellum, medulla, and cervical portion of spinal cord; cerebral softening.

ZINCI SULPHAS (U. S. P.).—ZINC SULPHATE.

FORMULA: $ZnSO_4+7H_2O$. MOLECULAR WEIGHT: 286.64.

SYNONYMS: *Vitriolum album*, *White vitriol.*

"Zinc sulphate should be kept in well-stoppered bottles"—(*U. S. P.*).

Preparation.—Zinc sulphate is usually prepared by dissolving metallic zinc in dilute sulphuric acid, whereby hydrogen gas is evolved. An excess of zinc insures the absence of lead in the solution. In order to remove iron, the solution is first treated with chlorine water, which converts the ferrous into ferric chloride; the iron is then precipitated as hydroxide by the addition of pure zinc oxide or freshly prepared basic zinc carbonate. Filter from the precipitate and evaporate the solution until it commences to crystallize. (For detailed directions, see *Br. Pharm.*, 1885.) The *white vitriol* (*crude white vitriol*) of commerce is an impure sulphate of zinc; it is prepared by roasting the native sulphide of zinc, or *zinc blende*, in a reverberatory furnace, then exposing it to the air in a moist state until the sulphide is converted by oxidation into the sulphate; this is lixiviated, and the solution, concentrated by evaporation, is poured into molds, where it concretes into cakes like loaf sugar. In this state it contains many impurities, as copper, lead, cadmium, and especially iron, in the form of sulphates; it may be purified by redissolving it, and treating with chlorine and carbonate of zinc, as mentioned before, which will precipitate the iron as well as the other foreign metals; the solution is then evaporated to crystallization.

Description.—Pure sulphate of zinc forms colorless, rhombic prisms or needle-like crystals, resembling magnesium sulphate, when produced from concentrated solutions by disturbed crystallization. As required by the *U. S. P.*, sulphate of zinc forms "colorless, transparent, rhombic crystals, without odor, and having an astringent, metallic taste. Efflorescent in dry air. Soluble in 0.6 part of water at 15° C. (59° F.), and in 0.2 part of boiling water; also soluble in about 3 parts of glycerin; insoluble in alcohol. When rapidly heated, the salt melts. At a higher temperature it is partly decomposed, losing both water and sulphuric acid. When very gradually heated to 50° C. (122° F.), it loses 5 molecules of its water (31.3 per cent) without melting. At 100° C. (212° F.) a sixth molecule is lost, while the last may be removed by a current of dry air at 110° C. (230° F.). The aqueous solution gives an acid reaction with litmus paper" (*U. S. P.*).

Tests.—The aqueous solution of sulphate of zinc is precipitated white by caustic potash or soda, or alkali carbonates, hydroxide of zinc being thrown down in the former, basic carbonate in the latter case; the hydroxide is soluble in an excess of the alkali. If iron or magnesium salts be present, their hydroxides will not be redissolved by the alkali (compare with *U. S. P.* tests below). The solution of zinc sulphate will be colored blue by excess of aqueous ammonia when copper is an impurity; if iron be present, ferrocyanide of potassium will cause a bluish-white precipitate. Either of these reagents produce a white precipitate with a solution of pure sulphate of zinc. Hydrogen sulphide gas throws down white sulphide of zinc, precipitation being complete only in neutral or acetic acid solutions.

From the above reactions it follows that zinc sulphate is incompatible with solutions of ammonia, soda, and potassa, and their carbonates; also with alkali sulphides, phosphates, acetate of lead, lime-water, vegetable astringent infusions (tannate of zinc being precipitated), milk, mucilage, etc.

The *U. S. P.* gives the following tests of identity and purity: "A 5 per cent aqueous solution yields a pure white precipitate with potassium ferrocyanide T.S.; also with ammonium sulphide T.S., and with barium chloride T.S. If a small portion of the salt be moistened with a drop of cobaltous nitrate T.S., and heated before the blowpipe, it will assume a vivid green color"—(*U. S. P.*). (See *Zinci Carbonas Præcipitatus.*) "No residue should be left on dissolving 1 Gm. of the salt in 20 Cc. of water (absence of lead and other insoluble matters). The aqueous solution (1 in 20), after being acidulated with hydrochloric acid, should not be colored or rendered turbid by an equal volume of hydrogen sulphide T.S. (absence of arsenic, cadmium, copper, etc.). The aqueous solution should yield with ammonium carbonate T.S. a pure white precipitate, which should redissolve completely in an excess of the reagent (absence of iron, aluminum, calcium, etc.). If from this solution in ammonium carbonate T.S., the zinc be completely precipitated by ammonium sulphide T.S., the filtrate should leave no fixed residue on evaporation (absence of alkalies, magnesium, etc.). The aqueous solution (1 in 20) should not be rendered turbid by silver nitrate T.S. (absence of chloride). If 1 Gm. of zinc sulphate, in small fragments, be agitated for some time with 10 Cc. of alcohol, the filtrate should not redden moistened blue litmus paper (absence of free acid)"—(*U. S. P.*). "A readily applied and sensitive test for free acid is the addition of a drop of methyl-orange solution to an aqueous solution of the salt. In presence of acid, the solution is reddened" (C. E. Smith, *Digest of Criticisms on the U. S. P.*, Part II., 1898). The presence of free acid is due to the addition of an excess of acid in the preparation of zinc sulphate, the purpose being to convert the basic zinc sulphate that may have been formed by the addition of too much zinc carbonate into the neutral salt (see *Preparation*, preceding page; also see test for free acid, in *Amer. Jour. Pharm.*, 1888, p. 344).

Action, Medical Uses, and Dosage.—In large doses sulphate of zinc is an irritant poison, causing vomiting, purging, coldness of the extremities, fluttering pulse, and great depression; but seldom occasioning death. In doses of from 10 grains to ½ drachm it occasions prompt vomiting, and on this account, as well as for the absence of that distressing nausea which usually follows other emetics, it is generally used to dislodge *narcotic poisons* from the stomach; its promptness and want of nausea prevents any great degree of absorption of the poison to be removed. It should not be employed to remove irritant poisons. It is likewise employed as an emetic in *pseudo-membranous croup*. In doses of from 1 to 5 grains it is reputed tonic, astringent, and antispasmodic, and has been used in *dyspepsia*, *gastric catarrh*, *chronic dysentery*, and *diarrhœa*, *chronic bronchial affections* with profuse secretions, *gleet*, *leucorrhœa*, *intermittent fever*, *chorea*, *hysteria*, *epilepsy*, *spasmodic asthma*, *whooping-cough*, etc. Like chloride of zinc, it has a great affinity for albumen and fibrin. By quite a large class of practitioners its internal use is entirely dispensed with for other agents of a more desirable character. Used in solution varying from 1 to 6 or 8 grains of the salt to 1 fluid ounce of water, it has proved beneficial as a collyrium in *chronic ophthalmia*, as an injection in *chronic gonorrhœa*, *gleet*, and *leucorrhœa*, as a gargle in *ulceration of the throat*, and *relaxed uvula*, and as a wash for *rectal ulcerations* and other *ulcers* attended with profuse discharge, or with loose, flabby granulations. It is not well adapted for *acute conjunctivitis*. Applied to *gangrenous* or *mortified parts*, powdered sulphate of zinc corrects the fetor, and arrests further decomposition; it should be applied over the affected part, and then be covered with flour paste, or an elm poultice. Used in this manner, it is also useful in *malignant ulcerations*, to check *hemorrhages*, etc. Combined with powdered bloodroot, it has been successfully used in *nasal polypi*, and also in *phagedenic chancres*. Sulphate of zinc was at one time a secret remedy for *cancerous tumors*. *Anhydrous sulphate of zinc*, in the form of powder or paste, has been successfully employed as a local application in *lupus*, *condylomata*, *warts*, *ulcers of the cervix uteri*, *callous ulcers*, *fistula in ano*, *vascular tumor in the meatus urinarius of females*, etc. It is very painful, but acts promptly and efficiently. The powder should be impalpable, and the paste may be made by adding a sufficient quantity of glycerin to it. In cases where large doses of sulphate of zinc have been swallowed, the vomiting usually prevents any dangerous effects; any inflammation or irritation, however, that may be produced should be met with mucilaginous drinks, opiates, etc., and be treated upon general principles. The dose for internal administration is from ¼ grain to 5 grains; it is seldom, however, used internally, except when used as an emetic, the dose then ranging from 10 to 30 grains, in warm water.

ZINCI SULPHOCARBOLAS.—ZINC SULPHOCARBOLATE.

FORMULA: $Zn2C_6H_5SO_4$. MOLECULAR WEIGHT: 410.18.
SYNONYM: *Zinc sulphophenate.*

Preparation.—Sulphocarbolate of zinc is made by double decomposition of a solution of sulphocarbolate of calcium with the exact quantity of sulphate of zinc, filtering and evaporating. In like manner other sulphocarbolates may be prepared as desired (also see *Sodii Sulphocarbolas*). The *British Pharmacopœia* (1898) directs that "zinc sulphocarbolate, or zinc phenol-para-sulphonate ($Zn[OH.C_6H_4.SO_3]_2.H_2O$) may be obtained by heating a mixture of phenol and sulphuric acid, and saturating the product with zinc oxide"—(*Br. Pharm.*, 1898).

Description.—According to the same authority, zinc sulphocarbolate occurs in "colorless, transparent, tabular, efflorescent crystals; soluble in 2.5 parts of alcohol (90 per cent), and in 2 parts of water. The aqueous solution is colored violet by test solution of ferric chloride, and affords a white precipitate with solution of ammonium hydrosulphide. It should yield no characteristic reaction with the tests for lead, copper, cadmium, arsenium, iron, aluminum, calcium, magnesium, sodium, potassium, ammonium, acetates, or chlorides, and only the slightest reactions with the tests for sulphates"—(*Br. Pharm.*, 1898). From calcium sulphate it may be separated by means of alcohol (see Wm. Procter, Jr., *Amer. Jour. Pharm.*, 1870, p. 135).

Action, Medical Uses, and Dosage.—Sulphocarbolate of zinc possesses both antiseptic and astringent properties, and is less irritating in its effects than carbolic acid. As a local application it has proven, in many instances, to be superior to the sodium salt. As a spray or wash, it will be found useful in *surgical dressings*, in certain *pseudo-membranous exudations*, in *gangrenous conditions*, and in *chronic ophthalmia;* in injection it will prove useful in *chronic gonorrhœa*, *leucorrhœa*, and *gleet*. As an astringent it may be advantageously substituted for sulphate of zinc in urethral injections, possessing all its benefits without any of its inconveniences. The strength of the solution in water will vary from 1 to 5 parts of the salt to 100 or more parts of water. The chief field for the exhibition of this drug is in *septic conditions of the intestinal tract*, and in the *fevers* arising therefrom. Dr. W. H. Halbert, of Nashville, Tenn. (*Ec. Med. Jour.*, 1895, p. 72), gives clearly the uses of this salt, to which article the reader is referred. Dr. Halbert, whose experience in the treatment of *typhoid and similar fevers* has been large, believes that if given early it will abort typhoid fever, basing his belief upon the theory that there must be a septic condition of the intestines to give rise to such fevers. The cases of well-developed typhoid fever reported as benefited were those in which there was high temperature, full abdomen, with marked tympanites, bowels loose—from 8 to 10 foul-smelling evacuations daily, and in some cases hemorrhage. These were promptly controlled with 2½-grain doses every 2 hours, the temperature dropping, the discharges gradually checking, and the tympanitic condition being quickly overcome. He is positive that it checks fermentative changes in the bowels, but that it is useless in all bowel disorders if there be no sepsis. In typhoids it prevents *hemorrhage* by controlling the bowel lesions before destructive action has set in. Dr. Halbert ranks it next to turpentine and baptisia as an intestinal antiseptic, but calls attention to the fact that many can not take the former, while the latter is sometimes not powerful enough to meet the conditions. From sulphocarbolate of zinc he has seen no bad results. He also advises it in *cholera infantum*, *cholera morbus*, *septic diarrhœa*, *dysentery*, *malignant dysentery*, *chronic dysentery*, and *tuberculosis* with dysenteric complications. It appeared to benefit *peritonitis*. He suggests its probable utility in *cholera* and *yellow fever*. Dr. Halbert employs pills of zinc sulphocarbolate chiefly, but in cholera morbus and cholera infantum he gives the agent in solution. Prof. R. L. Thomas, M. D., uses this agent quite extensively, and has formulated the following specific indications for its use: "Tongue pallid, moist, pasty, and dirty." He has tried it when the tongue was red, but failed to get results. Following the indications given, he declares it a very good remedy in *typhoid fever*, and has had excellent results from its use in the *intestinal complications of la grippe*, and in *dysentery*. He employs a trituration of equal parts of sugar of milk and sulphocarbolate of zinc, the dose of which is from 2 to 5 grains. The crude article in powder causes too much burning. The dose of sulphocarbolate of zinc may range from 1 to 10 grains, in pill, solution, or trituration. The most commonly employed doses range from 1 to 3 grains.

Specific Indications and Uses.—"Tongue pallid, moist, pasty, and dirty" (Thomas); intestinal sepsis, with copious, foul-smelling alvine discharges; tympanitis; septic fever and hemorrhage in typhoid fever, and other septic bowel disorders. It is of decided value as an intestinal antiseptic.

ZINCI VALERIANAS (U. S. P.)—ZINC VALERIANATE.

FORMULA: $Zn(C_5H_9O_2)_2+2H_2O$. MOLECULAR WEIGHT: 302.56.

SYNONYMS: *Valerianate of zinc*, *Zincum valerianicum*.

"Zinc valerianate should be kept in small, well-stoppered bottles"—(*U. S. P.*).

Preparation.—Zinc valerianate may be obtained by dissolving freshly precipitated and well-washed basic zinc carbonate in an aqueous solution of (iso-) valerianic acid (see *Acidum Valerianicum*), and evaporating to crystallization. The *British Pharmacopœia* (1885) prepares the anhydrous salt ($Zn[C_5H_9O_2]_2$) by the double decomposition between sulphate of zinc and valerianate of sodium (see *Sodii Valerianas*). D. Vitali (*Pharm. Jour.*, Vol. VIII, 1899, p. 56, London) obtains the salt by dissolving sodium valerianate (100 parts) and zinc sulphate (117.4 parts) separately, in the smallest possible volume of water, by the aid of heat, mixing the solution, evaporating to dryness, on the water-bath, below 70° C. (158° F.), and extracting the powdered residue, at 70° C. (158° F.), with alcohol (95 per cent). On evaporation, zinc valerianate crystallizes out. (Also see Wm. Procter, Jr., *Amer. Jour. Pharm.*, 1845, p. 2, for its preparation from valerian.)

Description.—Anhydrous valerianate of zinc ($Zn[C_5H_9O_2]_2$) crystallizes in snow-white, exceedingly light plates, of a mother-of-pearl luster, and resembling boric acid. Cold ether dissolves $\frac{1}{300}$, boiling ether $\frac{1}{20}$ of its weight. The hydrated salt is not different in appearance from the anhydrous, its formula is $Zn(C_5H_9O_2)_2.2H_2O$.

The salt recognized in the *French Codex* contains $12H_2O$. At 100° C. (212° F.), it loses its water of crystallization, or about 45 per cent of its weight. It is soluble in 50 parts of cold water.

The salt recognized by the *U. S. P.* forms "white, pearly scales, having the odor of valerianic acid, and a sweetish, astringent and metallic taste. On exposure to the air, it slowly loses valerianic acid. Soluble, at 15° C. (59° F.), in about 100 parts of water, and in 40 parts of alcohol; somewhat more soluble in absolute alcohol. Boiling renders the solution turbid from loss of acid and formation of a basic salt. When heated, the salt melts. At a higher temperature, it is decomposed, giving off inflammable vapors, and finally leaving a residue of zinc oxide. The aqueous solution reddens blue litmus paper"—(*U. S. P.*).

Tests.—"If 0.5 Gm. of zinc valerianate be dissolved in a mixture of 0.5 Cc. of hydrochloric acid and 4.5 Cc. of water, the valerianic (isovalerianic) acid will be liberated, and float as an oily layer on the surface of the liquid. After its removal, the clear solution should be neither colored nor rendered turbid by the addition of an equal volume of hydrogen sulphide T.S. (absence of arsenic, cadmium, lead, copper, etc.). Zinc valerianate should dissolve without residue in ammonia water (absence of iron, etc.). If from this solution the zinc be completely precipitated by ammonium sulphide T.S., the precipitate should have a pure white color, and the filtrate should leave no fixed residue on evaporation (absence of alkalies, magnesium, etc.). If 0.5 Gm. of zinc valerianate be triturated with 2 Cc. of water and 0.2 Cc. of ferric chloride T.S. added, the filtrate should not show a red color (absence of acetate). If a concentrated solution of copper acetate in water be added to a concentrated, aqueous solution of zinc valerianate, the mixture should remain perfectly clear (absence of butyrate)"—(*U. S. P.*). In the latter test, the presence of butyrate would cause a bluish-white precipitate (Larocque and Hurant; see this *Dispensatory*, preceding edition). F. Sutton (*Amer. Jour Pharm.*, 1866, p. 537) detects the presence of excess of zinc oxide (if the salt be roughly prepared by triturating valerianic acid with zinc oxide), by treating with diluted solution of citric or tartaric acid, which dissolves zinc valerianate without liberating valerianic acid, while zinc oxide is not dissolved.

Action, Medical Uses, and Dosage.—Valerianate of zinc has been employed as an antispasmodic in *neuralgia*, especially *spinal neuralgia* and *neuralgia of the fifth nerve*, *chorea*, *epilepsy*, *neuralgic and nervous headaches*, *hysteria*, *sciatica*, *ovaralgia*, *angina pectoris*, and other nervous diseases. The dose is from 1 to 3 grains, 2 or 3 times a day, in pill form, or in solution. By some practitioners, it is said to have produced no beneficial results. As a topical astringent and sedative, a collyrium composed of from 2 to 4 grains of the salt, in 1 or 2 fluid ounces of distilled water, has been employed in *chronic conjunctivitis*. Its intolerable odor is largely a bar to its use.

Specific Indications and Uses.—"Colic, reflex from ovarian or uterine disease; headache; paleness; dizziness; sleeplessness; anemia. Three to 5 grains of third decimal trituration every 2 hours" (Watkins, *Comp. of Ec. Med.*, p. 453).

ZINCUM (U. S. P.)—ZINC.

SYMBOL: Zn. ATOMIC WEIGHT: 65.10.

SYNONYMS: *Spelter*, *Spiauter*.

"Metallic zinc in the form of thin sheets, or in irregular, granulated pieces, or molded into thin pencils, or in a state of fine powder"—(*U. S. P.*).

Source, History, and Preparation.—Zinc ore (*cadmia*) was described by Dioscorides and Pliny as having the property of coloring copper yellow (*i. e.*, forming what is now known as brass); the name *cadmia* was then also applied to the deposit which formed in the flues of brass foundries (see *Tutty*). The name zinc first occurs in the writings of Basil Valentine, and the metal was obtained on a large scale at Bristol, England, as far back as 1743 (see Roscoe and Schorlemmer's *Chemistry*). Zinc occurs in nature in the form of oxide (*zincite*, *red zinc ore*, ZnO), as sulphide (*zinc blende*, or *black jack*, ZnS), as sulphate (*white vitriol*, $ZnSO_4+7H_2O$), as carbonate (*zinc spar*, also called *calamine*, *galmei*, *smithsonite*, $ZnCO_3$), as silicate (*siliceous calamine*, $Zn_2SiO_4+H_2O$), as aluminate (*Gahnite*, $ZnO+$

Al_2O_3), as *Franklinite* ($ZnO.FeO.Fe_2O_3$), etc. The chief zinc-producing countries are Silesia, Carinthia, Belgium, Rhenish Prussia, England, and many parts of the United States. When zinc is obtained from the carbonate (calamine), or the sulphide (zinc blende), the ores are previously roasted to drive off carbon dioxide from the former, and sulphur (as dioxide) from the sulphide. The resulting oxide is then reduced with charcoal to metallic zinc, which distills, and is condensed and collected, melted, and cast into ingots. Distillation is carried out in cylindrical tubes (*Belgian process*), or in muffles (*Silesian process*). (For details, see Roscoe and Schorlemmer's *Chemistry*.) During the distillation of the zinc, part of it burns, and the oxide, mixed with some zinc (*Silesian zinc-flowers*), is found in the receiver.

Crude zinc is liable to contain the following impurities: Iron, lead, copper, sulphur, phosphorus, arsenic, antimony, cadmium, and charcoal. To purify the zinc for medicinal purposes, it is subjected to redistillation in a retort consisting of a closed crucible, through the bottom of which an iron tube is fitted, projecting somewhat over half way into the crucible, and dipping into a vessel with water below. The crucible being heated, the zinc is vaporized, and passes down through the tube into the water. A chemical method recommended to purify zinc of its most objectionable impurities consists in oxidizing the melted zinc with potassium nitrate, and subsequently fusing it with zinc chloride; this removes arsenic, antimony, sulphur, and phosphorus, while iron, lead, and copper are not affected (Lescoeur, *Amer. Jour. Pharm.*, 1893, p. 175).

ZINCUM GRANULATUM, or *Granulated zinc*, is prepared by fusing, in an earthenware crucible, commercial metallic zinc, and pouring the melted liquid into cold water. The zinc, in granular condition, is then drained from the water and dried.

ZINC DUST is obtained either by distillation of zinc, and removing the zinc oxide that is formed by partial combustion, by means of ammonium chloride and aqueous ammonia; or, by powdering zinc in a mortar at a temperature above 200° C. (392° F.), and below 400° C. (752° F.), just short of its melting point (see *Description*, below). Zinc dust is a useful agent in effecting reductions in organic chemistry by dry distillation. Zinc is extensively used in the arts in the form of *galvanized iron* (iron-coated with zinc), for a variety of purposes. With copper it forms the alloy known as *brass* (20 parts zinc, 80 parts copper), and also enters into a number of other alloys.

Description.—As described by the *U. S. P.*, zinc is "a bluish-white metal, showing a crystalline fracture, and having a specific gravity, ranging from 6.9 when it is cast to 7.2 after it is rolled. Soluble in diluted sulphuric or hydrochloric acid, with evolution of hydrogen gas. When heated above 100° C. (212° F.), and not above 150° C. (302° F.), the metal becomes malleable and ductile; above 200° C. (392° F.) it becomes sufficiently brittle to be powdered in an iron mortar; at 412° to 415° C. (773.6° to 779° F.) it melts, and at 940° C. (1724° F.) it boils, and may be readily distilled"—(*U. S. P.*). In the air zinc gradually loses its luster, becoming covered with a thin gray coating of oxide, of a similar nature to the scum which forms on fusing; if this scum be removed when the metal is at a bright-red heat, the latter ignites and burns with a clear, greenish-white flame to oxide (see *Zinci Oxidum*). Zinc containing traces of other metals is readily soluble in dilute nitric, hydrochloric and sulphuric acids, with evolution of hydrogen gas and formation of the respective zinc salts. In the case of nitric acid, the nascent hydrogen induces secondary reactions, with formation of the lower nitric oxides, and even nitrogen, and finally ammonia (see C. Montemartini, *Amer. Jour. Pharm.*, 1892, p. 619). Chemically pure zinc is not soluble in dilute sulphuric acid, while commercial zinc even decomposes water upon boiling (*ibid.*, 1886, p. 127, from *Chemiker Zeitung*). Zinc is also soluble in solutions of caustic alkalies. Metallic zinc throws out arsenic, cadmium, copper, lead, etc., from their solutions and replaces them. Metallic zinc is not used in medicine; several of its salts, however, are employed, and are described under separate headings. They are mostly soluble in water, acid in reaction, and have an unpleasant metallic taste. The salts of zinc with volatile acids leave a residue of zinc oxide when they are heated to redness. The chloride, when thus heated (see *Zinci Chloridum*), is partly volatilized unchanged.

Tests.—When a salt of zinc is mixed with sodium carbonate and heated on charcoal in the reducing flame of a blowpipe, a non-volatile film of zinc oxide is deposited on the coal; this film is yellow when hot, and white when cold. (For another dry-way test [formation of Rinmann's green], see *Zinci Carbonas Præcipitatus.*) Solutions of zinc salts form a precipitate of zinc hydroxide ($Zn[OH]_2$) with caustic soda or potassa, or aqua ammoniæ. The precipitate is soluble in excess of the precipitant, and in ammonium salts (thus differing from cadmium, iron, etc.). From neutral solutions of zinc salts, ammonium sulphide precipitates characteristic white zinc sulphide (Zn_2S+HO). The sulphides of lead, copper, bismuth, iron, etc., are black, those of arsenic and cadmium are yellow. Zinc sulphide is readily soluble in mineral acids, insoluble in acetic acid; hence it is not precipitated by hydrogen sulphide gas when the solutions are acidulated with mineral acids; it is precipitated, however, when acidulated by acetic acid (compare *U. S. P.* tests, below). Potassium cyanide precipitates from solutions of neutral zinc salts white zinc cyanide ($Zn[CN]_2$), soluble in excess of potassium cyanide, forming a double salt ($Zn[CN_2].2[CN]K$). From this solution, hydrogen sulphide gas or ammonium sulphide produces no precipitate (difference from cadmium). As stated before, impurities liable to occur in zinc are: Iron, lead, copper, arsenic, sulphur, phosphorus, antimony, cadmium, and carbon. To establish the absence of these, the *U. S. P.* directs the following tests: "When zinc is dissolved in diluted hydrochloric acid, the hydrogen gas which is evolved should not have any disagreeable odor, nor should it color a strip of paper moistened with lead acetate T.S. (absence of sulphur), or with silver nitrate T.S. (absence of arsenic, antimony, phosphorus). The solution should be clear and colorless, and should yield a pure white precipitate with potassium ferrocyanide T.S., and with ammonium sulphide T.S. If an equal volume of hydrogen sulphide T.S. be added to the solution, neither color nor turbidity should be perceptible (absence of arsenic, cadmium, lead, copper, etc.). If ammonia water be added to the solution, a white precipitate should form, which should redissolve completely in an excess of the reagent, yielding a clear, colorless solution (absence of more than traces of iron, lead, copper, etc.)"—(*U. S. P.*). (For additional special tests, see this *Dispensatory*, preceding edition.)

Zinc Compounds.—ZINCI CYANIDUM ($Zn[CN]_2$), *Zinc cyanide, Zinci cyanuretum, Cyanuret of zinc.* To a solution of 1 part of chloride of zinc in 10 parts of distilled water, add solution of cyanide of potassium, in small quantities at a time, so long as any precipitate occurs, being careful not to add an excess of the cyanide, which would redissolve the precipitate: filter, wash the precipitate, and dry it. The chloride of zinc is preferable to the employment of the sulphate, because the resulting potassium chloride can be washed out better than the sulphate. Another method of preparing zinc cyanide consists in precipitating solution of acetate of zinc with aqueous hydrocyanic acid. It forms a snow-white, odorless, tasteless powder, insoluble in water or alcohol, but is soluble in ammonium and potassium cyanides, caustic potash and aqua ammoniæ. If a strong mineral acid be added to it, it is decomposed, hydrocyanic acid being developed, and a soluble salt of zinc obtained. This salt has been proposed in Germany as a substitute for prussic acid. Dr. Henning, who used it with much success, asserts that it is not only of service in those cases in which hydrocyanic acid is commonly exhibited, but also in *verminous diseases of children.* He gave it in 1-grain doses, mixed with pulverized jalap; and in the nervous affection called *cramp of the stomach*, he administered an antigastralgic powder, composed of cyanide of zinc, 3 grains; calcined magnesia, 24 grains; powdered cinnamon, 12 grains. Mix and divide into 12 powders, of which the patient takes 1 every 4 hours. This salt has also been recommended in *chorea, epilepsy* and other nervous and spasmodic diseases. The dose is $\frac{1}{8}$ grain, 3 times a day, in pill or powder, cautiously increased to 1 grain. Even $\frac{1}{2}$-grain doses may produce nervous trembling, congestion of the brain, and sleepiness. In *neuralgia*, and especially of the fifth nerve, it appears to be of some value, while in *nervous affections of the heart*, with arythmic movements, pain, and palpitation, $\frac{1}{4}$-grain doses, every 1 or 2 hours, have been recommended.

ZINCI ET POTASSII CYANIDUM ($K_2Zn[CN]_4$), *Zinc and potassium cyanide.*—This salt may be obtained in permanent white or colorless crystals, having a sweet, metallic taste, upon evaporating an alkaline liquid produced by dissolving cyanide of zinc in an aqueous solution of cyanide of potassium. It has an advantage over zinc cyanide in being readily soluble in water. Its uses and doses are the same as those for zinc cyanide. By the addition of dilute acids, zinc cyanide is reprecipitated from the solution.

ZINCI FERROCYANIDUM ($Zn_2Fe[CN]_6$ $3H_2O$). *Zinc ferrocyanide, Zinci ferrocyanuretum, Ferrocyanuret of zinc.* Dissolve ferrocyanide of potassium, 30 parts, in boiling water, and gradually add to it a solution of sulphate of zinc, 40 parts, in boiling water; add these solutions together while hot, and continue dropping in the last-named solution as long as it causes a precipitate; filter, wash the precipitate until free from potassium sulphate, and dry it. It forms a tasteless, white powder, insoluble in water or alcohol, and unaffected by very dilute acids. When warmed with diluted sulphuric acid, it decomposes, liberating hydrocyanic acid. It is dissolved by strong alkali. Its action is similar to that of the cyanide of zinc, and it is used in the same diseases, in doses of 1 grain, gradually increased to 3 or 4 grains. It may be given in powder with magnesia and cinnamon, in pill form, or suspended in water.

Zinci Lactas ($Zn[C_3H_5O_3]_2.3H_2O$), *Lactate of zinc.*—Easily prepared by dissolving pure oxide or carbonate of zinc in diluted lactic acid, and evaporating to crystallization. It forms short needles, or 4-angled crystals, having a sourish, metallic taste, and acid reaction. Quite soluble in hot water (6 parts), but less soluble in cold water (about 60 parts), and scarcely soluble in alcohol. Its uses are similar to those of zinc oxide (which see), but it is recommended as preferable on account of its supposed milder effects upon the stomach. Dose, ¼ to 1 grain, 4 or 5 times a day.

Zinci Phosphas ($Zn_3[PO_4]_2.4H_2O$), *Zinc phosphate, Trizincic orthophosphate.*—Prepared by the interaction of an alkali phosphate and zinc sulphate, the following reaction taking place: $3ZnSO_4 + 2PO_4HNa_2 = (PO_4)_2Zn_3 + 2Na_2SO_4 + H_2SO_4$. The precipitate is at first gelatinous, but soon becomes crystalline. It is a white powder, soluble in diluted acids, but not in water. Like other phosphates, this agent has been used in *nervous disorders*, and especially in *epilepsy* of menstrual origin. It has also been thought of value in *insanity* following *fevers*.

Zinci Salicylas ($Zn[C_7H_5O_3]_2.2H_2O$), *Zinc salicylate.*—This salt may be prepared by boiling for several minutes a solution of sodium salicylate (34 parts), and zinc sulphate (29 parts) in water (125 parts). Allow to cool, wash the crystals with cold water, and recrystallize from boiling water (L. van Itallie, *Amer. Jour. Pharm.*, 1889, p. 180; also see *ibid.*, 1886, pp. 246 and 599). F. Vigier (*Amer. Jour. Pharm.*, 1878, p. 182) prepares the salt by adding oxide of zinc to a boiling solution of salicylic acid in water. Vigier's salt crystallizes with 3 molecules of water. Long, satin-like, acicular crystals, having a sweetish and bitterish styptic or metallic taste. Alcohol, ether, methyl alcohol, and hot water freely dissolve it; cold water less readily (1 in about 25). This agent is used locally as an antiseptic and astringent, a ½ to 1 per cent solution being reputed useful in *gonorrhœa*, *conjunctivitis*, and *common and malignant ulcers*.

ZINGIBER (U. S. P.)—GINGER.

"The rhizome of *Zingiber officinale*, Roscoe"—(*U. S. P.*) (*Amomum Zingiber*, Linné).

Nat. Ord.—Scitamineæ.

Illustration: Bentley and Trimen, *Med. Plants*, 270.

Botanical Source.—The ginger plant has a perennial, tuberous root or rhizome: the stems are erect, oblique, round, annual, and invested by the smooth sheaths of the leaves, 2 or 3 feet in height. The leaves are subsessile, on long sheaths, alternate, lanceolate, linear, acute, smooth above and nearly so beneath, bifarious, 4 to 6 inches long by 1 inch broad; the sheaths smooth and crowned with a bifid ligula. Scapes radical, solitary, a little removed from the stems, 6 to 12 inches high, enveloped in a few obtuse sheaths, the uppermost of which end in tolerably long leaves, and terminate in oblong spikes, about the size of the thumb. Exterior bracts imbricated, 1-flowered, obovate, smooth, membranous at the edge, faintly striated lengthwise; interior enveloping the ovary, calyx, and the greater part of the tube of the corolla. The flowers are small, and of a dingy-yellow color. Calyx tubular, opening on one side, 3-toothed; corolla with a double limb, outer of three, nearly equal, oblong segments: inner a 3-lobed lip, of a dark-purple color. Sterile stamens subulate; filament short. Anther oblong, double, crowned with a long, curved, tapering, grooved horn. Ovary oval, 3-celled, with many ovules in each; style filiform; stigma funnel-shaped, ciliate and lodged just under the apex of the horn of the anther (L.).

Fig. 260.

Zingiber officinale.

History and Description.—The native country of ginger is unknown, though supposed to be Asia. It is cultivated in the tropical regions of Asia and America, and also at Sierra Leone, on the west African coast. The flowers and stalks have a fragrant odor, which is especially developed when they are rubbed or bruised. The fresh root is perennial, firm, knotted, of a compressed, roundish form, beset with transverse rugæ, covered with ash-colored bark, partly of a purplish tinge, and sends off many long fibers and offsets. The internal substance of the younger roots is softish, fleshy, and greenish; of the older it is compact, fibrous, whitish, and, when powdered, has a yellowish appearance (T.). The root forms the ginger of commerce, and is gathered from December to March, or soon after the decay of the stalks. The growth of ginger exhausts the soil to such an extent that, in Jamaica, each succeeding season a new field is planted, for which the ground is supplied by cutting down the forests and burning the timber. The second year's growth on the same field yields an inferior product (*ratoon* or *blue ginger*). Yet, by judicious treatment and alternation with other crops (*e. g.*, arrow root), ginger can be grown in the same field for many years (see Wm. Fawcett, *Amer. Jour. Pharm.*, 1894, pp. 184 and 593). The rhizomes, dug up, washed, and scraped, *e. g.*, deprived of their epidermis, and then dried in the sun and open air, are termed *White ginger* (*uncoated* or *scraped ginger*). When picked, cleaned, scalded gradually in boiling water, and then dried in the sun, they form the *Black ginger* (*coated, unscraped*) of commerce. The *White ginger* is the official kind, and the best grade is that grown in Jamaica (*Jamaica ginger*). The *U. S. P.* describes it as being "about 5 to 10 Cm. (2 to 4 inches long, 10 to 15 Mm. ($\frac{2}{5}$ to $\frac{3}{5}$ inch) broad, and 4 to 8 Mm. ($\frac{1}{6}$ to $\frac{1}{3}$ inch) thick, flattish, on one side lobed or clavately branched; deprived of the corky layer; pale-buff colored, striate, breaking with a mealy, rather fibrous fracture, showing numerous small, scattered resin-cells and fibro-vascular bundles, the latter enclosed by a nucleus sheath; agreeably aromatic, and of a pungent and warm taste"—(*U. S. P.*). Black gingers are the *African*, the *East Indian*, and some grades of *Cochin ginger*. White Cochin ginger is next in quality to Jamaica ginger. *Green ginger* is sometimes imported from Jamaica; it consists of soft and juicy rhizomes with buds, which have merely been washed after collection. *Preserved ginger*, or *succades*, consist of young rhizomes preserved in syrup. Large quantities are sent to England from the East. Bleaching the ginger, by means of chlorinated lime, is often practiced, also whitewashing the ginger with diluted milk of lime. This procedure, however, does not improve the article. Age, and especially exposure, impair the active properties. Water, proof-spirit, and alcohol take up the virtues of ginger. The best ginger is that which cuts pale, but bright; its quality, however, must be judged by its color, odor, taste, heaviness, and freedom from perforation by insects. (For interesting details regarding the cultivation, etc., of the various commercial grades of ginger, see P. L. Simmonds, *Amer. Jour. Pharm.*, 1891, p. 528; as to Jamaica ginger, see W. Fawcett [*loc. cit.*], and F. B. Kilmer, "In the Land of Ginger—Jamaica," *Amer. Jour. Pharm.*, 1898, p. 65.)

