by macerating the bark for three or four days in carbon disulphide, then permitting the liquid to evaporate, exhausting the residue with alcohol, which leaves the fatty matter behind, evaporating the alcoholic liquid to dryness, and recrystallizing from ether. As thus obtained it is in fine yellow crystals, melting at about 249° C. (480·2° F.), and subliming in golden-yellow needles. It is insoluble in water, soluble in 160 parts of warm 80 per cent. alcohol, nearly insoluble in cold alcohol, soluble in hot fixed oils, benzin, and oil of turpentine. It communicates its color to cotton, silk, and wool. Kubly obtained an amorphous glucoside, *avornin*, $C_{16}H_{18}O_8$, from the bark, and Liebermann and Waldstein obtained from old frangula bark the glucoside *emodin*, and proved its identity with the same principle found in rhubarb.

Medical Properties. In its fresh state this drug is very irritant to the gastro-intestinal mucous membrane, producing, when taken in sufficient quantity, violent catharsis, accompanied by vomiting, and much pain. During drying it is said to lose much of its irritant powers, and the dried bark is affirmed to resemble rhubarb in its action. In this country it is gradually coming into use. A *decoction* (half ounce to the half pint) may be used in tablespoonful doses, or a dessertspoonful of an *elixir*, four fluidounces of the fluid extract to twelve of elixir of orange, or the officinal fluid extract in doses of fifteen to thirty minims (0·9 to 1·9 C.c.).

Off. Prep. Extractum Frangulæ Fluidum, *U. S.*

GALBANUM. *U. S., Br. Galbanum.*

(GĂL'BĂ-NŬM.)

"A gum-resin obtained from Ferula galbaniflua, Boissier et Buhse, and probably from other allied plants. (*Nat. Ord.* Umbelliferæ, Orthospermæ.)" *U. S.* "A gum-resin, derived from an unascertained umbelliferous plant. Imported from India and the Levant." *Br.*

Gummi-Resina Galbanum; Galban, Mutterharz, *G.*; Galbano, *It., Sp.*

It is uncertain from what plant galbanum is derived. At one time it was supposed to be the product of *Bubon Galbanum*, an umbelliferous plant of the eastern coast of Africa. It has also been referred to the *Ferula Ferulago* of Linnæus, the *Ferula galbanifera* of Lobel, which inhabits the coast of the Mediterranean, and is found also in Transylvania and the Caucasus. But no part of either of these plants has the odor of galbanum; and it is, therefore, scarcely probable that they yield the drug. Mr. Don, having found the seeds taken from a parcel of galbanum to belong to an undescribed genus of umbelliferous plants, and concluding that they came from the same source as the gum-resin itself, gave the title of Galbanum to the new genus, and named the species *Galbanum officinale*. This was rather hastily adopted by the London College; as it is by no means certain that the same plant produced the seeds and the gum-resin. Specimens of a plant were received in England from Persia having a concrete juice adhering to them, which was taken by Dr. Lindley for galbanum: and that botanist, finding that the plant belonged to an undescribed genus, named it *Opoïdia*, with the specific name *galbanifera*. Dr. Pereira, however, found the substance not to be galbanum; and this supposed origin of the drug, therefore, must be considered as more than doubtful. A German traveller, F. A. Buhse, who has resided in Persia, states that, in 1848, he met with the gal*banum* plant on the declivities of the Demavend, near the southern coast of the Caspian. He saw the gum-resin exuding spontaneously from the plant, and was informed by the natives that the drug was collected from it. The plant is a Ferula, and has received the name of *F. galbaniflua*, Boissier and Buhse. Buhse also states that the Persian galbanum is yielded by a second plant, which is doubtfully distinct from *F. galbaniflua;* this is the *F. rubricaulis*, Boissier (*F. erubescens*, Berg). Galbanum is said to be obtained by making incisions into the stem, or cutting it off a short distance above the root. A cream-colored juice exudes, which concretes upon exposure to the air. A portion of juice also exudes spontaneously from the joints, and hardens in the shape of tears. The drug is brought from India and the Levant.

Properties. Galbanum usually appears in the form of masses composed of whitish, reddish, or yellowish tears, from the size of a pin's head to that of a pea, and

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larger, irregularly agglutinated by a darker colored yellowish brown or greenish substance, more or less translucent, and generally mixed with pieces of stalk, seeds, or other foreign matters. It is also found, though rarely in our markets, in the state of distinct roundish tears, about as large as a pea, of a yellowish white or pale brownish yellow color, shining externally as if varnished, translucent, and often adhering together. Galbanum has in cool weather the consistence of firm wax, but softens in summer, and by the heat of the hand is rendered ductile and adhesive. At 100° C. (212° F.) it is sufficiently liquid to admit of straining; and it generally requires to be strained before it can be used. A dark brown or blackish color, a consistence always soft, the absence of whitish grains, a deficiency in the characteristic odor and taste, and the intermixture of earthy impurities, are signs of inferiority.

The odor of galbanum is peculiar and disagreeable; its taste bitterish, warm, and acrid; its sp. gr. 1·212. Triturated with water, it forms an imperfect milky solution, which on standing deposits the greater portion of what was taken up. Wine and vinegar act upon it in a similar manner. Alcohol dissolves a considerable proportion, forming a yellow tincture, which has the smell and taste of galbanum, and becomes milky with water, but affords no precipitate. In dilute alcohol it is wholly soluble, with the exception of impurities. Ether dissolves the greater portion. "When moistened with alcohol, galbanum acquires a purple color on the addition of a little hydrochloric acid." *U. S.* It contains volatile oil, resin, and mucilage. The oil, amounting to 7 per cent., is a slightly yellowish liquid, partly consisting of a hydrocarbon, $C_{10}H_{16}$, boiling at from 170° to 180° C. The greater part of oil of galbanum, however, consists of hydrocarbons of a much higher boiling point. The crude oil is dextrogyrate. The resin, constituting about 60 per cent., is very soft, and dissolves in ether or in alkaline liquids, even in milk of lime, but only partially in bisulphide of carbon. When heated with hydrochloric acid for some time, it yields *umbelliferone*, $C_9H_6O_3$, which may be dissolved from the acid liquid by means of ether or chloroform, and obtained on evaporation in colorless acicular crystals. The aqueous solution of umbelliferone exhibits, especially on addition of an alkali, a brilliant blue fluorescence, which is destroyed by an acid. If a small fragment of galbanum is immersed in water, a fluorescence is produced by a drop of ammonia. Asafœtida shows the same, but ammoniacum does not.

Galbanum submitted to dry distillation yields a thick oil of brilliant blue color. This oil on rectification yields a greenish portion, and then a superb blue oil. Kachler (*Ber. Ch. Ges.*, 1871, p. 36) found a colorless oil, $C_{10}H_{16}$, and a blue oil, $C_{10}H_{16}O$, boiling at 289° C. The blue oil, according to Kachler, after purification, agrees with the blue oil of the flowers of *Matricaria Chamomilla*.

By fusing galbanum resin with potash, Hlasiwetz and Barth (*Ann. Ch. Pharm.*, 130, p. 354) obtained *resorcin*, together with acetic and volatile fatty acids.

According to Ludewig, a gum-resin, designated as *Persian galbanum*, is received in Russia by the way of Astracan or Orenburg, and is the kind used in that country. It comes enclosed in skins, and is in masses of a reddish brown color with whitish streaks, of a disagreeable odor, somewhat like that of asafœtida, and of an unpleasant, bitter, resinous taste. It is so soft as to melt with a slight elevation of temperature. It differs from common galbanum in its odor, in its color, which is never greenish, and in the absence of tears, and is probably derived from a different plant. It abounds in impurities.

Medical Properties and Uses. Galbanum was known to the ancients. It is stimulant, expectorant, and antispasmodic, and is considered as intermediate in power between ammoniac and asafœtida. It has chiefly been used in chronic affections of the bronchial mucous membrane, amenorrhœa, and chronic rheumatism. It is occasionally applied externally as a plaster to indolent swellings, with the view of promoting resolution or suppuration. The dose is from ten to twenty grains (0·65–1·3 Gm.), and may be given in pill, or triturated with gum arabic, sugar, and water, so as to form an emulsion.

Off. Prep. Emplastrum Asafœtidæ, *U. S.;* Emplastrum Galbani; Pilula Assafœtidæ Composita, *Br.;* Pilulæ Galbani Compositæ, *U. S.*

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GALLA. *U. S.* *Nutgall.* [*Galls.*]

(GĂL'LĄ.)

"Excrescences on Quercus lusitanica, Webb, *var.* infectoria, De Candolle (*Nat. Ord.* Cupuliferæ), caused by the punctures and deposited ova of Cynips Gallæ tinctoriæ. Olivier. (*Class*, Insecta. *Order*, Hymenoptera.)" *U. S.* "Excrescences on Quercus infectoria, caused by the punctures and deposited ova of Diplolepis Gallæ tinctoriæ." *Br.*

Gallæ, *P.G.;* Gale Halepense, vel Hercica, vel Levantica, vel Tinctoria, vel Quercina; Galle de Chêne, Noix de Galle, *Fr.;* Galläpfel, *G.;* Galla, *It.;* Agallas de Levante, *Sp.*

Many plants, when pierced by certain insects, particularly those of the genus *Cynips*, are affected at the points of puncture with a morbid action, resulting in excrescences, which, as they are derived from the juices of the plant, partake more or less of its chemical character. Most of the oaks are occasionally thus affected; and the resulting excrescences, having in a high degree the astringency of the plant, have been employed for various practical purposes. They are known by the name of *galls*, a term which, as well as their use in medicine, has been handed down from the ancients. *Quercus infectoria*, *Q. Ægilops*, *Q excelsa*, *Q. Ilex*, *Q. Cerris*, and *Q. Robur* have been particularized as affording this product; but it is now generally admitted, on the authority of Olivier, that the officinal galls are derived chiefly, if not exclusively, from *Q. infectoria.**

QUERCUS. See *Quercus Alba.*

Quercus infectoria. Willd. *Sp. Plant.* iv. 436; Olivier, *Voy. Orient.* t. 14 *et* 15; Carson, *Illust. of Med. Bot.* ii. 40, pl. 85. The *dyer's oak* is a small tree or shrub, with a crooked stem, seldom exceeding six feet in height. The leaves are obtusely toothed, smooth, of a bright green color on both sides, and stand on short footstalks. The acorn is elongated, smooth, two or three times longer than the cup, which is sessile, somewhat downy, and scaly. This species of Quercus grows, according to Olivier, throughout Asia Minor, from the Archipelago to the confines of Persia. Captain M. Kinnier found it also in Armenia and Kurdistan; General Hardwicke observed it growing in the neighborhood of Adwanie; and it probably pervades the middle latitudes of Asia.

The gall originates from the puncture of the *Cynips quercûsfolii* of Linnæus, the *Diplolepis gallæ tinctoriæ* of Geoffroy, a hymenopterous insect or fly, with a fawn-colored body, dark antennæ, and the upper part of its abdomen shining brown. The insect pierces the shoots and young boughs, and deposits its egg in the wound. This irritates the part, and a small tumor quickly rises, which is the result of a morbid growth, exhibiting various cells under the microscope, but no proper vegetable fibre. The egg grows with the gall, and is soon converted into a larva, which feeds upon the vegetable matter around it, and thus forms a cavity in the centre of the excrescence. The insect at length becomes a fly, and escapes by eating its way

* Under the name of *Chinese galls*, a product has been brought from China, supposed to be caused by an insect allied to the Aphis, as such an insect has been found in the interior of them. They are irregularly spindle-shaped, often more or less bent, with obtusely pointed protuberances, about two inches long by an inch in diameter at the central thickest part, of an ash color and a soft velvety feel, very light, hollow, with translucent walls about a line in thickness, of a slight odor recalling that of ipecacuanha, and a bitter astringent taste. From an examination of fragments of leaves and petioles found among these galls, Dr. Schenck concluded that the tree on which they are found is a species of Rhus; but, according to M. Decaisne, professor at the Museum of Natural History in Paris, their true source is probably the *Distylium racemosum* of Zuccarini (*Flor. Japon.*, i. p. 178, t. 94), a large tree of Japan, the leaves of which produce a velvety gall, resembling the one in question. (Guibourt, *Hist. Nat. des Drogues*, 1850, iii. 703.) More recently, however, it has been asserted by Mr. Daniel Hanbury that this opinion of Decaisne is erroneous (*P. J. Tr.*, Feb. 1862, p. 421); as, in his examination of the packages imported from China and Japan, he has found remains of different parts of a species of Rhus, but never any of a Distylium. Besides, the form of the galls of the Distylium, as figured by Siebold and Zuccarini, is entirely different. The species of Rhus which yields the commercial Chinese galls is the *R. semi-alata.* (Murray.) The Chinese make great use of this product both in dyeing and as a medicine. L. A. Buchner, Jr., has found it to contain 65 per cent. of tannic acid identical with that of the officinal galls. (*Pharm. Centralblatt*, July, 1851, p. 526.) It is recommended by Stenhouse for the manufacture of gallic acid, being preferable for this purpose to the officinal galls, in consequence of its less amount of coloring matter. (*P. J. Tr.*, Dec. 1862.) An inferior kind of galls is produced in great quantities in England, by the attack of the *Cynips Kollari* of Hartig, upon the common English oak; but they have been ascertained to contain little tannic acid, and are of little value.

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out. The galls are in perfection when fully developed, before the egg has been hatched, or the fly has escaped. Collected at this period, they are called, from their dark color, *blue*, *green*, or *black galls*, and are most highly esteemed. Those which are gathered later and have been injured by the insect are *white galls*. They are usually larger, less heavy and compact, and of a lighter color than the former.

The galls collected in Syria and Asia Minor are brought to this country chiefly from the ports of Smyrna and Trieste, or from London. As they are produced abundantly near Aleppo, it has been customary to designate them by the name of that town; though the designation, however correct it may formerly have been, is now wholly inapplicable, as they are obtained from many other places, and the produce of different parts of Asiatic Turkey is not capable of being discriminated, at least in our markets. Great quantities of galls, very closely resembling those from the Mediterranean, have been brought to the United States from Calcutta. Dr. Royle states that they are taken to Bombay from Bussorah through the Persian Gulf. We are, nevertheless, informed that galls are among the products of Moultan. Those of France and other southern countries of Europe have a smooth, shining reddish surface, are little esteemed, and are seldom brought to the United States.

Properties. Galls are nearly round, from the size of a pea to that of a very large cherry, with a surface usually studded with small tuberosities, in the intervals of which it is smooth. The best are externally of a dark bluish or lead color, sometimes with a greenish tinge, internally whitish or brownish, hard, solid, brittle, with a flinty fracture, a striated texture, and a small spot or cavity in the centre, indicating the presence of the undeveloped or decayed insect. Their powder is of a light yellowish gray. Those of inferior quality are of a lighter color, sometimes reddish or nearly white, of a loose texture, with a large cavity in the centre, communicating externally by a small hole through which the fly has escaped. The U. S. P. directs that "light, spongy and whitish-colored Nutgalls should be rejected," but allows "in the centre a cavity containing either the partly developed insect, or pulverulent remains left by it," and therefore permits white galls of good quality. Galls have a bitter, very astringent taste, and when whole are inodorous or nearly so, but bruised or in powder they have a decided and peculiar though not very strong smell. The tannin of galls, which is a distinct variety usually known as *gallo-tannic acid*, appears to exist in the galls as a glucoside, but one very easily broken up by ferments like pectase into glucose and *di-gallic acid*, $C_{14}H_{10}O_9$, which is the material, therefore, extracted from the galls. This di-gallic acid may be considered as the anhydride of *gallic acid*, $C_7H_6O_5$, formed from two molecules of this latter by the elimination of one molecule of water. Commercial tannin yields from 0 to 22 per cent. of glucose, showing the presence of varying amounts of the unaltered glucoside. Galls yield on an average from 65 to 77 per cent. of tannin. (See *Acidum Tannicum* and *Acidum Gallicum*, pages 114 and 60.) All the soluble matter of galls is taken up by forty times their weight of boiling water, and the residue is tasteless. Alcohol dissolves seven parts in ten, ether five parts. (*Thompson's Dispensatory.*) A saturated decoction deposits upon cooling a copious pale yellow precipitate. The infusion or tincture affords precipitates with sulphuric and hydrochloric acids, lime-water, and the carbonates of ammonium and potassium; with solutions of acetate and subacetate of lead, the sulphates of copper and iron, the nitrates of silver and mercury, and tartrate of antimony and potassium; with solution of gelatin; and with the infusions of Peruvian bark, columbo, opium, and many other vegetables, especially those containing alkaloids, with most of which tannic acid forms insoluble compounds. The infusion of galls reddens litmus paper, is rendered orange by nitric acid, milky by the corrosive chloride of mercury, and has its color deepened by ammonia; but yields no precipitate with either of these reagents. Sulphate of zinc was said by Dr. A. T. Thomson to occasion a slow precipitate, but this result was not obtained by Dr. Duncan.

A variety of galls was imported into Germany, which was said to be derived from Central Asia, especially from the provinces of Khokan, Khiva, and Bucharia, where they are used in dyeing. They are of various forms, some being long, others round, cylindrical, or angular; and sometimes they are grouped upon a single stalk,

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and covered with little elevations. They differ from all other galls by their color, being on one side yellow, and on the other of a fine red. Most of them present a little opening; and in the interior are eggs and larvæ of a peculiar species of Aphis. They have yielded, on analysis, 43·10 per cent. of tannin, 3·03 of a green wax, 16 of cellulose, and an undetermined quantity of fecula and volatile oil. (R. Palne, *Journ. de Pharm.*, Avril, 1873, p. 336.)

Medical Properties and Uses. Galls are powerfully astringent, but are no longer used internally.*

Off. Prep. Tinctura Gallæ; Unguentum Gallæ; Unguentum Gallæ cum Opio. *Br.*

GAULTHERIA. *U. S.* *Gaultheria.* [*Wintergreen.*]

(GÂUL-THĒ'RĮ-Ą—gâwl-thē'rį-ą.)

Boxberry, Chickerberry; Feuilles de Gaulthérie (de Paloninier), Thé du Canada, Thé de Terreneuve, *Fr.*; Canadischer Thee, Bergthee, *G.*

"The leaves of Gaultheria procumbens. Linné. (*Nat. Ord.* Ericaceæ.)" *U. S.*

Gen. Ch. Calyx five-cleft, bibracteate at the base. *Corolla* ovate. *Capsule* five-celled, invested with the berried calyx. *Pursh.*

Gaultheria procumbens. Willd. *Sp. Plant.* ii. 616; Bigelow, *Am. Med. Bot.* iii. 27; Barton, *Med. Bot.* i. 171. This is a small, indigenous, shrubby, evergreen plant, with a long, creeping, horizontal root, which sends up at intervals one or two erect, slender, round, reddish stems. These are naked below, leafy at top, and usually less than a span in height. The *leaves* are short-petiolate, obovate or roundish-oval, about an inch and a half (4 centimeters) long, and three-quarters of an inch (2 centimeters) or more broad, acute, revolute at the edges with a few mucronate serratures, coriaceous, shining, bright green above, paler beneath, of unequal size, and supported irregularly on short red petioles. The flowers, of which not more than from three to five are usually on each stem, stand upon curved, drooping, axillary peduncles. The calyx is white, five-toothed, and furnished at its base with two concave cordate bracts, described by some as an outer calyx. The corolla is white, ovate, or urceolate, contracted at the mouth, and divided at the border into five small acute segments. The stamens have curved, plumose filaments, and oblong orange-colored anthers opening on the outside. The germ, which rests upon a ring having ten teeth alternating with the ten stamens, is roundish, depressed, and surmounted by an erect filiform style, ending in an obtuse stigma. The fruit is a small, five-celled, many-seeded capsule, with a fleshy covering, formed by the enlarged calyx, and presenting the appearance of a bright scarlet berry.

