This leads us to the corollary that the stoppage of growth is not due to the reaching of maturity, but is merely the final term of a series of losses. It has been asserted by Herbert Spencer, Carpenter, and others, that there is an inherent opposition between growth and reproduction, because the assimilative processes cannot perform enough to supply material for the growth of mother and offspring both. These authors and their followers see in the commencement of reproduction the beginning of a tax upon the organism which stops its growth; but as Minot has pointed out, the cause is mistaken for the effect, and probably the loss of vital force is the stimulus causing reproduction. Certainly the decline, which goes on from birth, cannot be caused by a phenomenon which begins only when the decline is nearly completed. Direct observations show that Spencer's view is erroneous, for growing guinea-pigs will bear one-third of their own weight of young while growing, and still reach as full an adult size as those producing no young (Hensen). My own experiments suggest that they become even larger. We thus learn that the fundamental conception on which Spencer's theory rests is imaginary—that conception being, that the assimilative power is approximately equal only to the needs of the growing animal. In reality there is a large excess of assimilation possible within normal limits.

The next point to be noticed is that animals tend, as they grow, to approximate to the special size of the species. This shows itself by the fact that the range of variation is less for adults than for the young. The following table shows this: The first column gives the age; the second column gives the average variation above the mean weight for that age, the variation being expressed as a percentage; the third column gives the variation below the mean—averages being based on 4,200 observations in all

MALE GUINEA-PIGS.

Age.	Variation above. Per cent.	Variation below. Per cent.
0 to 0 day	19.51	19.49
1 to 15 days	18.95	18.99
16 to 30 days	17.13	16.87
31 to 65 days	15.68	16.31
70 to 140 days	12.12	13.31
145 to 215 days	7.52	7.48
8 to 12 months	10.66	9.72
13 to 17 months	10.38	11.41
18 to 24 months	12.10	10.82

The variation of adults is barely over half that at birth in range. Remarkable is the low variation from 145 to 215 days, and from 8 to 12 months. The higher values for older periods is perhaps due to variations in obesity, which we know from common observation increases in the human species with age. The growth of an individual also indicates the existence of this tendency to attain the typical adult size; if the growth of the animal is retarded by illness, after recovery the growth is accelerated to make up. This has practical importance, for, unless the illness of a child is very prolonged, no permanent effect upon its size is to be anticipated.

The size of an animal or the limit of its growth depends upon, first, the rate, and second, the duration of its growth. This is well shown by comparing man with the rabbit and the guinea-pig, as to the average daily growth. A man acquires a weight of about 63,000 gm. in twenty-five years; a rabbit, of the larger breeds, about 2,500 gm. in one year, and a guinea-pig about 750 in the same period. For man add 280 days, for rabbits 30 days, for guinea-pigs 68 days, on account of the period of gestation.

Man	63,000 gm.	÷ 9,139 + 280 =	6.69 gm.	per diem.
Rabbit	2,500 gm.	÷ 365 + 30 =	6.30 "	" "
Guinea-pig	750 gm.	÷ 365 + 68 =	1.73 "	" "

Man grows about as fast as a rabbit, but becomes much bigger, because he grows longer; but the rabbit is bigger than the guinea-pig, because he grows much faster. This is matter of common observation; all that we gain from our calculation is a quantitative expression more suited for ready comparison.

Of course, the whole shaping of the organism depends upon variations in the growth rates of the single parts, but what causes such variations is unknown. Many writers have sought to account for the variations by purely mechanical factors, principally strain and pressure; but although such assumptions have been very frequently put forward by His, van Beneden, Kölliker, and a host more, they must all be condemned as more or less ill-considered speculations. A growing trout assumes a certain form; why? because it is its inherited tendency; of the physiological nature of that tendency we know hardly anything, except that it is *not* mechanical, but only an unexplained growth force.

LITERATURE.—The only general works are the very important treatise of Vierordt in Gerhardt's "Handbuch der Kinderkrankheiten," Bd. 1, Abth. 1, pp. 219–290; Davenport's treatise in the second volume of his "Experimental Morphology" (1899); and the useful summaries given by Preyer in his "Physiologie des Embryos," by Hensen in the sixth volume of Hermann's "Physiology," and Daffner, in "Das Wachstum des Menschen" (1897). The number of special papers is very large; a few references are given below; for additional ones consult Vierordt.

Charles Sedgwick Minot.
Revised by *R. P. Bigelow.*

I. GROWTH OF FŒTUS.—See Preyer's Specielle Physiologie des Embryo for a synopsis of the observations and references to the literature.—Pagliani: Lo Sviluppo umano, per età, sesso, etc., 8vo, Milano, 1879.—Fehling: Beiträge zur Physiologie des Placentenstoffverkehrs. Arch. f. Gynäk., xl., 1877, pp. 523–527.