Chemical Composition.—The aroma of ginger resides in a volatile oil (*oil of ginger*); the rhizome yields from 2 to 3 per cent. It is thickish, greenish-yellow, bland to the taste, and has the specific gravity of 0.875 to 0.885. Its lower fractions contain the hydrocarbons *dextro-camphene* and *phellandrene*; the bulk of the oil boils between 256° and 266° C. (492.8° and 510.8° F.) (Gildemeister and Hoffmann, *Die Ætherischen Oele*, 1899, p. 406). The pungency of ginger is due to an oleoresin, which may be extracted, together with the volatile oil, by ether, alcohol, acetone (see T. H. W. Idries, *Amer. Jour. Pharm.*, 1898, p. 466), and other solvents. Ginger was carefully investigated by J. C. Thresh (*Pharm. Jour. Trans.*, Vol. X, 1879–80, pp. 171 and 191; and Vol. XII, 1881–82, pp. 243 and 721). The oleoresin, abstracted by ether, contained volatile oil, inert neutral resin, inert acid resins, fat, and the pungent, active principle, *gingerol* (0.6 to 1.4 per cent), a viscid, odorless liquid of neutral reaction, non-glucosidal, soluble in diluted and strong alcohol, benzol, volatile oils, carbon disulphide, caustic potassa and ammonia, and glacial acetic acid; very slightly soluble in petroleum ether. The ether-insoluble part of ginger contained mucilage, starch (13 to 18 per cent), a trace of alkaloid, etc., and left, upon incineration, 3.5 to 5 per cent of ash. R. G. Davis (*Amer. Jour. Pharm.*, 1895, p. 520) finds the ash to vary from 3.6 to 6.5 per cent. According to Jones (*Archiv der Pharm.*, 1886, p. 769, from *The Analyst*, 1886), the quantity of starch in ginger is much greater than had hitherto been believed; he found 52.92 per cent. The amount of oleoresin obtainable from different grades of ginger, is not necessarily a criterion of the quality of the article. Dr. S. J. Riegel (*Amer.*

Jour. Pharm., 1891, p. 533) found Jamaica ginger to yield 5 per cent of oleoresin, obtainable by alcohol, ether, or chloroform, while the inferior East Indian ginger yielded to the same solvents 8 per cent of the oleoresin. A similar conclusion was previously reached by F. M. Siggins (*ibid.*, 1888, p. 278), as well as by Thresh, and later by W. S. Glass (*ibid.*, 1897, p. 320). The latter author remarks that the extract from the inferior (African) variety, though larger in quantity, presents an unsightly, brown appearance. (On the examination of a ginger from Fiji, being remarkably rich in active constituents, see E. H. Gane, *Pharm. Jour. Trans.*, Vol. XXII, 1892, p. 802.) The oleoresin of ginger represents the medicinal virtues of the drug (compare *Oleoresina Zingiberis*). (On chemical methods for the detection of exhausted ginger, see B. Dyer and J. F. H. Gilbard, *Proc. Amer. Pharm. Assoc.*, 1894, p. 936; and A. H. Allen and C. G. Moore, *Amer. Jour. Pharm.*, 1894, p. 342.)

Action, Medical Uses, and Dosage.—Ginger is stimulant, rubefacient, errhine, and sialagogue. When chewed it occasions an increased flow of saliva, and when swallowed it acts as a stimulating tonic, stomachic, and carminative, increasing the secretion of gastric juice, exalting the excitability of the alimentary muscular system, and dispelling gases accumulated in the stomach and bowels. It is much used to disguise other drugs, concealing their nausea, or preventing their tendency to cause tormina. When taken into the nostrils it causes severe sneezing. It has been used in combination with astringents or other agents, in *diarrhœa* and *dysentery;* prepared with rhubarb, in the form of cordial or syrup, few articles are more valuable in *cholera morbus* and *cholera infantum*, when there is coldness of the surface and extremities, and nausea and vomiting accompany. It is eminently useful in *habitual flatulency, atonic dyspepsia, hysteria*, and enfeebled and relaxed habits, especially of old and gouty individuals; and is excellent to relieve *nausea, pains and cramps of the stomach and bowels*, and to obviate tenesmus, and especially when those conditions are due to *colds*, or to the ingestion of unripe or otherwise unwholesome fruit. Ginger is occasionally of value in *fevers*, particularly where the salivary secretions are scanty and there is pain and movement of gases within the intestines. Here, though a stimulant, it will assist in producing sedation by re-establishing secretion and relieving the distressing gastro-intestinal annoyances. Ginger, in the form of "ginger tea," is popular and efficient as a remedy for breaking up *colds*, and in relieving the pangs of *disordered menstruation*. Combined with black-willow bark, it forms an excellent poultice to *indolent ulcers;* and has been used as a sialagogue to relieve *paralytic affections of the tongue, toothache*, and *relaxed uvula*. Ginger in powder, formed into a plaster with warm water, and applied on paper or cloth to the forehead, has relieved violent *headache*. Cakes made of ginger and molasses, with flour, etc., are very beneficial to the stomach, when eaten in moderation. Dose of ginger, in powder, from 10 to 30 grains; of the infusion, prepared by adding ½ ounce of the powdered or bruised root to a pint of boiling water, 1 or 2 fluid ounces. A large quantity of ginger, taken internally, might produce serious effects.

Specific Indications and Uses.—Loss of appetite; flatulence; borborygmus; spasmodic gastric and intestinal contractions; painful menstruation; acute colds; cool extremities; and cold surface in children's diseases.

Preparations of Ginger.—GINGER WINE. A good ginger wine may be made by boiling ½ pound of the best ginger, bruised, in 6 gallons of water, for ½ hour, and then filtering the decoction. Place the decoction in a demijohn, and add to it 6 pounds of raisins, cut in two, and the thin rinds of 5 lemons. Let this stand until vinous fermentation has ensued, then filter, add 1 pint of French brandy, and 1½ ounces of good isinglass previously dissolved in some of the wine. Place this in a strong vessel, cork it well and securely, and keep it for 6 months in a cool cellar (the longer the better); then carefully remove the wine from any sediment which may have formed, and bottle it for use. It improves by age.

GINGER BEER.—A good ginger beer may be prepared as follows: Take of white sugar, 2 pounds; lemon juice or cream of tartar, 14 drachms; honey, 12½ drachms; bruised ginger, 13 drachms; water, 2 gallons. Boil the ginger in 2 pints of the water for ½ hour; add the sugar, lemon juice, and honey, with the remainder of the water, and strain; when cold, add the white of an egg, and 24 minims of essence of lemon; let it stand for 4 days, and then bottle.

ETHEREAL EXTRACT OF GINGER.—Ethereal extract of ginger is made by placing 4 ounces of ginger in 6 ounces of ether, in a percolator; evaporate the percolate by means of a water-bath; 1 part of this is equivalent to 16 parts of ginger.

Related Drugs.—Zerumbet Root. This drug is the tuberous rhizome of *Zingiber Zerumbet*, Roscoe (*Amomum Zerumbet*, Linné). The root is flattish and spongy, of a yellowish hue internally, with light-brown bundles of fibro-vascular structure, and brownish externally. The odor is pleasant, and the taste, besides being bitter, resembles somewhat that of ginger. It is indigenous to Java.

Cassumunar Root.—The product of *Zingiber Cassumunar*, Roxburgh, a native of India. This and the preceding root have been confounded with each other. Cassumunar root is about 2 inches broad, compressed, jointed, and beset with white tubers, and many fleshy, white radicles. Externally, it is pale-brown and scaly, and ligneous and yellow within. Its taste is hot, pungent, and spicy, and its odor camphoraceous. Neither root is now in commerce.

Zedoaria, *Zedoary*.—The rhizomes of *Curcuma Zedoaria*, Roscoe (*Amomum Zedoaria*, Willdenow), and *Curcuma Zerumbet*, Roxburgh (*Amomum Zerumbet*, Kœnig), both of the natural order *Scitamineæ*, furnish respectively the *Radix zedoariæ longæ*, and *Radix zedoariæ rotundæ*, as formerly named. Both plants are indigenous to India and the East Indies. The ovate, or pyriform tuberous rhizome, is from 1½ to 2 inches long, and is generally cut, for the purpose of drying, into transverse, and occasionally into longitudinal sections. Zedoary is found in commerce, usually in the form of discs, almost circular, from ⅙ to ⅖ inch in thickness, and from ½ to 1½ inches in diameter. Externally, grayish-brown; internally, grayish. The endoderm near the edge is darker in color. Throughout the interior with the woody bundles are seen many orange-colored small resin cells. The discs are hard and compact, break with a short, mealy, or wax-like fracture, have a distinctive aromatic odor, and a pungent, bitterish, camphoraceous, aromatic taste. They contain starch granules (13 per cent) not unlike those of ginger; a soft, pungent resin (3 per cent); mucilage (9 per cent); bitter extractive; and a camphoraceous, volatile oil which may be obtained by distilling with water. The round zedoary, recognized by the *French Codex*, is ascribed to *Curcuma aromatica* of Roscoe, and is said to furnish the yellow discs sometimes found in the commercial zedoaria. Zedoary, though milder and less acrid, has properties very similar to those of ginger. It is employed chiefly as a carminative and stomachic. The dose of the powder is 5 to 30 grains; of the infusion (℥ss to wine or water Oss), 2 to 4 fluid drachms.

APPENDIX.

LIST OF REAGENTS.

(U. S. P.)

I. PRELIMINARY REMARKS.

Official Substances as Reagents.—Some official substances (chemicals, chemical solutions, etc.) are sufficiently pure to be used as reagents, if they comply with the tests of purity prescribed by the Pharmacopœia. In the case of others, the presence of certain impurities, though immaterial for their use as medicines, renders their employment as reagents unsuitable. Whenever a greater degree of purity is required than is provided for by the text of the Pharmacopœia, it will be specially mentioned in the following lists.

Abbreviations and Signs Used:

T. S.=Test solution.
V.S.=Volumetric solution.
$\frac{N}{1}$=Normal (see under "Volumetric Solutions" in List III).
$\frac{N}{2}$=Seminormal; $\frac{N}{10}$=Decinormal; $\frac{N}{100}$=Centinormal.
$\frac{2}{N}$=Double-normal (sometimes written: 2 N).

Asterisk (*) *in front* of a figure denotes that the quantity or value expressed by the figure is approximate. In the case of a volumetric solution, for instance, *25 Cc. means "about 25 Cc.," and this is to be interpreted as standing for "24.5 to 25.5 Cc.," the allowable variation in such cases being 2 per cent either way. In the text of the Pharmacopœia, this is expressed by saying "about 25 Cc.," or "about 16 per cent of iron," etc.

Keeping of Reagents.—Reagents should be kept in bottles made of glass free from lead and arsenic, and proof against corrosion by acids and alkalies, preferably in those made of Bohemian glass.

The bottles should be closed by well-ground glass stoppers. Stoppers of bottles containing alkali hydrates, ammonium sulphide, ammonia water, tannic acid, and other substances rapidly attacking ground glass surfaces, should be lubricated with a thin film of petrolatum.

Reagents easily affected by light, such as hydrogen sulphide T.S., ammonium sulphide T.S., chlorine water, etc., should be kept in bottles made of dark amber-colored glass.

Note.—As some of the following test solutions are in certain cases directed in definite quantities in lieu of regular volumetric solutions, it is important that they should always be prepared of the *exact strength prescribed.*

II. REAGENTS AND TEST SOLUTIONS.

Note.—The reagents are arranged in alphabetical order. The test solutions are usually mentioned in connection with the principal chemical or other substance from which they are prepared. The volumetric solutions will be found in List III Nos. 116–135).

Whenever *water* is required or mentioned as a solvent in the tests given in the Pharmacopœia, or in the preparation of any reagent, it is understood that *distilled water* shall be used.

1. Absolute Alcohol (Ethyl alcohol, C_2H_5OH=45.9).—Use the official absolute alcohol (*Alcohol Absolutum*).

2. Acetic Acid ($HC_2H_3O_2$=59.86).—Use the official acetic acid (*Acidum Aceticum*).

3. Albumen Test Solution.—Carefully separate the white of a hen's egg from the yolk, shake it thoroughly with 100 Cc. of water, and filter. This solution should be freshly made when required.

4. Aluminum (Metallic aluminum, Al=27.04) in the form of foil, wire, or ribbon. It should be tested for arsenic by Fleitmann's method (see below, No. 13), when no color should be imparted to the silver nitrate within 2 hours.

5. Ammonia Water (NH_3=17.01).—Use the official ammonia water (*Aqua Ammoniæ*).

6. Ammonium Carbonate Test Solution.—Dissolve 10 Gm. of ammonium carbonate ($NH_4HCO_3NH_4NH_2CO_2$=156.77 [*Ammonii Carbonas, U. S. P.*]) in a mixture of 10 Cc. of ammonia water and 40 Cc. of water.

For detecting arsenic sulphide in presence of antimony sulphide, the addition of ammonia water is omitted, and 10 Gm. of the salt are dissolved in a sufficient quantity of water to make 100 Cc.

7. Ammonium Chloride Test Solution.—Dissolve 10 Gm. of ammonium chloride (NH_4Cl=53.38 [*Ammonii Chloridum, U. S. P.*]) in enough water to make 100 Cc.

8. Ammonium Molybdate Test Solution.—Dissolve 1 Gm. of finely powdered ammonium molybdate ($[NH_4]_2MoO_4$=195.76) in 6.7 Cc. of hot water, using a little ammonia water, if necessary, to effect solution. Then gradually pour the liquid into a mixture of 3.3 Cc. of nitric acid (specific gravity 1.414) and 3.4 Cc. of water. Preserve the test solution in the dark, if a sediment should form in it after some days, carefully decant the clear solution from it.

9. Ammonium Oxalate Test Solution.—Dissolve 4 Gm. of pure, crystallized ammonium oxalate ($[NH_4]_2C_2O_4+H_2O$=141.76), free from metals, chloride, and sulphate, in enough water to make 100 Cc. Or, dissolve 4 Gm. of pure oxalic acid (see below, No. 121) in 100 Cc. of water, add 20 Cc. of ammonia water, boil to expel excess of ammonia, and bring the volume to 113 Cc. On evaporating a portion of the test solution, and igniting the residue, it should be completely volatilized (absence of fixed impurities).

10. Ammonium Phosphate Test Solution.—Dissolve 1 Gm. of ammonium phosphate ($[NH_4]_2HPO_4$=131.82), together with 2 Cc. of ammonia water, in enough water to make 100 Cc. This solution does not keep well. It should be freshly made when required, or frequently renewed.

10b. Ammonium Sulphate ($[NH_4]_2SO_4$=131.84).—The purified salt, leaving no residue upon ignition.

11. Ammonium Sulphide Test Solution.—Saturate 3 parts of pure ammonia water with pure, washed hydrogen sulphide, and add to the solution (which now contains ammonium sulphhydrate, NH_4HS=50.99) 2 parts of ammonia water, which converts the greater portion of the ammonium sulphhydrate into ammonium sulphide ($[NH_4]_2S$=68.0). The solution should be perfectly clear and colorless, and, on being evaporated, leave no residue. It should not be rendered turbid either by magnesium sulphate T.S. (absence of free ammonia), or by calcium chloride T.S. (absence of ammonium carbonate). It should be protected against air and light by being kept in small, dark amber-colored bottles, in a dark place. As soon as a notable deposit of sulphur has made its appearance in the solution, it should be rejected.

Ammonium polysulphide test solution is occasionally required. This is a yellow liquid, prepared by dissolving a small quantity of pure sulphur in the preceding, colorless ammonium sulphide test solution.

12. Arsenic Test, Bettendorff's.—To a small quantity of the liquid to be tested, which should contain much pure concentrated hydrochloric acid, or should be a solution of the substance to be tested in pure, concentrated hydrochloric acid, add an equal volume of a saturated solution of freshly prepared stannous chloride in pure, concentrated hydrochloric acid, together with a small piece of pure tin foil. The presence of arsenic is revealed by the production of a brown color or a brown precipitate, the appearance of which is hastened by a gentle heat (see *Stannous Chloride*, No. 108).

13. Arsenic Test, Fleitmann's.—Into a test-tube of at least 15 Cm. in length, and 15 to 18 Mm. in diameter, place a single, solid piece of zinc (see below, No. 115), weighing about 1 to 1.25 Gm., and add about 5 Cc. of potassium hydrate T.S. (*Liquor Potassæ, U. S. P.*), both ingredients having previously been proven free from arsenic by having been subjected, alone, to the test about to be described, during at least 2 hours, with negative result. Now add the liquid to be tested, which must not contain any free acid, nor very materially increase the volume of the contents of the test-tube. Immediately secure over the mouth of the test-tube a previously prepared cap made of three thicknesses of pure filter paper free from dust, and apply to the upper filter paper a drop of a saturated, aqueous solution of silver nitrate acidulated with nitric acid (see *Silver Nitrate T.S.*, No. 96). Then place the tube at once, upright, into a box containing sand heated to about 90° C. (194° F.), and fitted with a cover, so as to exclude light and dust, and permit the reaction to proceed for such a time as may be specially prescribed in each case. The presence of arsenic (but not of antimony) is revealed by the production, upon the moistened paper cap, of a brown or black stain. In absence of arsenic, if the test has been carefully conducted, the spot will remain colorless. In place of zinc, metallic aluminum, best in form of wire, cut into small pieces, may be employed (Gatehouse's modification). The method of testing, and the results, are the same as in Fleitmann's test.

14. Arsenic Test, Gutzeit's.—Into a test-tube of at least 15 Cm. in length, and 15 to 18 Mm. in diameter, place a single, solid piece of zinc (see below, No. 115), weighing about 1 to 1.25 Gm., and add about 5 Cc. of a mixture, previously prepared and kept in readiness for this purpose, of 10 Cc. of pure sulphuric acid of specific gravity 1.835, and 190 Cc. of water, the ingredients having previously been proven free from arsenic by having been subjected, alone, to the test about to be described, during at least 2 hours, with negative results. Now add the liquid to be tested, which should not be alkaline, nor exceed 1 Cc. About 1 Cm. below the open end of the test-tube insert a loose plug, about 1 Cm. long, of glass-wool or cotton, which has been moistened with 0.5 Cc. of lead acetate T.S. Then secure over the mouth a cap made of three thicknesses of clean filter paper, and apply to the upper one a drop of a saturated, aqueous solution of silver nitrate, acidulated with nitric acid (see *Silver Nitrate T.S.*, No 96). Place the tube into a box to exclude light, and let the reaction proceed as long as may be prescribed in each case. The presence of arsenic is shown by the production, upon the moistened paper cap, of a bright yellow stain which becomes black or brown by application of water. Antimony colors the spot black or brown at once without showing a yellow color while dry. In this case, traces of arsenic may be overlooked; it is therefore advisable to subject a fresh portion of the specimen to Fleitmann's test (see No. 13), which responds only to arsenic. If the plug moistened with lead acetate T.S. be strongly colored, so that doubt exists whether the coloration is due to metallic silver reduced by arsenic, or to silver sulphide, produced by the escape of H_2S through the plug, moisten the silver stain with diluted nitric acid, which will dissolve the metallic silver reduced by arsenic, but will not affect the black silver sulphide. Or else, put on a new cap of filtering paper, moistened with a drop of lead acetate T.S. If this remain colorless, sulphide is absent.

15. Barium Carbonate.—Pure barium carbonate ($BaCO_3$ 196.75) prepared by dissolving 12 parts of pure, crystallized barium chloride in 20 parts of boiling water, then adding a solution of 5 parts of ammonium carbonate in 10 parts of boiling water, and afterward 5 parts of ammonia water; finally washing the precipitate thoroughly and drying it.

16. Barium Chloride Test Solution.—Prepared from pure barium chloride ($BaCl_2+2H_2O$ 243.56). The aqueous solution of the salt should be perfectly neutral, and should not yield a precipitate with hydrogen sulphide T.S. or ammonium sulphide T.S. (absence of metals, etc.). The aqueous solution, after being precipitated by diluted sulphuric acid in slight excess, yields a filtrate which should not leave any permanent residue when evaporated and heated on platinum-foil (absence of other fixed bases and salts). Diluted alcohol, after remaining in contact with it for several hours, should, upon ignition, show a pure yellowish-green colored flame, without red streaks (absence of traces of strontium). To prepare the test solution, dissolve 12.2 Gm. of the salt in enough water to make

100 Cc. (This solution is of normal strength$=\frac{N}{1}$V.S., so as to permit of its use for volumetric purposes also.)

17. Barium Hydrate Test Solution.—A saturated solution of barium hydrate (barium hydroxide, $Ba[OH]_2=170.82$) in water. This solution rapidly absorbs carbon dioxide from the air. It is preferably prepared freshly as wanted.

18. Barium Nitrate Test Solution.—Prepared from pure barium nitrate ($Ba[NO_3]_2=260.68$). This salt should respond to the same tests as barium chloride (see No. 16). In addition, its aqueous solution, slightly acidulated with nitric acid, should not be rendered turbid by silver nitrate T.S. (absence of chloride . To prepare the test solution, dissolve 1 Gm. of the salt in water to make 15.3 Cc. (This solution is of half normal strength$=\frac{N}{2}$V.S., so as to permit of its use for volumetric purposes also.)

19. Benzin, or Petroleum Ether.—Use the official benzin (*Benzinum*).

20. Benzol, or Benzene.— Benzol ($C_6H_6=77.82$) is a colorless, transparent liquid of a peculiar, aromatic odor, of a specific gravity of 0.8846 at 15° C. (59° F.), congealing at 0° C. (32° F.), and boiling at 80.37° C. (176.7° F.). It is insoluble in water, but soluble in 4 parts of alcohol, and in ether. In concentrated sulphuric acid it should dissolve without producing a color. On shaking 2 Cc. of benzol with 0.5 Cc. of sulphuric acid and 1 drop of fuming nitric acid, no green or blue tint should be produced (absence of thiophene).

21. Brazil Wood Test Solution.—(See under *Indicators*, No. 49.)

22. Bromine Water (Bromine Test Solution, $Br=79.76$).—An aqueous solution of bromine (*Bromum, U. S. P.*), prepared by dissolving 1 Cc. of bromine in enough water to make 100 Cc.

23. Calcium Chloride Test Solution.—Dissolve 10.925 Gm. of crystallized calcium chloride ($CaCl_2+6H_2O=218.41$) in enough water to make 100 Cc. (This solution is of normal strength$=\frac{N}{1}$V.S., so as to permit of its use for volumetric purposes also.)

24. Calcium Hydrate Test Solution (Lime-water, $Ca[OH]_2=73.83$).—Use the official lime-water (*Liquor Calcis*).

25. Calcium Sulphate Test Solution.—Introduce transparent crystals of native gypsum (selenite, $CaSO_4+2H_2O=171.65$) into a flask filled with water, and decant the clear, saturated solution when required. One part of gypsum requires, at 15° C. (59° F.), 398 parts of water for solution.

26. Carbon Disulphide.—Use the official carbon disulphide (*Carbonei Disulphidum*).

27. Chlorine Water (Chlorine Test Solution, $Cl=35.37$).—Use the official chlorine water (*Aqua Chlori*). Since it rapidly deteriorates by keeping, it should be frequently renewed or freshly prepared when required.

28. Chloroform ($CHCl_3=119.08$).—Use the official chloroform (*Chloroformum*).

29. Cobaltous Nitrate Test Solution ($Co[NO_3]_2+6H_2O=290.14$).—The crystallized, commercial salt is sufficiently pure, if, after it is dissolved in water, and the cobalt completely precipitated by ammonium sulphide T.S., the filtrate leaves no residue on evaporation. To make the test solution, dissolve 1 Gm. of the salt in 10 Cc. of water.

30. Cochineal Test Solution.—(See under *Indicators*, No. 50.)

31. Copper (Metallic copper, $Cu=63.18$) in the form of wire, foil, or turnings. The commercial article, brightened, if necessary, by scouring with diluted hydrochloric acid, is suitable for all purposes except testing for arsenic. If required for this purpose, the absence of arsenic must first be proven. A small portion (about 0.5 Gm.) of the copper is to be dissolved in hot, concentrated sulphuric acid, and this solution subjected to Gutzeit's test (see No. 14). No color should be imparted to the silver nitrate within 2 hours (absence of arsenic).

82. Cupric Ammonium Sulphate Test Solution.—A solution of cupritetrammonium sulphate ($Cu[NH_3]_4SO_4+H_2O=245.0$). To copper sulphate T.S add ammonia water, until the precipitate first formed is nearly, but not completely redissolved, then filter. This solution is apt to decompose on keeping. It should be made freshly when required.

33. Cupric Sulphate Test Solution.— Dissolve 10 Gm. of cupric sulphate ($CuSO_4+5H_2O=248.8$ [*Cupri Sulphas, U. S. P.*]) in enough water to make 100 Cc.

34. Cupric Tartrate Test Solution.—(See below, under *Volumetric Solutions*, No. 117.)

35. Corallin Test Solution.—(See under *Indicators*, No. 51.)

36. Diphenylamine, and Diphenylamine Test Solution.—(See under *Indicators*, No. 52.)

37. Eosin Test Solution.—(See under *Indicators*, No. 53.)

38. Ether.—Use the official ether (*Æther*). It should be strictly neutral to litmus paper.

39. Ferric Ammonium Sulphate Test Solution.—Dissolve 10 Gm. of ferric ammonium sulphate (*Ferri et Ammonii Sulphas, U. S. P.*) in enough water to make 100 Cc.

40. Ferric Chloride Test Solution.—Dissolve 10 Gm. of ferric chloride ($Fe_2Cl_6+12H_2O$ = 539.50 [*Ferri Chloridum, U. S. P.*]), in enough water to make 100 Cc.

41. Ferrous Sulphate Test Solution.—Dissolve a clear crystal of ferrous sulphate ($FeSO_4+7H_2O$ = 277.42 [*Ferri Sulphas, U. S. P.*]) in about 10 parts of water previously boiled to expel air. This solution should be freshly prepared immediately before use.

42. Ferrous Sulphide (FeS = 87.86).—A heavy solid, in form of black or brownish-black irregular masses, or fused into sticks, soluble in sulphuric or hydrochloric acid with copious evolution of hydrogen sulphide. On dissolving 2 Gm. of ferrous sulphide in pure nitrohydrochloric acid diluted with a little water, evaporating the solution to dryness, and testing the residue for arsenic by Gutzeit's method (see No. 14), no color should be imparted to the silver nitrate within 2 hours.

43. Fluorescein Test Solution.—(See under *Indicators*, No. 54.)

44. Gelatin Test Solution.—Dissolve 1 Gm. of isinglass (*Ichthyocolla, U.S.P.*) in 50 Cc. of water, by the aid of a gentle heat, and filter if necessary. This solution should be freshly made when wanted for use.

45. Gold Chloride Test Solution.—The commercial chloride of gold, usually prepared by dissolving gold in nitrohydrochloric acid and carefully evaporating to dryness, mostly consists of aurochloric acid ($HAuCl_4+2H_2O$ = 375.1), which is converted into neutral auric chloride ($AuCl_3$—302.81), by fusing it at a temperature not exceeding 150° C. (302° F.), moistening the residue (now consisting of auric and aurous chloride) with enough hot water to produce a syrupy liquid (whereby the aurous chloride is decomposed into auric chloride and metallic gold), and then pouring off the clear liquid from the precipitate. To prepare the test solution, dissolve the liquid finally obtained in the before-mentioned process in 20 volumes of water. Or, dissolve 1 Gm. of dry auric chloride in 30 Cc. of water.

46. Hydrochloric Acid, Pure, for Tests (HCl—36.37).—In addition to the tests prescribed for this acid in the text of the *Pharmacopœia*, it is required to conform to the following more rigorous tests, before it can be employed as a reagent: The addition of 1 Cc. of barium chloride T.S. to 1 Cc. of the acid diluted with 9 Cc. of water should cause no turbidity within 24 hours (absence of sulphuric acid). A crystal of diphenylamine dropped into the acid should not turn blue (absence of free chlorine). On substituting it for sulphuric acid in Gutzeit's test, as described under No. 14, no color should be imparted to the silver nitrate within 2 hours (absence of arsenic or antimony).

47. Hydrogen Sulphide (H_2S = 33.98).—A gas generated by treating ferrous sulphide with diluted sulphuric acid, and washing the gas by passing it through water.

48. Hydrogen Sulphide Test Solution (or Hydrosulphuric acid, H_2S = 33.98).—A saturated, aqueous solution of hydrogen sulphide. To prepare about 1 liter of the solution, treat 20 Gm. of ferrous sulphide, in a suitable apparatus, with a mixture of 20 Cc. of pure sulphuric acid (specific gravity 1.835) 250 Cc. of water, pass the gas through a wash bottle containing a small quantity of water, and conduct it into a bottle of the capacity of about 1½ liters, containing 1 liter of water. When the gas is no longer absorbed, transfer the solution to small, dark amber-colored bottles, to be filled nearly to the top, pass a stream of hydrogen sulphide for a few minutes through each, and then at once stopper them tightly, and preserve them afterward in a cool and dark place. Before putting them aside, introduce into one of these bottles a few drops of hydrochloric acid, and keep it in a warm place during 24 hours, after which time no precipitate should be found in it (absence of arsenic). Before any of the solution is used, it should be ascertained that it still retains a strong odor of hydrogen sulphide, and that, when it is added to an equal volume of ferric chloride T.S., a copious precipitate of sulphur is formed at once.

INDICATORS FOR ACIDIMETRY, ALKALIMETRY, ETC. (Nos. 49-59).

Note.—Each test solution used as indicator should be examined as soon as prepared, and afterward from time to time, as to its neutrality. If necessary, it should be brought, by the cautious addition of diluted sulphuric acid, or of a diluted solution of an alkali, to such a point that, when a few drops of it are added to 25 Cc. of water, a single drop of a centinormal acid or alkali V.S., respectively, will distinctly develop the corresponding tints.

Since many of the colored test solutions are injured by exposure to light, it is best to preserve them in dark amber-colored vials. Papers prepared with them should be kept in dark bottles or paper boxes.

49. Brazil Wood Test Solution.—Boil 50 Gm. of finely cut Brazil wood (the heart-wood of *Peltophorum dubium* [Sprengel] Britton, *Nat. Ord.*—Leguminosæ) with 100 Cc. of water during half an hour, replacing the water from time to time. Allow the mixture to cool; strain, wash the contents of the strainer with water until 100 Cc. of the strained liquid are obtained, add 25 Cc. of alcohol, and filter. This solution turns purplish-red with alkalies, and yellow with acids.

50. Cochineal Test Solution.—Macerate 1 Gm. of unbroken cochineal (*Coccus, U. S. P.*), during 4 days, with 20 Cc. of alcohol, add 60 Cc. of water; then filter. The color of this test solution turns violet with alkalies, and yellowish-red with acids. As an indicator, it is used chiefly when ammonia or alkaline earths are present.

51. Corallin Test Solution.—Dissolve 1 Gm. of corallin (a coloring matter derived from coal-tar, and containing rosolic and para-rosolic acids) in 10 Cc. of alcohol and enough water to make 100 Cc.

52. Diphenylamine ($[C_6H_5]_2NH=168.65$) is in form of grayish-white or colorless crystals, of a peculiar, aromatic odor, melting at 54° C. (129.2° F.), slightly soluble in water, more soluble in acids. It is used either in the dry state, or in solution in dilute sulphuric acid, as a test for nitric acid (in sulphuric acid, water, etc.), or for chlorine (in hydrochloric acid). To test a solution for the presence of nitric acid, a small portion of it is mixed with 1 or 2 drops of diphenylamine T.S., and then concentrated sulphuric acid, *free from nitrose*, is poured in so as to form a layer beneath the solution. The presence of nitric acid is shown by a deep-blue color at the zone of contact.

Diphenylamine test solution is prepared by dissolving 0.1 Gm. of diphenylamine in 50 Cc. of diluted sulphuric acid. The solution should be colorless.

53. Eosin Test Solution.—Dissolve 1 Gm. of commercial "yellowish" eosin ($K_2C_{20}H_6Br_4O_5$) in 30 Cc. of water. This solution is red by transmitted light, and shows a strong green fluorescence by reflected light. Acids destroy the fluorescence, and alkalies restore it.

54. Fluorescein Test Solution.—Agitate 1 Gm. of fluorescein ($C_{20}H_{12}O_5$) with 100 Cc. of diluted alcohol, until the latter is saturated; then filter. This solution shows a strong green fluorescence, by reflected light, in presence of the least excess of an alkali.

55. Litmus Paper and Test Solution.—Exhaust coarsely powdered litmus with boiling alcohol (which removes a peculiar, red coloring matter, erythrolitmin), and digest the residue with about an equal weight of cold water, so as to dissolve the excess of alkali present. The blue solution thus obtained, after being acidulated, may be used to make *red litmus paper*. Finally extract the residue with about 5 times its weight of boiling water, and filter. Preserve the filtrate, as *test solution*, in wide-mouthed bottles stoppered with loose plugs of cotton to exclude dust but to admit air.

Litmus Paper, Blue.—Impregnate, with the test solution just described, strips of white, unsized paper, free from wood pulp, but not too porous, and dry them by suspending them on strings of clean twine.

Litmus Paper, Red.—Prepare this with the same kind of paper and in the same manner as described in the preceding paragraph. To impregnate the paper, either use the blue solution obtained from litmus, by treating the mass, after extraction by alcohol, with cold water, acidulating the same with just enough hydrochloric acid to impart to it a distinctly red tint; or, use the regular test solution, after acidulating it in the same manner.

Neither blue nor red litmus paper should have a very intense color.

Preserve the test paper in paper boxes or bottles, so as to exclude dust and acid or ammoniacal vapors.

56. Methyl Orange Test Solution.—Dissolve 1 Gm. of methyl orange (the sodium or ammonium salt of dimethylamidoazobenzolsulphonic acid, $HC_{14}H_{14}N_3SO_3$ = 304.47; also known as helianthin, or tropæolin D, or Poirrier's Orange 3 P) in 1000 Cc. of water. Add to it, carefully, diluted sulphuric acid, in drops, until the liquid turns red and just ceases to be transparent; then filter. The solution acquires a yellow color when brought in contact with alkali hydrates, carbonates, or bicarbonates. Carbonic acid does not affect it, but sulphuric, hydrochloric, and other acids change its color to crimson. It is not suited for use with organic acids.

57. Phenolphtalein Test Solution.—Dissolve 1 Gm. of phenolphtalein ($C_{20}H_{14}O_4$) in 100 Cc. of diluted alcohol. The solution is colored deep purplish-red by alkali hydrates or carbonates; bicarbonates and most other salts do not produce such color; acids render the reddened solution colorless. It is not suitable as an indicator for ammonia or bicarbonates.