The plant extends from Canada to Georgia, growing in large beds in mountainous tracts, or in dry barrens and sandy plains, beneath the shade of shrubs and trees, particularly of other evergreens, as the Kalmiæ and Rhododendra. It is abundant in the pine-barrens of New Jersey. In different parts of the country, it is variously called *partridge-berry*, *deer-berry*, *tea-berry*, *wintergreen*, and *mountain-tea*. The flowers appear from May to September, and the fruit ripens at corresponding periods. Though the leaves only are officinal, all parts of the plant are endowed with the peculiar flavor for which these are employed, and which is found in several other plants, particularly in the bark of *Betula lenta*, or sweet birch. The fruit possesses it in a high degree, and, being at the same time sweetish, is much relished by some persons, and forms a favorite article of food with partridges, and other wild animals. To the very peculiar aromatic odor and taste which belong to the whole plant, the leaves add a marked astringency. The aromatic properties reside in a volatile oil, which may be separated by distillation. (See *Oleum Gaultheriæ.*)

Medical Properties and Uses. Gaultheria has the usual stimulant operation of the aromatics, united with astringency, and may, therefore, be used with advantage

* *Aromatic Syrup of Galls.* The following old formula based upon one of Dr. Physick's is still sometimes employed. Macerate for twenty-four hours half an ounce of powdered galls, two drachms of bruised cinnamon, and two drachms of bruised nutmeg, in half a pint of brandy; then percolate, and, when the liquor has ceased to pass, add enough diluted alcohol to yield half a pint of filtered liquor. Put this into a shallow capsule, suspend over it two ounces of sugar on a slip of wire-gauze, and set the tincture on fire. The sugar melts with the flame, and falls into the liquid beneath. When the combustion ceases, agitate and filter. A highly astringent aromatic syrup is obtained, a fluidrachm of which may be given in diarrhœa. (*A. J. P.*, xxvii. 416.)

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in some forms of chronic diarrhœa. Like other substances of the same class, it has been employed as an emmenagogue, and with the view of increasing the secretion of milk; but its chief use is in the form of oil to impart an agreeable flavor. Death, from gastric inflammation, has been produced by about a fluidounce of the oil.

Off. Prep. Oleum Gaultheriæ, *U. S.;* Spiritus Gaultheriæ, *U. S.*

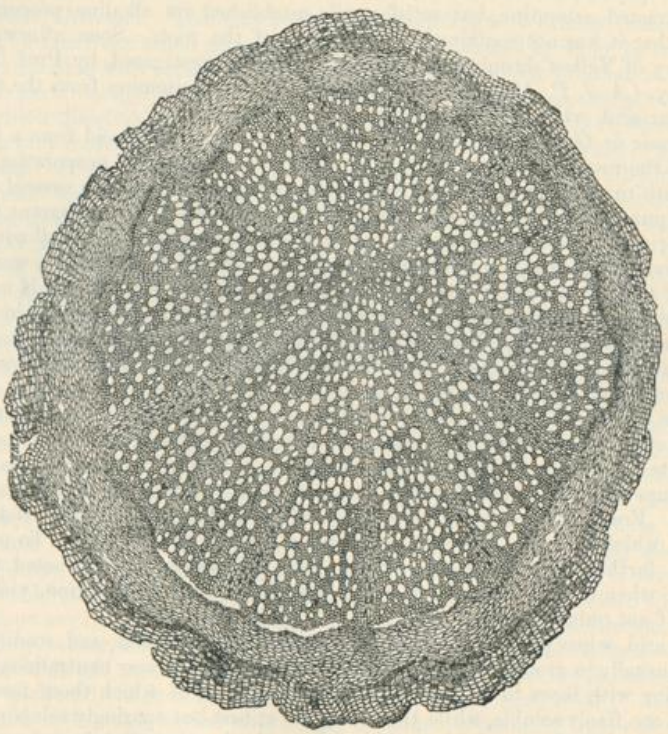
GELSEMIUM. *U. S.* *Gelsemium.* [*Yellow Jasmine.*]

(JĘL-SĒM'I-ŪM.)

"The rhizome and rootlets of Gelsemium sempervirens. Aiton. (*Nat. Ord.* Loganiaceæ.)" *U. S.* "The root of Gelsemium sempervirens (Gray, *Manual of Botany*)." *U. S.*

Gen. Ch. *Calyx* five-parted. *Corolla* funnel-form, with a spreading border, five-lobed, nearly equal. *Anthers* oblong, sagittate. *Style* long and slender. *Stigmas* two, two-parted. *Capsule* elliptical, flat, two-valved, two-celled. *Seeds* flat, attached to the margin of the valves.

Gelsemium sempervirens. Gray, *Man. of Bot.*— *Gelseminum nitidum.* Michaux.— *Bignonia sempervirens.* Willd. *Sp. Plant.* iii. 291. Figured in *A. J. P.*, xxvii. 197. The *yellow* or *Carolina jasmine* is one of the most beautiful climbing plants of our Southern States, ascending lofty trees, and forming festoons from one tree to another, and in its flowering season, in the early spring, scenting the atmosphere with its



Gelsemium, transverse section.

delicious odor. The stem is twining, smooth, and shining; the leaves perennial, opposite, shortly petiolate, lanceolate, entire, dark green above, and paler beneath; the flowers in axillary clusters, large, of a deep yellow color, and fragrant, with a very small, five-leaved calyx, and a funnel-shaped corolla, having a spreading, five-lobed, nearly equal border. The fruit is a flat, compressed capsule, divisible into

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two parts, two-celled, and furnished with flat seeds, which adhere to the margins of the valves. The plant grows in rich, moist soils along the sea-coast from Virginia to the south of Florida. The flowers are said to be poisonous.

Properties. As we have seen it in commerce, the rhizome is sliced into pieces, about an inch in length, cylindrical or split, very light and fibrous, of a dirty yellowish white color, but darker where the epidermis remains, of a slight feebly narcotic odor, and a bitterish, not unpleasant taste. It is officinally described as "cylindrical, long, or cut in sections, occasionally an inch and a quarter (3 cm.) thick, the roots much thinner; externally light brown-yellow with purplish brown, longitudinal lines; tough; fracture splintery; bark thin, with silky bast-fibres, closely adhering to the pale yellowish, porous wood, having fine, medullary rays, and in the rhizome a thin pith." The figure (page 703), shows in transverse section its well-marked characteristics. It yields its virtues to water, and readily to diluted alcohol. Analyzed by Mr. Henry Kollock, it was found to contain gum, starch, pectic acid, albumen, gallic acid, fixed oil, a fatty resin, a dry acrid resin, yellow coloring matter, volatile oil, extractive, lignin, a peculiar alkaloid called *gelsemine*, salts of potassa, lime, and magnesia, iron and silica. The alkaloid, however, was not obtained sufficiently pure to admit of a full investigation of its properties. (*A. J. P.*, xxvii. 203.) After Mr. Kollock's experiments, the alkaloid was obtained in a crystalline form, but still impure, by Prof. Maisch, from a tincture of the root, by a process of which a very brief abstract is given in *A. J. P.*, 1869, p. 36, by Mr. C. L. Eberle, who, in the same paper, publishes the results of his own investigation. Mr. Eberle not only extracted gelsemine, but satisfactorily established its alkaline properties, and proved that it was not contained in the wood of the root. Soon afterwards, the chemistry of Yellow Jasmine was more thoroughly investigated by Prof. Theo. G. Wormley. (*A. J. P.*, 1870, p. 1.) He obtained pure gelsemine from the root, and a peculiar acid, which he called *gelseminic* (gelsemic) acid.

Gelsemic or *Gelseminic Acid.* Prof. Wormley obtains the acid from a fluid extract of the root, which is actually a concentrated tincture, by evaporating it on a water-bath to about one-eighth of its volume, adding to the residue several times its bulk of pure water, allowing the mixture to stand until the supernatant liquid is nearly or quite clear, then transferring to a filter, washing the solids well with water, and reducing the filtrate thus obtained, together with the washings, on a water-bath, to about the volume of the concentrated fluid extract. To this, filtered if necessary, hydrochloric acid is added in the proportion of a drop of the pure acid to each fluidounce of the original fluid extract; the acidulated liquid is then agitated with twice its volume of ether; and, after the liquids have separated, the ethereal portion is decanted, the aqueous liquid again agitated with a similar quantity of ether, which is in its turn decanted, and the watery part finally washed with about its volume of ether. On mixing the ethereal liquids thus obtained, and allowing them to evaporate spontaneously, the gelsemic acid is left, chiefly in the form of nearly colorless groups of crystals, together with more or less yellowish or brownish resinous matter. From this the crystals are separated by washing with a little cold absolute alcohol, which dissolves the resin, with but a little of the crystals. To purify the crystals further, they are mixed with a little hot water, and extracted from the mixture when cool by chloroform, which, on spontaneous evaporation, yields them nearly if not quite colorless.

The acid, when pure, is colorless, inodorous, almost tasteless, and readily crystallizable, usually in groups or tufts of fine needles. It has strong neutralizing powers; combining with bases to form completely neutral salts, of which those formed with alkalies are freely soluble, while the others are at best but sparingly soluble in water. The acid itself is freely soluble in chloroform and ether, but slightly so in cold water, which takes up only about one-thousandth of its weight of the acid. Hot water dissolves it more freely, but on cooling deposits it in long, slender needles. The action of concentrated nitric acid may be considered as a test. If a drop of this acid be added to gelsemic acid or any of its salts, it forms a yellow, reddish, or red solution, which, if treated with ammonia in excess, becomes of a deep blood-red color, lasting for hours. The $\frac{1}{1000}$ of a grain will exhibit these changes. Caustic potassa, soda,

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or ammonia, added to the acid, causes it to become intensely yellow, and forms with it highly fluorescent solutions. The acid is fusible, and, at a high heat, volatilizable without change.

Robbins (*Deut. Chem. Ges.*, 1876, p. 1182), who has also investigated gelsemic acid, states that it is identical with *æsculin* (the glucoside of the horse-chestnut), and gives it the formula $C_{30}H_{34}O_{19} + 2H_2O$. Dragendorff (*Jahresb. für Pharmacog., Pharm. und Toxicol.*, 1878, p. 640) reinvestigated the constituents of Gelsemium sempervirens, and found æsculin and gelsemine, extracting the former out of an acid solution by chloroform and the latter from an alkaline solution by benzin and chloroform. Schwartz (*Inaugural Dissertation*, Dorpat, 1882) also found æsculin, the identity of which he established by a series of reactions, and some *æsculetin*, presumably from the decomposition of portions of the æsculin. The subject has very recently (*A. J. P.*, July, 1882) been re-examined by Prof. Wormley, who finds that gelsemic acid differs from æsculin in the following well-marked particulars: 1, in crystallization, the gelsemic acid crystallizes much more readily; 2, its insolubility in water and ether, the gelsemic acid is more soluble in ether and less soluble in water than æsculin; 3, gelsemic acid is not soluble in hydrochloric acid, while æsculin is; 4, corrosive sublimate gives a copious yellow precipitate with gelsemic acid, while it gives no result with æsculin; 5, sulphate of copper and acetate of lead yield precipitates with gelsemic acid differing from those of the same reagents with æsculin. Wormley, therefore, concludes that they are "very different substances."

Gelsemine, Gelsemia. This may be obtained, according to Wormley, from the concentrated extract from which gelsemic acid has been separated by ether, by rendering it slightly alkaline with potassa (Schwartz (*loc. cit.*) prefers soda solution on account of the too great energy of the caustic potassa), then agitating repeatedly with chloroform, which dissolves the alkaloid with some impurities, and yields it, when evaporated at a very moderate heat, in the form of a hard, gum-like, yellowish, or brownish yellow solid. If this be treated with a little water, and acidulated with hydrochloric acid, it yields the alkaloid with some impurities to the liquid, which, if now filtered, evaporated to about one-sixteenth by volume of the original fluid extract employed, and then treated with a slight excess of caustic potassa, will give up the alkaloid in the form of a more or less white precipitate. This, upon being separated, and allowed to dry, shrinks greatly, and becomes dark. To purify it, the dry mass is powdered, and dissolved, with the aid of a few drops of hydrochloric acid, in a little water, from which the alkaloid is precipitated by a slight excess of caustic potassa, and then taken up by ether, which leaves it, on spontaneous evaporation, in the state of a very hard, brittle, and transparent mass, strongly adhering to the surface of the vessel employed. If now detached and pulverized, it forms a powder nearly or quite colorless. If still colored, it may be again treated with ether.

Gelsemine, when pure, is a colorless inodorous solid, not yet obtained in well-defined crystals, of an intensely bitter and persistent taste, having strongly basic properties, and completely neutralizing the strongest acids. Of its salts, the sulphate, nitrate, chloride, and acetate are freely soluble in water. It is itself sparingly soluble in water, requiring several hundred times its weight for solution; but it is very freely soluble in chloroform and ether. A drop of strong sulphuric acid added to a little gelsemine, or any one of its colorless salts, produces with it a reddish solution, which, if moderately heated, acquires a beautiful purple color; but if without heating, after addition of sulphuric acid, potassium dichromate be added, a cherry-red color is immediately produced. (Schwartz, *Inaugural Dissertation*, Dorpat, 1882.) If instead of potassium dichromate ceroso-ceric oxide be added, a beautiful rose-red color is obtained. (*Robbins.*) Robbins (*loc. cit.*) gives it the formula $C_{11}H_{19}NO_2$, or more probably $C_{22}H_{38}N_2O_4$.

Medical Properties.* Gelsemium produces in the healthy adult agreeable sensa-

* Gelsemium is said to have been long popularly employed as a vermifuge in the Southern and Southwestern States; but its more valuable properties have been known but for a few years. Their discovery was accidental. A planter of Mississippi, laboring under an obstinate bilious fever, directed his servant to get a particular root from the garden, and prepare a tea from it. The tea was

tions of languor, with muscular relaxation, so that the subject finds some difficulty in moving the eyelids, and keeping the jaws closed. More largely taken, it occasions dizziness, dimness of vision, dilated pupil, general muscular debility, and universal prostration; reducing the frequency and force of the pulse, and the frequency of respiration, and producing insensibility to pain; but without stupor or delirium. After a short time these symptoms usually pass off, leaving no unpleasant effects, except that in some instances there has been severe diarrhœa. In at least six recorded cases, however, they have progressively increased until death has occurred. Consciousness is usually preserved until near the close: dropping of the jaw, dilatation of the pupil, and a tendency to internal squint and ptosis are somewhat characteristic symptoms. The effects usually begin in half an hour, and pass off in two or three hours, if at all.

The treatment of poisoning by gelsemium should consist in evacuating the stomach, maintaining absolute rest in the horizontal position, keeping up the bodily temperature, if required, by external warmth, and administering spinal and arterial stimulants. It is probable that hypodermic injections of atropine, strychnine, and digitaline would be effective.

Recent physiological studies, whilst by no means complete, have thrown much light upon the action of gelsemium. The muscular weakness which it causes is always associated with a depression of reflex activity, and is the result of a direct paralyzing influence upon the spinal cord, as probably is also the diminution of sensibility; the nerves and muscles not being sensibly affected by the poison. The action upon the circulation is less marked than upon the nervous system, the heart and arterial pressure not being much affected by therapeutic doses. After toxic amounts there is great depression of the circulation, which has been shown by Dr. I. Ott to be at least in part due to a direct action upon the heart. The dilatation of the pupil which is present in poisoning with the drug, and which is also produced by its local application to the eye, is probably due to a paralysis of the oculo-motor nerve; to which also may be ascribed the palsy of accommodation and of the external rectus muscle. The diseases in which the medicine has been prescribed are intermittent, remittent, typhoid, and yellow fevers, the irritative fevers of childhood, inflammation of the lungs and pleura, dysentery, rheumatism and other inflammatory affections, neuralgia, dysmenorrhœa, morbid wakefulness, delirium tremens, trismus nascentium, chorea, hysteria, and epilepsy. The drug is, however, not applicable to the treatment of low fevers, and is not sufficiently powerful as a cardiac depressant to be relied upon in very sthenic inflammations; its use should be chiefly restricted to spasmodic and neuralgic affections. In supraorbital neuralgia and in odontalgia it has been especially commended.

There is much testimony as to its antiperiodic properties; and it may be used as an adjuvant to quinine in the treatment of remittent fever. Dr. James D. McGarghey praises it especially in cases of intermittent, when the attacks are disposed to return obstinately and irregularly. (*Phila. Med. Times*, March 7, 1874.) It has also been employed with a measure of success in controlling cardiac palpitations.

Gelsemium should be administered in the form either of the tincture or of the fluid extract; the dose of the tincture being ten minims (0·6 C.c.), that of the fluid extract two minims (0·12 C.c.); to be repeated, if necessary, every 2, 4, or 6 hours, and be gradually increased till the object is obtained, or some obvious effect is produced on the system. How much exactly would produce fatal effects has not been determined. In one fatal case recorded, 40 drops of the fluid extract were said to have been taken; but very much less than this would be a dangerous dose.

The alkaloid gelsemine is exceedingly powerful. Prof. Wormley injected one-

prepared accordingly, and drunk by the invalid, who was soon afterwards affected with great prostration, and especially muscular debility, so that he could not raise a limb, but without stupor. These effects gradually passed off, and with them the fever. The servant had made a mistake in the root, and dug that of the Gelsemium instead of the one intended. The planter, having made this discovery, employed the root afterwards with success upon his own plantation and in the neighborhood. The remedy passed into the hands of irregular practitioners, and was used by the "eclectic physicians" before its virtues came to the knowledge of the profession.

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eighth of a grain into a strong cat, with the result of death in one and a half hours. He also found, as the average result of several experiments, that eight fluidounces of the fluid extract yield 3·20 grains of the pure alkaloid. On the basis of this result, the dose of gelsemia may be estimated at the 200th or 300th of a grain, supposing all the virtue of the root to reside in the alkaloid. But this estimate probably exceeds its strength; and the proper dose can be determined only by a series of carefully conducted trials.

Off. Prep. Extractum Gelsemii Fluidum, *U. S.;* Tinctura Gelsemii, *U. S.*

GENTIANA. *U. S.* *Gentian.*

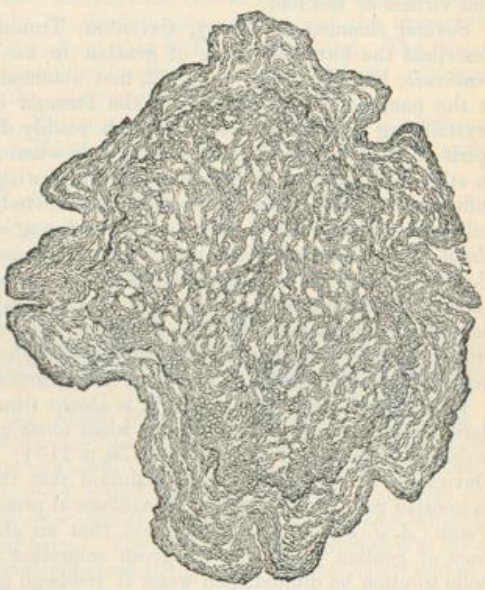
(ǴĖN-TĮ-Ā′NĄ—jĕn-shę-ā′ną.)

"The root of Gentiana lutea. Linné. (*Nat. Ord.* Gentianaceæ.)" *U. S.* "The dried root of Gentiana lutea." *Br.*

Gentianæ Radix, *Br.;* Gentian Root; Radix Gentianæ, *P. G.;* Radix Gentianæ Rubræ (vel Luteæ vel Majoris); Racine de Gentiane (de Gentiane jaune), Gentiane jaune, *Fr.;* Enzian, Enzianwurzel, Bitterwurzel, Rother Enzian, *G.;* Genziana, *It.;* Genciana, *Sp.*

Gen. Ch. Corolla one-petalled. *Capsule* two-valved, one-celled, with two longitudinal receptacles. *Willd.*

Gentiana lutea. Willd. *Sp. Plant.* i. 1331; Woodv. *Med. Bot.* p. 273, t. 95; Carson, *Illust. of Med. Bot.* ii. 12, pl. 60. *Yellow Gentian* is among the most remarkable of the species which compose this genus, both for its beauty and great comparative size. From its thick, long, branching, perennial root, an erect, round stem rises to the height of three or four feet, bearing opposite, sessile, ovate, acute, five-nerved leaves of a bright green color, and somewhat glaucous. The lower leaves, which spring from the root, are narrowed at their base into the form of a petiole. The flowers are large and beautiful, of a yellow color, peduncled, and placed in whorls at the axils of the upper leaves. The calyx is monophyllous, membranous, yellowish, and semi-transparent, splitting when the flower opens, and reflected when it is fully expanded; the corolla is rotate, and deeply divided into five or six lanceolate, acute segments; the stamens are five or six, and shorter than the corolla.



Gentian, transverse section.

This plant grows among the Apennines, the Alps, the Pyrenees, and in other mountainous or elevated regions of Europe. The root is the only part used.

Several other species possess analogous virtues, and are used for similar purposes. The roots of *G. purpurea* and *G. punctata*, inhabiting the same regions as *G. lutea*, and of *G. Pannonica*, growing in Austria, are said to be often mingled with the officinal, from which they are scarcely distinguishable. The *G. macrophylla* of Pallas is used in Siberia; one indigenous species, *G. Catesbæi*,* growing in the

* *Gentiana Catesbæi.* The blue gentian has a perennial, branching, somewhat fleshy root, and a simple, erect, rough stem, rising eight or ten inches in height, and bearing opposite leaves, which are ovate-lanceolate, acute, and rough on their margin. The flowers are of a palish blue color, crowded, nearly sessile, and axillary or terminal. The divisions of the calyx are linear-lanceolate, and longer than the tube. The corolla is large, ventricose, plaited, and divided at its border into ten segments, of which the five outer are more or less acute, the five inner bifid and fringed. The

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Southern States, formerly had a place in the secondary catalogue of the U. S. Pharmacopœia, and is reputed to be but little inferior to the officinal species. *G. quinqueflora*, growing throughout the Northern and Northwestern States, is said to be much used in domestic practice.

Properties. As found in the shops, gentian is in pieces of various dimensions and shape, usually of considerable length, consisting sometimes of longitudinal slices, sometimes of the root cut transversely, twisted, wrinkled externally, sometimes marked with close transverse rings of a grayish brown color on the outside, yellowish or reddish within, and of a soft, spongy texture. It is officinally described as occurring "in nearly cylindrical pieces or longitudinal slices, about one inch (25 mm.) 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.*

There is no distinct pith, no distinct liber-cells, starch granules, or raphides. (For further details, see *P. J. Tr.*, July, 1872, p. 42.) The odor is feeble, but decided and peculiar. The taste is slightly sweetish and intensely bitter, without being nauseous. The powder is yellowish. Water and alcohol extract the taste and virtues of the root.

Several chemists, as Henry, Caventou, Trommsdorff, Leconte, and Dulk, have described the bitter principle of gentian in an impure state under the name of *gentianin*, but Kromayer, in 1862, first obtained it in a state of purity, and gave it the name of *gentio-picrin*, and the formula $C_{20}H_{30}O_{12}$. It is a neutral body, crystallizing in colorless needles, which readily dissolve in water. It is soluble in spirit of wine, but in absolute alcohol only when aided by heat; it does not dissolve in ether. A solution of caustic soda forms with it a yellow solution. Under the influence of dilute acids, gentio-picrin is resolved into glucose and an amorphous yellowish brown neutral substance named *gentiogenin*. Fresh gentian roots yield about $\frac{1}{10}$ per cent. of gentio-picrin. Another constituent is *gentianin*, or *gentisin*, $C_{14}H_{10}O_5$. It forms tasteless, yellowish prisms, sparingly soluble in alcohol, and, with alkalies, yields intensely yellow, crystallizable compounds, easily decomposed by carbonic acid. Hlasiwetz and Habermann showed, in 1875, that when *gentianin* was melted with caustic potash, it yielded *phloroglucin*, $C_6H_3(OH)_3$, and *oxysalicylic acid* $C_6H_3.(OH)_2COOH$. The latter was at first called *gentianic* or *gentisinic acid*.

Prof. Maisch believes that tannin is absent from gentian root, and states that the dark, olive-green coloration observed when ferric chloride is added to its preparations is due to gentisic acid. (*A. J. P.*, 1876, p. 117); Ville (*A. J. P.*, 1877, p. 429) and Davies (*P. J. Tr.*, 1879, p. 220) maintain that there is a small quantity of tannin in gentian root, but the weight of evidence at present is against the assertion. Prof. Patch (*A. J. P.*, 1876, p. 188) found that an alcoholic solution of an ethereal extract of gentian yielded a dark green coloration with ferric salts, but if the alcoholic solution be diluted with water it yields no precipitate with gelatin.

M. Louis Magnes found in the root, when perfectly dried at 100° C. (212° F.), 15 per cent. of glucose, and 12 per cent. in the root in its ordinary state. (*A. J. P.*, pp. 333–4.) When gentian is macerated in cold water, it undergoes the vinous fermentation, in consequence of the presence of this saccharine principle. From the fermented infusion a spirituous liquor is obtained by distillation, which, though bitter and unpleasant to the smell, is said to be relished by the Swiss and Tyrolese.

number of stamens is five, and the two stigmas are seated on the germ. The capsule is oblong, acuminate, with two valves, and a single cell. *G. Catesbæi* grows in the grassy swamps of North and South Carolina, where it flowers from September to December. It was named by Walter and Elliot in honor of Catesby, by whom it was delineated nearly a century ago. The dried root is said to have at first a mucilaginous and sweetish taste, which is soon succeeded by an intense bitterness, approaching nearly to that of the officinal gentian. Alcohol and boiling water extract its virtues, and the tincture and decoction are even more bitter than the root in substance. It may be given in powder in the dose of from fifteen to thirty grains, or in the form of extract, infusion, wine or tincture, which may be prepared in the manner directed for the similar preparations of foreign gentian.

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Infusion of gentian is precipitated by tannic acid and the soluble salts of lead, but is compatible with the salts of iron.

Medical Properties and Uses. Gentian possesses, in a high degree, the tonic powers which characterize the simple bitters. It excites the appetite, invigorates digestion, moderately increases the temperature of the body and the force of the circulation, and operates in fact as a general corroborant. In very large doses, however, it is apt to load and oppress the stomach, to irritate the bowels, and even to occasion nausea and vomiting. It has been known as a medicine from the highest antiquity, and is said to have derived its name from Gentius, a king of Illyria. Many of the complex preparations handed down from the Greeks and Arabians contain it among their ingredients; and it enters into most of the stomachic combinations employed in modern practice. It may be used in all cases of pure debility of the digestive organs, or where a general tonic impression is required. Dyspepsia, atonic gout, amenorrhœa, hysteria, scrofula, intermittent fever, diarrhœa, and worms are among the many affections in which it has proved useful; but it is the condition of the stomach and of the system generally, not the name of the disease, which must be taken into consideration in prescribing it; and there is scarcely a complaint in which it can be advantageously given under all circumstances. Its powder has been applied externally to malignant and sloughing ulcers. It should be administered only in the form of preparation. A syrup may be prepared by forming a saccharated infusion by means of percolation, and incorporating this at a boiling heat with simple syrup; or, perhaps more eligibly, by dissolving two drachms of the extract of gentian, and afterwards fifteen ounces of sugar, in half a pint of water. The porous property of the root causes it to expand with moisture, and it has been employed, as a substitute for sponge tent, in the enlargement of strictured passages.

Off. Prep. Extractum Gentianæ; Extractum Gentianæ Fluidum, *U. S.;* Infusum Gentianæ Compositum, *Br.;* Mistura Gentianæ, *Br.;* Tinctura Gentianæ Composita.

GERANIUM. *U. S.* *Geranium.* [*Cranesbill.*]

(ĢĘ-RĀ'NĮ-ŪM.)

"The rhizome of Geranium maculatum. Linné. (*Nat. Ord.* Geraniaceæ)." *U. S.*

Cranesbill Root; Racine de Bec-de-Grue tacheté, Racine de Pied-de-Corneille, *Fr.;* Fleckstorchschnabel-Wurzel, *G.*

Gen. Ch. Calyx five-leaved. *Corolla* five-petalled, regular. *Nectary* five melliferous glands, united to the base of the longer filaments. *Arilli* five, one-seeded, awned, at the base of a beaked receptacle; awns simple, naked, neither spiral nor bearded. *Willd.*

Geranium maculatum. Willd. *Sp. Plant.* iii. 705; Bigelow, *Am. Med. Bot.* i. 84; Barton, *Med. Bot.* i. 149. This plant has a perennial, horizontal, fleshy root, which is furnished with short fibres, and sends up annually an herbaceous stem, with several radical leaves. The stem is erect, round, dichotomously branched, from one to two feet high, of a grayish green color, and thickly covered, in common with the petioles and peduncles, with reflexed hairs. The leaves are deeply divided into three, five, or seven lobes, which are variously incised at their extremities, hairy, and of a pale green color, mottled with still paler spots. Those which rise from the root are supported on footstalks eight or ten inches long; those of the stem are opposite, the lower petiolate, the upper nearly sessile, with lanceolate or linear stipules. The flowers are large, and usually of a purple color. The peduncles spring from the forks of the stem, and severally support two flowers upon short pedicels. The calyx is composed of five oblong, ribbed, cuspidate leaves; the petals are five, obovate, and entire; the stamens ten, with oblong, deciduous anthers, the five alternate filaments being longer than the others, and having glands at their base; the germ is ovate, supporting a straight style as long as the stamens, and surmounted by five stigmas. The fruit consists of five aggregate, one-seeded capsules, attached by a beak to the persistent style, curling up and scattering the seeds when ripe.

The cranesbill is indigenous, growing throughout the United States, in moist woods, thickets, and hedges, and generally in low grounds. It flowers from May to July. The root should be collected in autumn.

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Properties. Geranium occurs in pieces from one to three inches long, from a quarter to half an inch in thickness, somewhat flattened, contorted, wrinkled, tuberculated, and beset with slender fibres. It is externally of an umber-brown color, internally reddish gray, compact, inodorous, and of an astringent taste, without bitterness or other unpleasant flavor. "The bark is thin; the wood-wedges yellowish, small, forming a circle near the cambium line; the medullary rays broad; the central pith large, and the rootlets thin and fragile." Water and alcohol extract the virtues of geranium. According to Dr. Edward Staples, it contains tannic and gallic acids, mucilage, red coloring matter, resin, and a crystallizable vegetable principle. (*A. J. P.*, 1829, p. 171.) The Messrs. Tilden found, besides tannic and gallic acids, gum, pectin, sugar, starch, albumen, resin soluble in alcohol, oleoresin soluble in ether only, coloring matter, chlorophyll, lignin, and various salts. (*P. J. Tr.*, 1863, p. 22.) Tannic and gallic acids are probably the sole active ingredients.

Medical Properties and Uses. Geranium is one of our best indigenous astringents, and may be employed for all the purposes to which these medicines are applicable. The absence of unpleasant taste, and of other offensive qualities, renders it peculiarly serviceable in the case of infants, and persons of very delicate stomach. Diarrhœa, chronic dysentery, cholera infantum in the latter stages, and the various hemorrhages are the forms of disease in which it is most commonly used, and with greatest advantage; but care should be taken, before it is administered, that the condition of the system and of the part affected is such as not to contraindicate the use of astringents. As an application to indolent ulcers, an injection in gleet and leucorrhœa, and a gargle in relaxation of the uvula and aphthous ulcerations of the throat, it answers the same purpose as kino, catechu, and other medicines of the same class. It is a popular domestic remedy in various parts of the United States, and is said to be employed by the Indians. It may be given in substance, decoction, tincture, or extract. The dose of the powder is twenty or thirty grains (1·3–1·95 Gm.); that of a decoction, made by boiling an ounce of the root in a pint and a half of water to a pint, from one to two fluidounces (30–60 C.c.); that of the fluid extract, twenty to thirty minims (1·25 to 1·9 C.c.). The medicine is sometimes given to children, boiled in milk.

Off. Prep. Extractum Geranii Fluidum, *U.S.*

GLYCERINUM. *U.S.*, *Br.* *Glycerin.*

(GLĬÇ-Ē-RĪ'NŬM.)

Glycerina, *U.S.* 1870; Glycerine; Glycerinum, *P.G.*; Glycérine, *Fr.*; Oelsüss, *G.*

"A liquid obtained by the decomposition of fats and fixed oils, and containing not less than 95 per cent. of absolute Glycerin [$C_3H_5(HO)_3$; 92. — $C_6H_8O_6.3HO$; 92.]" *U.S.* "A sweet principle, $C_6H_8O_6$, obtained from fats and fixed oils, and containing a small percentage of water." *Br.*

In the process for making lead plaster, litharge, olive oil, and water are boiled together, when the olein of the oil is decomposed by the lead oxide, according to the following reaction: $2(C_3H_5(OC_{18}H_{33}O)_3) + (PbO)_3 + (H_2O)_3 = 2(C_3H_5(OH)_3) + 3(Pb(OC_{18}H_{33}O)_2)$, when we obtain lead oleate or plaster and free glycerin. (See *Emplastrum Plumbi.*) It follows, therefore, that the plaster, while still hot and in the liquid state, contained glycerin diffused through it. It was this process that was used for preparing glycerin in the formula of U. S. P. 1850. In accordance with this, when the liquid plaster is mixed with an equal measure of boiling water, and the mixture stirred briskly, a solution of glycerin is obtained; which, after having been decanted, and evaporated to a limited extent, is freed from lead by sulphuretted hydrogen. The liquid is then filtered to separate sulphide of lead, heated to free it from sulphuretted hydrogen, and finally evaporated to expel the water, which is known to be all removed when the mass ceases to lose weight.

Glycerin was discovered in 1789 by Scheele, by whom it was called the *sweet principle of oils.* It is produced not only during the saponification of the fats and oils by oxide of lead in forming lead plaster, but also during the same process when effected by potassa and soda in the manufacture of soap; the alkalies uniting with the oily acids, and setting the glycerin free. Soap-makers' waste is an abundant

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source of glycerin; but, when thus obtained, it is apt to have more or less odor, which even percolation through animal charcoal does not always remove. A method of purifying glycerin from soap-makers' waste is given by M. Bruère-Perrin. (*A. J. P.*, xx. 549.) The process of Mr. Richard A. Tilghman, of this city, patented Jan. 9, 1854, consists in subjecting fatty bodies to the action of water at a high temperature under pressure, whereby the fats, which are *glycerides* or ethers of the fatty acids, are broken up into free glycerin and free fatty acids, the water supplying the elements of hydrogen and oxygen necessary for that change. The reaction is as follows for the case of a fat like stearin: $C_3H_5(OC_{18}H_{35}O)_3 + (H.OH)_3 = C_3H_5(OH)_3 + 3(C_{18}H_{35}O.OH)$. (*A. J. P.*, March, 1855, p. 121.) Thus obtained it is called *distilled glycerin*, and is produced at once in the purest form. This process is used at the great candle manufactory of Price & Co., London, as well as by our home manufacturers. Through a distillatory apparatus containing palm oil, heated steam between 550° and 600° is passed. The oil is decomposed into free acids and glycerin, which, together with water, distil over, and, condensing in the receiver, separate into two layers, the lower of which is glycerin. If this, as first procured, contain too much water, it must be concentrated; if discolored, it must be redistilled with vapor. (*P. J. Tr.*, 1861, p. 350.) Ordinary impure glycerin may be purified by distillation with steam under pressure. Though, when distilled alone, it is partially decomposed, giving off pungent vapors of *acrolein*, yet in a current of superheated steam it passes over unchanged at temperatures between 204·4° C. and 260° C. (400° F. and 500° F.). (*Brande & Taylor.*) Very pure glycerin is now produced in the United States in immense quantities; the great advance in price which took place in 1880, due to its extended employment in the manufacture of nitroglycerin, has somewhat curtailed its use. (See *Nitroglycerin*, Part II.)

Properties. Glycerin is "a clear, colorless liquid, of syrupy consistence, oily to the touch, hygroscopic, without odor, very sweet and slightly warm to the taste, and neutral in reaction. It is soluble, in all proportions, in water and in alcohol, also in a mixture of 3 parts of alcohol and 1 part of ether, but insoluble in ether, chloroform, benzol, or fixed oils. Its sp. gr. should not be less than 1·250, corresponding to the presence of at least 95 per cent. of absolute Glycerin. In solution with water it is slowly vaporized, with steam, at 100° C. (212° F.); exposed alone to higher temperature, it yields acrid decomposition vapors of a characteristic odor, with a little Glycerin vapor, and at 290° C. (554° F.) it boils, and is decomposed. If a fused bead of borax, on a loop of platinum wire, be moistened with Glycerin previously made slightly alkaline with diluted solution of soda, and after a few minutes held in a colorless flame, the latter will be tinted deep green." *U. S.* This last officinal test is that of Senier and Lowe. (*Jour. Chem. Society*, Sept. 1878.) In properties, glycerin is intermediate between water and the oils. When exposed to the air it gradually absorbs moisture. As already stated, though decomposed by a high heat in its unmixed state, yet with water under pressure it is volatilizable unchanged at a temperature between 204·4° C. and 260° C. (400° F. and 500° F.). Cooled down rapidly, it only becomes more viscid, without congealing, even when a temperature of —40° C. is attained; but, if kept for some time at a temperature of about 0° C. (32° F.), it gradually forms hard but deliquescent crystals, which melt only at about 22° C. (71·6° F.).* This fact is now utilized as a means of concentrating and purifying glycerin. According to Mr. G. F. Wilson, glycerin, when of the density 1·24, contains 94 per cent. of anhydrous glycerin; when of the density 1·26, 98 per cent. The following table by Dr. Wilhelm Lenz (*Zeitsch. f. Anal. Chem.*, 1880, p. 297), showing the percentage of absolute glycerin in mixtures of glycerin and water, was obtained by a quantitative determination of the carbon in the various dilutions by ultimate analysis.

* Mr. Wm. Crookes gives an account, in the *Chem. News* of Jan. 18, 1867, of 5 tons of glycerin imported into London from Germany in casks of 8 cwt. each, which, though when it left the continent it was in its ordinary state of a viscid liquid, was found, on reaching London, to have become solidified into a mass of very hard, brilliant crystals. The same result has been noticed in Vienna, in a mass of glycerin which had been in an iron tank more than a year. (*Chem. News*, April 5, 1867, p. 174.) The crystalline mass noticed by Mr. Crookes yielded pure glycerin when melted.

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Anhydrous Glycerin %	Spec. Grav.	Anhydrous Glycerin %	Spec. Grav.	Anhydrous Glycerin %	Spec. Grav.	Anhydrous Glycerin %	Spec. Grav.
100	1·2691	75	1·2016	50	1·1320	25	1·0635
95	1·2581	70	1·1889	45	1·1183	20	1·0498
90	1·2425	65	1·1733	40	1·1045	15	1·0374
85	1·2292	60	1·1582	35	1·0907	10	1·0245
80	1·2152	55	1·1455	30	1·0798	5	1·0123

Glycerin possesses extensive powers as a solvent, and is an excellent excipient for many medicinal substances. It dissolves bromine and iodine, the iodide of sulphur, the chlorides of potassium and sodium, the fixed alkalies, some of the alkaline earths, lime, for example, for which it increases the solvent powers of water (*Journ. de Pharm.*, Juin, 1874), and a large number of neutral salts. It also dissolves the vegetable acids, particularly tannic acid. It is a good solvent of pepsin, and is used for the extraction of this principle from the mucus of the stomach. Two parts and a half of glycerin dissolve one of sugar, and three and a half parts, one of gum. When starch-paste and glycerin are heated together, a turbid liquid is formed, which deposits on cooling; the supernatant liquid holding starch in solution. (*Journ. de Pharm.*, Nov. 1868, pp. 361–2.) Prof. J. S. Blockley, of London, has ascertained that certain neutral vegetable substances are far more soluble in glycerin than in water. Thus salicin dissolves in eight parts of cold glycerin, and santonin in eighteen parts when boiling. The latter solution, when of half this strength, forms on cooling an almost solid mass. It is not always a good solvent for alkaloids or their salts, and will *sometimes precipitate the latter from their watery solutions.* Glycerin, next to alcohol, is the best solvent of iodine. Iodine and iodide of potassium, when dissolved in it, form *iodized glycerin*, the medical applications of which are given under iodine. (See *Iodinium.*)* It combines with potassa and baryta, and also with sulphuric acid. Glycerin is not susceptible of becoming rancid, or of fermenting spontaneously; but will generate a portion of alcohol under the combined influence of chalk, and of a ferment formed of cheese or animal tissue. During this change there is no intermediate formation of glucose, provided carbonate of calcium is present. (*Berthelot.*) Glycerin does not evaporate when exposed to the air; nor can it be distilled without decomposition, unless in the presence of water or steam. When decomposed by heat, it emits extremely irritating vapors. At a full red heat it takes fire, and burns with a blue flame. In consequence of the high temperature required for its volatilization, it has been proposed to use it for an evaporating bath, in which a heat beyond that of boiling water is required. Glycerin is antiseptic, and has been recommended by Mr. Warington and M. Demarquay to preserve alimentary substances and objects of natural history, and to inject bodies for dissection. According to Dr. W. Frazer, it does not answer to keep pathological preparations; as they are completely softened by its action. M. Berthelot, of Paris, has succeeded in combining glycerin with a number of acids, both mineral and organic, forming three distinct series of neutral compounds. Among others he has united it with the fatty acids, producing, by synthesis, the organic fatty substances, stearin, palmitin, olein, etc. Glycerin has been formed artificially from

* The following table, by Klever, gives a general view of the solvent powers of glycerin. 100 parts of glycerin dissolving the annexed quantities of substances:

	PARTS.		PARTS.		PARTS.		PARTS.
Acidum arseniosum	20	Brucine	2·25	Morphine	0·45	Sodii bicarbonas	8
" arsenicum	20	Calcii sulphid	5	Morphinæ acetas	20	" boras	60
" benzoicum	10	Cinchonine	0·30	" murias	20	" carbonas	98
" boracicum	10	Cinch. sulphas	6·70	Phosphorus	0·20	" chloras	20
" oxalicum	15	Cupri acetas.?	10	Plumbi acetas	20	Sulphur	0·10
" tannicum	50	" sulphas	30	Potassii arsenias	50	Strychnine	0·25
Alumen	40	Ferr. et potas. tart.	8	" chloras	3·50	Strychninæ nitras	4
Ammonii carbonas	20	" lactas	16	" bromidum	25	" sulphas	22·50
" murias	20	" sulphas	25	" cyanidum	32	Urea	50
Antimon. et pot. tart.	5·50	Hydrarg. chlorid. corrosiv.	7·50	" iodidum	40	Veratrine	1
Atropine	3	" cyanidum	27	Quinine	0·50	Zinci chloridum	50
Atropinæ sulphas	33	Iodinium	1·90	Quininæ tannas	0·25	" iodidum	40
Barii chloridum	10			Sodii arsenias	50	" sulphas	35

(*Neues Jahrb. für Pharm.*, 1869, Mai u. Juni, 315.)