Phenolphtalein Paper is prepared by impregnating white, unsized paper with the test solution and drying it.

58. Rosolic Acid Test Solution.—Dissolve 1 Gm. of commercial rosolic acid (chiefly methylaurin, $C_{20}H_{16}O_3$ = 303.28) in 10 Cc. of diluted alcohol, and add enough water to make 100 Cc. The solution turns violet-red with alkalies, yellow with acids. In place of rosolic acid, commercial pæonin (also known as aurin R) (chiefly $C_{19}H_{14}O_3$—289.31) may be employed.

59. Turmeric Tincture.—Digest any convenient quantity of ground curcuma root (from *Curcuma longa*, Linné, *Nat. Ord.*—Scitamineæ) repeatedly with small quantities of water, and throw this liquid away. Then digest the dried residue for several days with 6 times its weight of alcohol, and filter.

Turmeric Paper.—Impregnate white, unsized paper with the tincture, and dry it. The tincture, as well as the paper, turns brown with alkalies, and the yellow color is restored by acids. Boric acid, however, even in presence of hydrochloric acid, turns the color to reddish-brown, and this is changed to bluish-black by ammonia.

60. Indigo Test Solution.—Place 6 Gm. (3.3 Cc.) of fuming sulphuric acid into a beaker well cooled by immersion in water, and stir into it, very gradually, 1 Gm. of finely powdered Bengal indigo. Set the mixture aside for 2 days, then pour it into 20 Cc. of water, and decant. Or, dissolve 1 Gm. of commercial indigo-carmine (the sodium or potassium salt of sulphindigotic acid) in 150 Cc. of water.

61. Iodine Test Solution.—For preparing the ordinary test solutions (as a reagent for starch, alcohol by iodoform test, etc.), iodine (I = 126.53), fulfilling the requirements of the Pharmacopœia (see *Iodum, U. S. P.*), is sufficiently pure. For this purpose dissolve 1 Gm. of iodine and 3 Gm. of potassium iodide in 50 Cc. of water. For use in volumetric analysis, or in other cases where the ordinary impurities present in official iodine are objectionable, *Purified iodine* must be employed (see under No. 120).

62. Iron, Metallic (Fe = 55.88).—Bright and perfectly clean iron in the form of wire, sheet, or filings, according to the uses to be made of it. For making solutions of pure iron salts, fine, thin, bright wire (so-called florists' wire) should be used. For detecting copper, bright pieces of sheet-iron or knitting-needles are used; for detecting nitric acid, by reduction to ammonia, iron filings are preferable.

63. Lead Acetate Test Solution.—Dissolve 10 Gm. of clear, transparent crystals of lead acetate ($Pb[C_2H_3O_2]_2+3H_2O$ = 378.0 [*Plumbi Acetas, U. S. P.*]), free from adhering lead carbonate, in enough water to make 100 Cc. Preserve the solution in well-stoppered bottles.

64. Basic Lead Acetate Test Solution.—Use the official solution of lead subacetate (*Liquor Plumbi Subacetatis*).

65. Litmus Paper and Test Solution.—(See under *Indicators*, No. 55.)

66. Magnesia Mixture.—Dissolve 10 Gm. of magnesium sulphate (*Magnesii Sulphas, U. S. P.*), and 20 Gm. of ammonium chloride (*Ammonii Chloridum, U. S. P.*), in 80 Cc. of water, add 42 Cc. of ammonia water, set the mixture aside for a few days in a well-stoppered vessel, and filter. It should never be used freshly made.

67. Magnesium Sulphate Test Solution.—Dissolve 10 Gm. of magnesium sulphate ($MgSO_4+7H_2O=245.84$ [*Magnesii Sulphas, U. S. P.*]) in enough water to make 100 Cc.

68. Mercuric Chloride Test Solution.—Dissolve 5 Gm. of mercuric chloride ($HgCl_2=270.54$ [*Hydrargyri Chloridum Corrosivum, U. S. P.*]) in enough water to make 100 Cc.

69. Mercuric Potassium Iodide Test Solution.—Use the decinormal mercuric potassium iodide volumetric solution (No. 121).

70. Alkaline Mercuric Potassium Iodide Test Solution (Nessler's Solution).—Dissolve 5 Gm. of potassium iodide (*Potassii Iodidum, U. S. P.*) in 5 Cc. of hot water, and add to this a hot solution of 2.5 Gm. of mercuric chloride (*Hydrargyri Chloridum Corrosivum, U. S. P.*) in 10 Cc. of water. To the turbid, red mixture add 16 Gm. of potassium hydrate (*Potassa, U. S. P.*) dissolved in 40 Cc. of water, and finally make up the volume to 100 Cc. A surplus of red mercuric iodide deposits on cooling, and may be left in the bottle, the clear solution being decanted as needed.

71. Mercurous Nitrate Test Solution ($Hg_2[NO_3]_2+2H_2O=559.3$).—Into a porcelain capsule put 1 Gm. of pure mercury with 0.5 Cc. of pure nitric acid and 0.5 Cc. of distilled water, and place it for 24 hours into a cool, dark room. Separate and drain the crystals, and dissolve them in 100 Cc. of water. Preserve the solution in a dark amber-colored bottle, into which a small globule of mercury has been placed.

72. Methyl Alcohol ($CH_3OH=31.93$).—For the identification of salicylic acid, the rectified, commercial wood alcohol, having a specific gravity of about 0.820, is sufficiently pure, if it forms a clear, transparent mixture with an equal volume of distilled water.

73. Methyl Orange Test Solution.—(See under *Indicators*, No. 56.)

74. Nitric Acid, Pure, for Tests ($HNO_3=62.89$).—In addition to the tests prescribed for this acid in the text of the Pharmacopœia, it is required to conform to the following more rigorous test before it can be used as a reagent: On supersaturating 0.5 Cc. of the acid with pure potassium hydrate T.S., and testing a portion of this solution by Fleitmann's method (see under No. 13), no color should be imparted to the silver nitrate within 2 hours (absence of arsenic).

75. Fuming Nitric Acid (Red Fuming Nitric Acid).—The commercial acid will answer, if it is of specific gravity 1.450, or over. It should be carefully kept in glass-stoppered bottles, in a cool place.

76. Oxalic Acid Test Solution.—Use the decinormal volumetric solution (No. 123).

77. Phenolphtalein Test Solution.—(See under *Indicators*, No. 57.)

78. Picric Acid Test Solution.—Dissolve 1 Gm. of pure, distinctly crystalline picric acid (trinitrophenol, $C_6H_2[NO_2]_3OH=228.57$) in 100 Cc. of water. cool the solution, and filter, if necessary.

79. Platinic Chloride Test Solution.—Heat 1 Gm. of pure platinum, in chips, with 6 Cc. of concentrated hydrochloric acid to 80° C. (186° F.), and very gradually add 1 Cc. of strong nitric acid (specific gravity 1.414) until very nearly all the platinum is dissolved. Evaporate the solution to dryness on a water-bath, moisten the residue with a few drops of hydrochloric acid, and again evaporate to expel the excess of acid. Dissolve the residue in 20 Cc. of water. The *test solution* may also be prepared by dissolving 1.7 Gm. of neutral platinic chloride ($PtCl_4=335.78$), or 2.6 Gm. of chloroplatinic acid ($H_2PtCl_6+6H_2O=516.28$), in 20 Cc. of water. On evaporating a small portion of the solution to dryness and igniting the residue, pure, metallic platinum should be left behind, which should yield nothing soluble to nitric acid.

80. Potassium Carbonate Test Solution.—Dissolve 10 Gm. of anhydrous potassium carbonate (K_2CO_3=137.91 [prepared from *Potassii Carbonas, U. S. P.*]) in enough water to make 100 Cc.

81. Potassium Chromate Test Solution.—Dissolve 1 Gm. of potassium chromate (K_2CrO_4=193.9) in enough water to make 10 Cc. On adding silver nitrate T.S. to a little of the solution, a red precipitate is produced which should be completely dissolved by nitric acid (absence of chloride). Another portion of the solution, mixed with an equal volume of diluted hydrochloric acid, should yield no precipitate with barium chloride T.S. (absence of sulphate).

82. Potassium Cyanide Test Solution.—This should be freshly prepared, when required, by dissolving 1 Gm. of potassium cyanide (KCN=65.01 [*Potassii Cyanidum, U. S. P.*]) in 4 parts of water.

83. Potassium Bichromate.—Use the official potassium bichromate ($K_2Cr_2O_7$=293.78 [*Potassii Bichromas*]).

84. Potassium Bichromate Test Solution.—Dissolve 10 Gm. of potassium dichromate (*Potassii Bichromas, U. S. P.*) in enough water to make 100 Cc.

85. Potassium Ferricyanide Test Solution.—Dissolve 1 part of potassium ferricyanide ($K_6Fe_2[CN]_{12}$=657.7) in about 10 parts of water. This solution should be made freshly, when required, as it is rapidly decomposed by light. A freshly-prepared, aqueous solution, when mixed with some ferric chloride T.S. and diluted with water, should show a brown tint, free from turbidity, or a shade of green.

86. Potassium Ferrocyanide Test Solution.—Dissolve 10 Gm. of potassium ferrocyanide ($K_4Fe[CN]_6+3H_2O$=421.76) in enough water to make 100 Cc.

87. Potassium Hydrate Test Solution (KOH=55.99).—Use the official solution of potassa (*Liquor Potassæ*). For use in Fleitmann's test for arsenic (see above, No. 13), it should have previously been subjected, by itself, to this test, for at least 2 hours, with negative result (absence of arsenic).

88. Potassium Iodide Test Solution.—Dissolve 16.556 Gm. of potassium iodide (KI=165.56 [*Potassii Iodidum, U. S. P.*]) in enough water to make 100 Cc., and keep the solution in dark amber-colored, well-stoppered bottles, to prevent the formation of iodate. The solution should be frequently renewed, or freshly prepared when required. (This solution is of normal strength=$\frac{N}{1}$V.S., so as to permit of its use for volumetric and gasometric purposes also.)

89. Potassium Nitrate.—The dry salt (KNO_3=100.92 [*Potassii Nitras, U.S.P.*]), responding to the tests of purity required by the Pharmacopœia, particularly to those for absence of chloride and sulphate.

90. Potassium Permanganate ($KMnO_4$=157.67).—See below, under No. 127.

91. Potassium Sulphate Test Solution.—Dissolve 1 Gm. of potassium sulphate (K_2SO_4=173.88 [*Potassii Sulphas, U. S. P.*]) in enough water to make 115 Cc. (This solution is of decinormal strength=$\frac{N}{10}$V.S., so as to permit of its use for volumetric purposes also, as a substitute for decinormal sulphuric acid, when it is desired not to disturb the neutrality of a liquid.)

92. Potassium Sulphocyanate Test Solution (KSCN=96.99).—Use the decinormal volumetric solution (No. 129).

93. Pyrogallol.—Use the official pyrogallol ($C_6H_3[OH]_3$=125.7 [*Pyrogallol*]).

94. Rosolic Acid.—(See under *Indicators*, No. 58.)

95. Silver Ammonium Nitrate Test Solution.—Dissolve 1 Gm. of silver nitrate (*Argenti Nitras, U. S. P.*) in 20 Cc. of water, and add ammonia water, drop by drop, until the precipitate first produced is almost, but not entirely, redissolved. Filter the solution, and preserve it in dark amber-colored and well-stoppered bottles.

96. Silver Nitrate Test Solution ($AgNO_3$=169.55).—For ordinary purposes, use the decinormal volumetric solution (see No. 130). For Gutzeit's test (No. 14), use a saturated solution of silver nitrate in water acidulated with about 1 per cent of nitric acid.

97. Silver Sulphate Test Solution.—Dissolve 1 Gm. of silver nitrate (*Argenti Nitras, U. S. P.*) in 0.5 Cc. of warm water, and add 1.5 Cc. of pure, concentrated sulphuric acid. On cooling, small transparent crystals of silver sulphate (Ag_2SO_4=311.14) separate. Carefully pour off the acid liquid, wash the crystals repeatedly, by decantation, with cold water, transfer them to a bottle, add 100 Cc. of water, and agitate so as to produce a saturated solution. For use, decant a sufficient quantity of the latter.

98. Sodium Acetate Test Solution.—Dissolve 10 Gm. of sodium acetate (*Sodii Acetas, U. S. P.*) in enough water to make 100 Cc.

99. Sodium Bitartrate Test Solution.—Dissolve 150 Gm. of tartaric acid (*Acidum Tartaricum, U. S. P.*) in 100 Cc. of hot water, and divide the solution into two equal portions. Neutralize one of these accurately with sodium bicarbonate (which will require about 84 Gm. of this salt), and then add the other portion of the acid solution. On cooling, crystals of sodium bitartrate ($NaHC_4H_4O_6+H_2O=189.6$) will separate. Remove these, dry them, and keep them in well-stoppered bottles. The *test solution* is freshly prepared, when required, by dissolving 1 Gm. of the salt in 4 Cc. of water.

100. Sodium Carbonate.—The anhydrous salt ($Na_2CO_3=105.85$) conforming to the tests of purity prescribed by the Pharmacopœia for *Sodii Carbonas*, but absolutely free from chloride or sulphate.

101. Sodium Carbonate Test Solution.—Dissolve 10.6 Gm. of anhydrous sodium carbonate (No. 100; $Na_2CO_3=105.85$) in enough water to make 100 Cc. (This solution is of double-normal strength$=\frac{2}{N}$V.S., so as to permit of its use for volumetric purposes also.)

102. Sodium Cobaltic Nitrite Test Solution ($Co_2[NO_2]_6 6NaNO_2+H_2O=824.32$).—Dissolve 4 Gm. of cobaltous nitrate ($Co[NO_3]_2+6H_2O=290.14$) and 10 Gm. of sodium nitrite ($NaNO_2=68.93$) in about 50 Cc. of water; add 2 Cc. of acetic acid, and dilute with enough water to make 100 Cc. Should any of the nitrous acid be lost by keeping the solution, a few drops of acetic acid may be added.

103. Sodium Hydrate Test Solution ($NaOH=39.96$).—Use the official solution of sodium hydrate (*Liquor Sodæ, U. S. P.*).

104. Sodium Hyposulphite (or Thiosulphate, $Na_2S_2O_3+5H_2O=247.64$).—(See below, under No. 133.)

105. Sodium Nitrite ($NaNO_2=68.93$).—The purest commercial salt, generally in form of pencils, is sufficiently pure.

106. Sodium Nitroprusside Test Solution.—Dissolve 1 part of sodium nitroprusside ($Na_2Fe[NO][CN]_5+2H_2O=297.67$) in 10 parts of water immediately before using.

107. Sodium Phosphate Test Solution.—Dissolve 10 Gm. of sodium phosphate ($Na_2HPO_4+12H_2O=357.32$ [*Sodii Phosphas, U. S. P.*]) in enough water to make 100 Cc.

108. Stannous Chloride Test Solution.—Heat pure tin (see No. 113), in form of foil or granules, with concentrated hydrochloric acid, taking care that the metal be in excess. When the acid is saturated, crystals of stannous chloride ($SnCl_2+2H_2O=225.46$) begin to form. Remove and drain these, dissolve them in 10 parts of water, and preserve the solution in well-stoppered bottles, into each of which a granule of pure tin, or a piece of pure tin-foil, has previously been introduced.

For Bettendorff's test (see above, No. 12), pure, concentrated hydrochloric acid is saturated with the freshly-prepared crystals.

109. Starch Test Solution.—Mix 1 Gm. of starch with 10 Cc. of cold water, and then add enough boiling water, under constant stirring, to make about 200 Cc. of a thin, transparent jelly. If it is desired to preserve this test solution for any length of time, 10 Gm. of zinc chloride ($ZnCl_2=135.84$ [*Zinci Chloridum, U. S. P.*]) should be added to it, and the solution transferred to small bottles, which should be well stoppered.

110. Sulphuric Acid, Pure, for Tests ($H_2SO_4=97.82$).—The sulphuric acid of the Pharmacopœia, which may have a specific gravity as low as 1.835, will answer as a reagent for most purposes, provided it is of the required degree of purity. But when "concentrated" sulphuric acid is specially directed in a test, it is intended that the strongest obtainable, pure acid, of a specific gravity of not less than 1.840, be employed.

In addition to the tests prescribed for this acid in the text of the Pharmacopœia, it is required to conform to the following more rigorous tests before it can be employed as a reagent. If 1 Cc. of diphenylamine T.S. (see No. 52) be carefully poured, as a separate layer, upon 5 Cc. of sulphuric acid, contained in a test-tube, no distinct blue color should appear in the zone of contact (absence of nitric acid). If a few crystals of pyrogallol (*Pyrogallol, U. S. P.*) be dissolved in about 1 Cc. of pure water, and this solution be carefully poured, as a separate layer, upon some of the sulphuric acid, contained in a test-tube, no brown color should appear in the zone of contact (absence of nitric or nitrous acid). If a small portion of the acid be subjected to Gutzeit's test, as described under No. 14, no color should be imparted to the silver nitrate within 2 hours (absence of arsenic, etc.).

If it is impossible to obtain any sulphuric acid which will comply with each of these requirements, two kinds of the acid may be kept, one absolutely free from arsenic, for making the arsenic tests; the other free from nitrose (nitric and nitrous acids), for the detection of nitric acid.

111. Tannic Acid Test Solution.—Dissolve 1 Gm. of tannic acid ($HC_{14}H_9O_9 = 321.22$ [*Acidum Tannicum, U. S. P.*]) in 1 Cc. of alcohol, and enough water to make 10 Cc., immediately before use.

112. Tartaric Acid Test Solution.—Dissolve 1 part of tartaric acid ($H_2C_4H_4O_6 = 139.64$ [*Acidum Tartaricum, U. S. P.*]) in 3 parts of water. In the volumetric estimation of soda in potassa, directed by the preceding text of the Pharmacopœia, the tartaric acid test solution employed for precipitating the potassa should contain 3 Gm. of the acid in 20 Cc. Since fungous growths rapidly destroy the solution of tartaric acid, it should be prepared only as wanted.

113. Tin.—Pure metallic tin ($Sn = 118.8$) in form of granules. Its solution in hydrochloric acid should not be precipitated by potassium sulphate T.S. (absence of lead), and, when examined by Gutzeit's test, as described under No. 14, it should not cause silver nitrate to become colored within 2 hours (absence of arsenic).

114. Turmeric Paper and Tincture.—(See under *Indicators*, No. 59.)

115. Zinc.—Metallic zinc ($Zn = 65.1$) preferably in the form of thin pencils, about 5 Mm. in diameter, prepared by fusing the metal and casting it in molds, or in form of thin sheets. It should respond to all the tests required by the text of the Pharmacopœia, and in addition, when examined by Gutzeit's test, as described under No. 14, it should not cause the silver nitrate to become colored within 2 hours (absence of arsenic).

116. Zinc-Iodide-Starch Test Solution.—To 100 Cc. of freshly-prepared starch test solution (see No. 109) add 5 Gm. of zinc chloride (*Zinci Chloridum, U. S. P.*) and 3 Gm. of zinc iodide (*Zinci Iodidum, U. S. P.*). Preserve the colorless solution carefully in small, dark amber-colored and well-stoppered vials.

III. VOLUMETRIC SOLUTIONS.

Note.—Since most of the volumetric instruments (burettes, pipettes, mixing cylinders, flasks, etc.) which are for sale in the market are graduated to hold the number of cubic centimeters indicated by weighing into them the corresponding number of grammes of water at the temperature of 15.556° C. (60° F.), or 15° C. (59° F.), it is necessary not to deviate materially from this temperature in making the volumetric solutions, or in using them in testing.

All measuring vessels employed for volumetric determinations should agree among themselves in accuracy of graduation.

All bottles in which volumetric solutions are to be kept, as well as the burettes or pipettes in which they are to be measured, should, prior to use, be rinsed with a small quantity of the solution they are to contain.

Volumetric solutions are designated as normal ($\frac{N}{1}$) when they contain in 1 liter the molecular weight of the active reagent, expressed in grammes, and reduced to the valency corresponding to 1 atom of replaceable hydrogen, or its equivalent.

Thus, hydrochloric acid ($HCl = 36.37$), having but 1 H atom replaceable by a basic element, has 36.37 Gm. of HCl in 1000 Cc. of the normal volumetric solution; while sulphuric acid ($H_2SO_4 = 97.82$) having 2 replaceable H atoms, contains only one-half this number, or 48.91 Gm. of H_2SO_4 in 1000 Cc. of its normal solution. Potassium hydrate ($KOH=55.99$) has but 1 K to replace 1 H in acids, hence its normal solution contains 55.99 Gm. of KOH in 1 liter. Two molecules of potassium permanganate ($2KMnO_4=315.34$), in oxidation, give off 5 atoms of O, which are equivalent to 10 atoms of H; hence its normal solution should contain $\frac{315.34}{10}$ or 31.534 Gm. in 1 liter.

Solutions containing in 1 liter one-tenth of the quantity of the active reagent in the normal solution are called decinormal ($\frac{N}{10}$); those containing one-hundredth, centinormal ($\frac{N}{100}$); those containing twice the amount, double-normal ($\frac{2}{N}$); half the amount, seminormal ($\frac{N}{2}$).

Solutions containing quantities of the active reagent having *no* simple relation to the molecular weight are called empirical.

In the following list full decimals are given, which, however (especially when delicate balances and weights are not at hand), are in practice frequently abbreviated or rounded off, as, for instance, oxalic acid: 62.85 Gm. to 63 Gm.

When weighing out portions of a substance which is to be tested volumetrically, it will, in most cases, be advantageous to weigh out such a multiple of the amount required, as will suffice for several repetitions of the test, and will, at the same time, bring the amount to be weighed out as near to a whole number of grammes as possible.

117. Alkaline Cupric Tartrate Volumetric Solution (Fehling's Solution).—*A. The Copper Solution.*—Dissolve 34.64 Gm. of carefully selected, small crystals of pure cupric sulphate, showing no trace of efflorescence or of adhering moisture, in a sufficient quantity of water to make the solution measure, at or near 15° C. (59° F.), exactly 500 Cc. Keep this solution in small, well-stoppered bottles.

B. The Rochelle Salt Solution.—Dissolve 173 Gm. of potassium and sodium tartrate (*Potassii et Sodii Tartras, U. S. P.*), and 125 Gm. of potassium hydrate (*Potassa, U. S. P.*), in a sufficient quantity of water to make the solution measure, at or near 15° C. (59° F.), exactly 500 Cc. Keep the solution in small, rubber-stoppered bottles. For use, mix exactly equal volumes of the two solutions at the time required.

One cubic centimeter of the mixed solution is the equivalent of:

	Gramme.
Cupric sulphate, crystallized, $CuSO_4+5H_2O$	0.03464
Cupric tartrate, $CuC_4H_4O_6+3H_2O$	0.03685
Glucose, anhydrous, $C_6H_{12}O_6$	0.00500

118. Decinormal Bromine Volumetric Solution (Koppeschaar's Solution) ($Br=79.76$; 7.976 Gm. in 1 liter. $NaBrO_3=150.64$.—$NaBr=102.76$. $KBrO_3=166.67$.—$KBr=118.79$).—Dissolve 3 Gm. of sodium bromate and 50 Gm. of sodium bromide (or 3.2 Gm. of potassium bromate and 50 Gm. of potassium bromide) in enough water to make, at or near 15° C. (59° F.), 900 Cc. Of this solution transfer 20 Cc., by means of a pipette, into a bottle having a capacity of about 250 Cc., provided with a glass stopper; add 75 Cc. of water, next 5 Cc. of pure hydrochloric acid, and immediately insert the stopper. Shake the bottle a few times, then remove the stopper just sufficiently to quickly introduce 5 Cc. of potassium iodide T.S., taking care that no bromine vapor escape, and immediately stopper the bottle. Agitate the bottle thoroughly, remove the stopper and rinse it and the neck of the bottle with a little water so that the washings flow into the bottle, and then add from a burette decinormal sodium hyposulphite V.S. until the iodine tint is exactly discharged, using toward the end a few drops of starch T.S. as indicator. Note the number of cubic centimeters of the sodium hyposulphite V.S. thus consumed, and then dilute the bromine solution so that equal volumes of it and of decinormal sodium hyposulphite V.S. will exactly correspond to each other under the conditions mentioned above.

Example.—Assuming that the 20 Cc. of the bromine solution have required 25.2 Cc. of the hyposulphite to completely discharge the iodine tint, the bromine solution must be diluted in the proportion of 20 to 25.2. Thus, if 850 Cc. of it are remaining, they must be diluted with water to measure 1071 Cc.

After the solution is thus diluted, a new trial should be made in the manner above described, in which 25 Cc. of the decinormal sodium hyposulphite V.S. should exactly discharge the tint of the iodine liberated by the bromine set free from the 25 Cc. of bromine solution. Keep the solution in dark amber-colored glass-stoppered bottles.

One cubic centimeter of decinormal bromine solution V.S. is the equivalent of:

	Gramme.
Bromine, Br	0.007976
Carbolic acid, C_6H_5OH	0.001563

The following article is tested with this solution:

	Gm. taken.	Cc. required.	Per cent of strength indicated.
Acidum carbolicum	0.039	24	96 of pure phenol.

119. Normal Hydrochloric Acid (HCl=36.37; 36.37 Gm. in 1 liter).—Mix 130 Cc. of hydrochloric acid of specific gravity 1.163 with enough water to make it measure, at or near 15° C. (59° F.), 1000 Cc. Of this liquid (which is still too concentrated) carefully measure 10 Cc. into a flask, add a few drops of phenolphtalein T.S., and gradually add, from a burette, potassium hydrate V.S., until the red tint produced by it no longer disappears on vigorous shaking, but is not deeper than pale pink. Note the number of cubic centimeters of potassium hydrate V.S. consumed, and then dilute the acid solution so that equal volumes of this and of the potassium hydrate V.S. neutralize each other.

Example.—Assuming that 10 Cc. of the acid solution first prepared required exactly 11 Cc. of potassium hydrate V.S., each 10 Cc. of the former must be diluted to 11 Cc., or the whole of the remaining acid solution in the same proportion. Thus, if 950 Cc. are remaining, 95 Cc. of water must be added. After the liquid is thus diluted, a new trial should be made in the manner above described, in which 50 Cc. of the acid solution should require for neutralization exactly 50 Cc. of potassium hydrate V.S. If necessary, a new adjustment should then be made to render the correspondence perfect.

One cubic centimeter of normal hydrochloric acid is the equivalent of:

	Gramme.
Hydrochloric acid, absolute, HCl	0.03637

Note.—Normal hydrochloric acid is in every respect equivalent in neutralizing power to normal sulphuric acid (see below, No. 134), and may be employed, if more convenient, for the same purposes.

120. Decinormal Iodine Volumetric Solution (I=126.53; 12.653 Gm.† in 1 liter).—Dissolve 12.653 Gm.† of pure iodine (see below) in a solution of 18 Gm. of pure potassium iodide in 300 Cc. of water. Then add enough water to make the solution measure, at or near 15° C. (59° F.), exactly 1000 Cc. Transfer the solution to small, glass-stoppered vials, which should be kept in a dark place.

Preparation of Pure Iodine.—Heat powdered iodine in a porcelain dish placed over a boiling water-bath, and stir it constantly with a glass rod, so that the adhering moisture, together with any cyanogen iodide and most of the iodine bromide and chloride that may be present, may be vaporized. After 20 minutes transfer the iodine to a porcelain or other non-metallic mortar, and triturate it with about 5 per cent of its weight of pure, dry potassium iodide, so as to decompose any remaining iodine, bromide and chloride. Then return the mass to the dish, cover it with a clean glass funnel, and heat the dish on a sand-bath. Detach the sublimed, pure iodine, and keep it in well-stoppered bottles, in a cool place.

One cubic centimeter of decinormal iodine V.S. is the equivalent of:

	Gramme.
Iodine, I	0.012653
Arsenic trioxide (arsenous acid), As_2O_3	0.004942
Potassium sulphite, crystallized, $K_2SO_3 \cdot 2H_2O$	0.009692
Sodium bisulphite, $NaHSO_3$	0.005193
Sodium hyposulphite (thiosulphate) crystals, $Na_2S_2O_3 \cdot 5H_2O$	0.024764
Sodium sulphite, crystallized, $Na_2SO_3 \cdot 7H_2O$	0.012579
Sulphur dioxide, SO_2	0.003195
Antimony and potassium tartrate, cryst., $2K(SbO)C_4H_4O_6 \cdot H_2O$	0.016560

---

† Instead of taking 12.653 Gm., this figure is often rounded off to 12.6 [illegible] delicate [illegible] have also the exact amount above directed [illegible] the

The following articles are tested with this solution:

	Gm. taken.	Cc. required.	Per cent of strength indicated.
Acidum arsenosum	0.1	20.0	98.8 of As_2O_3.
Acidum sulphurosum	2.0	40.0	6.4 of SO_2.
Antimonii et potassii tartras (cryst.)	0.331	20.0	100 of pure salt.
Liquor acidi arsenosi	24.7 Cc.	49.4 to 50	1 of As_2O_3.
Liquor potassii arsenitis	24.7 Cc.	49.4 to 50	1 of As_2O_3.
Sodii bisulphis	0.26	45.0	90 of pure salt.
Sodii hyposulphis	0.25	9.9	98.1 of cryst. salt.
Sodii sulphis	0.63	48.0	96 of cryst. salt.

121. Decinormal Mercuric Potassium Iodide Volumetric Solution (**Mayer's Solution**) ($HgI_2+2KI=783.98$; 39.2 Gm. in 1 liter).—Dissolve 13.546 Gm. of pure mercuric chloride in 600 Cc. of water, and 49.8 Gm. of pure potassium iodide in 100 Cc. of water. Mix the two solutions, and then add enough water to make the mixture measure, at or near 15° C. (59° F.), exactly 1000 Cc.

One cubic centimeter of decinormal mercuric potassium iodide V.S. is the equivalent of:

	Gramme.
Mercuric potassium iodide, HgI_2+2KI	0.0392

122. Normal Oxalic Acid Volumetric Solution ($H_2C_2O_4+2H_2O=125.7$; 62.85 Gm.† in 1 liter).—Dissolve 62.85 Gm.† of pure oxalic acid (see below) in enough water to make, at or near 15° C. (59° F.), exactly 1000 Cc.

Pure Oxalic Acid, crystallized, is in form of colorless, transparent, clinorhombic crystals, which, on ignition upon platinum foil, leave no residue. One part of it is completely soluble in 14 parts of water at 15° C. (59° F.). Oxalic acid which leaves a residue on ignition, or on solution in water, must be purified, which may be done as follows: To 1 part of the acid add 10 parts of cold water, and shake until the latter is saturated. Filter off the solution from the undissolved crystals, evaporate the filtrate to about three-fourths of its volume, and set it aside so that the fixed salts which it contains may crystallize out. Carefully decant the liquid from the crystals, concentrate it by evaporation, and set it aside to crystallize, stirring occasionally to prevent the formation of large crystals which might enclose moisture. Drain the crystals in a funnel, dry them carefully on blotting paper, and preserve them in well-stoppered bottles.

Note.—Normal oxalic acid volumetric solution is in every respect equivalent in neutralizing power to *Normal Sulphuric Acid* (No. 134), or *Normal Hydrochloric Acid* (No. 119), and may be employed, if more convenient, for the same purposes. The solution, however, has a tendency to crystallize at the point of the burette.

One cubic centimeter of normal oxalic acid V.S. is the equivalent of:

	Gramme.
Oxalic acid, crystallized, $H_2C_2O_4+2H_2O$	0.06285
Ammonia gas, NH_3	0.01701
Sodium hydrate, NaOH	0.03996
Potassium hydrate, KOH	0.05599
Potassium permanganate, $KMnO_4$	0.03153

†This is frequently rounded off to 63 Gm., when a delicate balance and exact weights are not at hand.

123. Decinormal Oxalic Volumetric Solution ($H_2C_2O_4+2H_2O=125.7$; 6.285 Gm.† in 1 liter).—Dissolve 6.285 Gm.† of pure oxalic acid (see under No. 122) in enough water to make, at or near 15° C. (59° F.), exactly 1000 Cc.

One cubic centimeter of decinormal oxalic acid V.S. is the equivalent of:

	Gramme.
Oxalic acid, crystallized, $H_2C_2O_4+2H_2O$	0.006285
Ammonia gas, NH_3	0.001701
Calcium hydrate, $Ca(OH)_2$	0.003691
Potassium hydrate, KOH	0.005599
Potassium permanganate, $KMnO_4$	0.0031534
Sodium hydrate, NaOH	0.003996

†Generally rounded off to 6.3 Gm., when a delicate balance and exact weights are not available.

The following articles are tested with this solution:

	Gm. taken	Cc. required.	Per cent of strength indicated.
Liquor calcis	50.0	20.0	0.14 of $Ca(OH)_2$.
Potassii iodidum (alkalinity, K_2CO_3)	1.0	0.05	0.034 of alkali.
Potassii permanganas	0.1	31.3	98.70 of pure salt.

124. Decinormal Potassium Bichromate Volumetric Solution ($K_2Cr_2O_7$ 293.78; 4.896 Gm.† in 1 liter).—Dissolve 4.896 Gm.† of pure potassium dichromate (see below) in enough water to make, at or near 15° C. (59° F.), exactly 1000 Cc.

Pure potassium dichromate for use in volumetric analysis, besides responding to the tests given in the text of the Pharmacopœia (under *Potassii Bichromas*), must conform to the following tests. In a solution of 0.5 Gm. of the salt in 10 Cc. of water, rendered acid by 0.5 Cc. of nitric acid, no visible change should be produced either by barium chloride T.S. (absence of sulphate), or by silver nitrate T.S. (absence of chloride). In a mixture of 10 Cc. of the aqueous solution (1 in 20) with 1 Cc. of ammonia water, no precipitate should be produced by ammonium oxalate T.S. (absence of calcium).

When used with phenolphtalein as indicator, to neutralize alkalies, the volumetric solution of potassium dichromate is decinormal when it contains 14.689 Gm. in 1 liter. It is then the exact equivalent of any decinormal acid, corresponding to the amounts of alkalies quoted, for instance, under *Decinormal Oxalic Acid* V.S. (No. 123).

When used as an oxidizing agent to convert ferrous into ferric salts, or to liberate iodine from potassium iodide, the solution just mentioned (containing 14.689 Gm. in 1 liter) has the effect of a $\frac{3N}{10}$ volumetric solution, and a solution of one-third of this strength, containing 4.896 Gm. in 1 liter, has the value of a decinormal solution, and is the equivalent of equal volumes of decinormal potassium permanganate V.S., or, in the case of iodine liberated from potassium iodide, it is the equivalent of equal volumes of decinormal sodium hyposulphite V.S. For titrating iron in *ferrous* compounds, it is used in the following manner. Introduce the aqueous solution of the ferrous salt into a flask, and if it is not already acid, render it so with sulphuric acid. Now add, gradually, decinormal potassium dichromate V.S. from a burette, until a drop taken out upon a white surface no longer shows a blue color with a drop of freshly-prepared potassium ferricyanide T.S.

Decinormal potassium dichromate V.S. may also be used, in conjunction with potassium iodide (from which it liberates iodine) and sulphuric acid, for adjusting the titer of sodium hyposulphite (thiosulphate) V.S. and, by its means, that of the iodine V.S.

One cubic centimeter of decinormal potassium dichromate V.S. is the equivalent of:

	Gramme
Potassium dichromate, $K_2Cr_2O_7$	0.004896
Iron, in ferrous compounds	0.005588
Ferrous carbonate, $FeCO_3$	0.01157
Ferrous sulphate, anhydrous, $FeSO_4$	0.015170
Ferrous sulphate, crystallized, $FeSO_4 + 7H_2O$	0.027742
Ferrous sulphate, dried, $2FeSO_4 + 3H_2O$	0.017864
Potassium hydrate, KOH	0.001866
Sodium hyposulphite (thiosulphate), $Na_2S_2O_3 + 5H_2O$	0.024764

The following articles may be tested with this solution:

	Gm. taken	Cc. required	Per cent of strength indicated
Ferri carbonas saccharatus	1.116	15	7.5 of iron
Ferri sulphas	1.3871	50	100 of pure salt.
Ferri sulphas granulatus	1.3871	50	100 of pure salt

†Generally rounded off to 4.9 Gm. when a delicate balance and exact weights are not available.

125. Normal Potassium Hydrate Volumetric Solution (KOH 55.99; 55.99 Gm.† in 1 liter).—Dissolve 75 Gm. of potassium hydrate (*Potassa, U.S.P.*) in enough water to make, at or near 15° C. (59° F.), about 1050 Cc., and fill a burette with a portion of this liquid.

†This figure is frequently rounded off to 56 Gm.

Put 0.6285 Gm.[†] of pure oxalic acid (see No. 122) into a flask of the capacity of about 100 Cc., and dissolve it with about 10 Cc. of water. Add a few drops of phenolphtalein T.S., and then carefully add, from the burette, the potassium hydrate solution, frequently agitating the flask, and regulating the flow to drops toward the end of the operation, until the red color produced by its influx no longer disappears on shaking, but is not deeper than pale pink. Note the number of cubic centimeters of the potassium hydrate solution consumed, and then dilute the remainder of the solution so that exactly 10 Cc. of the diluted liquid shall be required to neutralize 0.6285 Gm.[†] of oxalic acid.

Example.—Assuming that 8.0 Cc. of the stronger solution of potassium hydrate first prepared has been consumed in the trial, then each 8.0 Cc. must be diluted to 10 Cc., or the whole of the remaining solution in the same proportion. Thus, if 1000 Cc. should be still remaining, this must be diluted with water to 1250 Cc.

After the liquid is thus diluted, a new trial should be made in the manner above described, in which 10 Cc. of the diluted solution should exactly neutralize 0.6285 Gm.[†] of oxalic acid. If necessary, a new adjustment should then be made to render the correspondence perfect.

Note.—Solutions of caustic alkalies are very prone to absorb carbon dioxide from the atmosphere, and thereby become liable to occasion errors when used with litmus T.S. or phenolphtalein T.S. as indicator (methyl orange T.S. is not affected by the presence of carbonic acid). Hence the volumetric solutions should be preserved in small vials provided with well-fitting corks or rubber stoppers, or better still, they should have tubes filled with a mixture of soda and lime attached to their stoppers, so as to absorb the carbon dioxide and prevent its access to the solution.

In place of potassium hydrate V.S., sodium hydrate V.S. (see No. 132) may be used, in the same manner and in the same quantity. Potassium hydrate V.S., however, is preferable, since it foams less, and attacks glass more slowly and less energetically.

One cubic centimeter of normal potassium hydrate V.S. is the equivalent of:

	Gramme.
Potassium hydrate, KOH	0.05599
Sodium hydrate, NaOH	0.03996
Ammonia gas, NH_3	0.01701
Ammonium chloride, NH_4Cl	0.05338
Acetic acid, absolute, $HC_2H_3O_2$	0.05986
Citric acid, crystallized, $H_3C_6H_5O_7+H_2O$	0.06983
Hydrobromic acid, absolute, HBr	0.08076
Hydrochloric acid, absolute, HCl	0.03637
Hydriodic acid, absolute, HI	0.12753
Hypophosphorous acid, HPH_2O_2	0.06588
Lactic acid, absolute, $HC_3H_5O_3$	0.08979
Nitric acid, absolute, HNO_3	0.06289
Oxalic acid, crystallized, $H_2C_2O_4+2H_2O$	0.06285
Phosphoric acid, H_3PO_4 (to form K_2HPO_4; with phenolphtalein)	0.0489
Phosphoric acid, H_3PO_4 (to form KH_2PO_4; with methyl orange)	0.0978
Potassium dichromate, $K_2Cr_2O_7$.	0.14689
Sulphuric acid, absolute, H_2SO_4	0.04891
Tartaric acid, crystallized, $H_2C_4H_4O_6$	0.07482

The following articles are tested with this solution:

	Gm. taken.	Cc. required.	Per cent of strength indicated.
Acidum aceticum	6.0	36.0	36 of absolute acid.
Acidum aceticum dilutum	24.0	24.0	6 of absolute acid.
Acidum aceticum glaciale	3.0	49.5	99 of absolute acid.
Acidum citricum	3.5	50.0	100 of crystall. acid.
Acidum hydrobromicum dilutum	8.08	10.0	10 of absolute acid.
Acidum hydrochloricum	3.64	31.9	31.9 of absolute acid.
Acidum hydrochloricum dilutum	3.64	10.0	10 of absolute acid.
Acidum hypophosphorosum dilutum	6.6	*10.0	*10 of absolute acid.

[†] This figure may be rounded off to 0.63 Gm., if a delicate balance and exact weights are not available.

	Gm. taken.	Cc. required	Per cent of strength indicated.
Acidum lacticum	4.50	37.5	75 of absolute acid.
Acidum nitricum	3.145	34.0	68 of absolute acid.
Acidum nitricum dilutum	6.29	10.0	10 of absolute acid.
Acidum phosphoricum	0.978	17.0	85 of absolute acid.
Acidum phosphoricum dilutum	4.89	10.0	10 of absolute acid.
Acidum sulphuricum	0.49	9.25	92.5 of absolute acid.
Acidum sulphuricum aromaticum	4.89	*18.5	*18.5 of absolute acid.
Acidum sulphuricum dilutum	4.89	10.0	10 of absolute acid.
Acidum tartaricum	3.75	50.0	100 of crystall. acid.
Vinum album Vinum rubrum	50.0	3.0 to 5.2	0.45 to 0.78 of acid assumed to be tartaric.

126. Centinormal Potassium Hydrate Volumetric Solution (KOH = 55.99; 0.5599 Gm. in 1 liter).—Dilute 10 Cc. of normal potassium hydrate volumetric solution with enough distilled water to make 1000 Cc.

One cubic centimeter of centinormal potassium hydrate V.S. is the equivalent of:

	Gramme.
Potassium hydrate, KOH	0.0005599
Sulphuric acid, H_2SO_4	0.0004891
Combined alkaloids of nux vomica*	0.00364

*Assumed to consist of equal parts of strychnine and brucine.—Centinormal potassium hydrate V.S. (in place of which centinormal sodium hydrate V.S., prepared in the same manner, may be employed) is used in the assay of extract of nux vomica, to neutralize the excess of decinormal sulphuric acid employed.

127. Decinormal Potassium Permanganate Volumetric Solution ($2KMnO_4$=315.34; 3.1534 Gm.† in 1 liter).—1. Place 3.5 Gm. of pure, crystallized potassium permanganate in a flask, add 1000 Cc. of boiling water, and boil until the crystals are dissolved. Close the flask, and set it aside for 2 days, so that any suspended matters may deposit. This is the *stronger solution*. Prepare another, *weaker solution*, in the same manner, using 6.6 Gm. of the salt and 2200 Cc. of water, and set this also aside for 2 days. After the lapse of this time, pour off the clear portion of each solution into separate vessels provided with glass stoppers, and then proceed to test each separately.

Introduce into a flask 10 Cc. of decinormal oxalic acid V.S., add 1 Cc. of pure, concentrated sulphuric acid, and, before this mixture cools, gradually add from a burette small quantities of the weaker permanganate solution, shaking the flask after each addition and reducing the flow to drops toward the end of the operation. When the last drop of the permanganate solution added is no longer decolorized but imparts a pinkish tint to the liquid, note the number of cubic centimeters consumed. In the same manner ascertain the titer of the stronger solution, and likewise note down the number of cubic centimeters of the latter consumed. Finally mix the two solutions in such proportions that 50 Cc. of the mixture will exactly correspond to an equal volume of decinormal oxalic acid V.S.

Note.—To obtain the accurate proportions for mixing the two solutions, deduct 10 from the number of cubic centimeters of the weaker solution required to decompose 10 Cc. of decinormal oxalic acid V.S. With this difference multiply the number of cubic centimeters of the stronger solution required for the same purpose. The product shows the number of cubic centimeters of the *stronger solution* needed for the mixture.

Next deduct the number of cubic centimeters of the stronger solution required to decompose 10 Cc. of decinormal oxalic acid V.S. from 10, and with the difference multiply the number of cubic centimeters of the weaker solution required for the same purpose. The product shows the number of cubic centimeters of the *weaker solution* needed for the mixture.

Or, designating by S the number of cubic centimeters of the stronger solution, and by W the number of cubic centimeters of the weaker solution required

---

†This quantity is never directly weighed, but adjusted either by oxalic acid or by iron. In calculations it is often abbreviated.

to decompose 10 Cc. of decinormal oxalic acid V.S., the following formula will give the proportions in which the solutions must be mixed:

Stronger Solution: Weaker Solution:

$$(W-10)S \quad + \quad (10-S)W$$

Example.—Assuming that 9 Cc. of the stronger (S) and 10.5 of the weaker (W) solution had been required, then, substituting these values in the above given formula, we obtain:

$$(10.5-10)9+(10-9)10.5$$
$$\text{or, } 4.5 \quad +\text{or, } 10.5$$

making 15 Cc. of final solution.

The bulk of the two solutions is now mixed in the same proportion, 450 Cc. of the stronger and 1050 Cc. of the weaker, or 900 Cc. of the stronger and 2100 Cc. of the weaker solution.

After the mixture is thus prepared, a new trial should be made, when 10 Cc. of the solution should exactly decompose 10 Cc. of the decinormal oxalic acid V.S. If necessary, a new adjustment should be made to render the correspondence perfect.

This solution should be kept in small, dark amber-colored and glass-stoppered bottles (or in bottles provided with tubes, especially designed for the purpose). Thus prepared, this solution will hold its titer for months; yet it should be tested occasionally, and, when it is found reduced, the liquid should be brought back to normal strength by the addition of such an amount of the stronger solution as may be determined in the manner above described.

II. When potassium permanganate V.S. is to be prepared for immediate use, this may be done in the following manner: Dissolve 3.5 Gm. of pure, crystallized potassium permanganate in 1000 Cc. of pure water, recently boiled and cooled. Introduce 10 Cc. of decinormal oxalic acid V.S. into a beaker, add 1 Cc. of pure concentrated sulphuric acid, and proceed as directed above for the weaker permanganate solution. Note the number of cubic centimeters of the solution consumed, and then dilute the remainder with pure water recently boiled and cooled, until 50 Cc. will exactly correspond to 50 Cc. of decinormal oxalic acid V.S.

Example.—Assuming that 9.1 Cc. of the permanganate solution first prepared had been required to produce a permanent pink tint, then every 9.1 Cc. of the solution must be diluted to 10 Cc., or the whole of the remaining solution in the same proportion. A new trial should then be made to verify the agreement.

Note.—Potassium permanganate V.S. thus prepared is liable to deteriorate more readily and quickly than that prepared by the method first given (under I.). It can not be safely trusted without verification each time it is to be used.

One cubic centimeter of decinormal potassium permanganate V.S. is the equivalent of:

	Gramme.
Potassium permanganate, $KMnO_4$	0.0031534
Barium dioxide, BaO_2	0.008441
Calcium hypophosphite, $Ca(PH_2O_2)_2$	0.0021209
Ferric hypophosphite, $Fe_2(PH_2O_2)_6$	0.0020877
Iron, in ferrous compounds, Fe	0.005588
Ferrous carbonate, $FeCO_3$	0.011573
Ferrous oxide, FeO	0.007195
Ferrous sulphate, anhydrous, $FeSO_4$	0.015170
Ferrous sulphate, crystals, $FeSO_4+7H_2O$	0.027742
Ferrous sulphate, dried, $2FeSO_4+3H_2O$	0.017864
Hydrogen dioxide, H_2O_2	0.001696
Hypophosphorous acid, HPH_2O_2	0.001647
Oxalic acid, crystallized, $H_2C_2O_4+2H_2O$	0.006285
Oxygen, O	0.000798
Potassium hypophosphite, KPH_2O_2	0.002598
Sodium hypophosphite, $NaPH_2O_2+H_2O$	0.002646

The following articles are tested with this solution:

	Gm. taken.	Cc. required.	Per cent of strength indicated.	
Acidum hypophosphorosum dilutum	0.5	*30.3	*10	of absolute acid
Aqua hydrogenii dioxidi	1.7 Cc.	*30.0	* 3	of H_2O_2.
Barii dioxidum	0.422	40.0	80	of pure BaO_2.
Calcii hypophosphis	0.1	47.0	99.68	of pure salt.
Ferri carbonas saccharatus	1.16	*15.0	*15	of $FeCO_3$.

	Gm taken.	Cc. required.	Per cent of strength indicated.
Ferri hypophosphis	0.1	47.0	98.1 of pure salt.
Ferri sulphas	1.39	50.0	100 of pure salt.
Ferri sulphas granulatus	1.39	50.0	100 of pure salt.
Ferrum reductum	0.056	8.0	80 of iron as metal.
Potassii hypophosphis	0.1	38.0	98.7 of pure salt.
Sodii hypophosphis	0.1	37.0	97.9 of pure salt.

128. Centinormal Potassium Permanganate Volumetric Solution ($2KMnO_4=315.34$; 0.31534 Gm. in 1 liter).—Dilute 10 Cc. of the decinormal potassium permanganate V.S., after having ascertained that it possesses its exact titer, with enough distilled water strictly complying with the tests given in the text of the Pharmacopœia for *Aqua Destillata*, to make 100 Cc. This solution should be freshly made when required.

One cubic centimeter of centinormal potassium permanganate V.S. is the equivalent of:

	Gramme.
Potassium permanganate, $KMnO_4$	0.00031534
Oxalic acid, crystallized, $H_2C_2O_4+2H_2O$	0.0006285
Oxygen (derived from the permanganate) available for oxidation	0.0000798

129. Decinormal Potassium Sulphocyanate Volumetric Solution (Volhard's Solution) ($KSCN=96.99$; 9.699 Gm. in 1 liter).—Dissolve 10 Gm. of crystals of pure potassium sulphocyanate in 1000 Cc. of water.

This solution is yet too concentrated, and has to be adjusted so as to correspond in strength exactly with decinormal silver nitrate V.S. For this purpose, introduce into a flask 10 Cc. of decinormal silver nitrate V.S., together with 0.5 Cc. of ferric ammonium sulphate T.S., and 5 Cc. of diluted nitric acid. To this mixture add, from a burette, in small portions at a time, the sulphocyanate solution. At first a white precipitate of silver sulphocyanate appears, then every drop falling from the burette is surrounded by a deep brownish-red color of ferric sulphocyanate which disappears on vigorous shaking of the flask as long as any of the silver nitrate remains unchanged. When all the silver has been converted into sulphocyanate, a single additional drop of the potassium sulphocyanate solution produces a brownish-red color which no longer disappears on shaking, but communicates a perceptible pale-brownish or reddish tint to the contents of the flask. Note the number of cubic centimeters of the potassium sulphocyanate solution used, and dilute the whole of the remaining solution so that equal volumes of this and of the decinormal silver nitrate V.S. will be required to produce the permanent brownish or reddish tint. The same depth of pale-brownish or reddish tint to which the volumetric solution is adjusted must be attained when the solution is used for volumetric assays.)

After the dilution, a new trial should be made, in which 50 Cc. of decinormal silver nitrate V.S., 2.5 Cc. of ferric ammonium sulphate T.S., and 25 Cc. of diluted nitric acid are used, and there should be required exactly 50 Cc. of the sulphocyanate solution to produce the same depth of a permanent pale-brownish or reddish tint. If necessary, a new adjustment should be made, to render the correspondence perfect.

One cubic centimeter of decinormal potassium sulphocyanate V.S. is the equivalent of:

	Gramme.
Potassium sulphocyanate, KSCN	0.009699
Silver, Ag	0.010766
Silver nitrate, $AgNO_3$	0.016955

The following articles are tested with this solution:

Ferri iodidum saccharatum Syrupus ferri iodidi	Determined by residual titration with decinormal silver nitrate V.S., and decinormal potassium sulphocyanate V.S.

130. Decinormal Silver Nitrate Volumetric Solution ($AgNO_3=169.55$; 16.955 Gm.† in 1 liter).—Dissolve 16.955 Gm.† of pure silver nitrate in enough water to make, at or near 15° C. (59° F.), exactly 1000 Cc. Keep the solution in small, dark amber-colored, glass-stoppered vials, carefully protected from dust.

---

†Frequently rounded off to 16.96 Gm., when a delicate balance and exact weights are not available.

Note.—Titration by decinormal silver nitrate V.S. may be managed in various ways, adapted to the special preparation to be tested:

a. In most cases it is directed by the *U. S. P.* to be used in presence of a small quantity of potassium chromate T.S., which serves to indicate the end of the reaction by the appearance of the red color of silver chromate.

b. In some cases (potassium cyanide, hydrocyanic acid) it is added until the first appearance of a permanent precipitate.

c. It may be used in *all* cases without indicator by observing the exact point when no further precipitate occurs. This may be practised in the case of ferrous iodide, where the addition of potassium chromate would be improper, but it consumes much time in waiting for the precipitate to subside so as to render the liquid sufficiently clear to recognize whether a further precipitate is produced by addition of the silver solution.

d. It may be added in definite amount, known to be in excess of the quantity required, and the excess of the decinormal silver solution measured back by the addition of decinormal potassium sulphocyanate V.S. (residual titration).

One cubic centimeter of decinormal silver nitrate V.S. is the equivalent of:

	Gramme.
Silver nitrate, $AgNO_3$	0.016955
Ammonium bromide, NH_4Br	0.009777
Ammonium chloride, NH_4Cl	0.005338
Calcium bromide, $CaBr_2$	0.0099715
Ferrous bromide, $FeBr_2$	0.010770
Ferrous iodide, FeI_2	0.015447
Hydrocyanic acid, absolute, HCN, with indicator	0.002698
Hydrocyanic acid, absolute, HCN, to first formation of precipitate	0.005396
Hydriodic acid, HI	0.012753
Hydrobromic acid, HBr	0.008076
Lithium bromide, LiBr	0.008677
Potassium bromide, KBr	0.011879
Potassium chloride, KCl	0.007440
Potassium cyanide, KCN, with indicator	0.006501
Potassium cyanide, KCN, to first formation of precipitate	0.013002
Potassium iodide, KI	0.016556
Potassium sulphocyanate, KSCN	0.009699
Sodium bromide, NaBr	0.010276
Sodium chloride, NaCl	0.005837
Sodium iodide, NaI	0.014953
Strontium bromide, $SrBr_2$ (anhydrous)	0.012341
Strontium iodide, SrI_2 (anhydrous)	0.017018
Zinc bromide, $ZnBr_2$	0.011231
Zinc chloride, $ZnCl_2$	0.006792
Zinc iodide, ZnI_2	0.015908

The following articles are tested with this solution:

	Gm. taken.	Cc. required.	Per cent of strength indicated.	
Acidum hydrocyanicum dilutum	1.35	10.0	2	of absolute acid.
Ammonii bromidum	0.3	30.9	99	of pure salt.
Calcii bromidum	0.25	25.0	99.7	of pure salt.
†Ferri iodidum saccharatum	1.55	*20.0	*20	of iodide.
Lithii bromidum	0.3	35.3	98	of pure salt.
Potassii bromidum	0.5	42.85	97	of pure salt.
Potassii cyanidum (to first precip.)	0.65	45.0	90	of pure salt.
Potassii iodidum	0.5	30.25	99.5	of pure salt.
Sodii bromidum	0.3	29.8	97.29	of pure salt.
Sodii chloridum	0.195	33.4	99.9	of pure salt.
Sodii iodidum	0.5	34.5 to 33.4	*98	of pure salt.
Strontii bromidum (dry)	0.3	24.6	98	of pure salt.
Strontii iodidum (dry)	0.3	18.0	98	of pure salt.
Syrupus acidi hydriodici	32.0	*25.0	* 1	of HI.
†Syrupus ferri iodidi	1.55	*10.0	*10	of FeI_2.
Zinci bromidum	0.3	26.7	99.95	of pure salt.
Zinci chloridum	0.3	44.1	99.84	of pure salt.
Zinci iodidum	0.5	31.0	98.62	of pure salt.

Note.—The articles marked with † are determined by residual titration with decinormal silver nitrate V.S. and decinormal potassium sulphocyanate V.S.

131. Decinormal Sodium Chloride Volumetric Solution ($NaCl—58.37$; 5.837 Gm.† in 1 liter).—Dissolve 5.837 Gm.† of pure sodium chloride (see below) in enough water to make, at or near 15° C. (59° F.), exactly 1000 Cc. Pure sodium chloride may be prepared by passing a current of dry hydrochloric acid gas into a saturated aqueous solution of the purest commercial sodium chloride, separating the crystalline precipitate, and drying it at a temperature sufficiently high to expel all traces of free acid. In place of this, transparent crystals of pure rock-salt may be employed.

One cubic centimeter of decinormal sodium chloride V.S. is the equivalent of:

	Gramme.
Sodium chloride, $NaCl$	0.005837
Silver, Ag	0.010766
Silver nitrate, $AgNO_3$	0.016955
Silver oxide, Ag_2O	0.011564

The following articles are tested with this solution:

	Gm. taken.	Cc. required.	Per cent of strength indicated.
Argenti nitras	0.34	20.0	100 of silver nitrate.
Argenti nitras dilutus	1.0	19.5	33.14 of silver nitrate.
Argenti nitras fusus	0.34	19.0	95 of silver nitrate.

†Frequently rounded off to 5.84 Gm., when a delicate balance and exact weights are not available.

132. Normal Sodium Hydrate Volumetric Solution ($NaOH—39.96$; 39.96 Gm.† in 1 liter).—Dissolve 54 Gm. of sodium hydrate (*Soda, U. S. P.*) in enough water to make, at or near 15° C. (59° F.), about 1050 Cc., and fill a burette with a portion of this liquid. Put 0.6285 Gm.‡ of pure oxalic acid (see under No. 122) into a flask of the capacity of about 100 Cc., and dissolve it with about 10 Cc. of water. Add a few drops of phenolphtalein T.S., and then carefully add, from the burette, the sodium hydrate solution, frequently agitating the flask, and regulating the flow to drops toward the end of the operation, until the red color produced by its influx no longer disappears on shaking, but is not deeper than pale pink. Note the number of cubic centimeters of the sodium hydrate solution consumed, and then dilute the remainder of it so that exactly 10 Cc. of the diluted liquid will be required to neutralize 0.6285 Gm.‡ of oxalic acid.

Example.—Assuming that 7.8 Cc. of the stronger solution of sodium hydrate first prepared had been consumed in the trial, then each 7.8 Cc. must be diluted to 10 Cc., or the whole of the remaining solution in the same proportion. Thus, if 980 Cc. should be still remaining, this must be diluted with water to 1258 Cc. After the liquid is thus diluted, a new trial should be made in the manner above described, in which 10 Cc. of the diluted solution should exactly neutralize 0.6285 Gm. of oxalic acid. If necessary, a new adjustment should then be made to render the correspondence perfect.

Note.—The same precautions should be taken for protecting this solution from the carbon dioxide of the air, as are prescribed for normal potassium hydrate V.S. (see No. 125).

This solution may be employed in place of the normal potassium hydrate V.S., volume for volume.

†Frequently rounded off to 40 Gm.
‡This may be rounded off to 0.63 Gm., when a delicate balance and exact weights are not available.

133. Decinormal Sodium Hyposulphite Volumetric Solution ($Na_2S_2O_3+5H_2O=247.64$; 24.764 Gm. in 1 liter).—Dissolve 30 Gm. of selected crystals of sodium hyposulphite (sodium thiosulphate) in enough water to make, at or near 15° C. (59° F.), 1100 Cc. Of this solution transfer 10 Cc. into a flask, add a few drops of starch T.S., and then gradually add, from a burette, decinormal iodine V.S., in small portions at a time, shaking the flask after each addition, and regulating the flow to drops toward the end of the operation. As soon as the color produced by the influx of the iodine solution no longer disappears on shaking, but is not deeper than very pale blue, note the number of cubic centimeters of the iodine solution consumed. Then dilute the sodium hyposulphite solution so that equal volumes of it and of decinormal iodine V.S. will exactly correspond to each other under the conditions mentioned above.

Example.—Assuming that 10 Cc. of the stronger sodium hyposulphite solution first prepared had required 10.7 Cc. of decinormal iodine V.S. to produce a faint reaction with starch, the hyposulphite solution must be diluted in the proportion of 10 Cc. to 10.7 Cc., or 1000 Cc. to 1070 Cc.

After the solution is thus diluted, a new trial should be made in the manner above described, in which 50 Cc. of the decinormal sodium hyposulphite V.S. should require exactly 50 Cc. of decinormal iodine V.S. to produce a faint reaction with starch. If necessary, a new adjustment should then be made to render the correspondence perfect.

Keep the solution in small, dark amber-colored, glass-stoppered bottles, carefully protected from dust.

Note.—When this solution is to be used, fill a burette with it, place the liquid to be tested either for the free iodine it already contains, or for that which it liberates from an excess of potassium iodide added to it, into a flask, and gradually add small portions of the solution from the burette, shaking after each addition, and regulating the flow to drops toward the end of the operation, until the brown color of the iodine has nearly disappeared. Now add a few drops of starch T.S., which will produce a blue color, and then continue to add the hyposulphite solution in drops until the blue tint is exactly discharged.

One cubic centimeter of decinormal sodium hyposulphite V.S. is the equivalent of:

	Gramme.
Sodium hyposulphite (thiosulphate), $Na_2S_2O_3+5H_2O$	0.024764
Bromine, Br	0.007976
Chlorine, Cl	0.003537
Iodine, I	0.012653
Iron, Fe, in ferric salts	0.005588

The following articles are tested with this solution:

	Gm. taken.	Cc. required.	Per cent of strength indicated.	
Aqua chlori	17.7	20.0	0.4	of chlorine.
Calx chlorata	0.354	35.0	35	of chlorine.
Ferri chloridum	0.56	20.0	20	of iron.
Ferri citras	0.56	*16.0	*16	of iron.
Ferri et ammonii citras	0.56	*16.0	*16	of iron.
Ferri et ammonii sulphas	0.56	11.6	11.6	of iron.
Ferri et ammonii tartras	0.56	*17.0	*17	of iron.
Ferri et potassii tartras	0.56	*15.0	*15	of iron.
Ferri et quininæ citras	0.56	*14.5	*14.5	of iron.
Ferri et quininæ citras solubilis	0.56	*14.5	*14.5	of iron.
Ferri et strychninæ citras	0.56	*16.0	*16	of iron.
Ferri phosphas solubilis	0.56	*12.0	*12	of iron.
Ferri pyrophosphas solubilis	0.56	*10.0	*10	of iron.
Ferri valerianas	0.56	15.0 to 20.0	15 to 20	of iron.
Ferrum reductum	0.056	8.0	80	of iron.
Iodum	0.32	25.0	98.85	of iodine.
Liquor ferri acetatis	1.12	*15.0	* 7.5	of iron.
Liquor ferri chloridi	1.12	*26.0	*13	of iron.
Liquor ferri citratis	1.12	*15.0	* 7.5	of iron.
Liquor ferri nitratis	1.12	* 2.8	* 1.4	of iron.
Liquor ferri subsulphatis	1.12	*27.2	*13.6	of iron.
Liquor ferri tersulphatis	1.12	*16.0	* 8	of iron.
Liquor iodi compositus	12.66	49.3 to 50	5	of iodine.
Liquor sodæ chloratæ	6.7	50.0	2.6	of chlorine.
Tinctura ferri chloridi	1.12	* 9.4	* 4.7	of iron.
Tinctura iodi	6.3 Cc.	*35.0	* 7 Gm.	of I in 100 Cc.

134. Normal Sulphuric Acid (H_2SO_4=97.82; 48.91 Gm. in 1 liter).—Carefully mix 30 Cc. of pure, concentrated sulphuric acid (of specific gravity 1.835) with enough water to make about 1050 Cc., and allow the liquid to cool to about 15° C. (59° F.). Place 10 Cc. of this liquid (which is yet too concentrated) into a flask, add a few drops of phenolphtalein T.S., and afterward, from a burette, normal potassium hydrate V.S., shaking after each addition, and regulating the flow to drops toward the end of the operation, until the red color produced by its influx no longer disappears on shaking, but is not deeper than pale pink. Note the number of cubic centimeters of potassium hydrate consumed. Then dilute the sulphuric acid solution so that equal volumes of this and of normal potassium hydrate V.S. exactly neutralize each other.

Example.—Assuming that 10 Cc. of the acid solution first prepared had required exactly 11.2 Cc. of normal potassium hydrate V.S., each 10 Cc. of the former must be diluted to 11.2 Cc., or each 1000 Cc. to 1120 Cc.

After the liquid is thus diluted, a new trial should be made in the manner above described, in which 50 Cc. of the acid solution should require for neutralization exactly 50 Cc. of potassium hydrate V.S. If necessary, a new adjustment should be made to render the correspondence perfect.

Note.—It is recommended that, in alkalimetric determinations, when an acid of normal strength is required, normal sulphuric acid be employed, in place of normal oxalic acid V.S. (see note under No. 122).

One cubic centimeter of normal sulphuric acid is the equivalent of:

	Gramme
Sulphuric acid, absolute, H_2SO_4	0.04891
Ammonia gas, NH_3	0.01701
Ammonium carbonate, $(NH_4)_2CO_3$	0.42035
Ammonium carbonate (*U. S. P.*), $NH_4HCO_3.NH_4NH_2CO_2$	0.05226
Lead acetate, crystallized, $Pb(C_2H_3O_2)_2+3H_2O$	0.18900
Lead subacetate, assumed as $Pb_2O(C_2H_3O_2)_2$	0.13662
Lithium benzoate, $LiC_7H_5O_2$ (to be ignited)	0.12772
Lithium carbonate, Li_2CO_3	0.0369[illegible]5
Lithium citrate, $Li_3C_6H_5O_7$ (to be ignited)	0.0698566
Lithium salicylate, $LiC_7H_5O_3$ (to be ignited)	0.14368
Potassium acetate, $KC_2H_3O_2$ (to be ignited)	0.09789
Potassium bicarbonate, $KHCO_3$	0.09988
Potassium bitartrate, $KHC_4H_4O_6$ (to be ignited)	0.18767
Potassium carbonate, anhydrous, K_2CO_3	0.068955
Potassium citrate, crystallized, $K_3C_6H_5O_7+H_2O$ (to be ignited)	0.10786
Potassium hydrate, KOH	0.05599
Potassium and sodium tartrate, $KNaC_4H_4O_6+4H_2O$ (to be ignited)	0.14075
Sodium acetate, $NaC_2H_3O_2+3H_2O$ (to be ignited)	0.13574
Sodium benzoate, $NaC_7H_5O_2$ (to be ignited)	0.14371
Sodium bicarbonate, $NaHCO_3$	0.08385
Sodium borate, crystallized, $Na_2B_4O_7+10H_2O$	0.19046
Sodium carbonate, anhydrous, Na_2CO_3	0.052925
Sodium carbonate, crystallized, $Na_2CO_3+10H_2O$	0.142725
Sodium hydrate, NaOH	0.03996
Strontium lactate, $Sr(C_3H_5O_3)_2$ (to be ignited)	0.13244

The following articles are tested with this solution:

	Gm. taken	Cc. required.	Per cent of strength indicated.
Ammonii carbonas	2.613	50.0	100 of pure salt.
Aqua ammoniæ	3.4	20.0	10 of dry gas.
Aqua ammoniæ fortior	1.7	28.0	28 of dry gas.
Liquor plumbi subacetatis	13.67	*25.0	25 of basic salt.
Liquor potassæ	28.00	25.0	5 of hydrate.
Liquor sodæ	20.00	25.0	5 of hydrate.
Lithii benzoas (to be ignited)	1.0	7.8	99.6 of pure salt
Lithii carbonas	0.5	13.4	98.98 of pure salt.
Lithii citras (to be ignited)	1.0	14.2	99.2 of pure salt.
Lithii salicylas (to be ignited)	2.0	13.8	99.13 of pure salt.
Potassa	0.56	9.0	90 of hydrate.
Potassii acetas (to be ignited)	1.0	10.0	98 of pure salt.
Potassii bicarbonas	1.0	10.0	100 of pure salt.
Potassii bitartras (to be ignited)	1.88	9.9	99 of pure salt.
Potassii carbonas	0.69	9.5	95 of anhyd. salt.
Potassii citras (to be ignited)	1.08	10.0	100 of crystall. salt.
Potassii et sodii tartras (to be ignited)	1.41	10.0	100 of pure salt.
Soda	[illegible].4	9.0	90 of hydrate.
Sodii acetas (to be ignited)	1.36	10.0	100 of pure salt.
Soda benzoas (to be ignited)	2.0	13.9	99.8 of pure salt.
Sodii bicarbonas	0.85	10.0	98.6 of pure salt.
Sodii carbonas, anhydrous	1.0	18.7	98.9 of anhyd. salt.
Sodii carbonas, exsiccatus	1.0	13.8	7[illegible] of anhyd. salt.
Spiritus ammoniæ	3.4	20.0	10 of ammonia.
Strontii lactas (to be ignited)	1.3[illegible]	9.9	98.6 of pure salt.

135. Decinormal Sulphuric Acid (H_2SO_4=97.82; 4.891 Gm. in 1 liter).—Dilute 10 Cc. of normal sulphuric acid with enough water to make 100 Cc.

One cubic centimeter of decinormal sulphuric acid is the equivalent of:

	Gramme.
Sulphuric acid, absolute, H_2SO_4	0.004891
Combined alkaloids of nux vomica, assumed to consist of equal parts of strychnine and brucine	0.0364
Potassium hydrate, KOH	0.005599

The following article is tested with this solution:

	Gm. taken.	Cc. required.	Per cent of strength required.
Extractum nucis vomicæ	0.4	†1.65	15 of total alkaloids.

†To be determined to at least 2 decimals by titrating the uncombined acid with centinormal potassium hydrate V.S.

GASOMETRIC ESTIMATIONS.

(U. S. P.)

In certain cases the Pharmacopœia directs the strength of a product or chemical substance to be determined by the volume of some gas (nitrogen dioxide) given off during a definite reaction. This volume is to be determined by the nitrometer in the following manner:

Arrange a nitrometer consisting of a measuring tube (graduated for at least 50 Cc.), and connected by stout rubber tubing with an open equilibrium tube (both tubes, preferably, provided with a globular expansion near the lower end) in such a manner, by suitable clamps attached to a stand, that either tube may be readily and quickly clamped at a higher or lower level. The stop-cock of the measuring tube having been opened, and the open equilibrium tube having been raised to a higher level, pour into the latter a saturated aqueous solution of sodium chloride, until the measuring tube, including the bore of the stop-cock, is completely filled. Then close the latter and fix the equilibrium tube at a low level. Having ascertained that the stop-cock is closed air-tight, and having, if necessary, wiped out the graduated funnel tube of the nitrometer, introduce into it the prescribed quantity of the liquid to be tested, and allow this to flow slowly into the measuring tube, being careful not to admit any air. Follow it by the prescribed quantities of the several reagents (potassium iodide T.S., and normal sulphuric acid). When the reaction, which takes place at once, moderates, remove the measuring tube from its clamp, and, being careful to hold it constantly so that the liquid contained in it stands at a higher level than that in the equilibrium tube, shake its contents, without permitting any gas to pass into the open tube. When the reaction has completely ceased, restore the tube to its fastening, and allow the apparatus and contents to acquire the ordinary temperature of the room, which is assumed to be at or near 25° C. (77° F.). Then adjust the two tubes so that the liquid columns are at exactly the same level, and read off the volume of gas in the measuring tube. Multiply this figure by the weight of the substance yielding 1 Cc. of nitrogen dioxide (see below). The result will be the weight of the pure substance (nitrite) contained in the amount taken for the assay.