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tribromallyl, by Wurtz, and from trichlorhydrin, by Friedel and Silva. Neither synthesis is practical on a large scale, nor could they compete with its preparation from natural fats. By Pasteur it has been ascertained to be one of the products of the vinous fermentation. Glycerin is a triatomic alcohol, being a compound of the triad radical (C_3H_5) with 3(OH) groups. In the natural fats, the three H atoms of these OH groups are replaced by fatty acid radicals like stearyl, $C_{18}H_{35}O$, palmityl, $C_{16}H_{33}O$, and oleyl, $C_{18}H_{33}O$. The natural fats are, therefore, compounds of an alcohol radical with an organic acid, and are true ethers, to which the special names of *glycerides* have been given.

The solvent and preservative properties as well as agreeable taste and permanent consistence of glycerin render it very useful as a menstruum in pharmacy; and a class of preparations consisting of medicinal substances dissolved in it has come into extensive use. The British Pharmacopœia has adopted such a class, under the name of *Glycerina* or *glycerines*. This title is not now available because these terminations are reserved for alkaloids, whilst the term *glyceroles*, adopted from the French, is objectionable, as the termination has been used as designative of certain proximate principles. But the U. S. title, *Glycerita* or *glycerites*, is satisfactory.

Impurities and Tests. Glycerin is occasionally deficient in density and consistency. According to M. Dalpiaz, it is sometimes perfectly colorless from being bleached by chlorine, when it is apt to contain chloride of calcium, as well as free chlorine. The latter may be detected by rendering the suspected sample slightly blue by a few drops of sulphate of indigo, and then adding a little sulphuric acid, when, if free chlorine be present, the blue color will disappear. The Pharmacopœia furnishes the following tests. "Glycerin should be neutral to litmus paper. Upon warming a portion of 5 or 6 Gm. with half its weight of diluted sulphuric acid, no butyric or other acidulous odor should be developed. A portion of 2 or 3 Gm., gently warmed with an equal volume of sulphuric acid in a test-tube, should not become dark colored (abs. of cane sugar). A portion of about 2 Gm., heated in a small, open porcelain or platinum capsule, upon a sand-bath, until it boils, and then ignited, should burn and vaporize so as to leave not more than a dark stain (abs. of sugars and dextrin, which leave a porous coal). A portion heated to about 85° C. (185° F.), with test-solution of potassio-cupric tartrate, should not give a decided yellowish brown precipitate, and the same result should be obtained, if, before applying this test, another portion be boiled with a little diluted hydrochloric acid for half an hour (abs. of sugars). After full combustion no residue should be left (metallic salts). Diluted with 10 times its volume of distilled water, portions should give no precipitates or colors, when treated with test-solution of nitrate of silver, chloride of barium, chloride of calcium, sulphide of ammonium, or oxalate of ammonium (acrylic, hydrochloric, sulphuric, or oxalic acids, iron or calcium salts)." *U. S.* Lime may be detected by oxalate of ammonium; lead, by hydrosulphate of ammonium; and sulphuric acid, by a soluble salt of baryta. Diluted, and boiled with a solution of potassa, it is not altered in color, showing the absence of glucose. Trommer's test is probably still more effectual. Chloroform was proposed as a test of sugar, in consequence of the complete insolubility of sugar in it, while glycerin was said to be very soluble; but subsequently chloroform has been shown to be incapable of dissolving glycerin, though readily forming an even mixture, which separates into its two constituents, on standing. (*Chem. News*, Feb. 25, 1870, p. 87.) The absence of sugar is shown, if, upon the addition of two drops of concentrated sulphuric acid, and the application of heat, no brown discoloration is observed. (*Journ. de Pharm.*, Nov. 1863, p. 405.) The late Prof. Procter believed that the most satisfactory method of detecting cane sugar is to dilute a little glycerin with three parts of water, then add a few grains of tartaric acid, and boil for a short time. Cane sugar, if present, is thus converted into glucose, which may be detected by adding first a solution of sulphate of copper, and then the solution of potassa to the heated liquid, when the formation of the reddish suboxide of copper will afford the requisite proof. (*A. J. P.*, 1867, p. 110.) According to M. Hager, sugar or dextrine may be detected in the following manner. Dilute the glycerin with water, add molybdate of ammonium and some drops of nitric acid, and boil.

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If these impurities are present, a blue color is produced; if not, it remains colorless. (*Ibid.*, May, 1869, p. 206.)*

Among the most injurious impurities of glycerin are thought to be oxalic and formic acids, the latter of which is especially irritating to the skin, so as to unfit glycerin for some of the purposes for which it is most employed. The oxalic acid is said to result from the action of sulphuric acid employed in purifying glycerin; the formic, from the reaction between glycerin and oxalic acid. They may be detected by the U. S. P. tests. Mr. Henry Bower, of Philadelphia, who manufactures very pure glycerin, says that nitrate of silver is the most reliable test. Glycerin which shows no reaction with this salt, he considers suitable for all uses. (*A. J. P.*, 1868, p. 265.) For a method of extracting glycerin from mixtures containing sugar and glucose, see a paper by Prof. Prescott. (*N. R.*, 1878, p. 354.)

Medical Properties. The uses of glycerin as a vehicle of other medicines have been already given. When given internally, it is laxative, and it has also been suggested as a substitute for cod-liver oil in phthisis, etc. Dr. R. P. Cotton, however, has tried it in the Consumption Hospital at Brompton, and concluded that it has generally but little influence, and that as a remedial agent it will bear no comparison with cod-liver oil. Dr. W. Lauder Lindsay made experiments with it, to determine its alterative and nutrient properties, and found it to increase the weight of the body; but his experiments were not on a sufficient scale to be conclusive. The general verdict of the profession is certainly not in favor of its use in tuberculous affections, and it is now very rarely employed. The same may be said of its administration in diabetes.

Glycerin has come into extensive use as an *external* remedy. Its emollient virtues and undrying property adapt it to the treatment of skin diseases in which a softening and soothing application is required. It appears to have been first employed externally, in 1846, by Mr. Thomas De la Rue, of London, whose observation of its utility led Mr. Startin to try it in the Hospital for Skin Diseases, where it came into extensive use. The principal cutaneous diseases in which it has been found beneficial are pityriasis, lepra, herpes, eczema, psoriasis, prurigo, and lichen. It is a useful addition to lotions in the incrusted form of lupus, and in various syphilitic and strumous eruptions. It is also useful in chapped skin and excoriated surfaces. Added to poultices, in a proportion varying from one-fourth to one-sixteenth, it has the effect of keeping them soft for a long time. To collodion it gives a plasticity which renders it often better suited to skin affections. Incorporated in very small proportion with extracts and pills, it keeps them soft and free from mouldiness. M. Devergie, in giving the results of his trials of glycerin in skin diseases, thinks its virtues have been exaggerated, and that it is not superior to pure lard and similar fatty substances; though it has the advantages of liquidity and freedom from odor. In cases of deafness, from deficiency, accumulation, or hardness of the cerumen, and attended with dryness of the meatus, glycerin is an excellent remedy, introduced into the canal by means of raw cotton saturated with it. Glycerin may be used in the form of an ointment.†

Glycerin has been recommended by M. Vogel as a substitute for the common water-bath. A temperature of 100° C. (212° F.) can be applied by means of it, without the diffusion of unpleasant odors, as from fixed oils or paraffine used in the same way. (*Journ. de Pharm.*, Oct. 1868, p. 315.)

* As impure glycerin is often irritant to the skin, and thus unfitted for some of the most important uses of this principle, it is very important to have a test by which this kind of impurity may be detected. According to M. Hager, if equal volumes of the irritating glycerin and pure sulphuric acid be mixed in a glass tube, there will be an immediate disengagement of gas; and, after the escape of gas has ceased, and the mixture allowed to rest, a renewed agitation will cause a new development of gas; and this phenomenon may be repeated several times; whereas, if the glycerin be pure and unirritant, there is a rise of temperature, and there may be a slight discoloration, but no effervescence, and only the production of a few bubbles of air on agitation. (*Journ. de Pharm. et de Chim.*, Nov. 1867, p. 360.)

† Mr. Ecky's *glycerin ointment* is made as follows. Take of spermaceti *half an ounce;* white wax *a drachm;* oil of almonds *two fluidounces;* glycerin *a fluidounce.* Melt the spermaceti and wax with the oil of almonds by a moderate heat. Then, having poured the melted liquid into a Wedgwood mortar, add the glycerin, and rub until the ingredients are thoroughly mixed and cool. This ointment may be used with advantage in chaps and excoriations.

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Off. Prep. Extracta Fluida, *U. S.;* Glycerinum, Acidi Carbolici, *Br.;* Glycerinum Acidi Gallici, *Br.;* Glycerinum Acidi Tannici, *Br.;* Glycerinum Amyli, *Br.;* Glycerinum Boracis, *Br.;* Glyceritum Amyli, *U. S.;* Glyceritum Vitelli, *U. S.;* Linimentum Potassii Iodidi cum Sapone, *Br.;* Mucilago Tragacanthæ, *U. S.*

GLYCERITA. *Glycerites.*

(GLĬÇ-Ē-RĪ'TĂ.)

Glycerina, *Br.;* Glycerines.

These are solutions of medicinal substances in glycerin. In the thirteenth edition of the Dispensatory various reasons were adduced for preferring the name glycerates for these preparations, but, as the revisers of the U. S. Pharmacopœia have since adopted that of glycerites, these reasons are omitted. The U. S. name is certainly much better than the English. (See p. 713.)

Glycerin has valuable properties as a solvent and vehicle of medicinal substances. Such are its not unpleasant taste and bland character; its wide range of solvent power, which adapts it sometimes as a menstruum where neither water nor alcohol could be advantageously used, and enables it to retain in solution insoluble substances so frequently deposited from infusions and decoctions; and its preservative influence, which often protects against oxidation, and, by a destructive agency upon all of the lowest forms of vegetable and animal life, prevents the various fermentative processes so destructive of organic bodies. Another important property, as a vehicle for external remedies, is the permanence of its liquid character, so that it does not, like water and alcohol, dry up when applied to the skin; resembling in this respect, as well as in its demulcent quality, the fixed oils, without their tendency to rancidity. Hence it has of late come into extensive use in the preparation of medicinal solutions, which under the name of *Glycérés* found admission into the French Codex of 1866, and are now recognized by both the United States and British Pharmacopœias.* In the last revision of the U. S. Pharmacopœia *all* of the formerly officinal glycerites were dropped, including two of the most valuable and frequently used, glycerite of tannic and carbolic acids. Two new glycerites were introduced, Glyceritum Amyli and Glyceritum Vitelli.

GLYCERINUM ACIDI CARBOLICI. *Br. Glycerine of Carbolic Acid.*

(GLĬÇ-Ē-RĪ'NŬM ĂÇ'Ĭ-DĪ CĂR-BŎL'Ĭ-CĪ.)

Glycérole d'Acide phénique, Glycérine phénique, *Fr.;* Phenol-Glycerit, *G.*

"Take of Carbolic Acid *one ounce* [avoirdupois]; Glycerine *four fluidounces* [Imperial measure]. Rub them together in a mortar until the Acid is dissolved." *Br.*

For the uses of this preparation, see *Acidum Carbolicum* (p. 54). It is nearly identical in strength with the *Glyceritum Acidi Carbolici* of U. S. P. 1870, which was made by mixing *one troyounce* of carbolic acid with *four fluidounces* of glycerin. It may be used internally or locally, and for both purposes should in general be diluted with water at the time of application. Four and a half minims represent about a grain of the acid. The dose is from five to ten minims (0·3–0·6 C.c.).

* *Glyceritum Picis Liquidæ.* U. S. 1870. *Glycerite of Tar.* "Take of Tar *a troyounce;* Carbonate of Magnesium, in powder, *two troyounces;* Glycerin *four fluidounces;* Alcohol *two fluidounces;* Water *ten fluidounces.* Having mixed the Glycerin, Alcohol, and Water, rub the Tar in a mortar, first with the Carbonate of Magnesium, and then with six fluidounces of the mixed liquids gradually added, and strain with expression. Rub the residue in like manner with half the remaining liquid, and strain as before. Repeat the process again with the remaining liquid. Put the residue into a percolator, add gradually the expressed liquids previously mixed, and afterwards a sufficient quantity of water to make the liquid which passes measure a pint." *U. S.*

This is a very excellent preparation of tar, which may be used either externally or internally. The formula is essentially the same as that proposed by Mr. J. B. Moore, although employing one-third less of the magnesium salt (*A. J. P.*, 1869, p. 115). As first made it is of a reddish brown color; after a time it is apt to deposit pitchy matter, which should be separated by filtration. An ounce of it represents half a fluidrachm of tar. The dose is a drachm to a half ounce (3·75–15 C.c.).

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GLYCERINUM ACIDI GALLICI. *Br. Glycerine of Gallic Acid.*

(GLĬÇ-Ę-RĪ'NŬM ĂÇ'Į-DĪ GĂL'LĮ-CĪ.)

Glycérole d'Acide gallique, *Fr.;* Gallussaüre-Glycerit, *G.*

"Take of Gallic Acid *one ounce* [avoirdupois]; Glycerine *four fluidounces* [Imperial measure]. Rub them together in a mortar, then transfer the mixture to a porcelain dish, and apply a gentle heat until complete solution is effected." *Br.*

This preparation was dropped at the last revision of the U. S. Pharmacopœia. The strength of the *Glyceritum Acidi Gallici* of U. S. P. 1870 was *one troyounce* of gallic acid to *four fluidounces* of glycerin, the manipulation being the same as in the British.

Glycerin is peculiarly fitted for a vehicle of gallic acid, which it readily dissolves, while the acid is but sparingly soluble in water. For the uses of this glycerite, see *Acidum Gallicum* (p. 62). The solution contains one grain of gallic acid in about four and a half minims of glycerin, and the dose is from twenty to sixty minims (1·25–3·75 C.c.).

GLYCERINUM ACIDI TANNICI. *Br. Glycerine of Tannic Acid.*

(GLĬÇ-Ę-RĪ'NŬM ĂÇ'Į-DĪ TĂN'NĮ-CĪ.)

Glycérole de Tannin, Glycérine tannique, *Fr.;* Tannin-Glycerol, *G.*

"Take of Tannic Acid *one ounce* [avoirdupois]; Glycerine *four fluidounces* [Imperial measure]. Rub them together in a mortar, then transfer the mixture to a porcelain dish and apply a gentle heat until a complete solution is effected." *Br.*

This, the most valuable of all glycerites, was unfortunately dropped at the last revision of the U. S. Pharmacopœia: the strength of the British preparation very closely corresponds with that of the *Glyceritum Acidi Tannici*, U. S. P. 1870, which was *one troyounce* of tannic acid to *four fluidounces* of glycerin.

This preparation may be used, both internally and externally, for most of the purposes to which tannic acid is applied. (See *Acidum Tannicum*, p. 117.) Dr. S. Ringer esteems it highly as a remedy in ozæna and other sanious or purulent discharges from the nostrils and ears, being omitted if the symptoms present an acute form. He has found it also very serviceable in the early stages of eczema, and in impetigo; the scabs being removed before it is applied; and considers it extremely useful in chronic inflammation and superficial ulceration of the fauces, with a relaxed, moist, and granular appearance of the pharyngeal mucous membrane. (*Am. Journ. of Med. Sci.*, Jan. 1869, p. 241.) The solution contains one grain of tannic acid in between four and five minims; and the dose is from ten to forty minims (0·6–2·5 C.c.).

On the whole, it is a most useful preparation of tannic acid for external use; as circumstances require it the officinal strength may be altered by directions of the physician; a very concentrated solution, two parts of glycerin to one of tannin, may be made by the aid of a moderate heat. This applied daily to nipples, during the later months of pregnancy, will usually prevent the occurrence of "sore nipples" during suckling.

GLYCERITUM AMYLI. *U.S., Br. Glycerite of Starch.*

(GLĬÇ-Ę-RĪ'TŬM Ą-MĬ'LĪ.)

Glycerinum Amyli, *Br.;* Glycerine of Starch; Unguentum Glycerini, *P. G.;* Glycamyl, Plasma Glycéré d'Amidon, Glycérat simple (d'Amidon), *Fr.;* Stärke-Glycerit, *G.*

"Starch, *ten parts* [or one ounce av.]; Glycerin, *ninety parts* [or seven fluidounces], To make *one hundred parts.* Rub them together in a mortar until they are intimately mixed. Then transfer the mixture to a porcelain capsule, and apply a heat gradually raised to 140° C. (284° F.), and not exceeding 144° C. (291° F.), stirring constantly, until the starch-granules are completely dissolved and a translucent jelly is formed." *U. S.*

"Take of Starch *one ounce* [avoirdupois]; Glycerine *eight fluidounces* [Imperial measure]. Rub them together until they are intimately mixed, then transfer the mixture to a porcelain dish, and apply a heat gradually raised to 240°, stirring it constantly until the starch particles are completely broken and a translucent jelly is formed." *Br.*

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Of these preparations it is only necessary to say that, with the exception of an inconsiderable difference in the proportions, they are the same as that brought into notice in 1858 by Mr. G. F. Schacht under the name of *plasma*, as a substitute for ointments, the emollient and demulcent properties of which they possess, without their inconvenience, whether used simply, or as a vehicle for other substances to be employed locally. Mr. Schacht prepares plasma by mixing 70 grains of starch in powder, and a fluidounce of glycerin, heating to 240° F. until the union is effected, and stirring constantly. The stirring should be continued moderately, during the cooling, to secure a proper consistence. As the plasma is liable to absorb moisture, it should be kept in well-closed vessels. (*P. J. Tr.*, Oct. 1866, p. 210.)

GLYCERINUM BORACIS. *Br.* *Glycerine of Borax.*

(GLĬÇ-Ę-RĪ'NŬM BO-RĀ'CĪS.)

Glycérole de Borax, *Fr.;* Borax-Glycerol, *G.*

"Take of Borax, in powder, *one ounce* [avoirdupois]; Glycerine *four fluidounces.* Rub them together in a mortar until the Borax is dissolved." *Br.*

The *Glyceritum Sodii Boratis* of U. S. 1870 was of the strength of *one troy-ounce* to *four fluidounces.* Otherwise it did not differ from the British preparation.

The demulcent properties and sweet taste of this preparation render it a useful and convenient method of applying borax to the infantile thrush, and other forms of sore mouth in children. It has been very highly commended in facial erysipelas by Prof. D. M. Salazar, of Madrid. The part should be freely painted with it and then covered with raw cotton. (*N. Y. Med. Record*, viii. 311.)

GLYCERITUM VITELLI. *U. S.* *Glycerite of Yolk of Egg.* [*Glyconin.*]

(GLĬÇ-Ę-RĪ'TŬM VĮ-TĔL'LĪ.)

"Fresh Yolk of Egg, *forty-five parts* [or thirteen ounces av.]; Glycerin, *fifty-five parts* [or sixteen ounces av.], To make *one hundred parts.* Rub the Yolk of Egg with the Glycerin gradually added, until they are thoroughly mixed." *U. S.*

Under the name of *Glyconin* there has been employed in France for many years, both for medical purposes and for those of the toilet, an emulsion made of glycerin and the yolk of eggs. When these two substances are rubbed together, they unite to form a very intimate mixture, which does not separate. It has the consistence of honey, and forms an opaque emulsion with water. It may be preserved almost indefinitely. The usual proportions of the ingredients are four parts of the yolk of eggs and five parts of pure glycerin. Attention was called to its usefulness as a vehicle for the administration of cod-liver oil by Mr. Geo. C. Close, of Brooklyn, N. Y., in 1874,* and it has since been repeatedly recommended for this purpose, and as a basis emulsion for general purposes. It is itself not medicinal. It is also used in the hospitals as a protective local application in burns, erysipelas, fissure of the nipples, and various cutaneous affections.

GLYCYRRHIZA. *U. S.* *Glycyrrhiza.* [*Liquorice Root.*]

(GLĬÇ-ĬR-RHĪ'ZĄ—glis-[r-ri'zą.)

Glycyrrhizæ Radix, *Br.;* Radix Liquiritiæ Glabræ, *P. G.;* Radix Glycyrrhizæ Hispanicæ; Spanish Licorice Root; Réglisse, Bois doux, Racine douce; Bois de Réglisse, *Fr.;* Spanisches Süssholz, Spanische Süssholzwurzel, Süssholzwurzel, *G.;* Liquirizia, *It.;* Regaliza, *Sp.*

"The root of Glycyrrhiza glabra. Linné. (*Nat. Ord.* Leguminosæ, Papilionaceæ.)" *U. S.* "The root or underground stem, fresh and dried, of Glycyrrhiza glabra." *Br.*

Gen. Ch. Calyx bilabiate; upper lip three-cleft, lower undivided. *Legume* ovate compressed. *Willd.*

* *Glyconin Emulsion of Cod-Liver Oil.* The formula proposed by Mr. Close, and at one time largely used by Drs. Andrews, Beard, and others, is as follows. Cod-Liver Oil 4 fluidounces, Glyconin 9 fluidrachms, Aromatic Spirit of Ammonia 1 fluidrachm, Sherry Wine 2 fluidounces, Diluted Phosphoric Acid 4 fluidrachms, Essence of Bitter Almond (made by dissolving 1 fluidrachm of the volatile oil in half a pint of alcohol) 2 fluidrachms. The cod-liver oil is to be added *very slowly* to the glyconin with brisk stirring, and the other ingredients added in the order named.

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Glycyrrhiza glabra. Willd. *Sp. Plant.* iii. 1144; Woodv. *Med. Bot.* p. 420, t. 152; Carson, *Illust. of Med. Bot.* i. 38, pl. 32. The liquorice plant has a perennial root, which is round, succulent, tough, and pliable, furnished with sparse fibres, rapid in its growth, and in a sandy soil penetrates deeply into the ground. The stems are herbaceous, erect, and usually four or five feet in height, have few branches, and are garnished with alternate, pinnate leaves, consisting of several pairs of ovate, blunt, petiolate leaflets, with a single leaflet at the end, of a pale green color, and clammy on their under surface. The flowers are violet or purple, formed like those of the pea, and arranged in axillary spikes supported on long peduncles. The calyx is tubular and persistent. The fruit is a compressed, smooth, acute, one-celled legume, containing from one to six small kidney-shaped seeds. There are two very distinct varieties of the plant, yielding the root; the typical form, which is smooth throughout, and the variety, *G. glandulifera*, W. K., in which the stem, leaves, and pods are more or less roughly glandular or pubescent.

The plant is a native of the south of Europe, Barbary, Syria, and Persia; and is cultivated in England,* the north of France, and Germany. Much of the root imported into this country comes from Messina and Palermo in Sicily. It is also largely produced in the north of Spain, where it is an important article of commerce. It is probable that a portion of the root from Italy and Sicily is the product of *G. echinata*, which grows wild in Apulia. This species is also abundant in the south of Russia, where, according to Hayne, sufficient extract is prepared from it to supply the whole Russian empire. Large quantities of liquorice root are now imported for the purpose of making the Extract, the imports for 1881 being 12,000 tons.

A species of Glycyrrhiza, *G. lepidota*, grows abundantly about St. Louis, in the State of Missouri, and flourishes along the banks of the Missouri River to its source. It is probably the same as the liquorice plant mentioned by Mackenzie as growing on the northern coast of this continent. Mr. Nuttall states that its root possesses in no inconsiderable degree the taste of liquorice.

Properties. The liquorice root of the shops is in long pieces, varying in thickness from a few lines to two inches, fibrous when not peeled, externally grayish brown and longitudinally wrinkled by desiccation, internally yellowish, pliable, tough, without smell, and of a sweet mucilaginous taste, mingled with a slight degree of acrimony. "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." *U. S.* There are two chief varieties of it, the Spanish and the Russian. The roots of the latter form are much larger than the Spanish, and their taste has more or less bitterness mixed with its sweetness. Mr. Henry N. Rittenhouse informs us that commercially the roots are preferred in the following order: 1, Italian; 2, Spanish; 3, Syrian; 4, Turkish; 5, Russian,—the Italian being the sweetest and the Russian the most bitter. Liquorice root is often worm-eaten and more or less decayed. The best pieces are those which have the brightest yellow color internally, and of which the layers are distinct. The bark is chiefly liber, consisting of parenchymatous tissue with bast-cells, which are stained yellow by iodine, and are arranged so as to make ordinary liber bundles, and also a sort of net-work. In the Russian root the prosenchymatous wood-cells are larger than in the Spanish. The powder is of a grayish yellow color, when the root is pulverized without being deprived of its epidermis; of a pale sulphur-yellow, when the epidermis has been removed. Robiquet found the following ingredients in liquorice root: 1, a peculiar transparent yellow substance, called *glycyrrhizin*, of a sweet taste, scarcely soluble in cold water, very soluble in boiling water, with which it gelatinizes on cooling, thrown down from its aqueous solution by acids, readily soluble in cold alcohol, insusceptible of the vinous fermentation, yielding no oxalic acid by the action of the nitric, and therefore wholly distinct from sugar; 2, a crystallizable principle named *agedoïte* by Robiquet,

* It is cultivated in England at Pontefract in Yorkshire, and somewhat largely at Mitcham in Surrey, whence considerable quantities are sent into market. For an account of its growth at Mitcham the reader is referred to an article in *A. J. P.*, 1874, p. 473–4. Attempts have been made to introduce its cultivation into this country, but hitherto with no great success commercially.

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but subsequently proved to be identical with *asparagin;* 3, starch; 4, albumen; 5, a brown acrid resin; 6, a brown nitrogenous extractive matter; 7, lignin; 8, salts of lime and magnesia, with phosphoric, sulphuric, and malic acids. The chief constituent, *glycyrrhizin*, Gorup-Besanez (*Ann. Ch. und Pharm.*, 118, p. 236) found to be a glucoside, having the composition $C_{24}H_{36}O_9$. On boiling with dilute acids it breaks up into glycyrretin and an uncrystallizable sugar capable of fermentation. Roussin (*Journ. de Pharm. et de Chim.*, July, 1875, p. 6) found that the sweet taste of the root was not owing to the free glucoside, but to its compound with ammonia. Habermann (*Ann. Ch. und Pharm.*, 197, p. 105) found that glycyrrhizin-ammonia was the acid ammonium salt of glycyrrhizic acid, a nitrogenous acid, and gave the formula $C_{44}H_{62}NO_{18}.NH_4$ for it. (See *Glycyrrhizinum Ammoniatum.*) He succeeded in extracting from the commercial "ammoniacal glycyrrhizin" *glycyrrhizic acid*, which may be considered to be the active constituent of liquorice. It was obtained by dissolving the crude glycyrrhizin in glacial acetic acid at a boiling temperature, rapidly filtering, again treating the crystalline parts of the filtrate in the same manner, and finally purifying by repeated crystallizations from 90 per cent. alcohol. Its properties are peculiar, and account to a great extent for the singular behavior of liquid liquorice preparations. With water, in which the substance is but little soluble at ordinary temperature, it forms a transparent, faintly yellow jelly. On mixing 1 Gm. of the body with 100 C.c. of water, the mixture after a few hours becomes so jelly-like that the open vessel may be inverted without losing any substance. It is insoluble in ether, but slightly soluble in absolute alcohol (even boiling), more so in alcohol of 90 per cent., and especially so when hot. Its solubility increases with the decrease of the percentage of alcohol. (*Lieb. Ann. de Chem.*, 197, 105; *N. R.*, Sept. 1879.) By fusing glycyrrhizin with caustic potash, Weselsky and Benedikt (*Deutsch. Chem. Ges.*, 1876, p. 1158) obtained *paraoxybenzoic acid.*

Medical Properties and Uses. Liquorice root is an excellent demulcent, well adapted to catarrhal affections, and to irritations of the mucous membrane of the bowels and urinary passages. It is best given in the form of decoction, either alone, or combined with other demulcents. It is frequently employed as an addition to the decoctions of acrid or irritating vegetable substances, such, for example, as seneka and mezereon, the acrimony of which it covers, while it renders them more acceptable to the stomach. Before being used, it should be deprived of its cortical part, which is somewhat acrid, without possessing the peculiar virtues of the root. The decoction may be prepared by boiling an ounce of the bruised root, for a few minutes, in a pint of water. By long boiling, the acrid resinous principle is extracted. Perhaps, however, to this principle may in part be ascribed the therapeutical virtues of liquorice root in chronic bronchial diseases. The powder is used in the preparation of pills, either to give due consistence, or to cover their surface and prevent them from cohering.

Off. Prep. Confectio Terebinthinæ, *Br.;* Decoctum Sarsæ Compositum, *Br.;* Decoctum Sarsaparillæ Compositum, *U. S.;* Extractum Glycyrrhizæ, *Br.;* Extractum Glycyrrhizæ Fluidum, *U. S.;* Extractum Glycyrrhizæ Purum; Glycyrrhizinum Ammoniatum; Pulvis Glycyrrhizæ Compositus; Extractum Sarsaparillæ Fluidum Compositum, *U. S.;* Infusum Lini, *Br.;* Pilula Ferri Iodidi, *Br.;* Pil. Hydrargyri; Syrupus Sarsaparillæ Compositus, *U. S.*

GLYCYRRHIZINUM AMMONIATUM. *U. S.* *Ammoniated Glycyrrhizin.*

(GLĬÇ-ŸR-RHĮ-ZĪ'NŬM ĄM-MŌ-NĮ-Ā'TŬM—glis-ĭr-rĭ-zī'nŭm.)

"Glycyrrhiza, in No. 20 powder, *one hundred parts* [or sixteen ounces av.]; Water, Water of Ammonia, Sulphuric Acid, each, *a sufficient quantity.* Mix *ninety-five parts* [or six pints] of Water with *five parts* [or five fluidounces] of Water of Ammonia, and, having moistened the powder with the mixture, macerate for twenty-four hours. Then pack it moderately in a cylindrical percolator and gradually pour water upon it until *five hundred parts* [or five pints] of percolate are obtained.

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Add to the percolate, slowly and while stirring, a sufficient quantity of Sulphuric Acid, so long as a precipitate is produced. Collect this on a strainer, wash it with cold Water, redissolve it in Water with the aid of Water of Ammonia, 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 Water of Ammonia previously diluted with an equal volume of Water, and spread the clear solution upon plates of glass, so that, on drying, the product may be obtained in scales." *U. S.*

This is a new officinal preparation; its introduction is a result of the very important researches of Z. Roussin, communicated to the Société de Pharmacie of Paris, June 2, 1875. This investigator noticed that *glycyrrhizin*, the sweet principle of liquorice root, was insipid when compared with the root itself, and suspected that it existed in a modified form in the root. Experiment showed that alkalies developed the sweet taste, and he ultimately proved that the alkali with which it was combined in the root was ammonia, and that glycyrrhizin played the part of an acid. He named the compound *glycyrrhizate of ammonium*, and called attention to the fact that liquorice root which had lost a portion of its sweetness through fermentation and the development of acetic acid and precipitation of insoluble glycyrrhizin could be restored to its former sweetness if allowed to remain a sufficient length of time in an ammoniacal atmosphere. The officinal process for ammoniated glycyrrhizin is closely modelled after Roussin's, with the exception of the substitution of percolation by a slightly ammoniated menstruum for maceration and expression with cold water. Roussin purified his product by redissolving it in alcohol and precipitating with ether; this is deemed unnecessary for a preparation which is intended to be useful without being expensive. (See *Proc. A. P. A.*, 1876, p. 544.) Connerade has proposed some modification of Roussin's method; his process is as follows. "Macerate ground liquorice root with one and a half parts by weight of water, strain, wash the residue with a very small quantity of water, heat the mixed liquids to boiling to coagulate albumen, strain again, and then add diluted sulphuric acid (1 in 10), as long as a precipitate is produced. Let this settle, decant the liquid, and dissolve the precipitate in solution of ammonia, diluted with nine parts of water. Filter the latter and evaporate it to dryness. The compound then remains as a brown, friable varnish, unaltered by air, of a pure, sweet taste, easily soluble in cold water, and imparting to the latter, even when diluted to 1 in 1000 parts, an amber color. The yield is about 10 per cent. of the weight of the root." (*N. R.*, March, 1881.)

Properties. The following is the description given in the U. S. Pharmacopœia. "Dark brown or brownish red scales, inodorous, of a very sweet taste, and soluble in water and in alcohol. The aqueous solution, when heated with potassa or soda, evolves vapor of ammonia. On supersaturating the aqueous solution with an acid, a substance (Glycyrrhizin) is precipitated, which, when dissolved in hot water, forms a jelly on cooling. This substance, when washed with diluted alcohol and dried, appears as an amorphous, yellow powder, of a strong, bitter-sweet taste, and an acid reaction." *U. S.*

Medical Properties and Uses. This substance appears to possess the medical properties of liquorice, and may be used as an elegant substitute for it in mixtures which are neither acid nor alkaline. The dose of it is from five to fifteen grains.

GOSSYPII RADICIS CORTEX. *U. S.* *Cotton Root Bark.*

(GŌS-SĬP'Ī-Ī RĂ-DĪ'CĬS CŌR'TĔX.)

"The bark of the root of Gossypium herbaceum, Linné, and of other species of Gossypium. (*Nat. Ord.* Malvaceæ.)" *U. S.*

Cottonroot Bark; Écorce de la Racine de Cotonnier, *Fr.*; Baumwollen-Wurzelrinde, *G.*

Gen. Ch. Calyx cup-shaped, obtusely five-toothed, surrounded by a three-parted involucel, with dentate-incised, cordate leaflets, cohering at the base. *Stigmas* three to five. *Capsule* three to five-celled, many-seeded. *Seeds* surrounded by a tomentose wool. *De Cand.*

In consequence of changes produced in the plants of this genus by cultivation, botanists have found great difficulty in determining which are distinct species, and

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which are merely varieties. De Candolle describes thirteen species in his Prodromus, and mentions six others, but considers them all uncertain. Royle describes eight and admits others. Schwartz thinks they may all be referred to one original species. The plants inhabit different parts of tropical Asia and Africa, and many of them are cultivated for their cotton in climates adapted to their growth. The species from which most of the cotton of commerce has been thought to be obtained, is the one specially indicated by the U. S. Pharmacopœia. According to Dr. Royle, it is the India cotton which is produced by *G. herbaceum*, while *G. Barbadense* furnishes all the cotton of North America, and *G. Peruvianum* that produced in Brazil, Peru, and other parts of South America. (See *A. J. P.*, 1858, p. 339.) Dr. A. W. Chapman, however, in his *Flora of the Southern United States* (N. Y., 1860, p. 58), states that the numerous varieties of the cotton-plant are now referred to two species, the *long-staple*, or *sea-island*, to *G. album* (Haw.), and the *short-staple*, or *upland*, to *G. nigrum* (Haw.).

Gossypium herbaceum. Linn. *Sp. Plant.* 975; De Cand. *Prodrom.* i. 456. This is a biennial or triennial plant, with a branching stem from two to six feet high, and palmate hoary leaves, the lobes of which are somewhat lanceolate and acute. The flowers are pretty, with yellow petals, having a purple spot near the claw. The leaves of the involucel or outer calyx are serrate. The capsule opens when ripe, and displays a loose white tuft of long slender filaments, which surround the seeds and adhere firmly to the outer coating. The plant is a native of Asia, but is cultivated in most tropical countries. It requires a certain duration of warm weather to perfect its seeds, and, in the United States, does not mature north of Virginia.

The herbaceous part of the plant contains much mucilage, and has been used as a demulcent. The seeds yield by expression a fixed oil of the drying kind, which is employed for making soap and other purposes. (See *Oleum Gossypii*.) The bark of the root has been supposed to possess medical virtues, and is now recognized by the U. S. Pharmacopœia. Another officinal portion, and that for which the plant is cultivated, is the filamentous substance surrounding the seeds. This when separated constitutes the cotton of commerce.

Cotton seeds have been employed in our Southern States with great asserted success in the treatment of intermittents. In a communication from Prof. H. R. Frost to the *Charleston Medical Journal* for May, 1850, it is stated, on the authority of Dr. W. K. Davis, of Monticello, that this application of the cotton seed originated with a planter in Newberry District, South Carolina, who had often used the remedy in intermittents, and never failed to effect a cure. A pint of the seeds is boiled in a quart of water to a pint, and a teacupful of the decoction is given to the patient in bed, an hour or two before the expected return of the chill.

Properties. Cotton Root Bark is officinally described as "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 fibres long, tough, and separable into papery layers; inodorous; taste very slightly acrid and faintly astringent." *U. S.* Prof. E. S. Wayne, of Cincinnati, found in it a peculiar acid resin, colorless and soluble in water, when pure, but absorbing oxygen on exposure, and then becoming red and insoluble in water. It is deposited by the fluid extract on standing. He suggests that this may be the active principle of the root; but the fact has not been determined. (*A. J. P.*, 1872, p. 289.)

William C. Staehle (*A. J. P.*, 1875, p. 457) made an examination of this resin, and obtained results somewhat different from those of Prof. Wayne. Staehle's percolate was of a dark, reddish brown color, whilst Wayne's was pale amber. This is accounted for, however, by the presence of a principle which is colorless in the fresh bark, but of a dark red in bark which has been exposed to air and light. W. A. Taylor noticed that the change in color from pale amber to dark red took place in an alcoholic tincture. (*A. J. P.*, 1876, p. 403.) Staehle found the resin soluble in 14 parts of alcohol, 15 parts of chloroform, 23 parts of ether, and 122 parts of benzol.

Medical Properties. It has been employed by Dr. Bouchelle, of Mississippi,

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who believes it to be an excellent emmenagogue, and not inferior to ergot in promoting uterine contraction. He states that it is habitually and effectually resorted to by the slaves of the South for producing abortion, and thinks that it acts in this way without injury to the general health. To assist labor, he employs a decoction made by boiling four ounces of the inner bark of the root in a quart of water to a pint, and gives a wineglassful (60 C.c.) every twenty or thirty minutes. (*West. Journ. of Med. and Surg.*, Aug. 1840.) These opinions of Dr. Bouchelle have been confirmed by various Southern practitioners of medicine, but for some reason the drug has not come into general use. Dr. Bellany, of Columbus, Georgia, says that the root should be gathered as late as possible in the fall before frost. The officinal fluid extract may be used in doses of half a fluidrachm to one fluidrachm (1·9 to 3·75 C.c.), repeated at short intervals if necessary.

Off. Prep. Extractum Gossypii Radicis Fluidum, *U. S.*

GOSSYPIUM. *U.S., Br. Cotton.* [*Purified Cotton. Absorbent Cotton.*]

(GŎS-SĬP'I-ŬM.)