For pharmacopœial purposes the determination will be sufficiently exact if the evolved gas be measured at or near 25° C. (77° F.). If it be desired to ascertain the volume which the gas would occupy at any other temperature between 0° C. and 40° C. (32° to 104° F.), this may be done with the aid of the table below printed.

Example.—Assuming that the volume of gas read off was 44.5 Cc. at 27° C. (80.6° F.), and that it be desired to ascertain the corresponding volume at 0° C. (32° F.), barometric pressure not being taken into consideration, then the 44.5 Cc. must be reduced in the proportion of 1.098901 to 1; or 44.5 must be divided by 1.098901. The result will be 40.5 Cc.

The following table shows the expansion which 1 Cc. of a gas will undergo when it is raised from 0° C. (32° F.) to 40° C. (104° F.):

EXPANSION OF 1 Cc. OF A GAS, BETWEEN 0° AND 40° C.

°C.	Cc.	°C.	Cc.	°C.	Cc.
0	1.000000	14	1.051282	28	1.102564
1	1.003663	15	1.054945	29	1.106227
2	1.007326	16	1.058608	30	1.109890
3	1.010989	17	1.062271	31	1.113553
4	1.014652	18	1.065934	32	1.117216
5	1.018315	19	1.069597	33	1.120879
6	1.021978	20	1.073260	34	1.124542
7	1.025641	21	1.076923	35	1.128205
8	1.029304	22	1.080586	36	1.131868
9	1.032967	23	1.084249	37	1.135531
10	1.036630	24	1.087912	38	1.139194
11	1.040293	25	1.091575	39	1.142857
12	1.043956	26	1.095238	40	1.146520
13	1.047619	27	1.098901		

136. Estimation of Nitrogen Dioxide.—

$$NO = 29.97;\ 1 \text{ liter} \begin{cases} \text{at } 0° \text{ C. and 760 Mm.—1.3423 Gm.} \\ \text{at } 25° \text{ C. and 760 Mm.—1.2297 Gm.} \end{cases}$$

One cubic centimeter of nitrogen dioxide is the equivalent of:

	At 0° C. and 760 Mm. Gramme.	At 25° C. and 760 Mm. Gramme.
Nitrogen dioxide, $NO=29.97$	0.0013423	0.0012297
Amyl nitrite, $C_5H_{11}NO_2=116.78$	0.0052305	0.0047923
Ethyl nitrite, $C_2H_5NO_2=74.87$	0.0033529	0.0030716
Sodium nitrite, $NaNO_2=68.93$	0.0030873	0.0028283

The following articles are tested gasometrically by the volume of nitrogen dioxide evolved and measured at or near 25° C. (77° F.):

	Amount taken.	Volume of NO.	Strength indicated.
Amyl nitris	0.26 Gm.†	40 Cc.	*80% of pure amyl nitrite.
Sodii nitris	0.15 Gm.	50 Cc.	97.6% of pure salt.
Spiritus ætheris nitrosi (fresh)	5 Cc.	55 Cc.	* 4% of pure ethyl nitrite.

†This quantity will, theoretically, yield a little more than 40 Cc. of the gas, but there will be a slight loss, as the gas is somewhat soluble in the liquid.

ALKALOIDAL ASSAY BY IMMISCIBLE SOLVENTS.

(U. S. P.)

It is a property of many alkaloids that they are soluble in certain liquids in which their salts are insoluble, while in other liquids the case is reversed. When such liquids are not miscible, the conditions are favorable to what has been called the "shaking-out" process of separation. In many cases the extraction or separation may be effected by shaking together the concentrated aqueous extract, to which a suitable alkaline precipitant has been added, and some solvent, such as chloroform, ether, benzin, benzol, amyl alcohol, etc. The precipitated alkaloid is thus washed out of the aqueous solution, and is dissolved by the chloroform or other immiscible liquid employed. From the solution of the alkaloid thus obtained, the latter may again be abstracted by a dilute acid. In this Pharmacopœia the only liquid which is directed as solvent for alkaloids in such assays is *chloroform.* The extraction is directed to be performed in a glass separator or separatory funnel, which consists of an elongated (globular, cylindrical, or conical) glass-vessel, provided with a well-fitting stopper and an outlet-tube containing a well-ground glass stop-cock.

When the solution of an alkaloid, suitably prepared, is introduced into this vessel, and chloroform subsequently added, the latter, owing to its higher specific gravity, will form the lower layer. If the two layers are violently shaken together, there will often result an emulsion, which will separate only slowly, and often imperfectly. This is particularly liable to happen when the aqueous liquid containing the alkaloid either in suspension or in solution is strongly alkaline, and when it has a high specific gravity. To avoid the formation of an emulsion, the extraction should be accomplished rather by rapid rotation and frequent inversion of the separator than by violent shaking. When an emulsion has formed, its separation may be promoted by the addition of more of the solvent, preferably somewhat heated, aided, if necessary, by the external application of a gentle heat (the stopper being removed for the time being), or by the introduction of a small quantity of alcohol or of hot water. The separation of the two layers may also be promoted by stirring the lower, chloroformic layer with a glass rod and detaching from the walls of the separator the adhering drops of emulsion.*

On withdrawing the chloroform solution of an alkaloid from the separator, a small amount of the solution will generally be retained in the outlet-tube by capillary attraction. If this were lost, the results of the assay would be seriously vitiated. To avoid this loss, several successive, small portions of chloroform should be poured into the separator without agitation, and drawn off through the stop-cock to wash out the outlet-tube.

Another source of loss is the pressure sometimes generated in the separator by the rise of temperature caused when an alkaline and an acid liquid are shaken together. On loosening the stopper, the liquid which adheres to the juncture of the latter with the neck is liable to be ejected. This is best avoided by mixing the liquids at first by rotation (avoiding contact of the contents with the stopper), and allowing them to become cold before stoppering the separator.

The same precautions should be observed when an alkali carbonate has been used, in place of a caustic alkali, for setting free the alkaloid. In this case the liquids should be cautiously and gradually mixed by rotation, and the separator should be left unstoppered until gas is no longer given off.

If a regular glass separator is not available, an ordinary burette, stoppered with a sound cork, may be employed in its place. In this case the quantities of the alkaloidal solution and of the volatile solvent must be adjusted to the size of the burette.

DETERMINATION OF THE OPTICAL ROTATION OF ORGANIC SUBSTANCES.

(U. S. P.)

Many organic substances either liquid by nature or in solution in suitable solvents, when examined in a specially constructed polarizing apparatus or polaristrobometer, exhibit the property of circular polarization, or, in other words, are capable of rotating the plane of polarization of a ray of light either to the right or to the left. Such substances are termed "optically active," and when rotating to the right are designated as "dextro-rotatory" or "dextrogyrate," and when rotating to the left, as "lævo-rotatory" or "lævogyrate." Substances which do not possess this property of optical rotation are termed "optically inactive."

Among the substances recognized by this Pharmacopœia, there are several, particularly certain essential or volatile oils, and related bodies, for which the determination of the angle of rotation of a ray of polarized light, or, in some cases, the proof of their optical inactivity, affords the most simple and positive evidence of their identity or purity.

The instruments used for this purpose vary somewhat in their construction. Those which are most generally adapted for the examination of the substances mentioned above are the polaristrobometer of Wild, in which the optical activity of the substance is manifested by the appearance or disappearance of dark, parallel stripes, or the so-called "half-shadow" instrument of Laurent, in which the two sides of the field of vision are capable of becoming unequally illuminated. Both of the instruments permit the angle of rotation to be read off in degrees or fractions of a degree of a circle.

---

*In our experience, the breaking of emulsions may be facilitated considerably by placing a pellet of absorbent cotton, of suitable size, into the emulsified fluid, and repeatedly pressing the cotton against the walls of the separator by means of a glass rod.

These optical determinations are best made in a dark room, and by means of homogeneous or monochromatic light, the latter being obtained by introducing into a non-luminous flame, on a loop of platinum wire, a small bead of fused sodium chloride. The light thus radiated corresponds with the line D of the solar spectrum.

Since the deviation of the plane of polarization either to the right or to the left of the zero point is directly proportional to the length of the column of liquid, it is important that the observations should be made with tubes of a definite length, such as 100, 50, or 25 Mm. The selection of the length of the tube to be employed is, however, usually dependent upon the depth of color of the liquid and the extent of its optical rotation.

The rotatory power of an optically active, liquid substance, observed with sodium light, and referred to the ideal density 1. and in a tube having a length of 1 decimeter (100 Mm.), is designated as its *specific rotatory power*. This is usually expressed by the term $[\alpha]_D$. Since, however, not only the density of an optically active liquid, but also its rotation, is influenced by the temperature, the specific rotation varies with the latter. In stating the specific rotation it is, therefore, necessary to indicate at what temperature the rotation and the density of the liquid have been determined. But for the same temperature the specific rotation of a pure, optically active liquid is always a constant number.

For calculating the specific rotatory power of an optically active liquid substance, or solution of an optically active solid, the following formulas are of general application:

I. For liquid substances $[\alpha]_D = \frac{100 \times \alpha}{L \times d}$

II. For solutions of solids

$$\left\{ \begin{array}{l} [\alpha]_D = \dfrac{10000 \times \alpha}{L \times p \times d} \\ \text{or} \quad [\alpha]_D = \dfrac{10000 \times \alpha}{L \times c} \end{array} \right.$$

For calculating these formulas the determination of the following factors is necessary:

α = the angle of rotation of the liquid or solid observed with sodium light.
L = the length of the tube in millimeters.
d = the density or specific gravity of the active liquid.
p = the amount of active substance in 100 parts by weight of the solution.
c = the number of grammes of active substance in 100 cubic centimeters of the solution.

EXPLANATION

OF THE

PRINCIPAL ABBREVIATIONS

OCCURRING IN

PHARMACEUTICAL FORMULAE.

[Revised from the earlier editions of this Dispensatory.]

R., Recipe—Take.
F. S. A., Fiat secundum artem—Let it be made or prepared according to the rules of the art.
M., Misce—Mix.
M. S. D., Misce, signa, da—Mix the medicine, and deliver it afterward, with the requisite instruction, to the patient (or nurse) in writing.
M. F. P., Misce fiat pulvis—Mix to form a powder.
M. F. Mist., Misce fiat mistura—Mix to form a liquid mixture.
M. F. Pil., Misce fiant pilulæ—Mix to form pills.
Div., Divide—Divide.
Sol., Solve—Dissolve.
Fasc. j., Fasciculus—An armful.
Man. j., Manipulus—A handful, a gripe.
Pugil. j., Pugillus—A pinch.
Cyath. j., Cyathus—A glassful.
Cochl. j., Cochlear or Cochleare—A spoonful.
Gutt., Gutta—Drop.
No. 1, 2, 3, etc.—The number of pieces or parts, etc., written j, ij, iij, iv, v.
Ana, or āā—Of each.
P. Ae., Partes æquales—Equal parts.
Q. S., Quantum sufficit.
Q L., Quantum libet—As much as you like.
Q. V., Quantum volueris—As much as you like.
℔., Libra—A pound.
℥., Uncia—An ounce.
ʒ., Drachma—A drachm or dram.
℈., Scrupulus—A scruple.
Gr., Granum—A grain.
Pil., Pilula—A pill.
Pot., Potio—A potion.
Pulv., Pulvis—A powder. Pulvis factis, powdered.
Tinc., Tinctura—A tincture.
Ext., Extractum—An extract.
Chart., Chartula—A small paper.
Collyr., Collyrium—An eye-water.
Collutor., Collutorium—A mouth wash.
Cong.. Congius—A gallon.
O. Oct., Octarius—A pint.
f℥., Fluiduncia—A fluid ounce.
fʒ., Fluidrachma—A fluid drachm.
♏., or Min., Minimum—A minim.
Decoct., Decoctio, Decoctum—A decoction.
Garg., Gargarisma—A gargle.
Haust., Haustus—A draught.
Infus., Infusum—An infusion.
Mass., Massa—A mass.
Mist., Mistura—A mixture.
Ss., Semis—A half.
Zz., Zingiber—Ginger.

A VOCABULARY

OF THE WORDS MOST FREQUENTLY OCCURRING IN THE PRESCRIPTIONS OF PHYSICIANS.

A, āā, or ana, of each ingredient; more properly expressed by the genitive case plural (singulorum) of each; for instance:

R—Aquæ cinnamon, tinct. rhei, āā ʒij, means:
Take of cinnamon-water, and tincture of rhubarb, of each 2 drachms.

Abdom., Abdomen, the belly. Gen.—inis, of the belly. Dat. —ini, to the belly

Abs. febr., absente febre, while the fever is off.

Acc., Accuratè (adverb), accurately. Accuratè pensi, Acc. pen., weighed with the utmost exactness. Accuratè misceantur, Acc. mis., let them be mixed very completely.

Acid., Aciditas, sharpness. Ad. grat. acid., Ad gratam aciditatem, make it just acid enough to be palatable, and not too sour. To an agreeable sourness.

Acm., Acme, the height of a fever or any other disease.

Ad, to. Ad duas vices, at twice taking.

Add., Adde, add., let it or them be added. Addantur, let them be added. Addendus, to be added. Addendo, adding.

Ad lib., Ad libitum, at pleasure, as you like.

Ad recid. præc., Ad recidivium præcavendum, to prevent a relapse.

Admov., Admoveatur, let there be applied—antur, plural, when more than one is to be applied.

Adst. feb., Adstante febre, while the fever is on.

Æger, a sick person, a patient. Ægra, a female patient.

Agg. feb., Aggrediente febre, when the fever is coming on.

Aggressus, an attack. Aggressus febris, the attack of a fever.

Agit. vas., Agitato vasè, shaking the vial.

Albus, white. Alb., or Album.

Aliquant., Aliquantillum, a very little.

Aliquot, some. Aliquoties, sometimes.

Alt., Alter, altera, alterum, the other.

Altern., Alternus, alternate. Altern. hor., Alternis horis, every second hour. Altern. dieb., Alternis diebus, every alternate day.

Aluta, leather. Extende super alutam mollem, E. S. A. M., spread on soft leather, or A. M. E. S.

Alv., Alvus, the belly, the bowels. Adstrictâ alvo, when costive.

Amp., Amplus, large. Coch. amp. Cochleare amplum, a tablespoonful.

A. M., Ante meridiem, before noon. Antemeridianus, in the forenoon, any time before twelve o'clock at noon.

Antè, before. Ut antè, as before.

Apparatus, any sort of a preparation, instruments, or, in short, everything that is requisite to be had in readiness for performing any sort of operation. Also, the more delicate term for a bladder and pipe for clysters.

Aper., Aperiens, opening, gently purging.

Applic., Applicetur, let there be applied.

Aq., Aqua, water. Aquæ, of water. Aq. bull., Aqua bulliens, boiling water. Aq. ferv., Aqua fervens, hot water. Aq. dest., Aqua destillata, distilled water. Aq. font., Aqua fontana, spring water. Aq. marin., Aqua marina, sea or salt water. Aq. niv., Aqua nivalis, snow water. Aq. pluv., Aqua pluvialis, rain water. Aq. pur., Aqua pura, pure water.

Armatus. armed. Fistula armata, an apparatus for clysters; a pipe and bladder.

Auris, the ear. Auri, to the ear. Aures, ears. Auribus, to the ears.

Aut, or.

Bacc., Baccæ, berries.

Baln. mar., Balneum mariæ, a salt water bath. Baln. tep., Balneum tepidum, a lukewarm bath. Baln. vap., Balneum vaporis, a vapor bath. Baln. frigid., Balneum frigidum, a cold bath. Baln. cal., Balneum calidum, hot bath. Baln. ar., Balneum arenæ, sand bath.

Ben., Benè, well. Benè misceatur, B. M., let it be well mixed.

Bib., Bibat, let him drink.

Bidu., Biduum, two days. O. B. V. T., Omni biduò vel triduò, every two or three days.

Bih., Bihorium, the space of two hours. Om. Bih., Omni bihorio, every two hours.

Bis, twice: bis terve, twice or thrice.

Bis in d., Bis in dies, twice a day.

Bol., Bolus, a ball, a pill, a morsel, a dose.

Bullio, to boil: bulliens, boiling. Aq. bull., Aquæ bullientis, of boiling water.

Bull., Bulliant, let them boil.

Calef., Calefactus, made warm.

Cap., Capiat, let (the patient) take. Capt. cochl. iij magn., Capiat cochlearia tria magna, three tablespoonfuls to be taken.

Cat., Cataplasm, a poultice.

Cath., Catharticus, purging, cathartic.

Caut., Cautè, cautiously.

Cerevisia, beer. Cerevisia Londinensis, porter. Cerevisia Lagenaria, bottled porter or stout.

Chart., Charta, paper. Charta Cærulea, blue paper. Chartula, a little piece of paper. Cola trans chartam, filter through paper.

Cib., Cibus, food.

Circa, about. Circiter, about.

Cit., Citò, soon, quickly. Citissimè (the superlative degree), as quick as possible

Clausus, clausa, clausum, covered. Vase clauso, in a covered vessel.

Co., coch., Cochleare, a spoonful. Cochlearia, spoonfuls. Coch. magnum, amplum, a tablespoonful. Co. infantulorum, coch. medium, child's spoonful, a dessertspoonful. Co. parvum, a teaspoonful.

Coctio, a boiling. Sub. fin. coct., Sub finem coctionis, toward the end of the boiling; when almost boiled.

Cæruleus, blue. Charta cærulea, blue paper. Unguentum cæruleum, mercurial ointment.

Col., Cola (imperat. of Colo), strain, to filter.

Colatus, strained, filtered. Colato liquori, to the strained liquor.

Colatura, a straining, Colaturæ, to the strained liquor.

Coletur, let it be strained. Colentur, let them be strained.

Collum, a neck.

Comp., Compositus, compounded.

Conf., Confectio, confection.

Cons., Conserva, conserve (imperat.).

Consp., Conspergo, to sprinkle. Consp. pulv. cinnam., Conspergatur pulvere cinnamomi, sprinkle with (or roll in) powdered cinnamon; usually applied to pills.

Cont., Continuo, to continue. Cont. rem., Continuantur remedia, go on with the same medicines as last prescribed.

Contundo, to bruise. Contus., Contusus, bruised.

Contusio, a bruise, a contusion.

Coq., Coque, boil. Coque parùm, boil a little while.

Coquantur, let them be boiled.

Cor, the heart. Scrob. cord., Scrobiculus cordis, the pit of the stomach.

Cort., Cortex, the bark.

Coxa, Coxendix, the hip.

Cras, to-morrow. C. m., Cras mane, early to-morrow morning. C. M. S., cras mane sumendus, to be taken early to-morrow morning. C. V., Cras vespere, to-morrow evening. C. N., Cras nocte, to-morrow night.

Crastinus (adj.), of to-morrow. In usum crastinum, for to-morrow's use.

Cribrum, a sieve. Trans cribrum, through a sieve.

Cuj., Cujus, of which. Cuj. cap., or sum., Cujus capiat, or sumat, of which (the patient is to) take.

Cum, with.

Cyath., Cyathus, a cup. Cyath. vinar., Cyathus vinarius, a wineglass. Cyathus theæ, a teacupful. Cyatho theæ, in a cup of tea.

D. Dos., Dosis, a dose.

Da, give. Detur, dentur (plural), let be given.

De, of. De quo, or quâ, of which. De die, in a day.

Deauratus, gilt. Deaur. pil., Deaurentur pilulæ, let the pills be gilt.

Debilitas, weakness.

Debitus, due. Ad. deb. spiss. Ad. debitam spissitudinem, to a proper degree of thickness, as to consistence.

Decoct., Decoctio, decoction.

Dec., Decanta, pour off.

Decem, ten. Decimus, the tenth.

Decubitus, lying down. Horâ decubitûs, at bedtime.

Deglutio, to swallow. Deglutiatur, is swallowed—etur, let be swallowed.

Dein, deinde, then; afterward.

Dejectio, a depositing, or putting down, also a going to stool; as, post duas dejectiones alvi, after two motions.

Dejicio, to deposit. Donec alvus bis dejecerit, until the patient shall have had two stools.

Det., Detur, let it be given.

Dexter, the right. Manus dextra, the right hand. Auri dextro, to the right ear.

Dictus, spoken of, said.

Dies, a day. Die, in a day; bis die, twice a day. Diebus, in days; tertiis diebus, every third day. Alternis diebus, every alternate day. De d. in d., de die in diem, from day to day.

Dil., Dilutum, diluted.

Dim., Dimidium, the half. Dimidius, a, um (adjective), half.

D. P., Directione propria, with its proper direction.

Diu, a long time. Tere diu, rub for a long time.

Diut., Diuturnus, long-continued. Diuturnâ trituratione, D. trit., by long-continued rubbing, or grinding in the mortar. Diuturna coctione, by long boiling.

Div., Divido, divide.

Dolens, pained. Parti dolenti, to the pained part.

Dolor. pain. Dolores, pains. Doloris, of the pain.

Donec, until. Donec liquescat, till it melts. Donec alv. bis dej., Donec alvus bis dejecerit, until the bowels have been twice moved.

Dr., Drm., Drachma, a drachm.

Dum, whilst.

Dur. dol., Durante dolore, while the pain continues.

Eadem, eandem, the same. Eodem, in the same.

Effervescentia, the effervescence.

Effervescit, effervesces; donec effervescat, until it effervesces.

Effund., Effunde, pour out.

Ejusdem, of the same, the genitive case of idem.

Elect., Electuarium, an electuary.

Emp., Emplastrum, a plaster.

Enema, a clyster. Enemata, clysters.

Erit, shall be.

Evanesco, evanui, to disappear. Evan., Evanuerit, shall have disappeared.

Exhib., exhibe, Exhibeatur, give. Exhibendus, to be given.

Extendo, to extend, also to spread. Ext. sup. alut., Extende super alutam, spread it on leather.

Exten., Extensus, a, um, spread.

Ex., Ext., Extractum, an extract.

F., Ft., Fiat, let there be made.

Fac, make. Fac in pilulas xij, make into 12 pills.

Farina, flour. Farina seminis lini, linseed meal.

Febris, a fever. Febre durante, while the fever is on.

Femoribus, to the thighs. Femoribus internis, to the inner sides of the thighs.

Femur, a thigh.

Fervens, boiling. Fervidus, fervida, hot.

Ferventis, of boiling. ℞ aq. ferventis, take of boiling water.

Fiat, let be made, make (the singular number). Fiant, make (plural).

Filt., Filtra, filter.

Finis, the conclusion. Sub finem coctionis, when almost boiled enough.

Flo., Flors., Flores, flowers.

F., Fl., Fluidum. Fluid, liquid.

Fontana, fountain. Aqua fontana, spring water.

Formula, prescription.

Fotus, a fomentation.

Fruct., Fructus, fruit.

Frust., frustillatim, in small pieces.

Fuerit, shall have been; as, donec alvus soluta fuerit, until a motion is (or shall have been) procured.

Garg., Gargarisma, a gargle.

Gelatina, jelly. Gelatina ribesiorum, currant jelly. Gelatina quavis, in any sort of jelly.

Globulus, a little ball. Globuli Gascoigni, Gascoign's ball. Don. glob. evan., Donec globuli evanuerint, until the globules (of quicksilver) shall have totally disappeared (so that they can not be seen even with a microscope).

Grad., Gradatim, by slow degrees.

Gr., Grana, grains.

Gratus, grata, gratum, agreeable, pleasant. Ad gratum, aciditatem, so as to make it pleasantly acid without being too sour. In quovis grato vehiculo, in any agreeable vehicle.

Gutta, a drop. Gtt., Guttæ, drops. Guttas, drops.

Guttatim, drop by drop.

Hac, this. Hac nocte, this night. Hanc, this. Sumat hanc, let him take this.

Hactenus, hitherto, heretofore, up to the present day.

Harum, of these. Harum pilularum sumat tres, of these pills let him or her take 3.

Haust., Haustus, a draught.

H. P. N., Haustus purgans noster, a formula of purging draught made according to a practitioner's own private Pharmacopœia, and is prepared so as to keep a long time without spoiling, that we may not have the trouble of preparing it every time a draught is wanted. Mitt. H. P. N. ℥ij ad ij Vices C. M. S. Mitte Haustus purgantis nostri uncias duas ad duas Vices cras mane sumendus; send two ounces of our purging draught, to be taken to-morrow morning, at twice, that is, half at first, and the remaining half in an hour if the first does not operate.

Hebdomada, a week.

Heri, yesterday. Ut heri, as yesterday.

Hesternus, of yesterday. Hesterna nocte, last night.

Hirud., Hirudo, a leech. Hirudines, leeches.

His, in these, to these. His adde, add to these.

Hora, an hour. Horæ, of an hour. Horæ (plural), hours.

H. S. (horâ somni), at the hour of rest.

H. S. S. (horâ somni sumendus), to be taken at bedtime. Horâ decubitus, at the hour of going to rest, bedtime

Horâ vespertinâ, in the evening.

Horæ [illegible], horæ quadrante, quarter of an hour.

Horæ unius spatio, in the space of one hour.

Horis intermediis, at intermediate hours, when two medicines are to be taken. Horis intermediis, means that one is to be given exactly at midtime from the other (suppose a draught is ordered to be taken every six hours), and a powder horis intermediis, that is, every six hours intermediately, then a draught will be taken at six o'clock and at twelve and a powder at three and at nine.

Hujusmodi, of this sort, like these.

Idem, eadem, the same. Ejusdem, of the same, the genitive case of Idem.

Idoneus, proper, appropriate.

Imponatur (sing.), let there be put on—nantur (plural).

Impr., Imprimis, first.

In, in. In die, in a day.

Ind., Indiès (an adverb), every day, daily (from day to day).

Indicaverit, shows, indicates.

Infunde, infundatur, infuse.

Infus., Infusio, infusum, an infusion.

Infus. panis tostus, toast-bread water.

Inject., Injectio, injection.

Inter, between.

Injiciatur, let it be thrown in, thrown up. Injiciatur enema, let a clyster be administered.

Injiciendus, injiciendum, to be administered.

Inquietudo, restlessness. Urgente inquietudine, if restless.

Instar (an adverb), as big as. Sumat molem instar nucis moschatæ, the bigness of a nutmeg to be taken.

Intermedius, intermediate.

Internis, the inner side.

Jam, already. Jampridem, jamdudum, some time ago, heretofore.

Jugulum, the throat.

Jusculum, broth. Jusculum ovillum, mutton broth. Jus. bovinum, beef tea.

Juxta, near to.

Lac, milk. Lactis, of milk. Lacte, in milk.

Læv., Lævigatus, levigated.

Lana, flannel. Lana nova, new flannel.

Languor, faintness, lowness. In lang., In languoribus, in the fainting fits, when low and faint.

Latus, the side. Lateris, of the side. Lateri, to the side. Latus dolens, the pained side. Lateri dolenti, to the pained side.

Latus, lata, latum (adjective), broad.

Lectus, a bed. In lecto, in bed.

Liber, a book.

Libet (a verb impersonal), it pleases. Ad libitum, just as you please.

Libra, a pound. Libris, libras, pounds.

Linteum, lint; also linen.

Liquesco, to liquefy, to melt. Donec liquescat, till it melts.

Liquid., Liquidus, liquid. Sedes liquidæ, loose stools. In quovis liquido, in any liquid.

Liq., Liquor, liquor.

Londinensis, of London. Pharmacopœia Londinensis, the London Dispensatory.

Lot., Lotio, lotion.

Lumborum, of the loins.

Mac., Macera, macerate.

Mag., Magnus, magna, magnum, large. Magnum cochleare, a tablespoonful.

Major, greater, larger. Cochlearia duo majora, two tablespoonfuls.

Malleolus, the ankle. Malleolus internus, the inner ankle.

Manè, in the morning. Manè primo; valde manè, very early in the morning.

Manus, a hand. Manu calefacta, with a warm hand.

Mass., Massa, a mass. M. P., Massa pilularis, a mass fit for forming into pills.

Matutinus, in the morning or forenoon.

Maximè, chiefly.

Maximus, the greatest. Maximâ curâ. witn the greatest care.

Medioc., Mediocris, middle-sized. Pilulæ mediocres, middle-sized pills. Cochleare mediocre, a dessertspoonful, a papspoonful, or a child's spoonful. Mediocris also means indifferent, as to quality.

Medius, middle. Media nocte, in the middle of the night.

Melior, melius, better.

Mic. pan., Mica panis, crumb of bread.

Minatur, minaretur, threatens. Minante, threatening.

Minimus, very small. Coch. min., Cochleare minimum, a teaspoonful.

Minutum,* a minute.

M., Misce, mix. Bene misceatur, let it be well mixed.

Mist., Mistura, mixtura, a mixture.

Mitigatio, mitigation, alleviation. Donec doloris mitigatio sit, until the pain is easier.

Mitigatus, a, um, mitigated, lessened.

Mitt., Mittatur (singular), let it be sent. Mittantur (plural), let them be sent.

Mittatur sanguis, take blood away; *i. e.*, bleed the patient.

Mitte, send.

Modicus, middle-sized.

Modus, a manner. Modo præscripto, in the manner directed.

Moles, a mass, a lump, a piece. Sumat molem instar nucis moschatæ, let him (or her take the bigness or size of a nutmeg.

Molestus, troublesome. Molesto, to trouble, to be troublesome. Molestante dolore, when the pain is troublesome. Molestante tussi, when the cough is troublesome.

Mollis, molle, soft.

Mora, delay. Sine morâ, without delay.

---

*The word minutum, for a minute, is very barbarous Latin: we believe there is no such word: but the right Latin for a minute, Sexagesima pars horæ, is as long and tiresome to write as "Semivitreous oxide of lead," for the simple word "Litharge."—*Griffith.*

Mos, moris, manner. More solito, in the usual manner, also, in the same manner as I am in the habit of prescribing it to other people.

Morta., Mortarium, a mortar. Mortario aheneo, in the brass mortar. Mortario marmoreo, in the marble mortar. Mort. vitreo, in the glass mortar. Mort. lapideo, in the stone mortar.

Mucil., mucilago, mucilage.

Narthecium, a gallipot.

Nates, the buttocks.

Ne, lest, also, do not; as ne tradas sine nummo, N. T. S. N., do not deliver the medicine without the money.

Nec., necnon, also.

Ni, nisi, unless.

Nig., Niger, nigra, nigrum, black.

Nihil, nothing.

Nim., Nimis, nimium, too much.

Nisus, an endeavor, an attempt, a straining, a motion, a straining to vomit, or go to stool.

N., Nocte, at night. Noctes, nights. N. man., Nocte maneque, night and morning. Alt. noct., Alternis noctibus, every second night.

Nodulus, a little knot. Nodulo ligati, tied up in a piece of clean rag.

Nomen, nominis, a name. Signetur nomine proprio, S. N. P., write its common name upon the label.

Non., Nonus, the ninth.

Nov., novem, nine.

Novis., Novissimè, very lately, the last of all.

Novus, nova, novum, new.

Nucha, the nape of the neck. Nuchæ, to the nape.

Nuper, lately. Nuperrime, very lately.

N. M., Nux moschata, a nutmeg. Sumat magnitudinem nucis moschatæ, take the bigness of a nutmeg.

Numeri. Numbers.

1. or j. unus, una, unum, one.
unius, of one.
2. ij. duo, duæ, two.
duorum, of two.
duobus, in two, to two.
3. iij. tres, tria, three.
tribus, in three, to three.
trium, of three.
ter, three times.
4. iv. quatuor, four.
quartus, a, um, fourth.
quater, four times.
5. v. quinque, five.
quintus, fifth.
6. vj. sex, six.
sextus, sixth.
7. or vij. septem, seven.
septimus, seventh.
septimana, or
7 mana, a week.
8. viij. octo, eight.
octavus, eighth.
9. ix. novem, nine.
nonus, ninth.
10. x. decem, ten.
decimus, tenth.
11. xj. undecim, eleven.
12. xij. duodecim, twelve.
20. xx. viginti, twenty.
24. xxiv. viginti quatuor, twenty-four.

Obst., Obstante, hindering, preventing.

Occ., Occasio, occasion, opportunity.

O. Oct., Octarius, a pint.

Octavus, eighth. Octavo quaque horâ, every eighth hour.

Octo, eight.

Ol. Lini, S. I., Oleum lini sine igne, cold-drawn linseed oil.

O. O. O., Oleum olivæ optimum, best olive oil.

Olim, some time ago.

Olla, a pot, a gallipot.

Omnis, all. Omni mane, every morning. Omni horâ, every hour. Omni bihorio, every two hours. Omni nocte, every night. Omni ¼ horâ, Omni quadrante horâ, every quarter of an hour. Tere omnia, rub all together. Omn. alt. hor. omnibus alternis horis, every other hour.

Omninò, quite, wholly, entirely.

Optimè, very well, as well as possible.

Opt., Optimus, ma, mum, best.

Opus, need, occasion. Si opus sit, or fuerit, if it be necessary.

Ovil. jusc., Ovillum jusculum, mutton broth.

Ovum, an egg. Vitell. ovi, the yelk of an egg. Ovorum, of eggs.

Panis biscoctus, biscuit. Panis nauticus, sea biscuit. Panis tostus, toast bread. Infus. panis tostus, toast-bread water. Panis triticeus, wheat bread.

Pannus, a rag. Pannus linteus, a linen rag. Pannus laneus, Pannus è lanâ, a piece of flannel.

Paroxysmus, a paroxysm, a fit, a convulsion fit.

Pars, a part. Partes, parts. Parti dolenti, to the pained part.

Part. aff. Partem affectam, to the part affected.

P. Æ. Partes æquales, equal parts.

Partitus, parted. Part. vic., Partitis vicibus, means that you are not to give a medicine all at once, but divide the dose according to the directions most commonly previously given; for example, if a purging or emetic draught, half or a third (as the case may be) to be taken at first, and the other half or third at a certain distance of time, if the former quantity be not found sufficient to produce the desired effect.

Parum, a little. Parumper, a little.

Parv., Parvus, little. Coch. parv., Cochleare parvum, a teaspoonful.

Pauculum, pauxillum, paululum, a little.

Pect., Pectus, the breast. Pectoris, of the breast.

Pediluvium, a bath for the feet.

Pensus, weighed. Accuratè pensi, weighed exactly.

Per, by, or through.

Peractus, Perf., Perfectus, completed, perfected, quite done. gone through with; as, Peracta operatione emetici, after the emetic has quite done operating.

Perfric., Perfricetur, let it be rubbed. Perfricandus, to be rubbed.

Perg., Pergo, to go on with. Perg. in us. med., Pergat in usu medicinarum, he may continue the medicines as before.

Perpetuus, perpetual. Fiat perpetuum, keep it open (when it refers to a blister).

Ph., Pharmacopœia, a Pharmacopœia, or Dispensatory.

Ph. D., Pharmacopœia Dublinensis, Dublin Pharmacopœia.

Ph. E., Pharmacopœia Edinensis, Edinburgh Pharmacopœia.

Ph. L., Pharmacopœia Londinensis, London Pharmacopœia.

Ph. U. S., Pharmacopœia, United States Pharmacopœia, U. S. P.