"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.* "The hairs of the seed of various species of Gossypium, carded." *Br.*

Bonelyax, Lana (Lanugo, s. Pili) Gossvpii; Coton, *Fr.;* Baumwolle, *G.;* Cotone, *It.;* Algodon, *Sp.*

Cotton consists of "white, soft, fine filaments, under the microscope appearing as flattened, hollow and twisted bands, spirally striate and slightly thickened at the edges; inodorous, tasteless, insoluble in water, alcohol, or ether; soluble in an ammoniacal solution of sulphate of copper." It is without smell or taste, soluble in strong alkaline solutions, and decomposed by the concentrated mineral acids. In chemical character it is identical with lignin. By nitric acid it is converted into that remarkable explosive substance denominated gun cotton, for an account of which, see *Pyroxylinum* and *Collodium*. Officinal cotton is made by boiling the raw cotton in a diluted alkaline solution. A soap is formed through the union of the fatty matter with the alkali, and this is subsequently dissolved out by repeated washings. Mr. F. L. Slocum has published recently (1881) a process for preparing it. For details see the foot-note.* The U. S. P. tests are as follows. "Cotton should be perfectly free from all perceptible impurities, and, on combustion, should not leave more than 0·8 per cent. of ash. When thrown upon water, it should immediately absorb the latter and sink, and the water should not acquire either an acid or an alkaline reaction." *U. S.* The latter test proves the absence of fatty matter, for if even a small quantity be present the cotton will float in water. Repeated experiments have proven that cotton will take fire and burn spontaneously, if impregnated with olive oil, linseed oil, or almost any other fixed oil, and allowed to stand. (*P. J. Tr.*, 1872, p. 225.) Cotton, analyzed by M. Schunck, was found, independently of cellulose, ($C_6H_{10}O_5$), of which it chiefly consists, to contain vegetable wax, a fatty acid, coloring matter, pectic acid, and a little of an albuminoid substance. (*Journ. de Pharm.*, Sept. 1868, p. 233.) For medical use it should be carded into thin sheets. It is said that air passed through cotton loses the property of inducing the putrefactive fermentation in animal substances, on account of the microscopic organisms being strained out of it.

* Take of the best quality of carded cotton batting, any desired quantity, and boil it with a 5 per cent. solution of caustic potassa or soda for one-half hour, or until the cotton is entirely saturated with the solution, and the alkali has saponified all oily matter. Then wash thoroughly, to remove all soap, and nearly all alkali; press out the excess of water, and immerse in a 5 per cent. solution of chlorinated lime for 15 or 20 minutes; again wash, first with a little water, then dip in water acidulated with hydrochloric acid, and thoroughly wash with water; press out the excess of water, and again boil for 15 or 20 minutes in a 5 per cent. solution of caustic potassa or soda; now wash well, dipping in the acidulated water and washing thoroughly with pure water. Afterwards press out and dry quickly.

The amount of loss by this process is practically 10 per cent. A sample of 360 grs. lost, on boiling with alkali and bleaching, 15 grs., or 4·17 per cent., and 270 grs. of this bleached sample lost, on again boiling with an alkali, 14 grs., or 5·18 per cent., a total loss of 9·35 per cent. (*A. J. P.*, 1881, p. 53.)

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Medical Properties. Cotton has been used from time immemorial for the fabrication of cloth; but it is only of late that it has entered the catalogue of medicines. The use of cotton as a filtering medium and in the preparation of medicated waters has already been alluded to. It is chiefly employed in recent burns and scalds; an application of it adopted from popular practice. It is said to relieve the pain, diminish the inflammation, prevent vesication, and very much to hasten the cure. Whatever advantages result from it are probably ascribable to the absorption of effused liquids, and the protection of the part affected from the air. It is applied in thin and successive layers; and benefit is said to result from the application of a bandage when the skin is not too much inflamed. We have, however, seen cotton do much harm in burns, by becoming consolidated over a vesicated surface and acting as a mechanical irritant. Such a result may be prevented by first dressing the burn with a piece of fine linen spread with simple ointment. Cotton is also recommended in erysipelas, and as a dressing for blisters; and we have found it useful, applied in a large bunch over parts affected with rheumatism, especially in lumbago.* It has also been used as a dressing for wounds, including amputation and other operations by the surgeons; being largely applied to injured surfaces, and confined in its place by bandages, which are allowed to remain undisturbed, in order to prevent the injurious influence of the impure hospital air, and the access to the wounds of organic germs, which dispose to suppuration and septic disease. (See *Bost. Med. & Surg. Journ.*, May, 1872, p. 325; Aug. 1874, p. 197; *Arch. Gén.*, Dec. 1871; *Journ. de Pharm.*, Jan. 1872.)

Off. Prep. Pyroxylinum.

GRANATUM. *U. S.* *Pomegranate.*

(GRĂ-NĀ'TŬM.)

"The bark of the root of Punica Granatum. Linné. (*Nat. Ord.* Granataceæ.)" *U. S.* "The dried bark of the root." *Br.*

Granati Radicis Cortex, *Br.;* Cortex Radicis Granati, *P.G.;* Écorce de la Racine de Grenadier (de Balaustier), Écorce de Granade, *Fr.;* Granatwurzelrinde, Granatäpfelschale, *G.;* Malicorio, Scorza del Melogranati, *It.;* Corteza de Granada, *Sp.*

Gen. Ch. *Calyx* five-cleft, superior. *Petals* five. *Pome* many-celled, many-seeded. *Willd.*

Punica Granatum. Willd. *Sp. Plant.* ii. 981; Woodv. *Med. Bot.* p. 531, t. 190; Carson, *Illust. of Med. Bot.* i. 45, pl. 38. The pomegranate is a small shrubby tree, attaining in favorable situations the height of twenty feet, with a very unequal trunk, and numerous branches which sometimes bear thorns. The leaves are opposite, entire, oblong or lance-shaped, pointed at each end, smooth, shining, of a bright green color, and placed on short footstalks. The flowers are large, of a rich scarlet color, and stand at the end of the young branches. The petals are roundish and wrinkled, and are inserted into the upper part of the tube of the calyx, which is red, thick, and fleshy. The fruit is a globular berry, about the size of an orange, crowned with the calyx, covered with a reddish yellow, thick, coriaceous rind, and divided internally into many cells, which contain an acidulous pulp, and numerous oblong, angular seeds.

This tree grows wild upon both shores of the Mediterranean, in Arabia, Persia, Bengal, China, and Japan, has been introduced into the East and West Indies, and is cultivated in all civilized countries where the climate is sufficiently warm to allow the fruit to ripen. In higher latitudes, where it does not bear fruit, it is raised in gardens and hot-houses for the beauty of its flowers, which become double and acquire increased splendor of coloring by cultivation. Doubts have been entertained

* Absorbent cotton has been medicated in various ways and come largely into use. (See *Iodinized Cotton*, under *Iodinum.*) *Picric Cotton* is prepared by dissolving 0·25 Gm. of picric acid in 25 Gm. of ether, or of 94 per cent. alcohol, and immersing in the solution 10 Gm. of clean cotton, and drying. *Salicylic Cotton* (5 per cent.) may be prepared by Prof. Brun's process, by saturating 1 kilogramme of cotton with 4 litres of a solution of 50 Gm. of salicylic acid, 20 Gm. of castor oil in 3·930 litres of alcohol. *Benzoic Cotton* is made in the same way, substituting benzoic for salicylic acid. (*A. J. P.*, Dec. 1878.) *Chlorinated Cotton.* Prof. Pavesi subjects cotton moistened with glycerin, and suspended at the top of a large wide-mouthed bottle, to the action of chlorine vapor, generated by adding sulphuric acid to chlorinated lime. (*N. R.*, July, 1880.)

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as to its original country. The name of *Punicum malum*, applied by the ancients to its fruit, implies that it was abundant at an early age in the vicinity of Carthage. The fruit, for which the plant is cultivated, varies much in size and flavor. It is said to attain greater perfection in the West Indies than in its native country. The edible pulp is red, succulent, pleasantly acid, and sweetish. The flowers were recognized by the Dublin College, and the seeds are officinal in France.

Rind of the Fruit. This is presented in commerce under the form of irregular fragments, hard, dry, brittle, of a yellowish or reddish brown color externally, paler within, without smell, and of an astringent, slightly bitter taste. It contains a large proportion of tannin, and, in countries where the tree abounds, has been employed for tanning leather.

Flowers. The flowers, sometimes called *balaustines*, are inodorous, have a bitterish, astringent taste, and impart a violet-red color to the saliva. They contain tannic and gallic acids, and were used by the ancients in dyeing.

Bark of the Root. The roots of the pomegranate are hard, heavy, knotty, ligneous, and covered with a bark which is yellowish gray or ash-gray on the outer surface, and yellow on the inner. As officinally described, the bark is "in thin quills or fragments, from two to four inches (5 to 10 cm.) long, little over one twenty-fifth of an inch (1 mm.) thick; outer surface yellowish gray, free from lichens; somewhat warty, or longitudinally and reticulately ridged; inner surface smooth, finely striate, grayish yellow; fracture short, granular, greenish yellow, indistinctly radiate." *U. S.* It has little or no smell, colors the saliva yellow when chewed, and leaves in the mouth an astringent taste without disagreeable bitterness. The infusion of the bark yields a deep blue precipitate with salts of iron, and a yellowish white precipitate with solution of gelatin. The inner surface of the bark, steeped in water and then rubbed on paper, produces a yellow stain, which, by the contact of sulphate of iron, is rendered blue, and by that of nitric acid acquires a slight rose tint, which soon vanishes. (*Ibid.*, xvii. 438.) These properties serve to distinguish this bark from those of the box root and barberry, with which it is said to be sometimes adulterated. When used, it should be separated from the ligneous portion of the root, as the latter is inert.*

The bark contains more than 22 per cent. of tannic acid, which Rembold (*Ann. der Ch. und Pharm.*, 143, p. 285) found to consist for the most part of a peculiar variety called *punico-tannic acid*, $C_{20}H_{16}O_{13}$; when boiled with dilute sulphuric acid, it is resolved into *ellagic acid*, $C_{14}H_8O_9$, and sugar. Punico-tannic acid is accompanied by common tannic acid, yielding by means of sulphuric acid gallic acid, which appears sometimes to pre-exist in the bark.

Pomegranate bark also yields a considerable quantity of *mannite*, which was formerly described under the names of *punicin* or *granatin*. The active power of the root, however, is due, according to Tanret (*Comp.-Rend.*, 86, p. 1270, and 87, p. 358), to an alkaloid *pelletierine*, $C_8H_{13}NO$, a dextrogyrate liquid boiling at 180° to 185° C. The alkaloid is easily soluble in water, alcohol, and ether, and specially so in chloroform. It has strong basic properties, and precipitates many metallic salts. 1000 parts of dry bark yielded 4 parts of the alkaloid.

In a later communication (*Comp.-Rend.*, 88, p. 716), Tanret announces that he has found three additional volatile bases in the bark, a liquid left-rotating one, a liquid optically inactive one, and a crystallizable inactive one, which latter has the formula $C_9H_{15}NO + 2H_2O$, fuses at 46° C., and boils at 246° C. His process for obtaining these alkaloids is as follows. "A mixture of the salts of the alkaloids is prepared by mixing the powdered bark with a milk of lime, exhausting with water, shaking the resulting liquor with chloroform and neutralizing the latter with dilute acid. A solution of the mixed alkaloids is thus obtained in which one or other of

* Dr. C. Harz stated in 1870 that the commercial bark, sold as the bark of the root of the pomegranate, consisted really, in great measure, of that of the stem; a little of the proper root-bark being occasionally intermingled with it. The root-bark, the author observes, "has large cells; and at a distance from the cambium, the cells of the medullary rays are not elongated but quadratic. The trunk-bark, as well as that of the root, has anthelmintic properties." (*A. J. P.*, 1870, p. 220.) A minute description of the microscopic character of the root-bark, by which it may be distinguished, is contained in *P. J. Tr.* (1873, p. 703).

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them predominates, according to the source of the bark. Two of the four alkaloids are displaced from their salts by bicarbonate of sodium, and two are not. This solution is therefore treated with an excess of bicarbonate of sodium and shaken with chloroform, and this in its turn is agitated with dilute sulphuric acid. The resulting solution contains the sulphates of two alkaloids, to which the names of "*methylpelletierine*" and "*pseudopelletierine*" have been given. Caustic potash is then added to the first liquor, and upon repeating the treatment with chloroform and acid there is obtained a solution of the sulphates of "pelletierine" and "*isopelletierine*." (*P. J. Tr.*, 1880, p. 829.)

Medical Properties and Uses. The rind of the pomegranate fruit was formerly recognized by the U. S. Pharmacopœia. It is astringent, and in the form of decoction is sometimes employed in diarrhœa and colliquative sweats, and, more frequently, as an injection in leucorrhœa, and as a gargle in sore throat in the earlier stages, or after the inflammatory action has in some measure subsided. The powdered rind has also been recommended in intermittent fever. The flowers have the same medical properties, and are used for the same purposes. The bark of the root was used by the ancients as a vermifuge, and is recommended in the writings of Avicenna, but was unknown in modern practice till brought into notice by Dr. F. Buchanan, who learned its powers in India. The Mahometan physicians of Hindostan consider it a specific against tænia. One of these practitioners, having relieved an English gentleman in 1804, was induced to disclose his secret, which was then made public. The French writers prefer the product of the wild pomegranate, growing on the borders of the Mediterranean, to that of the plant cultivated in gardens for ornamental purposes. The bark may be administered in powder or decoction; but the latter form is usually preferred. The decoction is prepared by macerating two ounces of the bruised bark in two pints of water for twenty-four hours, and then boiling to a pint. Of this a wineglassful may be given every half-hour, hour, or two hours, until the whole is taken. It often nauseates and vomits, and usually purges. Portions of the worm often come away soon after the last dose. It is recommended to give a dose of castor oil and to diet the patient strictly on the day preceding the administration of the remedy; and, if it should not operate on the bowels, to follow it by castor oil, or an enema. If not successful on the first trial, it should be repeated daily for three or four days, until the worm is discharged. It appears to have been used by the negroes of St. Domingo before its introduction into Europe.

Various trials have been made to determine the tænifugal properties of pelletierine. They seem to show that the alkaloid is a valuable drug, and that the tannate has not only freedom from taste to recommend it, but is decidedly more effective and less apt to derange the stomach than the sulphate, probably because its insolubility prevents its absorption before it reaches the worm. M. Bérenger-Férand also studied the comparative value of the four alkaloids which M. Tanret has found in the bark, and showed that those alkaloids whose sulphates are not decomposable by the bicarbonate of sodium are nearly devoid of power. The dose of the tannate of pelletierine is half to three-quarters of a grain (0·03–0·05 Gm.), taken after fasting, and followed in 15 minutes by a sharp purgative. (*Bull. de Thérap.*, xcvi. xcvii.) Much larger doses are asserted, with very doubtful correctness, to be proper; thus, according to *N. R.*, 1879, 8 grains (0·52 Gm.) is the dose. The dose of the rind and flowers in powder is from twenty to thirty grains (1·3–1·95 Gm.). A decoction may be prepared in the proportion of an ounce of the medicine to a pint of water, and given in the dose of a fluidounce (30 C.c.). The seeds are demulcent.

Off. Prep. of the Bark of the Root. Decoctum Granati Radicis, *Br.*

GRINDELIA. *U. S.* *Grindelia.*

(GRĬN-DĒ'LĮ-Ą.)

"The leaves and flowering tops of Grindelia robusta. Nuttall. (*Nat. Ord.* Compositæ.)" *U. S.*

Gen. Ch. Heads solitary, terminating leafy branches, or occasionally more or less

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corymbose, heterogamous with the rays fertile, or in one species homogamous (rayless), many-flowered. *Involucre* hemispherical or globular, commonly coated with resin or balsam; its scales very numerous, imbricated, narrow, with coriaceous, appressed, bare, and slender, more or less spreading or squarrose, green tips. *Receptacle* flat or convex, foveolate. *Rays* numerous, narrow. *Branches* of the style tipped with a lanceolate or linear appendage. *Akenes* compressed or turgid, or the outermost somewhat triangular, glabrous, truncate. *Pappus* of two to eight caducous awns or stout corneous bristles. Biennial or perennial, and mostly coarse herbs, with sessile or partly clasping leaves, often viscid or resinous, and middle-sized or rather large heads of yellow flowers. *Torrey & Gray.*

This genus inhabits the western side of both North and South America. Most if not all of the species produce a resinous exudation, especially from the flower-heads, and it is probable that medical properties are common to the genus.

G. robusta, Nuttall, is an herbaceous plant, from one to three feet high, very glabrous, with leaves varying from broadly spatulate or oblong to lanceolate, or the upper cordate and clasping, commonly obtuse, sharply more or less serrate; the scales of the involucre are produced into long circinate, squarrose, awn-like tips; the pappus of two to three, rarely five, nearly smooth, flattish awns; akenes mostly one- to three-toothed at the apex.

Grindelia squarrosa, Dunal, is in general a less leafy and bushy plant than *G. robusta*, but so closely resembles some varieties of the latter, that after a careful study of various published descriptions and of the specimens in the herbarium of the Academy of Natural Sciences, we are not satisfied of this specific distinctness. The character pointed out by Torrey and Gray, that in *robusta* the leaves are broader at the base than above, does not hold; for in a specimen in the herbarium of the Philadelphia Academy of Natural Sciences labelled in Nuttall's handwriting, and, therefore, probably the type of *G. robusta*, the leaves are not broader at the base; whilst in various specimens of *G. squarrosa* they are not narrowed at the base. The most constant distinctive characters in the specimens at hand are that *G. robusta* has a more leafy involucre and its leaves usually are more coarsely serrate; but Watson describes a variety of *G. robusta* in which the upper leaves are entire. There is no constant difference in the scales of the involucre.

Properties. The officinal description of grindelia is as follows. "Leaves about two inches (5 cm.) or less long, varying from broadly spatulate or oblong to lanceolate, sessile or clasping, obtuse, more or less sharply serrate, pale green, smooth, finely dotted, brittle; heads many-flowered; the involucre hemispherical, about half an inch (12 mm.) broad, composed of numerous, imbricated, squarrosely tipped scales; ray-florets yellow, ligulate, pistillate; disk-florets yellow, tubular, perfect; pappus consisting of about three awns of the length of the disk-florets." *U. S.*

As it occurs in commerce, grindelia is in the form of the whole dried herb; the stems are about eighteen inches in length, light brownish, very frequently stripped of their leaves, but with some of the floral heads adherent. The brittle leaves are much broken, and with separated floral heads are mixed with the stem. The taste is warmish, peculiar, and very persistent. The specimens we have examined seemed to contain numerous floral heads, some according with those of the typical *G. robusta*, others without trace of involucral leaves. Some of the latter may have been removed, it is true, by accidents of carriage; but if *G. squarrosa* and *robusta* be distinct species, it would appear that they are indiscriminately collected. The activity of the drug probably resides in the resinous exudation. Dr. C. J. Rademaker obtained from it an oil, the odor of which closely resembled that of oil of turpentine, resin, and a crystalline body, having an alkaline reaction: the constituents deserve further chemical investigation. (*N. R.*, 1876, p. 205.)

Medical Properties and Uses. Attention was first called to the therapeutic value of grindelia by Dr. H. Gibbons, of San Francisco, and the medicine has since gradually worked its way into favor. Its chief use has been in asthma and in bronchitis; it is especially valuable in the latter complaint when there is much dyspnœa and a distinct tendency to bronchial spasm. The drug, however, probably not only exerts an antispasmodic influence, but also stimulates the bronchial

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mucous membrane, and it may be confidently exhibited in chronic bronchitis, especially of the aged. It has been employed with asserted success in hooping-cough. Its active principles appear to be excreted from the kidneys; hence after large doses there are sometimes evidences of renal irritation; and in chronic catarrh of the bladder good has been effected by its stimulant influence upon the mucous membrane of the viscus. As a local application, grindelia has been employed with asserted advantage in burns, vaginitis, genito-urinary catarrh, etc., applied either in the form of a poultice or in solution.

Off. Prep. Extractum Grindeliæ Fluidum, *U. S.*

GUAIACI LIGNUM. *U. S., Br.* *Guaiacum Wood.*

(GUĂ'IĄ-CĪ LĪG'NŬM—gwā'yą-sī.)

"The heart-wood of Guaiacum officinale, Linné, and of Guaiacum sanctum, Linné. (*Nat. Ord.* Zygophyllaceæ.)" *U. S.* "The wood reduced by the turning lathe to the form of a coarse powder or small chips." *Br.*

Lignum Guajaci, *P.G.;* Lignum Sanctum (vel Benedictum, vel Vitæ); Lignum Vitæ; Bois de Gayac, *Fr.;* Guajakholz, Franzosenholz, Pockenholz, *G.;* Legno Guaiaco, *It.;* Guayaco, *Sp.*

Gen. Ch. Calyx five-cleft, unequal. *Petals* five, inserted into the calyx. *Capsule* angular, three- or five-celled. *Willd.*

Guaiacum officinale. Willd. *Sp. Plant.* ii. 538; Woodv. *Med. Bot.* p. 557, t. 200; Carson, *Illust. of Med. Bot.* i. 25, pl. 17. This is a large tree, of very slow growth. When of full size it is from forty to sixty feet high, with a trunk four or five feet in circumference. The branches are knotted, and covered with an ash-colored striated bark. That of the stem is of a dark gray color, variegated with greenish or purplish spots. The leaves are opposite, and abruptly pinnate, consisting of two, three, and sometimes four pairs of leaflets, which are obovate, veined, smooth, shining, dark green, from an inch to an inch and a half long, and almost sessile. The flowers are of a rich blue color, stand on long peduncles, and grow to the number of eight or ten at the axils of the upper leaves. The seeds are solitary, hard, and of an oblong shape.

G. sanctum, L., is distinguished from *G. officinale* by its five-celled fruit and its oblong or obliquely obovate, or sometimes rhomboid-ovate leaflets, six to eight to each leaf. It grows in Cuba and some other of the West India Islands, and in the Bahama Islands. Its wood is smaller than that of *G. officinale*, and is said by Fée to be paler and less dense.

G. officinale grows in the West Indies, particularly in Hayti and Jamaica, and is found also in the warmer parts of the neighboring continent. All parts of the tree are possessed of medicinal properties; but the wood and the concrete juice only are officinal. The bark, though much more efficacious than the wood, is not kept in the shops. It is said that other species of Guaiacum contribute to the supplies brought into the market. *G. sanctum* of Linnæus, and *G. arboreum* of De Candolle, are particularly specified.

Guaiacum wood is imported from Hayti and other West India islands, in the shape of logs or billets, covered with a thick gray bark, which presents on its inner surface, and upon its edges when broken, numerous shining crystalline points. These were supposed by Guibourt to be benzoic acid, by others a resinous exudation from the vessels of the plant; but Dr. Otto Berg has determined that they are crystals of sulphate of calcium. The billets are used by the turners for the fabrication of various instruments and utensils, for which the wood is well adapted by its extreme hardness and density. It is kept by the druggists and apothecaries in the state of shavings or raspings, which they obtain from the turners. It is commonly called *lignum vitæ*, a name which obviously originated from the supposition that the wood was possessed of extraordinary remedial powers.

Properties. Guaiac wood is very hard and heavy. The color of the sap-wood is yellow, that of the older and central layers greenish brown, that of the shavings a mixture of the two. It is said that, when the wood is brought into a state of minute division, its color is rendered green by exposure to the air, and bluish green by the action of nitric acid fumes; and the latter change may be considered as a test of its

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genuineness. (*Duncan.*) An easier test is a solution of corrosive sublimate, which, added to the shavings and slightly heated, causes a bluish green color in the genuine wood. (*Chem. Gaz*, No. 80, Feb. 1846.) Guaiacum wood is almost without smell unless rubbed or heated, when it becomes odorous. When burnt it emits an agreeable odor. It is bitterish and slightly pungent, but requires to be chewed for some time before the taste is developed. It contains, according to Trommsdorf, 26 per cent. of resin, and 0·8 of a bitter pungent extractive, upon both of which, probably, though chiefly on the former, its medicinal virtues depend. (See *Guaiaci Resina.*) It yields its virtues but partially to water. One pound of the wood afforded to Geiger two ounces of extract.

Medical Properties and Uses. Guaiacum wood ranks among the stimulant diaphoretics. It is said to have been introduced to the notice of European practitioners by the natives of Hispaniola, soon after the discovery of America. It was used in Europe so early as 1508, and attained great celebrity as a remedy for lues venerea; but more extended experience has proved it to be wholly inadequate to the cure of that disease; and it is now employed simply to palliate the secondary symptoms, or to assist the operation of other and more efficient remedies. It is thought to be useful also in chronic rheumatism and gout, scrofula, certain cutaneous eruptions, ozæna, and other protracted diseases dependent on a depraved or vitiated condition of the system. It is usually exhibited in decoction, and in combination with other medicines, as in the compound decoction of sarsaparilla. As but a small portion of the guaiac contained in it is soluble in water, the probability is that its virtues have been greatly overrated, and that the good which has followed its employment resulted rather from the more active medicines with which it is associated, or from the attendant regimen, than from the wood itself. The simple decoction may be prepared by boiling an ounce in a pint and a half of water down to a pint, the whole of which may be administered in divided doses during the twenty-four hours. An aqueous extract is directed by the French Codex.

Off. Prep. Decoctum Sarsæ Compositum, *Br.;* Decoctum Sarsaparillæ Comp., *U. S.;* Syrupus Sarsaparillæ Comp., *U. S.*

GUAIACI RESINA. *U. S., Br. Guaiac.*

(GUĀ'IẠ-CĪ RĘ-ZĪ'NẠ—gwâ'yą-sī.)

"The resin of the wood of Guaiacum officinale. Linné. (*Nat. Ord.* Zygophyllaceæ.)" *U. S.* "The resin obtained from the stem by natural exudation, by incisions, or by heat." *Br.*

Resina Guajaci, *P.G.;* Guaiacum; Guaiacum Resin; Résine de Gayac, *Fr.;* Guajak, Guajakharz, *G.;* Resina de Guajaco, *It.;* Resina de Guayaco, *Sp.*

For a description of *Guaiacum officinale*, see *Guaiaci Lignum*, p. 727.

Guaiac is the concrete juice of this tree. It is obtained in several different modes. The most simple is by spontaneous exudation, or by incisions made into the trunk. Another method is by sawing the wood into billets about three feet long, boring them longitudinally with an auger, then placing one end of the billet on the fire, and receiving in a calabash the melted guaiac, which flows out through the hole at the opposite extremity. But the plan most frequently pursued is probably to boil the wood, in the state of chips or sawdust, in a solution of common salt, and skim off the matter which rises to the surface. Guaiac is brought to this market from the West Indies. It is usually in large irregular pieces of various size, in which small fragments of bark, sand, and other impurities are mixed with the genuine guaiac, so as to give to the mass a diversified appearance. Sometimes we find it in small roundish homogeneous portions, separate or agglutinated; sometimes in homogeneous masses, prepared by melting and straining the drug in its impure state. It is probable that the guaiac, obtained from the billets in the manner above described, is of uniform consistence.*

Properties. The masses are irregular or somewhat globular, of a glassy lustre

* Under the name of *Resina Guaiaci Peruviana Aromatica* there is a substance circulating in European commerce, which probably has no relation to guaiac. For a summary of our knowledge concerning it, see *A. J. P.*, 1877, p. 18.

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and resinous fracture. They are of a deep greenish brown or dark olive color on their external surface, and internally wherever the air can penetrate. The predominant hue of those parts not exposed to the air is reddish brown or hyacinthine, diversified, however, with shades of various colors. The odor is feeble but fragrant, and is rendered stronger by heat. The taste, which is at first scarcely perceptible, becomes acrid after a short period; and a permanent sense of heat and pungency is left in the mouth and fauces. Guaiac is brittle, and when broken presents a shining glass-like surface, conchoidal or splintery, with the smaller fragments more or less translucent. It is readily pulverized; and the powder, at first of a light gray color, becomes green on exposure to the light. Its sp. gr. varies from 1·2 to 1·23. It softens in the mouth, and melts with a moderate heat. Water dissolves a small proportion of guaiac, not exceeding nine parts in 100, forming an infusion of a greenish brown color and sweetish taste, which, upon evaporation, yields a brown substance soluble in hot water and alcohol, but scarcely so in ether. Alcohol takes up the whole, with the exception of impurities. The tincture is of a deep brown color, is decomposed by water, and affords blue, green, and brown precipitates, with the mineral acids. It is colored blue by nitric acid, by chlorine, and by tincture of the chloride of iron, and usually by spirit of nitrous ether; and is similarly changed when treated successively by dilute hydrocyanic acid, and solution of sulphate of copper. Either in substance or tincture, guaiac gives a blue color to gluten and substances containing it, to mucilage of gum arabic, to milk, and to various freshly cut roots, as the potato, carrot, and horseradish. It is soluble also in ether, alkaline solutions, and sulphuric acid. The solution in sulphuric acid is of a rich claret color, deposits, when diluted with water, a lilac precipitate, and, when heated, evolves charcoal. Exposed to air and light, guaiac absorbs oxygen and becomes green, and the change takes place rapidly in the sunshine. Tincture of guaiac has been used for the detection of blood-stains, which it does by the blue color produced by it, when in contact with the red coloring matter of blood, in connection with some ozonized substance, especially peroxide of hydrogen. (*Guy's Hosp. Reports*, 3d ser., xiii. 432.)

It may be used also to distinguish the blood of man and other mammals, in which the corpuscles are non-nucleated, from that of other classes, as birds, fishes, and reptiles, which have nucleated corpuscles. The following method of applying the test, made known by Dr. R. M. Bertolet, microscopist of the Philadelphia Hospital, has the advantage that it will present the evidence to the spectator, and thus be made to give conviction in jury trials. A microscopic preparation, duly mounted, is carefully irrigated with a simple tincture of guaiac resin, and then, under glass, exposed to the action of a very small quantity of an ethereal solution of peroxide of hydrogen. The mammalian corpuscles will exhibit a uniform blue coloration throughout, of different shades in the different corpuscles, while, if the blood corpuscle is nucleated, the nucleus is seen as a well-defined and deep blue body, with a delicate violet-colored medium around it. (*Am. Journ. of Med. Sci.*, Jan. 1874, p. 129.)

The composition of guaiacum resin was ascertained by Hadelich (*Journ. für pr. Chem.*, 87, p. 335) to be as follows. Guaiaconic acid 70·3 per cent., guaiaretic acid 10·5 per cent., guaiac beta-resin 9·8 per cent., gum 3·7 per cent., ash constituents 0·8 per cent., guaiacic acid, coloring matter (guaiac yellow), and impurities 4·9 per cent. Of these constituents, *guaiaretic acid*, $C_{20}H_{26}O_4$, was discovered by Hlasiwetz in 1859. It may be extracted from the crude resin by alcoholic potash or by quicklime, forming a crystalline salt with the former and an amorphous compound with the latter. The free acid is obtained by decomposing one of these salts with hydrochloric acid and crystallizing from alcohol. The crystals, which are soluble in ether, alcohol, benzol, chloroform, carbon disulphide, or acetic acid, but not in ammonia or in water, melt below 80° C., and may be volatilized without decomposition. They are not colored blue by oxidizing agents. If the mother-liquor from the potassium salt of the guaiaretic acid be decomposed with hydrochloric acid and the precipitate washed with water, ether will extract *guaiaconic acid*, $C_{38}H_{40}O_{10}$. This compound, discovered by Hadelich in 1862, is a light brown amorphous substance, fusing at 100° C. It is without acid reaction, but decomposes alkaline car-

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bonates, forming salts easily soluble in water and alcohol. It is insoluble in water, benzol, or bisulphide of carbon, but dissolves in ether, chloroform, acetic acid, or alcohol. With oxidizing agents it assumes a transient blue tint. After the extraction of the guaiaconic acid, there remains a substance insoluble in ether, to which the name of *Guaiac Beta-resin* has been applied. Its composition does not appear to differ greatly from that of guaiaconic acid.

Guaiacic acid, $C_{12}H_{16}O_6$, obtained in 1841 by Thierry, from guaiacum wood, or from the resin, crystallizes in colorless needles. Hadelich states that not more than one part in 20,000 can be obtained from the resin.

Guaiac yellow, the coloring matter of guaiacum resin, was first observed by Pelletier. It crystallizes in pale yellow quadratic octahedra, having a bitter taste, but is not a glucoside.

Guaiac resin also yields interesting products on dry distillation. First, *guaiacene*, C_5H_8O, at 118° C., next, *guaiacol*, $C_6H_4\begin{cases}OCH_3\\OH\end{cases}$, being the methyl ether of pyrocatechin, at 205°–210° C., and with it *kreosol*, $C_6H_3(CH_3)_2OH$, and finally, *pyroguaiacin*, $C_{38}H_{44}O_6$, in pearly scales, melting at 180° C. (*Pharmacographia*, 2d ed., p. 104.)

It will be inferred, from what has been said, that the mineral acids are incompatible with the solutions of guaiac.

Adulterations. This drug is sometimes adulterated with the resin of the pine. The fraud may be detected by the terebinthinate odor exhaled when the sophisticated guaiac is thrown upon burning coals, as well as by its partial solubility in hot oil of turpentine. This liquid dissolves resin, but leaves pure guaiac untouched. Amber is said to be another adulteration. Nitric acid affords an excellent test of guaiac. If paper moistened with the tincture be exposed to the fumes of this acid, it speedily becomes blue. Purgotti proposed guaiac resin as a test for copper. (See *A. J. P.*, June, 1880.)

Medical Properties and Uses. Guaiac is stimulant and alterative, producing, when swallowed, a sense of warmth in the stomach, with dryness of the mouth and thirst, and promoting various secretions. If given to a patient when covered warm in bed, especially if accompanied with opium and ipecacuanha, or the antimonials, and assisted by warm drinks, it often excites profuse perspiration; and hence it has been usually ranked among the diaphoretics. If the patient be kept cool during its administration, it is sometimes directed to the kidneys, the action of which it promotes. In large doses it purges; and it is thought by some practitioners to be possessed of emmenagogue powers. It has been given with asserted advantage in chronic rheumatism, gouty affections, secondary syphilis, scrofulous diseases, and cutaneous eruptions. It was much relied upon by the late Dr. Dewees in the cure of amenorrhœa and dysmenorrhœa. Dr. James Jackson, of Boston, recommends it occasionally as a laxative, in the dose of a drachm.

The medicine is given in substance or tincture. The dose of the powder is from ten to thirty grains (0·65–1·95 Gm.), which may be exhibited in pill or bolus, in the shape of an emulsion formed with gum arabic, sugar, and water, or as a syrup.* An objection to the form of powder is that it quickly aggregates. Guaiac is sometimes administered in combination with alkalies, with which it readily unites. Several European Pharmacopœias direct a *soap of guaiac*, under the name of *sapo guaiacinus*, to be prepared by diluting the liquor potassæ with twice its weight of water, boiling lightly, then adding guaiac gradually, with continued agitation, so long as it continues to be dissolved, and finally filtering, and evaporating to the pilular consistence. One scruple (1·3 Gm.) may be taken daily in divided doses.

Off. Prep. Mistura Guaiaci, *Br.;* Pilulæ Antimonii Compositæ, *U. S.;* Pilula Hydrargyri Subchloridi Composita, *Br.;* Tinctura Guaiaci, *U. S.;* Tinctura Guaiaci Ammoniata.

* *Syrup of Guaiac.* Dr. T. C. Craig. (*A. J. P.*, July, 1880.) Powd. Guaiac Resin, 640 grains; Caustic-Potassa, 58 grains; White Sugar, ℔j (avoird.); Water, q. s. Dissolve the Potassa in 8 fluidounces of water; moisten the Guaiac with this solution; pack it in a percolator and gradually pour on the remainder of the solution; when this ceases dropping, add sufficient water to make the percolate measure eight fluidounces; add the sugar and dissolve.

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GUARANA. *U.S.* *Guarana.**

(GUẠ-RĂ'NẠ.)

"A dried paste prepared from the crushed or ground seeds of Paullinia Sorbilis. Martius. (*Nat. Ord.* Sapindaceæ.)" *U. S.*

Paullinia, Brazilian Cocoa, Guarana Bread; Pao de Guarana, *Indian;* Pasta Guarana, *P.G.;* Guarana, *Fr., G.*

Gen. Ch. Capsule pyriform, septicidal. *Stem* climbing. *Leaves* compound. *Bentham and Hooker.*

There are described of the genus Paullinia 80 species, all of them confined in their geographical range to Eastern South America, except one, which has strayed to Western Africa. The name of the genus was given in honor of Christ. Fred. Paullini, a German medico-botanical writer, who died in 1712.

P. Sorbilis. Martius, *Reise in Brasil*, vol. iii. p. 1098; *B. & T.* 67.—*Guarana ilva.* This woody climber grows in the northern and western provinces of Brazil, ripening its seeds in October and November. The leaves are alternate, on long stalks, impari-pinnate, with five oblong oval, coarsely irregularly sinuate-dentate leaflets, five to six inches long by two to three broad, contracted into a shortly attenuated blunt point. The flowers are arranged in axillary, spicate panicles, four inches or more in length. The fruit is about the size of a grape, ovoid or pyriform, on a short peduncle, with a short strong beak, glabrous, with six longitudinal ribs. The three-valved pericarp is thin, tough, and strongly hairy within. Another species, the *P. Cupana*, growing on the banks of the Orinoco River, is said also to be used in making guarana. (*Ann. de Thérap.*, 1858, p. 70.)

Preparation and Properties. The seeds, which look like small horse-chestnuts, are contained in a three-celled, three-valved, coriaceous capsule, are lenticular and almost thorny, and invested with a flesh-colored arillus, which is easily separable when dry. From them the drug is prepared by powdering them in a mortar, or upon a chocolate-stone previously heated, mixing the powder with a little water, exposing it for some time to the dew, then kneading it into a paste, mixing with this some of the seeds either whole or merely bruised, and finally forming the mixture into cylindrical or globular masses, which are dried and hardened in the sun, or by the smoke of a fire. These masses are of a reddish brown color, rugose on the surface, very hard, with an irregular fracture, and of a marbled appearance when broken, due to the fragments of the seeds and their black testa imbedded in the mass. Paullinia is of a somewhat astringent and bitterish taste, and, in this as well as in its odor, bears some resemblance to chocolate, though not oleaginous. It swells up and softens in water, which partially dissolves it. Martius found in it a crystallizable principle, which he named *guaranine*, but which has been proved by MM. Berthemot and Dechastelus to be identical with *caffeine*. Alexander Bennett, in an elaborate series of physiological experiments, has confirmed this identity. The discovery of caffeine in plants belonging to distinct natural families, namely, the coffee and tea plants, the Paraguay tea, and the Paullinia, is a highly interesting result of recent chemical investigations. It is said to be more abundant in the Paullinia than in either of the other vegetables; 5·07 per cent. having been found by Dr. Stenhouse in Paullinia, while he got only 2·13 from good black tea, 1·00 per cent. from coffee, and 1·2 from Paraguay tea. (*P. J. Tr.*, xvi. 213.) According to Berthemot and Dechastelus, it exists in the seeds united with tannic acid, with which it appears to form two compounds, one crystallizable and soluble in water, the other of a resinoid appearance and insoluble. Besides these ingredients, the seeds contain free tannic acid, gum, albumen, starch, and a greenish fixed oil. (*Journ. de Pharm.*, xxvi. 514.) For a method of preparing guaranine, see *Journ. de Pharm.*, 4e sér., xviii. 224. Dr. F. V. Greene, U. S. N., prefers a process for obtaining caffeine from guarana similar to one proposed by Prof. Wayne for its extraction

* It is said to have been by mistake that *Paullinia* and *guarana* have been considered identical; the former term being applicable exclusively to the product of the two species of Paullinia above referred to, while the latter belongs properly to a preparation made by the aborigines, belonging to the tribe Guaranas, whence its name. This second substance contains the seeds of the Paullinia, but is a mixture of various substances, among them chocolate and farina, the precise composition of which is most carefully kept secret by the natives. (*Ann. de Thérap.*, 1858, p. 70.)