Pil., Pilulæ, pills.

Pluvialis, also pluviatilis aqua, rain water.

Poculum, a cup.

Pollex, the thumb. Pollex pedis, the great toe.

Pomeridianus, postmeridianus, in the evening or afternoon, time of the day.

Pomum, an apple. Pomi, of an apple.

P. M., post meridiem, after noon, in the afternoon, after twelve o'clock at noon.

P. R. N., Pro re natà, occasionally, according as circumstances may occur, according as the symptoms may require.

Pond., Pondere, by weight.

Pone, behind.

Porro, moreover.

Post, after. Postea, tnen, afterward.

Post sing. sed. liq., Post singulas sedes liquidas, after every loose stool.

Postul., Postulet, postulent, may require, demand.

Pot., Potus, drink, beverage of any kind.

Præc., Præcipue, especially.

Præp., Præparatus, prepared. Pr., Preparatio, preparation, or prescription.

Præparo, to prepare. Præp., Præparentur, let them be prepared.

Prim., Primus, ma, mum, the first. Primò, first of all. Primo mane, very early in the morning.

Prior, prius, the former. the first.

Prius, Priusquam, before that.

Pro, for. Pro re natâ, P. R. N., occasionally, according to the nature of the case, etc. Pro ratione, according to, or in proportion to; as pro ratione ætatis, according to the age of the patient, pro. rat. æt.

Pro pot. ord., Pro potu ordinario, for a common drink.

Prop., Proprius, a, um, proper. S. N. P., Signetur nomine proprio, mark it with its proper direction.

Prox. luc., Proxima luce, the day before.

Pruritus, an itching. Pruriens, itching. Dolichos pruriens, cowhage.

Psora, the itch.

Pug., Pugillus, a handful; a pinch-dose.

Pulp., Pulpa, the pulp.

Pulv., Pulvis, a powder. Pulveres, powders. Pulveribus, in powders.

Pulvis subtilissimus, the very finest powder. Pulv. subt.

Pur., Purificatus, a, um, purified.

Pyx., Pyxis, pyxidis, a pill-box, or lozenge-box.

Quac., quacum, with which.

Quad., Quadrans, quadrantis, quadrante, quarter. Omni quadrante horá, every quarter of an hour.

Quadruplicata, four times as much.

Quamp., Quamprimum, as soon as possible, without the least delay.

Quâqua, every. Quaq., Quaque, every one. Quàvis (fem.), with any.

Quartus, a, um, the fourth.

Quater, four times. Quatuor, four. Quarta pars, a fourth part.

—que (at the end of any Latin word), and.

Quem, quam, quod, which (the accusative case).

Qui, quæ, quod, which (the nominative case).

Quib., Quibus, to which, with which.

Quibusdam, to or with some. Cum guttis quibusdam, with a few drops.

Quiescat, goes to rest, is easier.

Quilibet, quælibet, quodlibet, gen. Cujuslibet, abl. Quolibet, any.

Quinq., Quinque, five. Quintus, a, um, the fifth. Quinquies, five times.

Quinquina (cinchona), Peruvian bark.

Quisq., Quisque, every one.

Q. P., Quantem plácet, as much as you please.

Q. Q. H., Quaque quarta hora, every four hours; or Quadrihoris.

Q. S. q. s., Quantum sufficiat, as much as may be sufficient.

Quor., Quorum, quarum, of which. Quos, quas, which. Quocum, quacum, with whic

Quovis, with any.

Rad., Radix, the root.

Ras., Rasuræ, shavings.

Ratio, a reason, also a proportion. Pro ratione ætatis, according to the age of the patient. Pro ratione doloris, according to the urgency of the pain.

Raucedo, hoarseness.

Recipe, take. Recipe (taken substantively), a prescription.

Red., Redactus, a, um, reduced. Red. in pulv., Redactus in pulverem, reduced to powder; or, in pulv. redact.

Red., Redigatur, let it be reduced. Redig. in pulv., Redigatur in pulverem, let it be reduced to powder.

Redigo, to reduce. Red., Redige, reduce. Redigatur, it may be reduced.

Refr., Refrixerit, the subjunctive perfect of refrigesco, to cool.

Regio, a region (an anatomical term for certain parts of the body); as, regio epigastrica, the epigastric region; regio lumborum, the region of the loins; appl. emplastr. regioni umbilicali, applicetur emplastrum, etc., let a plaster be applied to the umbilical region, or parts in the neighborhood of the navel. Reg. hep., Regio hepatis, region of the liver.

Reliq., Reliquus, a, um, the rest, the remaining part.

Rem., Remedium, a remedy. Cont. rem., Continuantur remedia, go on with the same remedies as before.

Repet., Repetatur, let it be repeated, repeat.

Repet., Repetendus, to be repeated.

Resp., Respondeo, responderit, shall have answered. Donec alvus ad sedes ij vel iij responderit, until two or three stools shall have been procured.

Retin., Retinendus, to be retained or kept.

Ribes, currants. Gelatina ribesiorum, currant jelly.

Ruber, rubra, rubrum, red.

Rubus idæus, raspberry.

S., Signa, write.

S. V. R., spiritus vini (or vinosus) rectificatus, rectified spirit of wine, alcohol.

S. V., Ten., or tenuis, proof-spirit.

Sacch. alb., Saccharum album, white sugar.

Sæpe, often; sæpius, oftener; sæpisme, very often.

Sal., Salt.

Salt., Saltem, at least.

Sang., Sanguis, blood,—inis, of blood. Sang. miss., Sanguinis missura, bloodletting.

Saph. ven., Saphena vena, the ankle vein.

Scapula, the shoulder blade. Inter scapulas, betweeen the shoulders.

Scil., Scilicet, to wit, namely.

Scrob. cord., Scrobiculus cordis, the pit of the stomach.

Sec., Secundus, a, um (adjective), second.

S. A., Secundum artem, according to art; that is, you are to use your own ingenuity to do it in the most proper and scientific way.

Sed, but.

Sedes, a stool—plural, stools.

Semel, once.

Sem., Semen, seed. Semina, seeds.

Ss., semis, Semi-, half. Semihora, half an hour. Semidrachma, half a drachm.

Semper, always.

Septem, seven.

Sept., Septimana, a week, seven days. Septimus, seventh.

Seq., Sequens, following. Seq. luce, sequens luce, the following day.

Serum is also the watery part of the blood which separates from the red part, or crassamentum, on standing until cold.

Serum lactis, whey. In sero lactis vinoso, in wine whey.

Serv., serva, keep or preserve.

Sesq., Sesqui, one and a half; as sesqhr., sesquihora, an hour and a half. Sesquiuncia, or sescuncia, an ounce and a half. Sesquidrachma, a drachm and a half. Remember well to attend to the difference between semi and sesqui, for many young men, by not knowing that sesqui means one and a half, but confounding it with semi, have made bad mistakes.

Sex, six. Sextus, sixth.

Si, if. Sive, or, whether.

Si N. V., Si non valet, if it does not answer.

S. O. S., Si op. sit, Si opus sit, if there be occasion.

Si V. P., Si vir. perm., Si vires permittant, if the strength allow.

Signatura, a label or direction.

Sig., Signetur, let it be marked, directed, written upon.

S. N. P., Signetur nomine proprio, mark it with the name it is usually known by.

Simul, together; as, terantur simul, let them be rubbed together. Simul ac, at the same time that.

Sine, without. Sine morâ, without delay.

Singultus, hiccup.

Singulus, a, um, each; in singulis, in each; Sing., singulorum, of each.

Sin., Sinister, tra, trum, the left. Aur. sin., Auri sinistro, to the left ear.

Sitis, thirst; si sitiat, if thirsty.

Soli., Solitus, accustomed.

Solus, alone, only.

Solutus, a, um, dissolved, also loosened; donec alvus soluta fuerit, until a stool is procured. Solu., Solutio, solution.

Solve, dissolve.

Som., Somnus, sleep. Hora somni, at bedtime.

Spina, the spine, the backbone; also, a thorn.

Spt., Spiritus, spirit. Spt. rect., Spiritus rectificatus, rectified spirits, alcohol.

Spissus, thick. Spissitudo, consistence of thickness.

Sq., Squama, æ, a scale.

Statim, directly, immediately.

St., Stent, let them stand. St., Stet, let it stand.

Sternutatorius pulvis, sneezing powder, snuff.

Stupa, tow.

Sub, subter, under. Sub fin. coct., Sub finem coctionis, when the boiling is almost finished. Sub prefixed to a word, implies diminution, or a process not completed; also, in many words has the same signification as the termination ish in English words, as subniger, blackish, not quite black; subtepidus, lukewarm. The same meaning prevails when applied to terms of chemistry, as subcarbonas, subsulphas, etc.

Subactus, a, um, subdued, dissolved.

Subige, dissolve it, make it unite. Subdue quicksilver with lard or balsam of sulphur.

Subinde, frequently, now and then.

Subitus, a, um, Subitaneus, sudden. Subito (adverb), suddenly.

Subtep., Subtepidus, a little warm, lukewarm.

Subt., Subtilis, subtle, reduced to fine powder. Pulv. subtilissimus, the very finest powder.

Succ., Succus, juice.

Succ. pom. ferment., Succus pomi fermentatus, cider.

Sudor, sweet.

Sumat, let him take. Sum., Sumatur, sumantur, let it (them) be taken, take. Sum., Sumendus, to be taken.

Sum. tal., Sumat talem, let the patient take one like this.

Superbibo, to drink after taking anything; as, chamomile tea or warm water after an emetic; or a cup of water, or any liquid medicine, to wash down a dose of any sort of pills.

Superinfundo, to pour upon.

Supra, above. Supradictus, above mentioned.

Syncope, a fainting fit.

Syr., Syrupus, syrup.

Tabel., Tabellæ, tabulæ, lozenges.

Tactus, the touch.

Tænia, the tapeworm.

Talis, such. Sumat talem, let him take such a one as this.

Talus, the ankle.

Tam, so. Tamen, yet.

Temperies, temperamentum, temperament, degree of heat.

Tempora, the temples. Temporibus, to the temples. Temp. dext., Tempori dextro, to the right temple. Tempori sinistro, to the left temple.

Tempus, temporis, time.

Tenacitus, tenacity. Ad debitam tenacitatem, to a proper degree of tenacity or consistence.

Teneo, to hold. Tenendus, to be held.

Tenuis, weak, thin, small, slender.

Tepef., Tepefactus, warmed, made warm.

Ter, three times, thrice. Ter quaterve, three or four times.

Teres, teretis, round, taper; also, teres is a name for the long and round worm infesting the human body, viz., vermis teres.

Tergum, the back. A tergo, behind.

Tero, to rub. Tere (imperative), rub. Terendus, to be rubbed. Terantur, let them be rubbed.

Tertius, tertia, tertium, the third.

Testacea, the prepared powders made of oyster shells, egg shells, crabs' claws, etc.

Thorax, the chest. Thoracis, of the chest.

Thus, frankincense.

Tinea capitis, scald head.

Torref., Torrefactus, toasted.

Tres, tria, three; tribus, in three, to three.

Triduum, three days.

Trituratio, a grinding. Trituratus, triturated, ground. Tritus, ground. Trituratur exactissime minutes decem, Trit. ex. min. dec., T. E. M. D., let it be triturated exactly ten minutes. Trituratur intime commisceantur, Trit. int. com., triturate intimately or accurately together. Trit., Tritura, triturate.

T. O., Tinctura Opii, what is commonly called Laudanum.

T. O. C., Tinctura Opii Camphorata, Camphorated Tincture of Opium, formerly called Paregoric Elixir. This tincture is also called (since the London Pharmacopœia, edit. 1809) Tinctura Camphoræ Composita.

Trans, through. Cola trans chartam, filter through filtering paper.

Tussis, a cough. Tuss. mol., Tussi molestante, when the cough is troublesome.

Ultimus, ultima, um, the last. Ult. pr., Ultimó præscriptus, which was last prescribed.

Umbilicus, the navel.

Unà (an adverb), together.

Uncia, an ounce. Unciam cum semisse, an ounce and a half (accus.).

Undecim, eleven.

Unus, una, unum, one. Unius, of one. Uni, to one.

Urg. tuss., Urgente tussi, when the cough is troublesome.

Urgeo, to urge, to oppress, to be troublesome, or painful.

Usque ad, up to, as far as.

Usus, use. Pergat in usu remediorum, continue the use of the medicine as before.

Ut, as, that, so that; in the same manner as.

Utatur, let him make use of.

Utend., Utendus, to be used.

Uterque, utraque, utrumque, both. Utriusque, of both. Utrique, to both, to either. Admoveantur hirudines ij tempori utrique, apply two leeches to each temple.

Utriuslibet, of whichever of the two, or more, the patient likes best.

Vacc., Vaccinatio, the act of inoculating for the cowpock.

Vaccinum lac, cow's milk.

Valde, very, very much.

Valeo, to avail; si non valeat, if it does not answer.

Varicella, the chicken-pox.

Variolæ, the smallpox.

Variolæ vaccinæ, the cowpock.

Vas, a vessel. Vasis, of a vessel. Vase clauso, in a covered vessel. Agitato vase, shaking the vessel. Vas vit., vas vitreum, a glass vessel.

Ve, vel, or, either; —ve is never at the beginning but the end of a word.

Vehiculum, a vehicle; that is, whatever liquid, or any other eatable or drinkable we take a medicine in, as barley water, whey, jelly, or panada, etc.

Vena, vein. Vena saphena, the ankle vein.

Venæsectio, bleeding. Fiat venæsectio, bleed him.

Vent., Ventriculus, the stomach.

Vertebræ, the joints of the neck, back or loins; the vertebræ altogether form that column of bones which is called the spine.

Verus, true, real, genuine.

V. S., Venæs., venæsectio, bloodletting.

V. S. B., Venæsectio brachii, bleeding in the arm. Fiat venæsectio in venâ saphena, bleed the patient in the ankle vein; or it may be understood, to bleed wherever you can find the best vein, at the top of the foot, to get blood from.

Vesp., Vespere, in the evening.

Vespertinus, in the evening; as, horâ VI^{a}, vespertina, at six o'clock in the evening.

Vice, in the room of. Vices, turns. Ad duas vices sumendus, to be taken at twice; that is, half to be taken at first, and the other half in some time after. Ad secundam vicem, for the second time.

Vicibus partitis. See Partitus, in P.

Viginti, twenty. Vicesimus, vigesimus, the twentieth.

Vinosus, vinarius, of wine. Cyathus vinarius, a wineglass.

Vires, strength. Si vires permittant, if the strength will bear it.

Vitellus, the yelk of an egg.

V. O. S., Vitello Ovi Solutum, dissolved in the yelk of an egg.

Vitrum, a glass. Vitreus, made of glass.

Vix, scarcely, hardly. Ut vix sentiatur, so that it can scarcely be perceivable.

Vomitio, a vomiting. Vomitione urgente, when the vomiting is troublesome.

Vultus, the countenance.

COMPARISON

OF THE

DIFFERENT THERMOMETRIC SCALES.

The thermometer used in this country is usually that of Fahrenheit. In this instrument the range between the freezing and boiling points of water is divided into 180°, and as the greatest possible degree of cold was supposed to be that produced by mixing snow and salt together, it was made the zero. Hence, the freezing point became 32°, and the boiling point 212°.

The Centigrade thermometer places the zero at the freezing point of water, and divides the range between the freezing and boiling points into 100°. This scale has long been used in Sweden, under the title of Celsius's thermometer, and is generally adopted on the continent.

Réaumur's thermometer, which was formerly used in France, divides the space between the freezing and boiling points of water into 80°, and places the zero at the freezing point. It is now little employed.

Le Lisle's thermometer is used in Russia. The graduation begins at the boiling point, and increases toward the freezing point. The boiling point is marked 0°, and the freezing point 150°.

To convert the degrees of Centigrade into those of Fahrenheit, multiply by 9, divide by 5, and add 32.

To convert the degrees of Centigrade into those of Réaumur, multiply by 4, and divide by 5.

To convert the degrees of Fahrenheit into those of Centigrade, deduct 32, multiply by 5, and divide by 9.

To convert the degrees of Fahrenheit into those of Réaumur, deduct 32, divide by 9, and multiply by 4.

To convert the degrees of Réaumur into those of Centigrade, multiply by 5, and divide by 4.

To convert the degrees of Réaumur into those of Fahrenheit, multiply by 9, divide by 4, and add 32.

EXAMPLES:

$$20^\circ\text{ C.}=\frac{20\times 9}{5}+32=68^\circ\text{ F.}$$

$$20^\circ\text{ C.}=\frac{20\times 4}{5}=16^\circ\text{ R.}$$

$$-14^\circ\text{ C.}=\frac{(-14)\times 9}{5}+32=\frac{-126}{5}+32=+6\tfrac{4}{5}^\circ\text{ F.}$$

$$-24^\circ\text{ R.}=\frac{(-24)\times 5}{4}=\frac{-120}{4}=-30^\circ\text{ C.}$$

$$275^\circ\text{ F.}=\frac{275-32}{9}\times 5=27\times 5=135^\circ\text{ C.}$$

$$-26^\circ\text{ F.}=\frac{-26-32}{9}\times 5=\frac{-58}{9}\times 5=-32\tfrac{2}{9}^\circ\text{ C., etc.}$$

TABLES OF WEIGHTS AND MEASURES.

"All weights and measures used in this country are now derived from the United States National Prototype Standards of the Meter and the Kilogramme, made of platinum-iridium, received by the United States Government from The International Bureau of Weights and Measures in 1890, and placed in the custody of the Office of Standard Weights and Measures at Washington. The value of the

United States National Prototype Standard Meter is identical with that of the International Standard Meter derived from the Mètre des Archives; and the United States National Prototype Standard Kilogramme, like the International Standard Kilogramme, is derived from the Kilogramme des Archives" —(*U. S. P.*).

"The actual liter is the volume of one kilogramme of pure water at the temperature of its maximum density, *in vacuo*. Theoretically the liter is equal to one cubic decimeter, or 1000 cubic centimeters. The United States *yard* is defined to be equal to $\frac{360000}{393700}$ meter; the commercial *pound* (Avoirdupois) is defined as being equal to $\frac{700000000}{1543235639}$ kilogramme; and the liquid *gallon* is the volume of 3785.434 grammes (58418.1444 grains) of water at the temperature of its maximum density, weighed *in vacuo**" —(*U. S. P.*).

"The weights and measures *referred to by physicians in prescribing, and used by pharmacists in dispensing medicines*, are, in the United States, the Apothecaries' Weights and Fluid Measures, and those of the Metric System."

"The Apothecaries' Weights and Fluid Measures used in the United States are the same as those used in England prior to 1825, the weights being originally derived from the Old English Troy Weight, and the Fluid Measures from the Wine Measure" —(*U. S. P.*).

"The Apothecaries' grain is identical in value with the Troy grain, the American commercial grain, and the grain of the British Imperial System"— (*U. S. P.*).

All merchandise sold by weight, except the precious metals and precious stones, is now bought and sold by Avoirdupois weight in all English-speaking countries. Precious metals and jewelry are sold by Troy weight; the latter is also in use in the British and United States Mints. Avoirdupois weight is also called Imperial weight in Great Britain. The term "pound," used in the present *Dispensatory*, refers to "avoirdupois," unless stated otherwise. O. Oldberg's *Manual of Weights and Measures*, 2d ed., 1887, Chicago, was freely consulted in the compilation of the subjoined tables; however, the figures below given are revised, as far as possible, according to the standards laid down in the *U. S. P.*, 1890, and the *Br. Pharm.*, 1898.

TROY WEIGHT.

Pound	Ounces.	Pennyweights.	Grains.	Grammes.	
1	12	240	5760	373.241664	0.822856 pound (av.).
	1	20	480	31.103472	1.097143 ounces (av.).
		1	24	1.5551736	24 grains (av.).
			1	0.0647989	1 grain (av.).

APOTHECARIES' WEIGHT.

Differs from the Troy System by the adoption of drachms and scruples, and the nonrecognition of pennyweights.

Pound.	Ounces.	Drachms.	Scruples.	Grains.	Grammes.	
℔ 1	12	96	288	5760	373.241664	0.822856 lb. (av.)=1 lb. (troy).
	℥ 1	8	24	480	31.103472	1.097143 ozs. (av.) = 1 oz. (troy).
		ʒ 1	3	60	3.887934	2.194286 drachms (av.).
			℈ 1	20	1.295978	20 grains (av.).
				gr 1	0.0647989	1 grain (av.) = 1 grain (troy).

AVOIRDUPOIS WEIGHT.

Ton	Hundredweights.	Stones.	Pounds (av.).	Ounces.	Drachms.	Grains.	Grammes.	
1	20	160	2240					
	1	8	112					
		1	14					
			1	16	256	7000	453.5924277	1.215278 lb. (troy).
				1	16	437.5	28.349527	0.911458 oz. (troy).
					1	27.34375	1.771845	1.13932 dwt. (troy).
						1	0.0647989	1 grain (troy).

---

* While the liquid gallon of the United States is designed to be a volume of 231 cubic inches, it is determined or adjusted by weight on the assumption that 252.892 grains of water, at its maximum density, weighed *in vacuo*, measure one cubic inch. If the theoretical kilogramme (the weight of one cubic decimeter of water at its maximum density, *in vacuo*) and the actual International Standard Kilogramme (the equivalent of which in terms of English weight is 15432.35639 grains) are identical values, then, as 39.370 inches equal one meter, the weight of a cubic inch of water at its maximum density, *in vacuo*, is 252.892 grains, and from this value the weight of 231 cubic inches of water at its maximum density, *in vacuo*, is found. These values are those employed by the Office of Standard Weights and Measures of the United States" —(*U. S. P.*).

WINE MEASURE, APOTHECARIES', OR U. S. LIQUID MEASURE.

Is now used in the United States exclusively.

Gallon.	Quarts	Pints.	Gills.	U. S. Fluid ounces.	U. S. Fluid drachms.	Minims.	Corresponding weight of water at 4° C. in grains.	Cubic inches.	Cubic centimeters.	Imperial measure.
1	4	8	32	128	1024	61440	58418.1444	231	3785.434	0.83321 gal.
	1	2	8	32	256	15360	14604.5361	57.750	946.3585	0.83321 qt.
		1	4	16	128	7680	7302.268	28.875	473.17925	0.83321 pt.
			1	4	32	1920	1825.567	7.21875	118.2948	0.83321 gill.
				1	8	480	456.392	1.8047	29.5737	1.04151 fl. ozs.
					1	60	57.0489	0.2256	3.696	1.04151 fl. drs.
						1	0.9508	0.00376	0.0616	1.04151 mins.
								1	16.387	

IMPERIAL MEASURES AND WEIGHTS.

The fluid measures of this system are not used in the United States; the weights are Avoirdupois.

Bushel.	Pecks.	Gallons	Pottles.	Quarts.	Pints.	Gills.	Fluid ounces.	Fluid drachms.	Minims.	Cubic inches.	Metric.	Corresponding weight of water at 16⅔° C. (62° F.).	U. S. Liquid measure.
1	4	8	16	32	64	256	1280	10240	614400	2217.920	36.3677048 liters.		
	1	2	4	8	16	64	320	2560	153600	554.480	9.0919262 liters.		
		1	2	4	8	32	160	1280	76800	277.240*	4.5459631 liters	10 lbs.(av.) = 70000 grs.	1.200175 gals.
				1	2	8	40	320	19200	69.310	1.136491 liters	2.5 lbs.(av.) = 17500 grs.	1.200175 qts.
					1	4	20	160	9600	34.655	0.568245 liter	1.25 lbs.(av.) = 8750 grs.	1.200175 pts.
							1	8	480	1.73275	0.0284123 liter	1 ounce (av.) = 437.5 grs.	0.960140 fl. oz.
									109.7143 (or 110 ♏)	....	....	= 100 grs.	
								1	60	0.2165	0.003552 liter	54.6875 grs.	0.960140 fl. dr.
									1	0.00361	0.000059 liter	0.91 gr.	0.960140 min.

---

*See O. Oldberg (*loc. cit.*), foot-notes, on pages 87 and 90.

OLD DRY, OR WINCHESTER MEASURE.

Was used in England prior to 1826; still in use in the United States.

Bushel.	Pecks	Gallons.	Quarts.	Pints.	Cubic Inches.	Liters
1	4	8	32	64	2150.42	35.24
	1	2	8	16		
		1	4	8	268.8	4.405

ENGLISH MEASURES OF LENGTHS.

League.	Miles.	Furlongs.	Poles or Rods	Yards.	Meters.
1	3	24	960	5280	4828.04256
	1	8	320	1760	1609.34752
		1	40	220	201.16844
			1	5½	5.029211

Yard.	Feet.	Inches.	Lines.	Meters.
1	3	36	432	0.914402
	1	12	144	0.304801, or 30.4801 centimeters.
		1	12	0.02540, or 25.40 millimeters.
			1	2.11666 millimeters.

METRIC LENGTHS, LIQUID MEASURES, AND WEIGHTS.

Kilometer.	Hektometers.	Dekameters.	Meters.	Yards.	
1	10	100	1000	1093.611	0.6214 mile.
	1	10	100		
		1	10		

Meter.	Decimeters.	Centimeters.	Milli-meters.	Yards.	Feet.	Inches.
1	10	100	1000	1.093611	3.280833	39.3700
	1	10	100	0.1093611	0.3280833	3.93700
		1	10	0.01093611	0.03280833	0.393700
Milli-meter.			**Micromilli-meters.**			
1			1000	0.001093611	0.003280833	0.0393700
			1			0.00003937

Kiloliter, or Cubic meter.	Hekto-liters.	Deka-liters.	Liters, or Cubic decimeters.	Cubic yards.	Cubic feet.	Cubic inches.	Wine gallons.	Imp. gallons.
1	10	100	1000	1.3081576	35.320255	61033.40	264.17	220.0
	1	10	100					
		1	10					

Liter, or Cubic decimeter.	Deci-liters.	Centi-liters.	Milliliters, or Cubic centimeters.				
1	10	100	1000	Volume of 1 Kg. of water at 4° C.	61.0334	0.264	0.220
	1	10	100				
		1	10				
			1		0.0610334	16.231 (Min. U. S.)	16.95 (Min. Imp.)

Kilogramme.	Pounds (Metric).	Hekto-grammes.	Deka-grammes.	Grammes.	Pounds (av.).	Pounds (troy).
1	2	10	100	1000	2.20462	2.679226
	1			500	1.10231	1.339613
		1	10	100		
			1	10		

Gramme.	Deci-grammes.	Centi-grammes.	Milli-grammes.	
1	10	100	1000	15.43235639 grains (av. and troy).
	1	10	100	
		1	10	

(For detailed tables, giving the equivalents of Metric weights and measures [from 1000 Gm. and Cc. downward], with the Avoirdupois and Troy systems, see *U. S. P.*, 1890.)

By means of the foregoing tables, the measures and weights of one system may be converted into their equivalents in other systems. Each table contains the factor necessary in calculating the conversion—for example, to convert Troy ounces into Avoirdupois ounces, multiply by 1.097143, or, approximately, add one-tenth.

To convert Imperial fluid ounces, fluid drachms, and minims, approximately. into the corresponding Wine (U. S.) measures, deduct 4 per cent; in the reversed case, add 4 per cent.

To convert grains, approximately, into grammes, multiply by 0.065; or divide by 15.4; more precisely, multiply by 0.0647989 (see table). To convert grammes, approximately, into grains, multiply by 15.4.

To convert inches, approximately, into millimeters, multiply by 25; or, more precisely, by 25.39977 (see table); to convert millimeters into inches, divide by this number.

The following is a brief abstract of the foregoing tables:

1 grain (troy)	=	1	grain (av.)	=	0.0648	gramme =64.8 milligrammes.
1 ounce (troy)	=	480	grains	=	31.1	grammes.
1 ounce (av.)	=	437.5	grains	=	28.35	grammes.
1 pound (troy)	=	7000	grains	=	373.24	grammes.
1 pound (av.)	=	5760	grains	=	453.59	grammes.
1 gallon (U. S.)	=	231	cubic in.	=	3.785	liters.
1 gallon (Imp.)	=	277.2	cubic in.	=	10 lbs. (av.) = 70000 grs. = 4.543 liters.	
1 fluid ounce (U. S.)	=	480	minims (U.S.)	=	29.574	cubic centimeters.
1 fluid ounce (Imp.)	=	480	minims (Imp.)	=	28.41	cubic centimeters.
1 foot	=	12	inches	=	30.48	centimeters.
1 inch	=	12	lines	=	25.4	millimeters.
1 liter	=	0.264	gallon (U.S.)	=	0.220	gallon (Imp.).
1 gramme	=	15.43	grains.			
1 kilogramme	=	2	pounds (Met.)	=	1000	grammes = 2.20 pounds (av.).
1 pound (Metric)	=	500	grammes	=	1.10	pounds (av.).

APPROXIMATE MEASUREMENTS.

A teacup contains about 3½ or 4 fluid ounces; a wineglass contains about 1½ or 2 fluid ounces; a tablespoon about 3½ or 4 fluid drachms; and a teaspoon about 50 minims or 1 fluid drachm. But these are very uncertain methods of measuring, especially where accuracy is required.

Drops are frequently supposed to be equal to minims, but this is not the case; 1 drop of some fluid substances will exceed 1 minim, while that of others will fall considerably below it. The same fluid may vary in the size of its drops, according to the size or form of the edge of the vessel from which it is dropped.

TABLE OF PROPORTIONATE DOSES

AT DIFFERENT AGES.

(GAUBIUS' TABLE.)

			Examples.	
Under ½ year	1-15th	of a full dose,	or 4	grains.
Under 1 year	1-12th	of a full dose,	or 5	grains.
Under 2 years.	1-8th	of a full dose,	or 7½	grains.
Under 3 years	1-6th	of a full dose,	or 10	grains.
Under 4 years	1-5th	of a full dose,	or 12	grains.
Under 7 years	1-3d	of a full dose,	or 20	grains.
Under 14 years	1-half	of a full dose,	or 30	grains.
Under 20 years	2-3ds	of a full dose,	or 40	grains.
Under 21 years	the full dose,		or 1	drachm.
Under 63 years	11-12ths	of a full dose,	or 55	grains.
Under 77 years	5-6ths	of a full dose,	or 50	grains.
Under 100 years	2-3ds	of a full dose,	or 40	grains.

The following is the more simple rule of Dr. Young:

"For children under 12 years, the dose of most medicines must be diminished in the proportion of the age to the age increased by 12. Thus, at 2 years, the dose will be $\frac{1}{7}$ of that for adults, viz: $\frac{2}{2+12}=\frac{1}{7}$. At 21 the full dose may be given."

To the above rule there are certain exceptions; thus castor oil requires to be given in larger proportionate doses, while opium and narcotics generally should be administered in smaller proportionate quantities.

Sex, temperament, and *idiosyncrasy* have also a modifying effect upon the dose, and they should always be kept in view in the administration of medicines. Females usually require smaller doses than males; and persons of sanguine temperament bear depletory medicines better than the phlegmatic.

TO DIVIDE MEDICINES INTO FRACTIONS OF A GRAIN.

1. Divide 1 grain of strychnine into doses of $\frac{16}{25}$ each.

Take of starch (or other inert or insoluble powder), 24 grains; strychnine, 1 grain; mix, and triturate thoroughly together, and then weigh out 16 grains of the mixture, which will be equal to $\frac{16}{25}$ grain of strychnine. Or, for a solution, take of distilled water, 49 minims; nitric or phosphoric acid, 1 minim; strychnine, 1 grain. Mix. When the strychnine is dissolved, 32 minims of the solution will be equal to $\frac{32}{50}$ or $\frac{16}{25}$ grain of the alkaloid.

2. Required a dose of an alkaloid, $\frac{8}{15}$ grain.

Take of starch (or other inert powder), 14 grains; of the alkaloid, 1 grain; mix, and triturate thoroughly together. Eight grains of the mixture will equal $\frac{8}{15}$ grain of the alkaloid. Or, for a tincture, take of alcohol, 30 minims; of the alkaloid, 1 grain; mix, and dissolve the alkaloid. Sixteen minims of the solution will be equal to $\frac{16}{30}$ of $\frac{8}{15}$ grain of the alkaloid. Or, for a solution, take of distilled water, 150 minims; of the alkaloid, 1 grain. Mix. Eighty minims of this solution is equal to $\frac{80}{150}$ or $\frac{8}{15}$ grain of the solution.

3. Required $\frac{7}{16}$ grain of chloride of gold and soda to add to 1 fluid ounce of water.

Take of chloride of gold and sodium, 1 grain; starch (or finely-powdered pumice stone, sand, or emery, etc.), 15 grains; mix, triturate well together, and then weigh out 7 grains, equal to $\frac{7}{16}$ of the gold salt, and add it to the water, which will dissolve this salt, but not the emery, or pumice, etc.

N. B.—The balance of the triturated medicine, not employed, should be kept for future use in a small vial, with the proportions of medicine and inert powder labeled upon it. In all cases where solutions or tinctures are to be made, and it is not desirable to have other matters to enter therein, triturate with some insoluble material, and when the solution is made, filter. Powdered emery, pumice-stone, sand, etc., may be used when the article is to be dissolved in water; and if in alcohol or ether, powdered starch, gum Arabic, tragacanth, or sugar of milk, etc.

4. Dissolve $10\frac{4}{15}$ grains of atropine in 1 pint of alcohol.

First, weigh out 10 grains of atropine and add it to the alcohol.

Second, triturate 1 grain of atropine with 14 grains of powdered pumice stone, and of this mixture add 4 grains to the alcohol, making $10\frac{4}{15}$ grains of atropine that have been added to the fluid. Filter, if required.

TABLE FOR DETERMINING WHAT QUANTITY OF MEDICINE, AT A GIVEN DOSE, IS REQUIRED TO ENTER INTO THE FORMATION OF A DEFINITE NUMBER OF PILLS OR POWDERS.

NUMBER OF PILLS OR POWDERS REQUIRED.