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from tea and coffee. The details of the method are as follows. The powdered guarana is intimately mixed with three times its weight of finely divided litharge, and the mixture boiled in distilled water, until, on allowing the temperature to fall below the boiling point, the insoluble portion is found to subside rapidly, leaving the supernatant liquid clear, and without color. When cool, the clear liquid is filtered, and the precipitate is transferred to the filter and washed with boiling water, the washing to be continued as long as yellowish precipitates are produced with either phosphomolybdic acid solution, auric or platinic chloride. A stream of sulphuretted hydrogen gas is now passed through the filtrate, and the sulphide of lead thus formed separated by filtration. The solution is evaporated on a water-bath to expel the excess of sulphuretted hydrogen, filtered to remove a trace of sulphur, finally evaporated to the crystallizing point, and the caffeine, which crystallizes out on cooling, removed from the mother-liquor and pressed between folds of bibulous paper. After being thus treated, the crystals will be found to be perfectly white. Dr. F. V. Greene has shown that the tannic acid from guarana has different properties from that found in other plants, and proposes to call it *paullinitannic acid.* (*A. J. P.*, 1877, p. 390.) M. Fournier has found in paullinia, besides tannate of caffeine, the following principles: gum, starch, an acrid green fixed oil, a concrete volatile oil, an aromatic liquid volatile oil soluble in water with a little alcohol, another liquid volatile oil scarcely soluble in water, a peculiar principle not precisely determined, and tannic acid. (*Ibid.*, Avril, 1861, p. 291.)

Medical Properties and Uses. The effects of guarana upon the system are chiefly those of its alkaloid, although it contains enough tannin to have an appreciable influence. It is habitually employed by the Indians, either mixed with articles of diet, as with cassava or chocolate, or in the form of drink, prepared by scraping it, and suspending the powder in sweetened water, precisely as other nations use teas, coffees, etc. It is also considered by the Indians useful in the prevention and cure of bowel complaints. Dr. Gavrelle, who was formerly physician to Dom Pedro, in Brazil, and there became acquainted with the virtues of this medicine, called the attention of the profession to it some years since in France. He had found it advantageous in the diarrhœa of phthisis, sick headache, paralysis, tedious convalescence, and generally as a tonic. It has since been employed in various affections, but is now chiefly used in migraine or nervous sick headaches, administered when the attack is developing. It may be given in substance, in the quantity of one or two drachms (3·9–7·8 Gm.), rubbed into powder and mixed with sweetened water; but the fluid extract may be substituted in equivalent doses.

Off. Prep. Extractum Guaranæ Fluidum, *U. S.*

GUTTA-PERCHA. *U. S.* *Gutta-Percha.*

(GŬT'TĄ PĔR'CHĄ.)

"The concrete exudation of Isonandra Gutta. Hooker. (*Nat. Ord.* Sapotaceæ.)" *U. S.*

Gutta-Percha Depurata, *P.G.*; Gutta-Taban; Gutta-Percha, *Fr., G.*

This valuable product of the East Indies was first brought into notice by Dr. Wm. Montgomerie, a British army surgeon, who became acquainted with its singular properties in the year 1842, at Singapore, and in the following year sent specimens of it to Europe. It is the product of a large tree growing in the southern extremity of the Malayan Peninsula, the islands of Singapore and Borneo, and probably many other islands in the neighborhood. *Isonandra gutta* is of considerable magnitude, with a trunk commonly three feet and sometimes as much as six feet in diameter, having numerous ascending branches, which are crowded with leaves at their extremities. The flowers are small and white; the leaves petiolate, oblong, four or five inches long by two in breadth, bright green above and brownish beneath.*

* *Bulata.* Under the name of *bulata*, the product of *Sapota Mulleri*, a tree growing in great abundance in Dutch Guiana in South America, has recently attracted considerable attention, having been imported into England from Demerara. It is said to have properties which will render it, in some instances, a useful substitute for gutta-percha, which it resembles in elasticity and exceeds in ductility, while requiring a much higher heat to soften. Its solubilities in various menstrua do not seem to have been determined; but they are probably analogous to those of gutta-percha and

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Dr. Montgomerie states that the natives procure the gutta-percha by the very wasteful mode of cutting down the tree, stripping off the bark, and then collecting the milky juice, which is put into convenient recipients, and coagulates on exposure to the air. Twenty or thirty pounds are thus collected from each tree; but the probability is that the product would be much greater if obtained by tapping the tree, and thus preserving it for future use. In consequence of the abundance in which it is collected, and the wasteful methods pursued, fears are entertained that the tree will before long be extirpated. Large quantities of gutta-percha are now imported into Europe and this country. As found in commerce it is generally impure, containing fragments of vegetable matter and earth. From these it may be freed by kneading it in hot water, or by melting it with oil of turpentine, straining, and evaporating. It may also be purified by means of chloroform. One part of gutta-percha cut into small pieces, put into a flask with 20 parts of chloroform, and frequently shaken, will be fully dissolved in two or three days. To this solution, which cannot be readily filtered, add one-fourth of a part of water, shaking the mixture, and then allowing it to rest for two weeks. The impurities rise or sink, and the clear intervening liquid yields pure gutta-percha by the distillation of the chloroform. (*Chem. Centralbl.*, Feb. 1857, p. 108.) A more satisfactory method is probably by dissolving one part of gutta-percha in twenty of boiling benzol, shaking the solution frequently with sulphate of calcium, which upon standing two or three days carries down with it the coloring matter, then decanting the clear liquid, and adding it, in small portions at a time, to alcohol, agitating continually. During this process the gutta-percha is deposited perfectly white. Thorough desiccation requires an exposure of several weeks, but it may be hastened by rubbing in a mortar. (*Journ. de Pharm.*, Août, 1863, p. 138.)*

Properties. Gutta-percha is of a dull white or whitish color, often with reddish brown streaks, of a feeble odor, tasteless, at ordinary temperatures hard and almost horny, somewhat flexible in thin pieces, having an unctuous feel under the fingers, and very tenacious. Its sp. gr. is 0·9791. (*Soubeiran.*) At about 49° C. (120° F.), it becomes softer and more flexible, but is still elastic, resisting, and tenacious. At 66° C. to 71° C. (150° F. to 160° F.), it is soft, very plastic, and capable of being welded and moulded into any form. It can be softened, either by means of hot water or by dry heat. On cooling it reassumes its former state, and retains any form which may have been given to it. In the softened state it is readily cut with a knife, though with some difficulty when cold. Exposed to a heat of 166° C. (330° F.), it loses a portion of water, and on hardening becomes translucent and gray; but it recovers its original characters if immersed in water. Subjected to igneous distillation, it yields volatile products, resembling closely the volatile oil obtained from caoutchouc by the same process. Heated in an open vessel, it melts, foams up, and takes fire, burning with a brilliant flame and smoke. A portion thus melted retains the state of a viscid fluid on cooling. Gutta-percha is a non-conductor of electricity. It is insoluble in water, alcohol, alkaline solutions, and the weak acids. Ether and the volatile oils soften it in the cold, and imperfectly dissolve it with the

caoutchouc. It is the concrete juice of the *Sapota Mulleri*, or *bullet tree*. The idea is entertained that it may serve as a good insulating material for submarine telegraphic wires. Another possible substitute for gutta-percha has been found in the concrete juice of an *Apocynea* growing in Ceylon, named *Alstonia scholaris*. (*P. J. Tr.*, 2d ser., vi. 490. See also *Caoutchouc*, Part II.)

* *Pure white gutta-percha.* For dental purposes, as for filling carious hollows, it is desirable that gutta-percha should be purified, and rendered perfectly white. But what is sold as such in the market is said to consist largely of the white oxide of zinc, and is on this account badly adapted to the purpose intended. Mr. F. Baden Benger recommends the following method of purification for dentists' use. He states that good crude gutta-percha will yield at least 75 per cent. of the purified. Four ounces of the gutta-percha, in small pieces, are to be digested for a few days with five pounds of methylated chloroform; and the solution thus formed should be filtered in such a way as to permit little or no loss of chloroform. To the liquid thus filtered, which should be nearly colorless, an equal bulk of alcohol should be added, or a sufficiency to precipitate the gutta-percha, which will separate as a white mass. This is to be washed with alcohol, pressed in a cloth, and dried by exposure to the air. In this state, the gutta-percha is perfectly white, but too porous for use. To give it the proper consistence, it should be boiled for half an hour in a porcelain capsule, and rolled into cylinders while hot. The dentist can prepare this himself with sufficient economy, if he guard against the loss of chloroform. This may be separated from alcohol by washing with water, and the alcohol from the water by distillation. (*P. J. Tr.*, Sept. 1868, p. 160.)

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aid of heat. Oil of turpentine dissolves it perfectly, forming a clear colorless solution, which yields it unchanged by evaporation. It is also dissolved by bisulphide of carbon, chloroform, and benzol and benzin. According to Soubeiran, it contains, besides pure gutta-percha, small portions of a vegetable acid, casein, and two resins, one soluble in ether and oil of turpentine, the other in alcohol. (*Journ. de Pharm.*, 3e sér., xi. 22.) Freed from these impurities, it has an ultimate composition closely analogous to if not identical with that of caoutchouc. For a particular account of the distinctive properties of pure gutta-percha, and the two resins mixed with it, the reader is referred to an article by M. Payen, in the *Journ. de Pharm.* (3e sér., xxii. 183), also in the *Chem. Gaz.* (x. 353). According to Baumhauer, pure gutta-percha, as it issues from the tree, is a hydrocarbon, with the formula $C_{10}H_{16}$, which he calls *gutta*, and by the oxidation of which, in various degrees, the different bodies constituting gutta-percha are produced. This hydrocarbon can be separated by treating gutta-percha with dilute hydrochloric acid, and boiling the residue with ether, which deposits the gutta on cooling; but the ethereal treatment must be frequently repeated to obtain it quite pure. (*Journ. für prakt. Chem.*, lxxviii. 279.) M. Arppe considers gutta-percha as a mixture of six different resins, which may have been formed from a hydrocarbon, $C_{10}H_{16}$. (See *Chem. Gaz.*, ix. 471.) Oudemans (*Jahresber.*, 1859, p. 517) finds two resinous products in gutta-percha: *fluavil*, fusing at 42° C., with the formula $C_{20}H_{32}O_2$, and soluble in cold alcohol, and *albau*, fusing at 140° C., with the formula $C_{10}H_{16}O$, and soluble in chloroform, bisulphide of carbon, and ether, from which last it crystallizes out on cooling. Gutta-percha resists putrefaction strongly; but in certain situations, as when employed to protect underground telegraph wires passing near the roots of the oak, it has been observed to undergo speedy decomposition, in consequence, as is supposed, of the action of fungi. (*P. J. Tr.*, xvii. 193.)

Gutta-percha has been applied to many useful and ornamental purposes. Its plasticity when moderately heated, great firmness and tenacity at ordinary temperatures, and insolubility in water and alcohol are the properties to which it chiefly owes its value. By immersing it in hot water, it is made susceptible of being formed into any desirable shape; so that utensils of various kinds, ornamental impressions, casts, sheets, bands, cords, sticks, tubes, etc., applicable to numerous purposes in the arts, may be made from it with great facility. To give it greater pliability, it is sometimes mixed with the tar resulting from the igneous decomposition of caoutchouc, or with its own tar and lampblack. It may be vulcanized in the same manner as caoutchouc, and undergoes a similar change of properties. (See *Caoutchouc.*) In the dissolved state it may be employed as a varnish, impervious to moisture.

Medical Uses. Gutta-percha has been introduced into surgery, in order to preserve limbs and joints in fixed positions, and has been used beneficially in club-foot, fractures, and diseases of the joints. It is employed for these purposes in the shape of bands, two or three inches broad and about a line thick, which, being softened in water, are applied in this state, and, when they harden, form a firm case for the limb. Holes should be made through the bands, for the escape of the vapor from the surface. It may in some cases be applied by moulding it, in its soft state, upon the part to be kept at rest, as to the hip and adjacent parts of the body and thigh, in cases of hip-joint disease, for which, when dried, it will form a support equal to the most accurately carved wooden splint. It is also used for the formation of catheters and other tubes, splints, stethoscopes, bougies, specula, pessaries, and various other instruments useful in surgery. In fractures it is much used as a splint; sometimes, after softening by immersion in warm water at the time, it is applied as a bandage without difficulty, and, hardening afterwards, acts as a splint to the injured limb. The officinal Liquor Gutta-Perchæ affords a liquid which, when applied by means of a camel's-hair pencil, forms, on the evaporation of the solvent, a thin, elastic covering, which completely excludes the air, and acts like an artificial cuticle to the part. Another application of gutta-percha is to serve as a vehicle of certain caustic substances, particularly chloride of zinc, and caustic potassa. The preparation is made by reducing the caustic substance to fine powder, and then thoroughly mixing it with its weight of gutta-percha, melted at the lowest possible temperature. (See

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Potassa, and *Zinci Chloridum*.) A great advantage of the preparation is that it may be made into any desirable form, and will retain that form when applied.

Off. Prep. Liquor Gutta-Perchæ, *U. S.*

HÆMATOXYLON. *U. S.* *Hæmatoxylon.* [*Logwood.*]

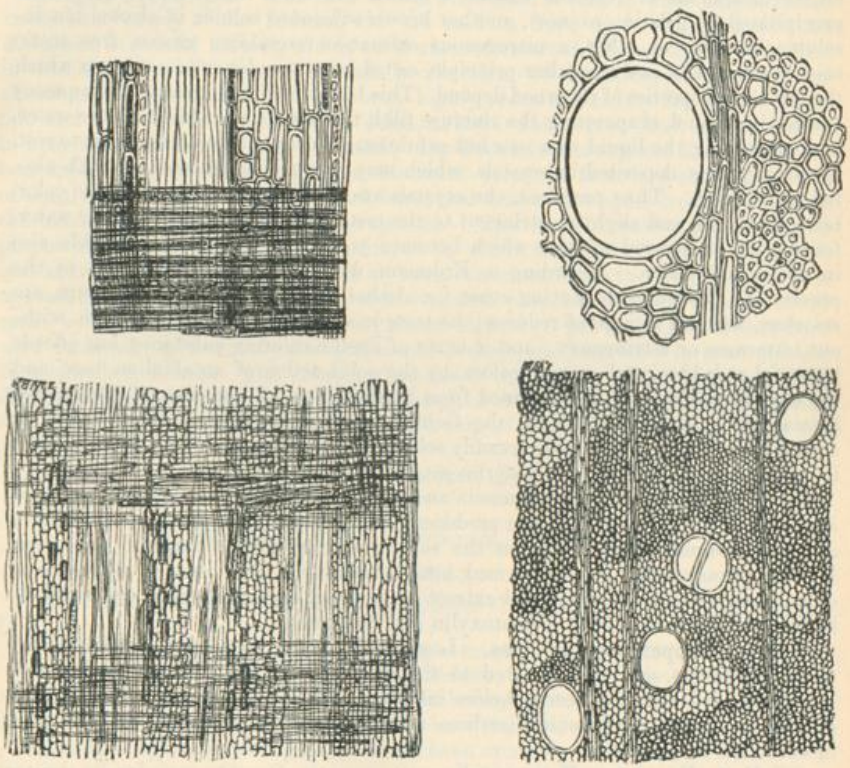
(HÆ-MĄ-TŎX'Y-LŎN.)

"The heart-wood of Hæmatoxylon Campechianum. Linné. (*Nat. Ord.* Leguminosæ, Papilionaceæ.)" *U. S.* "The sliced heart-wood of Hæmatoxylum Campechianum." *Br.*

Hæmatoxyli Lignum, *Br.*; Lignum Campechianum, *P.G.*; Lignum Cœruleum; Bois d'Inde, Bois de Sang, Bois de Campêche, *Fr.*; Blauholz, Campecheholz, Blutholz, Kampeschenholz, *G.*; Legno di Campeggio, *It.*; Palo de Campeche, *Sp.*

Gen. Ch. Calyx five-parted. *Petals* five. *Capsule* lanceolate, one-celled, two-valved, with the valves boat-form. *Willd.*

Hæmatoxylon Campechianum. Willd. *Sp. Plant.* ii. 547; Woodv. *Med. Bot.* p. 455, t. 163; Carson, *Illust. of Med. Bot.* i. 33, pl. 25. This is a tree of middle size, usually not more than twenty-four feet high, though, under favorable circumstances, it sometimes rises forty or fifty feet. The trunk, seldom exceeding twenty inches in diameter, is often very crooked, and is covered with a dark rough bark. The



Hæmatoxylon, longitudinal section, as seen under high and low powers.

Hæmatoxylon, transverse section, as seen under high and low powers.

branches are also crooked, with numerous smaller ramifications, which are beset with sharp spines. The sap-wood is yellowish, but the interior layers are of a deep red color. The leaves are alternate, abruptly pinnate, and composed of three or four pairs of sessile, nearly obcordate, obliquely nerved leaflets. The flowers, which are in axillary spikes or racemes near the ends of the branches, have a brownish purple

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calyx and lemon-yellow petals. They exhale an agreeable odor, said to resemble that of the jonquil.

The tree is a native of Campeachy, the shores of Honduras Bay, and other parts of tropical America, and has become naturalized in Jamaica. The wood, which is the part used in medicine, is a valuable article of commerce, and largely employed in dyeing. It comes to us in logs deprived of the sap-wood, and having a blackish brown color externally. For medical use it is cut into chips, or rasped into coarse powder, and in these states it is kept in the shops.

Properties. Logwood is hard, compact, heavy, of a deep red color, becoming purplish black by exposure, internally brown-red, and marked with irregular, concentric circles, splitting irregularly, of a slight peculiar odor, and a sweet, somewhat astringent taste. Logwood is generally kept in the shops in small chips or coarse powder of a dark brown-red color, often with a greenish lustre. When chewed it colors the saliva dark pink. It imparts its color to water and to alcohol. The infusion made with cold water, though red, is less so than that with boiling water. It affords precipitates with sulphuric, nitric, hydrochloric, and acetic acids, alum, sulphate of copper, acetate of lead, and sulphate of iron, striking a bluish black color with the last-mentioned salt. (*Thompson's Dispensatory.*) Precipitates are also produced with it by lime-water and gelatin. Chevreul found in logwood a volatile oil, an oleaginous or resinous matter, a brown substance the solution of which is precipitated by gelatin (*tannin*), another brown substance soluble in alcohol but insoluble in water or ether, a nitrogenous substance resembling gluten, free acetic acid, various salts, and a peculiar principle, called *hæmatoxylin* or *hématin*, on which the coloring properties of the wood depend. This is obtained by digesting the aqueous extract in alcohol, evaporating the tincture till it thickens, then adding a little water, and submitting the liquid to a new but gentle evaporation. Upon allowing it to rest, hæmatoxylin is deposited in crystals, which may be purified by washing with alcohol and drying. Thus procured, the crystals are shining, of a yellowish rose color, bitterish, acrid, and slightly astringent to the taste, readily soluble in boiling water, forming an orange-red solution which becomes yellow on cooling, and soluble also in alcohol and ether. According to Erdmann, who obtained hæmatoxylin by the process of Chevreul, substituting ether for alcohol, its crystals, when quite pure, are colorless, without a tinge of redness; its taste is sweet, like that of liquorice, without bitterness or astringency; and it is not of itself a coloring substance, but affords beautiful red, blue, and purple colors, by the joint action of an alkaline base and the oxygen of the air. He obtained from logwood 9 to 12 per cent. of crystallized hæmatoxylin, to which he gave the formula $C_{16}H_{14}O_6$. It crystallizes with 1 or with 3 molecules of water, and is readily soluble in hot water or alcohol, but sparingly in cold water or in ether. (*Journ. für pr. Chem.*, 36, p. 205.)

By the combined action of ammonia and oxygen dark violet crystalline scales of *hæmatëin*, $C_{16}H_{12}O_6 + 3H_2O$, are produced. They show a fine green hue, which is also very commonly observable on the surface of the logwood chips of commerce. Hæmatein may again be transformed into hæmatoxylin by means of hydrogen or of sulphurous acid. Commercial extract of logwood extracted from the wood by boiling water contains both hæmatoxylin and hæmatein.

Medical Properties and Uses. Logwood is a mild astringent, devoid of irritating properties, and well adapted to the treatment of that relaxed condition of bowels which is apt to succeed cholera infantum. It is also occasionally used with advantage in ordinary chronic diarrhœa and chronic dysentery. It may be given in decoction or extract.

Off. Prep. Extractum Hæmatoxyli.

HAMAMELIS. *U. S.* *Hamamelis.* [*Witchhazel.*]

(HĂM-Ą-MĒ'LĬS.)

"The fresh leaves of Hamamelis virginica, Linné (*Nat. Ord.* Hamamelaceæ), collected in autumn." *U. S.*

Gen. Ch. Flowers in little axillary clusters or heads, usually surrounded by a scale-like three-leaved involucre. *Calyx* four-parted, and with two or three bractlets