SIZE OF DOSE.	8		10		12		15		16		18		20		24		25		30		36		40		48		50		60		80		90		100	
Grains.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.
1/60		2/15		1/6		1/5		1/4		4/15		3/10		1/3		2/5		5/12		1/2		3/5		2/3		4/5		5/6		1		1 1/3		1 1/2		1 2/3
1/50		4/25		1/5		6/25		3/10		8/25		9/25		2/5		12/25		1/2		3/5		18/25		4/5		24/25		1		1 1/5		1 3/5		1 4/5		2
1/40		1/5		1/4		3/10		3/8		2/5		9/20		1/2		3/5		5/8		3/4		9/10		1		1 1/5		1 1/4		1 1/2		2		2 1/4		2 1/2
1/30		4/15		1/3		2/5		1/2		8/15		3/5		2/3		4/5		5/6		1		1 1/5		1 1/3		1 3/5		1 2/3		2		2 2/3		3		3 1/3
1/25		8/25		2/5		12/25		3/5		16/25		18/25		4/5		24/25		1		1 1/5		1 11/25		1 3/5		1 23/25		2		2 2/5		3 1/5		3 3/5		4
1/20		2/5		1/2		3/5		3/4		4/5		9/10		1		1 1/5		1 1/4		1 1/2		1 4/5		2		2 2/5		2 1/2		3		4		4 1/2		5
1/16		1/2		5/8		3/4		15/16		1		1 1/8		1 1/4		1 1/2		1 9/16		1 7/8		1 7/8		2 1/2		3		3 1/8		3 3/4		5		5 5/8		6 1/4
1/15		8/15		2/3		4/5		1		1 1/15		1 1/5		1 1/3		1 3/5		1 2/3		2		2 2/5		2 2/3		3 1/5		3 1/3		4		5 1/3		6		6 2/3
1/12		2/3		5/6		1		1 1/4		1 1/3		1 1/2		1 2/3		2		2 1/12		2 1/2		2 1/2		3 1/3		4		4 1/6		5		6 2/3		7 1/2		8 1/3
1/10		4/5		1		1 1/5		1 1/2		1 3/5		1 4/5		2		2 2/5		2 1/2		3		3 3/5		4		4 4/5		5		6		8		9		10
1/8		1		1 1/4		1 1/2		1 7/8		2		2 1/4		2 1/2		3		3 1/8		3 3/4		4 1/2		5		6		6 1/4		7 1/2		10		11 1/4		12 1/2
1/6		1 1/3		1 2/3		2		2 1/2		2 2/3		3		3 1/3		4		4 1/6		5		6		6 2/3		8		8 1/3		10		13 1/3		15		16 2/3
1/5		1 3/5		2		2 2/5		3		3 1/5		3 3/5		4		4 4/5		5		6		7 1/5		8		9 3/5		10		12		16		18		20
1/4		2		2 1/2		3		3 3/4		4		4 1/2		5		6		6 1/4		7 1/2		9		10		12		12 1/2		15		20		22 1/2		25
1/3		2 2/3		3 1/3		4		5		5 1/3		6		6 2/3		8		8 1/3		10		12		13 1/3		16		16 2/3		20		26 2/3		30		33 1/3
2/5		3 1/5		4		4 4/5		6		6 2/5		7 1/5		8		9 3/5		10		12		14 2/5		16		19 1/5		20		24		32		36		40
1/2		4		5		6		7 1/2		8		9		10		12		12 1/2		15		18		20		24		25		30		40		45		50
3/5		4 4/5		6		7 1/5		9		9 3/5		10 4/5		12		14 2/5		15		18		21 3/5		24		28 4/5		30		36		48		54	1	10
2/3		5 1/3		6 2/3		8		10		10 2/3		12		13 1/3		16		16 2/3		20		24		26 2/3		32		33 1/3		40		53 1/3	1	0	1	6 2/3
3/4		6		7 1/2		9		11 1/4		12		13 1/2		15		18		18 3/4		22 1/2		27		30		36		37 1/2		45	1	0	1	7 1/2	1	15
4/5		6 2/5		8		9 3/5		12		12 4/5		14 2/5		16		19 1/5		20		24		28 4/5		32		38 2/5		40		48	1	4	1	12	1	20
1		8		10		12		15		16		18		20		24		25		30		36		40		48		50	1	0	1	20	1	30	1	40
2		16		20		24		30		32		36		40		48		50	1	0	1	12	1	20	1	36	1	40	2	0	2	40	3	0	3	20
3		24		30		36		45		48		54	1	0	1	12	1	15	1	30	1	48	2	0	2	24	2	30	3	0	4	0	4	30	5	0
4		32		40		48	1	0	1	4	1	12	1	20	1	36	1	40	2	0	2	24	2	40	3	12	3	20	4	0	5	20	6	0	6	40
5		40		50	1	0	1	15	1	20	1	30	1	40	2	0	2	5	2	30	3	0	3	20	4	0	4	10	5	0	6	40	7	30	8	20
6		48	1	0	1	12	1	30	1	36	1	48	2	0	2	24	2	30	3	0	3	36	4	0	4	48	5	0	6	0	8	0	9	0	10	0
8	1	4	1	20	1	36	2	0	2	8	2	24	2	40	3	12	3	20	4	0	4	48	5	20	6	24	6	40	8	0	10	40	12	0	13	20
10	1	20	1	40	2	0	2	30	2	40	3	0	3	20	4	0	4	10	5	0	6	0	6	40	8	0	8	20	10	0	13	20	15	0	16	40
12	1	36	2	0	2	24	3	0	3	12	3	36	4	0	4	48	5	0	6	0	7	12	8	0	9	36	10	0	12	0	16	0	18	0	20	0
15	2	0	2	30	3	0	3	45	4	0	4	30	5	0	6	0	6	15	7	30	9	0	10	0	12	0	12	30	15	0	20	0	22	30	25	0
20	2	40	3	20	4	0	5	0	5	20	6	0	6	40	8	0	8	20	10	0	12	0	13	20	16	0	16	40	20	0	26	40	30	0	33	20
25	3	20	4	10	5	0	6	15	6	40	7	30	8	20	10	0	10	25	12	30	15	0	16	40	20	0	20	50	25	0	33	20	37	30	41	40
30	4	0	5	0	6	0	7	30	8	0	9	0	10	0	12	0	12	30	15	0	18	0	20	0	24	0	25	0	30	0	40	0	45	0	50	0
40	5	20	6	40	8	0	10	0	10	40	12	0	13	20	16	0	16	40	20	0	24	0	26	40	32	0	33	20	40	0	53	20	60	0	66	40
60	8	0	10	0	12	0	15	0	16	0	18	0	20	0	24	0	25	0	30	0	36	0	40	0	48	0	50	0	60	0	80	0	90	0	100	0

EXAMPLE.—I. How much will it require to make 48 pills or powders of podophyllin, at ¼-grain dose: quinine, at ½-grain dose; citrate of iron, at 1-grain dose; and cimicifugin, at 1-grain dose?

Answer: Podophyllin, (dose, ¼ grain)=grains, 12
Quinine, (dose, ½ grain)=grains, 24
Citrate of Iron, (dose, 1 grain)=grains, 48
Cimicifugin, (dose, 1 grain)=grains, 48

II. How many doses will 3 grains of strychnine make at 1/20 grain for a dose? Answer: 60.

Trace along the line from 1/20, the size of the dose, until 3 grains is reached, and, on looking at the top of the column in which it is placed, the answer 60 will be found.

TABLE OF DOSES IN SOLUTION.

Table for determining the quantity of a medicinal agent required to enter into a definite amount of fluid, which is to be administered in certain doses, each dose holding a given quantity of said agent.

QUANTITY OF MEDICINE REQUIRED IN FLUID.

SIZE OF DOSE.			℥ 1.		℥ 4.		℥ 8.		1 Pint.		℥ 20.		℥ 24.		℥ 30.		2 Pints.	
Dose			Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.
	Minims.	5		1 3/5		6 2/5		12 4/5		25 3/5		32		38 2/5		48		51 1/5
	“	10		4/5		3 1/5		6 2/5		12 4/5		16		19 1/5		24		25 3/5
	“	15		8/15		2 2/15		4 4/15		8 8/15		10 2/3		12 4/5		16		17 1/15
Grn.	“	20		2/5		1 3/5		3 1/5		6 2/5		8		9 3/5		12		12 4/5
	Drac'm.	½		4/15		1 1/15		2 2/15		4 4/15		5 1/3		6 2/5		8		8 8/15
	“	1		2/15		8/15		1 1/15		2 2/15		2 2/3		3 1/5		4		4 4/15
1/60	“	2		1/15		4/15		8/15		1 1/15		1 1/3		1 3/5		2		2 2/15
	Ounce.	½		1/30		2/15		4/15		8/15		2/3		4/5		1		1 1/15
	“	1		1/60		1/15		2/15		4/15		1/3		2/5		½		8/15
	“	2				1/30		1/15		2/15		1/6		1/5		¼		4/15
	Minims.	5		2 2/5		9 3/5		19 1/5		38 2/5		48		57 3/5		72		76 4/5
	“	10		1 1/5		4 4/5		9 3/5		19 1/5		24		28 4/5		36		38 2/5
	“	15		4/5		3 1/5		6 2/5		12 4/5		16		19 1/5		24		25 3/5
Grn.	“	20		3/5		2 2/5		4 4/5		9 3/5		12		14 2/5		18		19 1/5
	Drac'm.	½		2/5		1 3/5		3 1/5		6 2/5		8		9 3/5		12		12 4/5
	“	1		1/5		4/5		1 3/5		3 1/5		4		4 4/5		6		6 2/5
1/40	“	2		1/10		2/5		4/5		1 3/5		2		2 2/5		3		3 1/5
	Ounce.	½		1/20		1/5		2/5		4/5		1		1 1/5		1½		1 3/5
	“	1		1/40		1/10		1/5		2/5		½		3/5		¾		4/5
	“	2				1/20		1/10		1/5		¼		3/10		⅜		2/5
	Minims.	5		3 1/5		12 4/5		25 3/5		51 1/5	1	4	1	16 4/5	1	36	1	42 2/5
	“	10		1 3/5		6 2/5		12 4/5		25 3/5		32		38 2/5		48		51 1/5
	“	15		1 1/15		4 4/15		8 8/15		17 1/15		21 1/3		25 3/5		32		34 2/15
Grn.	“	20		4/5		3 1/5		6 2/5		12 4/5		16		19 1/5		24		25 3/5
	Drac'm.	½		8/15		2 2/15		4 4/15		8 8/15		10 2/3		12 4/5		16		17 1/15
	“	1		4/15		1 1/15		2 2/15		4 4/15		5 1/3		6 2/5		8		8 8/15
1/30	“	2		2/15		8/15		1 1/15		2 2/15		2 2/3		3 1/5		4		4 4/15
	Ounce	½		1/15		4/15		8/15		1 1/15		1 1/3		1 3/5		2		2 2/15
	“	1		1/30		2/15		4/15		8/15		2/3		4/5		1		1 1/15
	“	2				1/15		2/15		4/15		1/3		2/5		½		8/15

QUANTITY OF MEDICINE REQUIRED IN FLUID.

(CONTINUED.)

SIZE OF DOSE.			℥ 1.		℥ 4.		℥ 8.		1 Pint.		℥ 20.		℥ 24.		℥ 30.		2 Pints	
Dose.			Dr.	Gr.	Dr.	Gr.	Dr	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr
Grn. $\frac{1}{25}$	Minims.	5		$3\frac{21}{25}$		$15\frac{9}{25}$		$30\frac{18}{25}$	1	$1\frac{11}{25}$	1	$16\frac{4}{5}$	1	$32\frac{4}{25}$	1	$55\frac{1}{5}$	2	$2\frac{22}{25}$
	“	10		$1\frac{23}{25}$		$7\frac{17}{25}$		$15\frac{9}{25}$		$30\frac{18}{25}$		$38\frac{2}{5}$		$46\frac{2}{25}$		$57\frac{3}{5}$	1	$1\frac{11}{25}$
	“	15		$1\frac{7}{25}$		$5\frac{3}{25}$		$10\frac{6}{25}$		$20\frac{12}{25}$		$25\frac{3}{5}$		$30\frac{18}{25}$		$38\frac{2}{5}$		$40\frac{24}{25}$
	“	20		$\frac{24}{25}$		$3\frac{21}{25}$		$7\frac{17}{25}$		$15\frac{9}{25}$		$19\frac{1}{5}$		$23\frac{1}{25}$		$28\frac{4}{5}$		$30\frac{18}{25}$
	Drac'm.	$\frac{1}{2}$		$\frac{16}{25}$		$2\frac{14}{25}$		$5\frac{3}{25}$		$10\frac{6}{25}$		$12\frac{4}{5}$		$15\frac{9}{25}$		$19\frac{1}{5}$		$20\frac{12}{25}$
	“	1		$\frac{8}{25}$		$1\frac{7}{25}$		$2\frac{14}{25}$		$5\frac{3}{25}$		$6\frac{2}{5}$		$7\frac{17}{25}$		$9\frac{3}{5}$		$10\frac{6}{25}$
	“	2		$\frac{4}{25}$		$\frac{16}{25}$		$1\frac{7}{25}$		$2\frac{14}{25}$		$3\frac{1}{5}$		$3\frac{21}{25}$		$4\frac{4}{5}$		$5\frac{3}{25}$
	Ounce.	$\frac{1}{2}$		$\frac{2}{25}$		$\frac{8}{25}$		$\frac{16}{25}$		$1\frac{7}{25}$		$1\frac{3}{5}$		$1\frac{23}{25}$		$2\frac{2}{5}$		$2\frac{14}{25}$
	“	1		$\frac{1}{25}$		$\frac{4}{25}$		$\frac{8}{25}$		$\frac{16}{25}$		$\frac{4}{5}$		$\frac{24}{25}$		$1\frac{1}{5}$		$1\frac{7}{25}$
	“	2				$\frac{2}{25}$		$\frac{4}{25}$		$\frac{8}{25}$		$\frac{2}{5}$		$\frac{12}{25}$		$\frac{3}{5}$		$\frac{16}{25}$
Grn. $\frac{1}{20}$	Minims.	5		$4\frac{4}{5}$		$19\frac{1}{5}$		$38\frac{2}{5}$	1	$16\frac{4}{5}$	1	36	1	$55\frac{1}{5}$	2	24	2	$33\frac{3}{5}$
	“	10		$2\frac{2}{5}$		$9\frac{3}{5}$		$19\frac{1}{5}$		$38\frac{2}{5}$		48		$57\frac{3}{5}$	1	12	1	$16\frac{4}{5}$
	“	15		$1\frac{3}{5}$		$6\frac{2}{5}$		$12\frac{4}{5}$		$25\frac{3}{5}$		32		$38\frac{2}{5}$		48		$51\frac{1}{5}$
	“	20		$1\frac{1}{5}$		$4\frac{4}{5}$		$9\frac{3}{5}$		$19\frac{1}{5}$		24		$28\frac{4}{5}$		36		$38\frac{2}{5}$
	Drac'm.	$\frac{1}{2}$		$\frac{4}{5}$		$3\frac{1}{5}$		$6\frac{2}{5}$		$12\frac{4}{5}$		16		$19\frac{1}{5}$		24		$25\frac{3}{5}$
	“	1		$\frac{2}{5}$		$1\frac{3}{5}$		$3\frac{1}{5}$		$6\frac{2}{5}$		8		$9\frac{3}{5}$		12		$12\frac{4}{5}$
	“	2		$\frac{1}{5}$		$\frac{4}{5}$		$1\frac{3}{5}$		$3\frac{1}{5}$		4		$4\frac{4}{5}$		6		$6\frac{2}{5}$
	Ounce.	$\frac{1}{2}$		$\frac{1}{10}$		$\frac{2}{5}$		$\frac{4}{5}$		$1\frac{3}{5}$		2		$2\frac{2}{5}$		3		$3\frac{1}{5}$
	“	1		$\frac{1}{20}$		$\frac{1}{5}$		$\frac{2}{5}$		$\frac{4}{5}$		1		$1\frac{1}{5}$		$1\frac{1}{2}$		$1\frac{3}{5}$
	“	2				$\frac{1}{10}$		$\frac{1}{5}$		$\frac{2}{5}$		$\frac{1}{2}$		$\frac{3}{5}$		$\frac{3}{4}$		$\frac{4}{5}$
Grn. $\frac{1}{16}$	Minims.	5		6		24		48	1	36	2	0	2	24	3	0	3	12
	“	10		3		12		24		48	1	0	1	12	1	30	1	36
	“	15		2		8		16		32		40		48	1	0	1	4
	“	20		$1\frac{1}{2}$		6		12		24		30		36		45		48
	Drac'm.	$\frac{1}{2}$		1		4		8		16		20		24		30		32
	“	1		$\frac{1}{2}$		2		4		8		10		12		15		16
	“	2		$\frac{1}{4}$		1		2		4		5		6		$7\frac{1}{2}$		8
	Ounce.	$\frac{1}{2}$		$\frac{1}{8}$		$\frac{1}{2}$		1		2		$2\frac{1}{2}$		3		$3\frac{3}{4}$		4
	“	1		$\frac{1}{16}$		$\frac{1}{4}$		$\frac{1}{2}$		1		$1\frac{1}{4}$		$1\frac{1}{2}$		$1\frac{7}{8}$		2
	“	2				$\frac{1}{8}$		$\frac{1}{4}$		$\frac{1}{2}$		$\frac{5}{8}$		$\frac{3}{4}$		$\frac{15}{16}$		1
Grn. $\frac{1}{15}$	Minims.	5		$6\frac{2}{5}$		$25\frac{3}{5}$		$51\frac{1}{5}$	1	$42\frac{2}{5}$	2	8	2	$33\frac{3}{5}$	3	12	3	$24\frac{4}{5}$
	“	10		$3\frac{1}{5}$		$12\frac{4}{5}$		$25\frac{3}{5}$		$51\frac{1}{5}$	1	4	1	$16\frac{4}{5}$	1	36	1	$42\frac{2}{5}$
	“	15		$2\frac{2}{15}$		$8\frac{8}{15}$		$17\frac{1}{15}$		$34\frac{2}{15}$		$42\frac{2}{3}$		$51\frac{1}{5}$	1	4	1	$8\frac{4}{15}$
	“	20		$1\frac{3}{5}$		$6\frac{2}{5}$		$12\frac{4}{5}$		$25\frac{3}{5}$		32		$38\frac{2}{5}$		48		$51\frac{1}{5}$
	Drac'm.	$\frac{1}{2}$		$1\frac{1}{15}$		$4\frac{4}{15}$		$8\frac{8}{15}$		$17\frac{1}{15}$		$21\frac{1}{3}$		$25\frac{3}{5}$		32		$34\frac{2}{15}$
	“	1		$\frac{8}{15}$		$2\frac{2}{15}$		$4\frac{4}{15}$		$8\frac{8}{15}$		$10\frac{2}{3}$		$12\frac{4}{5}$		16		$17\frac{1}{15}$
	“	2		$\frac{4}{15}$		$1\frac{1}{15}$		$2\frac{2}{15}$		$4\frac{4}{15}$		$5\frac{1}{3}$		$6\frac{2}{5}$		8		$8\frac{8}{15}$
	Ounce.	$\frac{1}{2}$		$\frac{2}{15}$		$\frac{8}{15}$		$1\frac{1}{15}$		$2\frac{2}{15}$		$2\frac{2}{3}$		$3\frac{1}{5}$		4		$4\frac{4}{15}$
	“	1		$\frac{1}{15}$		$\frac{4}{15}$		$\frac{8}{15}$		$1\frac{1}{15}$		$1\frac{1}{3}$		$1\frac{3}{5}$		2		$2\frac{2}{15}$
	“	2				$\frac{2}{15}$		$\frac{4}{15}$		$\frac{8}{15}$		$\frac{2}{3}$		$\frac{4}{5}$		1		$1\frac{1}{15}$
Grn $\frac{1}{12}$	Minims.	5		8		32	1	4	2	8	2	40	3	12	4	0	4	16
	“	10		4		16		32	1	4	1	20	1	36	2	0	2	8
	“	15		$2\frac{2}{3}$		$10\frac{2}{3}$		$21\frac{1}{3}$		$42\frac{2}{3}$		$53\frac{1}{3}$	1	4	1	20	1	$25\frac{1}{3}$
	“	20		2		8		16		32		40		48	1	0	1	4
	Drac'm.	$\frac{1}{2}$		$1\frac{1}{3}$		$5\frac{1}{3}$		$10\frac{2}{3}$		$21\frac{1}{3}$		$26\frac{2}{3}$		32		40		$42\frac{2}{3}$
	“	1		$\frac{2}{3}$		$2\frac{2}{3}$		$5\frac{1}{3}$		$10\frac{2}{3}$		$13\frac{1}{3}$		16		20		$21\frac{1}{3}$
	“	2		$\frac{1}{3}$		$1\frac{1}{3}$		$2\frac{2}{3}$		$5\frac{1}{3}$		$6\frac{2}{3}$		8		10		$10\frac{2}{3}$
	Ounce.	$\frac{1}{2}$		$\frac{1}{6}$		$\frac{2}{3}$		$1\frac{1}{3}$		$2\frac{2}{3}$		$3\frac{1}{3}$		4		5		$5\frac{1}{3}$
	“	1		$\frac{1}{12}$		$\frac{1}{3}$		$\frac{2}{3}$		$1\frac{1}{3}$		$1\frac{2}{3}$		2		$2\frac{1}{2}$		$2\frac{2}{3}$
	“	2				$\frac{1}{6}$		$\frac{1}{3}$		$\frac{2}{3}$		$\frac{5}{6}$		1		$1\frac{1}{4}$		$1\frac{1}{3}$

QUANTITY OF MEDICINE REQUIRED IN FLUID.

(CONTINUED.)

SIZE OF DOSE.		℥ 1.	℥ 4.	℥ 8.	1 Pint.	℥ 20.	℥ 24.	℥ 80.	2 Pints
Dose.		Dr. Gr.	Dr. Gr	Dr. Gr.	Dr. Gr.	Dr. Gr.	Dr. Gr.	Dr. Gr.	Dr Gr
Grn. ⅒	Minims. 5	9⅗	38⅖	1 16⅘	2 33⅗	3 12	3 50⅖	4 48	5 7⅕
	" 10	4⅘	19⅕	38⅖	1 16⅘	1 36	1 55⅕	2 24	2 33⅗
	" 15	3⅕	12⅘	25⅗	51⅕	1 4	1 16⅘	1 36	1 42⅖
	" 20	2⅖	9⅗	19⅕	38⅖	48	57⅗	1 12	1 16⅘
	Drac'm. ½	1⅗	6⅖	12⅘	25⅗	32	38⅖	48	51⅕
	" 1	⅘	3⅕	6⅖	12⅘	16	19⅕	24	25⅗
	" 2	⅖	1⅗	3⅕	6⅖	8	9⅗	12	12⅘
	Ounce. ½	⅕	⅘	1⅗	3⅕	4	4⅘	6	6⅖
	" 1	⅒	⅖	⅘	1⅗	2	2⅖	3	3⅕
	" 2		⅕	⅖	⅘	1	1⅕	1½	1⅗
Grn. ⅛	Minims. 5	12	48	1 36	3 12	4 0	4 48	6 0	6 24
	" 10	6	24	48	1 36	2 0	2 24	3 0	3 12
	" 15	4	16	32	64	1 20	1 36	2 0	2 8
	" 20	3	12	24	48	1 0	1 12	1 30	1 36
	Drac'm. ½	2	8	16	32	40	48	1 0	1 4
	" 1	1	4	8	16	20	24	30	32
	" 2	½	2	4	8	10	12	15	16
	Ounce. ½	¼	1	2	4	5	6	7½	8
	" 1	⅛	½	1	2	2½	3	3¾	4
	" 2		¼	½	1	1¼	1½	1⅞	2
Grn. ⅙	Minims. 5	16	64	2 8	4 16	5 20	6 24	8 0	8 32
	" 10	8	32	1 4	2 8	2 40	3 12	4 0	4 16
	" 15	5⅓	21⅓	42⅔	1 25⅓	1 46⅔	2 8	2 40	2 50⅔
	" 20	4	16	32	1 4	1 20	1 36	2 0	2 8
	Drac'm. ½	2⅔	10⅔	21⅓	42⅔	53⅓	1 4	1 20	1 25⅓
	" 1	1⅓	5⅓	10⅔	21⅓	26⅔	32	40	42⅔
	" 2	⅔	2⅔	5⅓	10⅔	13⅓	16	20	21⅓
	Ounce. ½	⅓	1⅓	2⅔	5⅓	6⅔	8	10	10⅔
	" 1	⅙	⅔	1⅓	2⅔	3⅓	4	5	5⅓
	" 2		⅓	⅔	1⅓	1⅔	2	2½	2⅔
Grn. ⅕	Minims. 5	19⅕	1 16⅘	2 33⅗	5 7⅕	6 24	7 40⅘	9 36	10 14⅖
	" 10	9⅗	38⅖	1 16⅘	2 33⅗	3 12	3 50⅖	4 48	5 7⅕
	" 15	6⅖	25⅗	51⅕	1 42⅖	2 8	2 33⅗	3 12	3 24⅘
	" 20	4⅘	19⅕	38⅖	1 16⅘	1 36	1 55⅕	2 24	2 33⅗
	Drac'm. ½	3⅕	12⅘	25⅗	51⅕	1 4	1 16⅘	1 36	1 42⅖
	" 1	1⅗	6⅖	12⅘	25⅗	32	38⅖	48	51⅕
	" 2	⅘	3⅕	6⅖	12⅘	16	19⅕	24	25⅗
	Ounce. ½	⅖	1⅗	3⅕	6⅖	8	9⅗	12	12⅘
	" 1	⅕	⅘	1⅗	3⅕	4	4⅘	6	6⅖
	" 2		⅖	⅘	1⅗	2	2⅖	3	3⅕
Grn. ¼	Minims. 5	24	1 36	3 12	6 24	8 0	9 36	12 0	12 48
	" 10	12	48	1 36	3 12	4 0	4 48	6 0	6 24
	" 15	8	32	1 4	2 8	2 40	3 12	4 0	4 16
	" 20	6	24	48	1 36	2 0	2 24	3 0	3 12
	Drac'm ½	4	16	32	1 4	1 20	1 36	2 0	2 8
	" 1	2	8	16	32	40	48	1 0	1 4
	" 2	1	4	8	16	20	24	30	32
	Ounce. ½	½	2	4	8	10	12	15	16
	" 1	¼	1	2	4	5	6	7½	8
	" 2		½	1	2	2½	3	3¾	4

QUANTITY OF MEDICINE REQUIRED IN FLUID.

(CONTINUED.)

SIZE OF DOSE.			℥ 1.		℥ 4.		℥ 8.		1 Pint.		℥ 20.		℥ 24.		℥ 30.		2 Pints	
Dose.			Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.
Grn. ⅓	Minims.	5		32	2	8	4	16	8	32	10	40	12	48	16	0	17	4
	“	10		16	1	4	2	8	4	16	5	20	6	24	8	0	8	32
	“	15		10⅔		42⅔	1	25⅓	2	50⅔	3	33⅓	4	16	5	20	5	41⅓
	“	20		8		32	1	4	2	8	2	40	3	12	4	0	4	16
	Drac'm.	½		5⅓		21⅓		42⅔	1	25⅓	1	46⅔	2	8	2	40	2	50⅔
	“	1		2⅔		10⅔		21⅓		42⅔		53⅓	1	4	1	20	1	25⅓
	“	2		1⅓		5⅓		10⅔		21⅓		26⅔		32		40		42⅔
	Ounce.	½		⅔		2⅔		5⅓		10⅔		13⅓		16		20		21⅓
	“	1		⅓		1⅓		2⅔		5⅓		6⅔		8		10		10⅔
	“	2				⅔		1⅓		2⅔		3⅓		4		5		5⅓
Grn. ⅖	Minims.	5		38⅖	2	33⅗	5	7⅕	10	14⅖	12	48	15	21⅗	19	12	20	28⅘
	“	10		19⅕	1	16⅘	2	33⅗	5	7⅕	6	24	7	40⅘	9	36	10	14⅖
	“	15		12⅘		51⅕	1	42⅖	3	24⅘	4	16	5	7⅕	6	24	6	49⅗
	“	20		9⅗		38⅖	1	16⅘	2	33⅗	3	12	3	50⅖	4	48	5	7⅕
	Drac'm.	½		6⅖		25⅗		51⅕	1	42⅖	2	8	2	33⅗	3	12	3	24⅘
	“	1		3⅕		12⅘		25⅗		51⅕	1	4	1	16⅘	1	36	1	42⅖
	“	2		1⅗		6⅖		12⅘		25⅗		32		38⅖		48		51⅕
	Ounce.	½		⅘		3⅕		6⅖		12⅘		16		19⅕		24		25⅗
	“	1		⅖		1⅗		3⅕		6⅖		8		9⅗		12		12⅘
	“	2				⅘		1⅗		3⅕		4		4⅘		6		6⅖
Grn. ½	Minims.	5		48	3	12	6	24	12	48	16	0	19	12	24	0	25	36
	“	10		24	1	36	3	12	6	24	8	0	9	36	12	0	12	48
	“	15		16	1	4	2	8	4	16	5	20	6	24	8	0	8	32
	“	20		12		48	1	36	3	12	4	0	4	48	6	0	6	24
	Drac'm.	½		8		32	1	4	2	8	2	40	3	12	4	0	4	16
	“	1		4		16		32	1	4	1	20	1	36	2	0	2	8
	“	2		2		8		16		32		40		48	1	0	1	4
	Ounce.	½		1		4		8		16		20		24		30		32
	“	1		½		2		4		8		10		12		15		16
	“	2				1		2		4		5		6		7½		8
Gmn. ⅗	Minims.	5		57⅗	3	50⅖	7	40⅘	15	21⅗	19	12	23	2⅖	28	48	30	43⅕
	“	10		28⅘	1	55⅕	3	50⅖	7	40⅘	9	36	11	31⅕	14	24	15	21⅗
	“	15		19⅕	1	16⅘	2	33⅗	5	7⅕	6	24	7	40⅘	9	36	10	14⅖
	“	20		14⅖		57⅗	1	55⅕	3	50⅖	4	48	5	45⅗	7	12	7	40⅘
	Drac'm.	½		9⅗		38⅖	1	16⅘	2	33⅗	3	12	3	50⅖	4	48	5	7⅕
	“	1		4⅘		19⅕		38⅖	1	16⅘	1	36	1	55⅕	2	24	2	33⅗
	“	2		2⅖		9⅗		19⅕		38⅖		48		57⅗	1	12	1	16⅘
	Ounce.	½		1⅕		4⅘		9⅗		19⅕		24		28⅘		36		38⅖
	“	1		⅗		2⅖		4⅘		9⅗		12		14⅖		18		19⅕
	“	2				1⅕		2⅖		4⅘		6		7⅕		9		9⅗
Grn. ⅔	Minims.	5	1	4	4	16	8	32	17	4	21	20	25	36	32	0	34	8
	“	10		32	2	8	4	16	8	32	10	40	12	48	16	0	17	4
	“	15		21⅓	1	25⅓	2	50⅔	5	41⅓	7	6⅔	8	32	10	40	11	22⅔
	“	20		16	1	4	2	8	4	16	5	20	6	24	8	0	8	32
	Drac'm.	½		10⅔		42⅔	1	25⅓	2	50⅔	3	33⅓	4	16	5	20	5	41⅓
	“	1		5⅓		21⅓		42⅔	1	25⅓	1	46⅔	2	8	2	40	2	50⅔
	“	2		2⅔		10⅔		21⅓		42⅔		53⅓	1	4	1	20	1	25⅓
	Ounce.	½		1⅓		5⅓		10⅔		21⅓		26⅔		32		40		42⅔
	“	1		⅔		2⅔		5⅓		10⅔		13⅓		16		20		21⅓
	“	2				1⅓		2⅔		5⅓		6⅔		8		10		10⅔

QUANTITY OF MEDICINE REQUIRED IN FLUID.

(CONTINUED.)

SIZE OF DOSE.			℥ 1.		℥ 4.		℥ 8.		1 Pint.		℥ 20.		℥ 24.		℥ 30.		2 Pints	
Dose.			Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.
Grn. ¾	Minims.	5	1	12	4	48	9	36	19	12	24	0	28	48	36	0	38	24
	"	10		36	2	24	4	48	9	36	12	0	14	24	18	0	19	12
	"	15		24	1	36	3	12	6	24	8	0	9	36	12	0	12	48
	"	20		18	1	12	2	24	4	48	6	0	7	12	9	0	9	36
	Drac'm.	½		12		48	1	36	3	12	4	0	4	48	6	0	6	24
	"	1		6		24		48	1	36	2	0	2	24	3	0	3	12
	"	2		3		12		24		48	1	0	1	12	1	30	1	36
	Ounce.	½		1½		6		12		24		30		36		45		48
	"	1		¾		3		6		12		15		18		22½		24
	"	2				1½		3		6		7½		9		11¼		12
Grn. ⅘	Minims.	5	1	16⅘	5	7⅕	10	14⅖	20	28⅘	25	36	30	43⅕	38	24	40	57⅗
	"	10		38⅖	2	33⅗	5	7⅕	10	14⅖	12	48	15	21⅗	19	12	20	28⅘
	"	15		25⅗	1	42⅖	3	24⅘	6	49⅗	8	32	10	14⅖	12	48	13	39⅕
	"	20		19⅕	1	16⅘	2	33⅗	5	7⅕	6	24	7	40⅘	9	36	10	14⅖
	Drac'm.	½		12⅘		51⅕	1	42⅖	3	24⅘	4	16	5	7⅕	6	24	6	49⅗
	"	1		6⅖		25⅗		51⅕	1	42⅖	2	8	2	33⅗	3	12	3	24⅘
	"	2		3⅕		12⅘		25⅗		51⅕	1	4	1	16⅘	1	36	1	42⅖
	Ounce.	½		1⅗		6⅖		12⅘		25⅗		32		38⅖		48		51⅕
	"	1		⅘		3⅕		6⅖		12⅘		16		19⅕		24		25⅗
	"	2				1⅗		3⅕		6⅖		8		9⅗		12		12⅘
Grn. 1	Minims.	5	1	36	6	24	12	48	25	36	32	0	38	24	48	0	51	12
	"	10		48	3	12	6	24	12	48	16	0	19	12	24	0	25	36
	"	15		32	2	8	4	16	8	32	10	40	12	48	16	0	17	4
	"	20		24	1	36	3	12	6	24	8	0	9	36	12	0	12	48
	Drac'm.	½		16	1	4	2	8	4	16	5	20	6	24	8	0	8	32
	"	1		8		32	1	4	2	8	2	40	3	12	4	0	4	16
	"	2		4		16		32	1	4	1	20	1	36	2	0	2	8
	Ounce.	½		2		8		16		32		40		48	1	0	1	4
	"	1		1		4		8		16		20		24		30		32
	"	2				2		4		8		10		12		15		16
Grn. 2	Minims.	5	3	12	12	48	25	36	51	12	64	0	76	48	96	0	102	24
	"	10	1	36	6	24	12	48	25	36	32	0	38	24	48	0	51	12
	"	15	1	4	4	16	8	32	17	4	21	20	25	36	32	0	34	8
	"	20		48	3	12	6	24	12	48	16	0	19	12	24	0	25	36
	Drac'm.	½		32	2	8	4	16	8	32	10	40	12	48	16	0	17	4
	"	1		16	1	4	2	8	4	16	5	20	6	24	8	0	8	32
	"	2		8		32	1	4	2	8	2	40	3	12	4	0	4	16
	Ounce.	½		4		16		32	1	4	1	20	1	36	2	0	2	8
	"	1		2		8		16		32		40		48	1	0	1	4
	"	2				4		8		16		20		24		30		32
Grn. 3	Minims.	5	4	48	19	12	38	24	76	48	96	0	115	12	144	0	153	36
	"	10	2	24	9	36	19	12	38	24	48	0	57	36	72	0	76	48
	"	15	1	36	6	24	12	48	25	36	32	0	38	24	48	0	51	12
	"	20	1	12	4	48	9	36	19	12	24	0	28	48	36	0	38	24
	Drac'm.	½		48	3	12	6	24	12	48	16	0	19	12	24	0	25	36
	"	1		24	1	36	3	12	6	24	8	0	9	36	12	0	12	48
	"	2		12		48	1	36	3	12	4	0	4	48	6	0	6	24
	Ounce.	½		6		24		48	1	36	2	0	2	24	3	0	3	12
	"	1		3		12		24		48	1	0	1	12	1	30	1	36
	"	2				6		12		24		30		36		45		48

QUANTITY OF MEDICINE REQUIRED IN FLUID.

(CONTINUED.)

SIZE OF DOSE.			℥ 1.		℥ 4.		℥ 8.		1 Pint.		℥ 20.		℥ 24.		℥ 30.		2 Pints.	
Dose.			Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.
Grn. 4	Minims.	5	6	24	25	36	51	12	102	24	128	0	153	36	192	0	204	48
	“	10	3	12	12	48	25	36	51	12	64	0	76	48	96	0	102	24
	“	15	2	8	8	32	17	4	34	8	42	40	51	12	64	0	68	16
	“	20	1	36	6	24	12	48	25	36	32	0	38	24	48	0	51	12
	Drac'm.	½	1	4	4	16	8	32	17	4	21	20	25	36	32	0	34	8
	“	1		32	2	8	4	16	8	32	10	40	12	48	16	0	17	4
	“	2		16	1	4	2	8	4	16	5	20	6	24	8	0	8	32
	Ounce.	½		8		32	1	4	2	8	2	40	3	12	4	0	4	16
	“	1		4		16		32	1	4	1	20	1	36	2	0	2	8
	“	2				8		16		32		40		48	1	0	1	4
Grn. 5	Minims.	5	8	0	32	0	64	0	128	0	160	0	192	0	240	0	256	0
	“	10	4	0	16	0	32	0	64	0	80	0	96	0	120	0	128	0
	“	15	2	40	10	40	21	20	42	40	53	20	64	0	80	0	85	20
	“	20	2	0	8	0	16	0	32	0	40	0	48	0	60	0	64	0
	Drac'm.	½	1	20	5	20	10	40	21	20	26	40	32	0	40	0	42	40
	“	1		40	2	40	5	20	10	40	13	20	16	0	20	0	21	20
	“	2		20	1	20	2	40	5	20	6	40	8	0	10	0	10	40
	Ounce.	½		10		40	1	20	2	40	3	20	4	0	5	0	5	20
	“	1		5		20		40	1	20	1	40	2	0	2	30	2	40
	“	2				10		20		40		50	1	0	1	15	1	20
Grn. 6	Minims.	5	9	36	38	24	76	48	153	36	192	0	230	24	288	0	307	12
	“	10	4	48	19	12	38	24	76	48	96	0	115	12	144	0	153	36
	“	15	3	12	12	48	25	36	51	12	64	0	76	48	96	0	102	24
	“	20	2	24	9	36	19	12	38	24	48	0	57	36	72	0	76	48
	Drac'm.	½	1	36	6	24	12	48	25	36	32	0	38	24	48	0	51	12
	“	1		48	3	12	6	24	12	48	16	0	19	12	24	0	25	36
	“	2		24	1	36	3	12	6	24	8	0	9	36	12	0	12	48
	Ounce.	½		12		48	1	36	3	12	4	0	4	48	6	0	6	24
	“	1		6		24		48	1	36	2	0	2	24	3	0	3	12
	“	2				12		24		48	1	0	1	12	1	30	1	36
Grn. 8	Minims.	5	12	48	51	12	102	24	204	48	256	0	307	12	384	0	409	36
	“	10	6	24	25	36	51	12	102	24	128	0	153	36	192	0	204	48
	“	15	4	16	17	4	34	8	68	16	85	20	102	24	128	0	136	32
	“	20	3	12	12	48	25	36	51	12	64	0	76	48	96	0	102	24
	Drac'm.	½	2	8	8	32	17	4	34	8	42	40	51	12	64	0	68	16
	“	1	1	4	4	16	8	32	17	4	21	20	25	36	32	0	34	8
	“	2		32	2	8	4	16	8	32	10	40	12	48	16	0	17	4
	Ounce.	½		16	1	4	2	8	4	16	5	20	6	24	8	0	8	32
	“	1		8		32	1	4	2	8	2	40	3	12	4	0	4	16
	“	2				16		32	1	4	1	20	1	36	2	0	2	8
Grn. 10	Minims.	5	16	0	64	0	128	0	256	0	320	0	384	0	480	0	512	0
	“	10	8	0	32	0	64	0	128	0	160	0	192	0	240	0	256	0
	“	15	5	20	21	20	42	40	85	20	106	40	128	0	160	0	170	40
	“	20	4	0	16	0	32	0	64	0	80	0	96	0	120	0	128	0
	Drac'm.	½	2	40	10	40	21	20	42	40	53	20	64	0	80	0	85	20
	“	1	1	20	5	20	10	40	21	20	26	40	32	0	40	0	42	40
	“	2		40	2	40	5	20	10	40	13	20	16	0	20	0	21	20
	Ounce.	½		20	1	20	2	40	5	20	6	40	8	0	10	0	10	40
	“	1		10		40	1	20	2	40	3	20	4	0	5	0	5	20
	“	2				20		40	1	20	1	40	2	0	2	30	2	40

QUANTITY OF MEDICINE REQUIRED IN FLUID.

(CONTINUED.)

SIZE OF DOSE.			℥ 1.		℥ 4.		℥ 8.		1 Pint.		℥ 20.		℥ 24.		℥ 80.		2 Pints	
Dose.			Dr	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.
	Minims.	5	19	12	76	48	153	36	307	12	384	0	460	48	576	0	614	24
	"	10	9	36	38	24	76	48	153	36	192	0	230	24	288	0	307	12
	"	15	6	24	25	36	51	12	102	24	128	0	153	36	192	0	204	48
Grn.	"	20	4	48	19	12	38	24	76	48	96	0	115	12	144	0	153	36
	Drac'm.	½	3	12	12	48	25	36	51	12	64	0	76	48	96	0	102	24
	"	1	1	36	6	24	12	48	25	36	32	0	38	24	48	0	51	12
12	"	2		48	3	12	6	24	12	48	16	0	19	12	24	0	25	36
	Ounce.	½		24	1	36	3	12	6	24	8	0	9	36	12	0	12	48
	"	1		12		48	1	36	3	12	4	0	4	48	6	0	6	24
	"	2				24		48	1	36	2	0	2	24	3	0	3	12
	Minims.	10	12	0	48	0	96	0	192	0	240	0	288	0	360	0	384	0
	"	15	8	0	32	0	64	0	128	0	160	0	192	0	240	0	256	0
	"	20	6	0	24	0	48	0	96	0	120	0	144	0	180	0	192	0
Grn.	Drac'm.	½	4	0	16	0	32	0	64	0	80	0	96	0	120	0	128	0
	"	1	2	0	8	0	16	0	32	0	40	0	48	0	60	0	64	0
15	"	2	1	0	4	0	8	0	16	0	20	0	24	0	30	0	32	0
	Ounce.	½		30	2	0	4	0	8	0	10	0	12	0	15	0	16	0
	"	1		15	1	0	2	0	4	0	5	0	6	0	7	30	8	0
	"	2				30	1	0	2	0	2	30	3	0	3	45	4	0
	Minims	10	16	0	64	0	128	0	256	0	320	0	384	0	480	0	512	0
	"	15	10	40	42	40	85	20	170	40	213	20	256	0	320	0	341	20
	"	20	8	0	32	0	64	0	128	0	160	0	192	0	240	0	256	0
Grn.	Drac'm.	½	5	20	21	20	42	40	85	20	106	40	128	0	160	0	170	40
	"	1	2	40	10	40	21	20	42	40	53	20	64	0	80	0	85	20
20	"	2	1	20	5	20	10	40	21	20	26	40	32	0	40	0	42	40
	Ounce.	½		40	2	40	5	20	10	40	13	20	16	0	20	0	21	20
	"	1		20	1	20	2	40	5	20	6	40	8	0	10	0	10	40
	"	2				40	1	20	2	40	3	20	4	0	5	0	5	20
	Minims.	15	13	20	53	20	106	40	213	20	266	40	320	0	400	0	426	40
	"	20	10	0	40	0	80	0	160	0	200	0	240	0	300	0	320	0
Grn.	Drac'm.	½	6	40	26	40	53	20	106	40	133	20	160	0	200	0	213	20
	"	1	3	20	13	20	26	40	53	20	66	40	80	0	100	0	106	40
	"	2	1	40	6	40	13	20	26	40	33	20	40	0	50	0	53	20
25	Ounce.	½		50	3	20	6	40	13	20	16	40	20	0	25	0	26	40
	"	1		25	1	40	3	20	6	40	8	20	10	0	12	30	13	20
	"	2				50	1	40	3	20	4	10	5	0	6	15	6	40
	Minims.	15	16	0	64	0	128	0	256	0	320	0	384	0	480	0	512	0
	"	20	12	0	48	0	96	0	192	0	240	0	288	0	360	0	384	0
Grn.	Drac'm	½	8	0	32	0	64	0	128	0	160	0	192	0	240	0	256	0
	"	1	4	0	16	0	32	0	64	0	80	0	96	0	120	0	128	0
	"	2	2	0	8	0	16	0	32	0	40	0	48	0	60	0	64	0
30	Ounce.	½	1	0	4	0	8	0	16	0	20	0	24	0	30	0	32	0
	"	1		30	2	0	4	0	8	0	10	0	12	0	15	0	16	0
	"	2			1	0	2	0	4	0	5	0	6	0	7	30	8	0
	Minims.	20	16	0	64	0	128	0	256	0	320	0	384	0	480	0	512	0
	Drac'm.	½	10	40	42	40	85	20	170	40	213	20	256	0	320	0	341	20
Grn.	"	1	5	20	21	20	42	40	85	20	106	40	128	0	160	0	170	40
	"	2	2	40	10	40	21	20	42	40	53	20	64	0	80	0	85	20
40	Ounce.	½	1	20	5	20	10	40	21	20	26	40	32	0	40	0	42	40
	"	1		40	2	40	5	20	10	40	13	20	16	0	20	0	21	20
	"	2			1	20	2	40	5	20	6	40	8	0	10	0	10	40

QUANTITY OF MEDICINE REQUIRED IN FLUID.

(CONTINUED.

	SIZE OF DOSE.		℥ 1		℥ 4		℥ 8		1 Pint.		℥ 20		℥ 24		℥ 30		2 Pints.	
DOSE			Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.	Dr.	Gr.
	Drachm	½	16	0	64	0	128	0	256	0	320	0	384	0	480	0	512	0
	"	1	8	0	32	0	64	0	128	0	160	0	192	0	240	0	256	0
Grn.	"	2	4	0	16	0	32	0	64	0	80	0	96	0	120	0	128	0
60	Ounce	½	2	0	8	0	16	0	32	0	40	0	48	0	60	0	64	0
	"	1	1	0	4	0	8	0	16	0	20	0	24	0	30	0	32	0
	"	2			2	0	4	0	8	0	10	0	12	0	15	0	16	0

EXPLANATION.

The preceding table is designed to facilitate the determination of how much medicine, in a given dose, must be added to a required quantity of fluid, so that this fluid may be prescribed in doses of a certain amount. (1) The *given dose of the medicine* will be found in the first column, at the left of the brackets, or, in other words, the *quantity* of the *medicinal agent* required to be taken with each dose of the mixture or solution into which it enters; (2) the *dose of the fluid solution* of this medicine will be found in the first column, inclosed within the brackets, or in other words, the *size* of the dose of the *mixture* or *solution* prescribed; (3) the quantity of *fluid required* or *prescribed* to form the solution will be found at the heads of the other columns; and (4) the *quantity of the medicine which must be added* to the required or prescribed amount of fluid will be found in the column under the head of such amount. Thus:

I. It is desired to give 4 fluid ounces of liquid to a patient, to be taken in ½-fluid-drachm doses, each dose to contain strychnine, $\frac{1}{30}$ grain; quinine, ½ grain; morphine, ⅛ grain. How much of each of these alkaloids must be added to the 4 fluid ounces prescribed? As already explained, find the given dose of the strychnine, $\frac{1}{30}$ grain, and opposite to it, inclosed within the bracket, find the dose of the fluid solution, viz., ½ fluid drachm; from which follow out the line until the column under 4 fluid ounces has been reached, when it will be found that $2\frac{2}{15}$ grains of strychnine will be required. Again, find the given dose of the quinine, grain ½, and inclosed within its brackets also find the dose of the fluid solution, viz., ½ fluid drachm; from this, trace along the line as before, and in the column under 4 fluid ounces the quantity of fluid prescribed, will be found the required amount of quinine, viz., 32 grains. For the morphine, find the given dose, grain ⅛, then the ½ fluid drachm inclosed in its bracket, and tracing along, as before, the quantity of this alkaloid required will be found, 8 grains.

II. It is desired to prescribe 2 ounces of fluid to be taken in doses of 10 minims, each dose to contain $\frac{1}{50}$ grain of an alkaloid; how much of the alkaloid must be contained in the 2 fluid ounces? As $\frac{1}{50}$ grain is not in the table, find $\frac{1}{25}$ grain, and on the 10 minims line under 4 fluid ounces will be found $7\frac{17}{25}$ grains, or the quantity required, were the given dose of the alkaloid $\frac{1}{25}$ for 4 fluid ounces; one-half of which will be the amount of the alkaloid, at $\frac{1}{25}$-grain dose, for 2 fluid ounces, viz., $3\frac{21}{25}$ grains; and one-half of this again will be the quantity of the alkaloid, at $\frac{1}{50}$-grain dose, for 2 fluid ounces, viz., $1\frac{23}{25}$.

III. It is desired to add 2 grains of veratrine to a fluid, to be administered in 20 minim doses, each dose to contain $\frac{1}{25}$ grain of veratrine. How much of the fluid will be required for the 2 grains? Find the given dose, $\frac{1}{25}$ grain, and the dose of the fluid, 20 minims; follow this line until the amount nearest to 2 grains is found, which in the present instance will be $3\frac{21}{25}$ grains, in the column under 4 fluid ounces; $3\frac{21}{25}$ grains is $1\frac{21}{25}$ grains more than 2 grains, or an excess of $\frac{46}{25}$ grains=46 doses. By the following table it will be seen that 4 fluid ounces contain 96 doses of 20 minims each; subtract from this the excess of 46 doses, and

50 doses remain for the 2 grains, and as each dose is to consist of 20 minims of the solution, 50 doses will be=1000 minims=16 drachms and 40 minims of fluid. The same result may be obtained as follows: One dose is to contain $\frac{1}{25}$ grain, therefore 2 grains will give $\frac{50}{25}$, or 50 doses, which being multiplied by the number of minims required for each dose (20), will give 1000 minims=16 drachms and 40 minims.

IV. How much fluid will be required for 12 grains of morphine; the fluid to be given in 20-minim doses, each containing ½ grain of morphine? Answer: 1 ounce.

V. I have 1 ounce of iodide of ammonium which I desire to give in solution in doses of 1 teaspoonful containing 2 grains each; how much water will the ounce of iodide require?

Find the given dose of the iodide, *i. e.*, 2 grains, and the line containing the dose of the fluid, *i. e.*, 1 drachm; follow this line along until the column containing 1 ounce, or 8 drachms, is found, and at the top of this column will be found the required answer, viz., 30 ounces of fluid.

TABLE FOR DETERMINING THE NUMBER OF DOSES THERE ARE IN A DEFINITE AMOUNT OF FLUID MEDICINE, WHEN GIVEN IN A CERTAIN DOSE.

NUMBER OF DOSES IN

SIZE OF DOSE.	℥ 1	℥ 4	℥ 8	1 Pint.	℥ 20	℥ 24	℥ 30	2 Pints.
Minims 5	96	384	768	1536	1920	2304	2880	3072
Minims 10	48	192	384	768	960	1152	1440	1536
Minims 15	32	128	256	512	640	768	960	1024
Minims 20	24	96	192	384	480	576	720	768
Drachm ½	16	64	128	256	320	384	480	512
Drachm 1	8	32	64	128	160	192	240	256
Drachms 2	4	16	32	64	80	96	120	128
Ounce ½	2	8	16	32	40	48	60	64
Ounce 1	1	4	8	16	20	24	30	32
Ounces 2		2	4	8	10	12	15	16

How many doses of 15 minims, each, are there in 24 ounces of fluid?

By following the dose (15 minims), in the first line along, until the column under 24 ounces is reached, the answer will be found, viz.: 768 doses.

How many drachm doses are there in 30 ounces of fluid? Answer: 240.

TABLE FOR DETERMINING HOW MUCH FLUID MEDICINE MUST BE GIVEN TO A PATIENT TO LAST FOR A DEFINITE LENGTH OF TIME, WHEN TAKEN IN A CERTAIN DOSE, WHICH IS TO BE REPEATED THREE TIMES EVERY DAY.

Thus, 8 drops of a fluid, repeated 3 times a day, will require 1½ ounces to last a month. The small figures to the right of the drachms signify minims.

N. B.—A drop here is considered equal to a minim.

Size of Dose 3 times a day.	Quantity required for 2 weeks or 15 days.			Quantity required for 1 month.			Quantity required for 6 weeks.			Quantity required for 2 months.			Quantity required for 10 weeks.			Quantity required for 3 months.		
	Pt.	Oz.	Dr.	Pt.	Oz.	Dr.	Pt.	Oz.	Dr.	Pt.	Oz.	Dr.	Pt.	Oz.	Dr.	Pt.	Oz.	Dr.
3 drops........			2 $_{15}$			4 $_{30}$			6 $_{45}$		1	1		1	3 $_{15}$		1	5 $_{30}$
4 drops........			3			6			9		1	4		1	7		2	2
5 drops........			3 $_{45}$			7 $_{30}$		1	3 $_{15}$		1	7		2	2 $_{45}$		2	6 $_{30}$
6 drops........			4 $_{30}$		1	1		1	5 $_{30}$		2	2		2	6 $_{30}$		3	3
7 drops........			5 $_{15}$		1	2 $_{30}$		1	7 $_{45}$		2	5		3	2 $_{15}$		3	7 $_{30}$
8 drops........			6		1	4		2	2		3	0		3	6		4	4
9 drops........			6 $_{45}$		1	5 $_{30}$		2	4 $_{17}$		3	3		4	1 $_{45}$		5	0 $_{30}$
10 drops........			7 $_{30}$		1	7		2	6 $_{30}$		3	6		4	5 $_{30}$		5	5
12 drops........		1	1		2	2		3	3		4	4		5	5		6	6
15 drops........		1	3 $_{15}$		2	6 $_{30}$		4	1 $_{45}$		5	5		7	0 $_{15}$		8	3 $_{30}$
18 drops........		1	5 $_{30}$		3	3		5	0 $_{30}$		6	6		8	3 $_{30}$		10	1
20 drops........		1	7		3	6		5	5		7	4		9	3		11	2
25 drops..		2	2 $_{45}$		4	5 $_{30}$		7	0 $_{15}$		9	3		11	5 $_{45}$		14	0 $_{30}$
30 drops, or ½ dr.		2	6 $_{30}$		5	5		8	3 $_{30}$		11	2		14	0 $_{30}$	1	0	7
40 drops, or ⅔ dr.		3	6		7	4		11	2		15	0	1	2	6	1	6	4
60 drops, or 1 dr.		5	5		11	2	1	0	7	1	6	4	1	12	1	2	1	6
2 drachms......		11	2	1	6	4	2	1	6	2	13		3	8	2	4	3	4
4 drachms......	1	6	4	2	13		4	3	4	5	10		6	16	4	8	7	
1 ounce........	2	13		5	10		8	7		11	4		14	1		16	14	
2 ounces......	5	10		11	4		16	14		22	8		28	2		33	12	
4 ounces......	11	4		22	8		33	12		45			56	4		67	8	

EXAMPLE.

It is desired to give a patient enough fluid to last 6 weeks, to be taken in teaspoonful doses 3 times a day, each dose to contain 1 grain of quinine and ⅓ grain of morphine. What quantity of fluid must be given, and what proportions of quinine and morphine must it contain?

By the above table, a teaspoonful or drachm dose, given 3 times a day, will require 1 pint and 7 drachms of fluid to last for 6 weeks. Now, by referring to table on page 2161, on a line with the given dose, 1 grain, it will be found that for drachm doses 1 pint will require 2 drachms and 8 grains of the medicine, while 8 drachms or 1 ounce will require 8 grains, making 2 drachms and 16 grains; but as only 7 drachms are required, or 1 drachm less than the ounce, the amount of the dose for the superfluous drachm, which contains 1 grain, must be deducted, making 2 drachms and 15 grains of quinine. Again, by referring to the given dose, ⅓ grain, in same table, and following the line of drachm doses, it will be found that 1 pint will require 42⅔ grains, while 8 drachms will require 2⅔ grains, making in all 45⅓ grains; from which deduct the superfluous drachm, which contains ⅓ grain, and the result will be 45 grains of morphine.

TABLE OF ATOMIC WEIGHTS.

U. S. P.

(According to L. Meyer and K. Seubert.)

Names of elements occurring in pharmacopœial and medicinal chemicals, or in reagents used for pharmacopœial tests, are distinguished by the sign † placed after them.

Name.	Symbol.	Atomic weight.	Name.	Symbol.	Atomic weight.
Aluminum†	Al	27.04	Molybdenum†	Mo	95.9
Antimony†	Sb	119.6	Nickel	Ni	58.6
Arsenic†	As	74.9	Nitrogen†	N	14.01
Barium†	Ba	136.9	Osmium	Os	190.3
Beryllium (1	Be	9.03	Oxygen†	O	15.96
Bismuth†	Bi	208.9	Palladium	Pd	106.35
Boron†	B	10.9	Phosphorus†	P	30.96
Bromine†	Br	79.76	Platinum†	Pt	194.3
Cadmium†	Cd	111.5	Potassium†	K	39.03
Caesium	Cs	132.7	Rhodium	Rh	102.9
Calcium†	Ca	39.91	Rubidium	Rb	85.2
Carbon†	C	11.97	Ruthenium	Ru	101.4
Cerium†	Ce	139.9	Samarium	Sm	149.62
Chlorine†	Cl	35.37	Scandium	Sc	43.97
Chromium†	Cr	52.0	Selenium	Se	78.87
Cobalt†	Co	58.6	Silicon†	Si	28.3
Columbium (2	Cb	93.7	Silver†	Ag	107.66
Copper†	Cu	63.18	Sodium†	Na	23.0
Didymium (3	Di	142.0	Strontium†	Sr	87.3
Erbium	Er	166.0	Sulphur†	S	31.98
Fluorine†	F	19.0	Tantalum	Ta	182.0
Gallium	Ga	69.9	Tellurium	Te	125.0
Germanium	Ge	72.3	Terbium	Tb	159.1
Gold†	Au	196.7	Thallium	Tl	203.7
Hydrogen†	H	1.0	Thorium	Th	231.9
Indium	In	113.6	Tin†	Sn	118.8
Iodine†	I	126.53	Titanium	Ti	48.0
Iridium	Ir	192.5	Tungsten	W	183.6
Iron†	Fe	55.88	Uranium	U	238.8
Lanthanum	La	138.2	Vanadium	V	51.1
Lead†	Pb	206.4	Ytterbium	Yb	172.6
Lithium†	Li	7.01	Yttrium	Yt	88.9
Magnesium†	Mg	24.3	Zinc†	Zn	65.1
Manganese†	Mn	54.8	Zirconium	Zr	90.4
Mercury†	Hg	199.8			

1) Also called Glucinum (Gl—9.03).
2) Also called Niobium (Nb—93.7).
3) Composed of Neo- and Praseo-Didymium.

TABLES OF SPECIFIC GRAVITIES, ETC,

Relation between Specific Gravities and Degrees of Baumé's Hydrometer for Liquids Heavier than Water.

Sp. Gr.		Baumé.	Sp. Gr.		Baumé.	Sp. Gr.		Baumé.	Sp. Gr.		Baumé.
1.000	=	0	1.152	=	19	1.359	=	38	1.656	=	57
1.007	=	1	1.161	=	20	1.372	=	39	1.676	=	58
1.014	=	2	1.171	=	21	1.384	=	40	1.695	=	59
1.022	=	3	1.180	=	22	1.398	=	41	1.714	=	60
1.029	=	4	1.190	=	23	1.412	=	42	1.736	=	61
1.036	=	5	1.199	=	24	1.426	=	43	1.758	=	62
1.044	=	6	1.210	=	25	1.440	=	44	1.779	=	63
1.052	=	7	1.221	=	26	1.454	=	45	1.801	=	64
1.060	=	8	1.231	=	27	1.470	=	46	1.823	=	65
1.067	=	9	1.242	=	28	1.485	=	47	1.847	=	66
1.075	=	10	1.252	=	29	1.501	=	48	1.872	=	67
1.083	=	11	1.264	=	30	1.526	=	49	1.897	=	68
1.091	=	12	1.275	=	31	1.532	=	50	1.921	=	69
1.100	=	13	1.286	=	32	1.549	=	51	1.946	=	70
1.108	=	14	1.298	=	33	1.566	=	52	1.974	=	71
1.116	=	15	1.309	=	34	1.583	=	53	2.002	=	72
1.125	=	16	1.321	=	35	1.601	=	54	2.031	=	73
1.134	=	17	1.334	=	36	1.618	=	55	2.059	=	74
1.143	=	18	1.346	=	37	1.637	=	56	2.087	=	75

Relation between Specific Gravities and Degrees of Baumé's Hydrometer for Liquids Lighter than Water.

Sp. Gr.		Baumé.	Sp. Gr.		Baumé	Sp. Gr.		Baumé.	Sp. Gr.		Baumé.
1.000	=	10	0.918	=	23	0.849	=	36	0.789	=	49
0.993	=	11	0.913	=	24	0.844	=	37	0.785	=	50
0.986	=	12	0.907	=	25	0.839	=	38	0.781	=	51
0.980	=	13	0.901	=	26	0.834	=	39	0.777	=	52
0.973	=	14	0.896	=	27	0.830	=	40	0.773	=	53
0.967	=	15	0.890	=	28	0.825	=	41	0.768	=	54
0.960	=	16	0.885	=	29	0.820	=	42	0.764	=	55
0.954	=	17	0.880	=	30	0.816	=	43	0.760	=	56
0.948	=	18	0.874	=	31	0.811	=	44	0.757	=	57
0.942	=	19	0.869	=	32	0.807	=	45	0.753	=	58
0.936	=	20	0.864	=	33	0.802	=	46	0.749	=	59
0.930	=	21	0.859	=	34	0.798	=	47	0.745	=	60
0.924	=	22	0.854	=	35	0.794	=	48			

ALCOHOL TABLE.

Adapted From Dr. E. R. Squibb's Table in *U. S. P.*)

Per cent of alcohol by weight or volume.	SPECIFIC GRAVITY AT 15.55° C. (60° F.).		Per cent of alcohol by weight or volume.	SPECIFIC GRAVITY AT 15.55° C. (60° F.).	
	By weight.	By volume.		By weight.	By volume.
1	0.9981	0.9985	51	0.9160	0.9323
2	0.9965	0.9970	52	0.9135	0.9303
3	0.9947	0.9956	53	0.9113	0.9283
4	0.9930	0.9942	54	0.9090	0.9262
5	0.9914	0.9930	55	0.9069	0.9242
6	0.9898	0.9914	56	0.9047	0.9221
7	0.9884	0.9898	57	0.9025	0.9200
8	0.9869	0.9890	58	0.9001	0.9178
9	0.9855	0.9878	59	0.8979	0.9160
10	0.9841	0.9869	60	0.8956	0.9135
11	0.9828	0.9855	61	0.8932	0.9113
12	0.9815	0.9841	62	0.8908	0.9090
13	0.9802	0.9828	63	0.8886	0.9069
14	0.9789	0.9821	64	0.8863	0.9047
15	0.9778	0.9815	65	0.8840	0.9025
16	0.9766	0.9802	66	0.8816	0.9001
17	0.9753	0.9789	67	0.8793	0.8973
18	0.9741	0.9778	68	0.8769	0.8949
19	0.9728	0.9766	69	0.8745	0.8925
20	0.9716	0.9760	70	0.8721	0.8900
21	0.9704	0.9753	71	0.8696	0.8875
22	0.9691	0.9741	72	0.8672	0.8850
23	0.9678	0.9728	73	0.8649	0.8825
24	0.9665	0.9716	74	0.8625	0.8799
25	0.9652	0.9709	75	0.8603	0.8769
26	0.9638	0.9698	76	0.8581	0.8745
27	0.9623	0.9691	77	0.8557	0.8721
28	0.9609	0.9678	78	0.8533	0.8696
29	0.9593	0.9665	79	0.8508	0.8664
30	0.9578	0.9652	80	0.8483	0.8639
31	0.9560	0.9643	81	0.8459	0.8611
32	0.9544	0.9631	82	0.8434	0.8581
33	0.9528	0.9618	83	0.8408	0.8557
34	0.9511	0.9609	84	0.8382	0.8526
35	0.9490	0.9593	85	0.8357	0.8496
36	0.9470	0.9578	86	0.8331	0.8466
37	0.9452	0 9565	87	0.8305	0.8434
38	0.9434	0.9550	88	0.8279	0.8408
39	0.9416	0.9535	89	0.8254	0.8373
40	0.9396	0.9519	90	0.8228	0.8340
41	0.9376	0.9503	91	0.8199	0.8305
42	0.9356	0.9490	92	0.8172	0.8272
43	0.9335	0.9470	93	0.8145	0.8237
44	0.9314	0.9452	94	0.8118	0.8199
45	0.9292	0.9434	95	0.8089	0.8164
46	0.9270	0.9416	96	0.8061	0.8125
47	0.9249	0.9396	97	0.8031	0.8084
48	0.9228	0.9381	98	0.8001	0.8041
49	0.9206	0.9362	99	0.7969	0.7995
50	0.9184	0.9343	100	0.7938	0.7946

CANE SUGAR SOLUTIONS.

(According to Scheibler, from *Chemiker Kalender*, 1897.)

Per cent of sugar.	Specific gravity at 15° C.	Per cent of sugar.	Specific gravity at 15° C.	Per cent of sugar.	Specific gravity at 15° C.	Per cent of sugar.	Specific gravity at 15° C.	Per cent of sugar.	Specific gravity at 15° C.	Per cent of sugar.	Specific gravity at 15° C.
0	1.00000	13	1.05293	26	1.11101	39	1.17470	52	1.24444	65	1.32067
1	1.00390	14	1.05721	27	1.11571	40	1.17985	53	1.25007	66	1.32682
2	1.00783	15	1.06152	28	1.12044	41	1.18503	54	1.25574	67	1.33301
3	1.01178	16	1.06586	29	1.12520	42	1.19024	55	1.26144	68	1.33923
4	1.01576	17	1.07023	30	1.12999	43	1.19550	56	1.26718	69	1.34550
5	1.01978	18	1.07464	31	1.13482	44	1.20079	57	1.27297	70	1.35182
6	1.02382	19	1.07907	32	1.13969	45	1.20611	58	1.27879	71	1.35817
7	1.02789	20	1.08354	33	1.14458	46	1.21147	59	1.28465	72	1.36457
8	1.03199	21	1.08804	34	1.14952	47	1.21687	60	1.29056	73	1.37101
9	1.03611	22	1.09257	35	1.15448	48	1.22231	61	1.29650	74	1.37749
10	1.04027	23	1.09713	36	1.15949	49	1.22779	62	1.30248	75	1.38401
11	1.04446	24	1.10173	37	1.16452	50	1.23330	63	1.30850		
12	1.04868	25	1.10635	38	1.16960	51	1.23585	64	1.31457		

For further tables, giving specific gravity and percentage of solutions of Acetic, Hydrobromic, Hydrochloric, Nitric, Phosphoric, and Sulphuric Acids, as well as of Ammonia Water, **Potassium Hydrate**, and **Sodium Hydrate**, see *United States Pharmacopœia.*

SHOW COLORS FOR DRUGGISTS' SHOP WINDOWS.

BLUE.

No. 1.—Sulphate of copper, ℥j; sulphuric acid, ℥ss; water, ℥x.

No. 2.—Ammonio-sulphate of copper, ammonio-nitrate of nickel (see No. 5), and water.

No. 3.—Prussian blue, gr. x; oxalic acid, gr. xx; water, ℥xvj.

No. 4.—Dissolve nickel in diluted sulphuric acid, add ammonia in excess, and dilute with water.

No. 5.—Dissolve nickel in diluted nitric acid, add ammonia in excess, and dilute with water.

No. 6.—To the green color made by formula No. 8 under that color, add sufficient aqua ammoniæ to make it blue.

No. 7.—Dissolve sulphate of indigo in water.

GREEN.

No. 1.—Sulphate of copper, ℥ij; chloride of sodium, ℥iv; water, ℥xx.

No. 2.—Dissolve ℥j of nickel in ℥vj of nitric acid, and add Ov of water.

No. 3.—Dissolve nickel in dilute sulphuric acid, and dilute with water.

No. 4.—Dissolve sulphate of copper in water, and add bichromate of potassium until the required color is produced.

No. 5.—Dissolve ammonio-sulphate of copper in water, and add bichromate of potassium until the required color is produced.

No. 6.—Dissolve sulphate of copper in water, and add nitric acid until the required color is produced.

No. 7.—Dissolve verdigris in acetic acid, and dilute with water.

No. 8.—Dissolve a copper cent in nitric acid, and add enough of the solution to water or proof-spirit to give it the right shade.

No. 9.—Add distilled water and sulphate of copper to a strong decoction of turmeric.

LILAC.

No. 1.—Dissolve zaffre (impure oxide of cobalt) in hydrochloric acid, filter and add carbonate of ammonium in excess; to this add ammonio-sulphate of copper until the required color is produced.

No. 2.—Dissolve zaffre in hydrochloric acid, filter, and add carbonate of ammonium in excess; to this add ammonio-nitrate of nickel (see *Blue* No. 5) until the required tint is produced.

ORANGE.

No. 1.—Dissolve bichromate of potassium in water until the required tint is produced.

No. 2.—The same as No. 1, but adding some oil of vitriol, or hydrochloric acid.

PINK

No. 1.—Dissolve ℥ij of zaffre in ℥vj of hydrochloric acid, filter, add solution of carbonate of ammonium in excess; then add fl℥j of liquor potassæ, and dilute with water to produce the required color.

No. 2.—Nitrate of cobalt may be used, with carbonate of ammonium, in the same way as the preceding.

PURPLE.

No. 1.—Sulphate of copper, ℥j; carbonate of ammonium, ℥jss; water, Oijss.

No. 2.—The last color, with a small quantity of the *Pink* No. 1.

No. 3.—Dissolve permanganate of potassa in water.

No. 4.—Dissolve verdigris 2 drachms, and aqua ammoniæ 4 fluid ounces, in 1½ pints of water.

No. 5.—Acetate of lead, 1 ounce; powdered cochineal, 1 scruple; water, a sufficient quantity until the required tint is produced.

YELLOW.

No. 1.—Bichromate of potassium, ʒvj; carbonate of potassium, ʒiv; water, ℥xvj.

No. 2.—Add a sufficient quantity of tincture of iodine to alcohol or proof-spirit to make a bright straw color.

No. 3.—Dissolve iron in hydrochloric acid, and dilute with water.

No. 4.—Dissolve Indian yellow in water.

No. 5.—Pour boiling water on powdered turmeric, and filter. A small quantity of any alkaline solution converts it into a *brown* color.

VIOLET.

Ammonio-sulphate of copper, diluted with water, and enough of the pink color No. 1 to produce the required tint.

RED.

No. 1.—Macerate powdered cochineal in spirit of hartshorn, and dilute it with water.

No. 2.—Dissolve carmine in solution of ammonia, and dilute it with water.

No. 3.—Wash the best madder two or three times with cold water, then macerate it in solution of carbonate of ammonium, filter the solution, and dilute it with water

No. 4.—Dissolve madder lake in solution of carbonate of ammonium.

No. 5.—Add a sufficient quantity of tincture of iodine to alcohol or proof-spirit, to produce the desired color. Should it fade renew the color by adding more tincture of iodine.

No. 6.—Dissolve carmine in water to which a little chloride of tin has been added.

No. 7.—To a solution of sal ammoniac add a sufficient quantity of cochineal.

No. 8.—Boil a red beet in water, dilute it to the required tint, and brighten it with a little acetic acid.

N. B.—Alcohol answers better for colors than water or proof-spirit, as there is seldom any precipitate or decomposition; beside, as it does not freeze in winter, there is no breaking of the show-bottles, which is apt to ensue when water is used. Many show colors can now be made also from aniline dyes, by dissolving them in water or alcohol.

GENERAL INDEX

OF

BOTANY, MATERIA MEDICA, CHEMISTRY, AND PHARMACY.