II. WEIGHT AT BIRTH.—Rumpe: Arch. f. Gyn., xx., 117.—Ahlfeld: *ibid.*, xii., 489.—Lorey: Jahrb. Kinderheilk., N. F., xii., 200.—Ingerslev: Nord. Med. Ark., vii., 1875.—Frankenhäuser: Monatschr. Geburtsk., xiii., 170.—Elsässer: Henke's Zeitsch., xxxvii., 2.—Wagner: Centralbl. f. Gynäk., 1885, 359.—Negri: *ibid.*, 1886, p. 58.

III. GROWTH OF INFANTS.—Hesse: Arch. f. Gynäk., xiv., 491, and xvii., 150.—Petersen: Schmidt's Jahrb., Bd. 196, p. 31.—Hofmann: Neue Zeitschr. Geburtsk., xxvi., 145.—Siebold: Monatschr. Geburtsk., xv., 337.—Pfeiffer: Jahrbücher f. Kinderheilk., xix., 142.—Biedert: *ibid.*, xix., 275.—Woronoff: *ibid.*, xxii., 254; abstract in Schmidt's Jahrb., Bd. 205, p. 47.—Wolff: Centralbl. f. Gynäk., 1885, p. 16.—Rezmarozky: Arch. f. Gyn., v. For further literature see Vierordt, *loc. cit.*

IV. GROWTH OF CHILDREN.—Bowditch: The Growth of Children, Boston, 1877; also, The Growth of Children (a supplementary investigation), Boston, 1879; both republished from Reports of the Massachusetts State Board of Health.—Peckham: The Growth of Children, from Sixth Annual Report State Board of Health of Wisconsin.—Pagliani: Lo Sviluppo umano per età, sesso, etc., Milano, 1879; and Sopra alcuni fattori dello Sviluppo umano, Torino, 1876.—Malling Hansen: Gewicht der Kinder, Copenhagen, 1883; and Tägliche Wagungen, etc., Copenhagen, 1884.—Theile: Nova acta, xlvi., 3, 1884.—Ménard: Gazette Méd., Paris, January 9th, 1886.—Roberts, C.: Relative Increase in Size of the Body. Report of Brit. Assn. Adv. Sci., 1881.—Porter, W. T.: Growth of St. Louis School Children. Trans. Acad. Sci. St. Louis, 1893-94; and Pub. Amer. Statis. Assn., 1894-95.—Daffner, F.: Das Wachstum des Menschen, Leipzig, 1897.

V. ANTHROPOMETRY.—See the General Treatise of Roberts; Gould's Statistics, published by the U. S. Sanitary Commission; and Baxter: Statistics of the Provost-General's Office, 2 vols., 4to, Washington, 1876. Baxter gives an extensive bibliography.—Davenport, C. B.: Statistical Methods, New York, 1899.

VI. GROWTH OF ANIMALS.—Minot: Proc. Society of Arts, Boston, p. 50, 1884.—Hensen und Edelfsen: Arbeiten Physiol. Inst. Kiel, pl. 1. Kehren: Arch. f. Gyn., i., 224.

GUACAMPHOL, the camphoric acid ester of guaiacol, occurs in white, needle-like crystals or powder, and is tasteless and odorless, and insoluble in the ordinary solvents. It is said to pass unchanged through the stomach, and to split up in the intestines into guaiacol and camphoric acid; so it has been employed as an intestinal antiseptic, particularly in tuberculous diarrhœas. It is especially recommended, however, by Kaminer and Lasker, for combating the night sweats of pulmonary tuberculosis. The dose is 0.5–1 gm. (gr. viij.–xv.) in capsule at bedtime.

W. A. Bastedo.

GUACO.—The drug at present known by this name is only one of a number of products known by it in tropical America. It is the leaves of *Willoughbœa* Neck, or *Mikania* Willd., probably of more than one species (fam. *Compositæ*). It is a native of South America, and grows also, either wild or introduced, in the West Indies. Guaco has a great reputation among the inhabitants of

many South and Central American countries as an antidote to snake bites, and as a sort of corollary it has been supposed to be useful in hydrophobia, cancer, cholera, epilepsy, syphilis, etc. Fauré separated an amorphous bitter principle (which is probably not chemically pure) which he has called *guacin*. An odorous principle that appears to be present in the fresh, must be mostly dissipated in the dried, leaves. There is nothing in its chemical or evident physical properties that should lead one to regard guaco as other than a mild aromatic bitter, of the Eupatorium order.

In its native regions it is preferably given in the fresh state. Here the dried leaves may be prepared in any of the usual ways, and rather freely administered.

W. P. Bolles.

GUAIAC, including GUAIAC WOOD, GUAIACI LIGNUM, or *Lignum Vitæ*. "The heart-wood of *Guaiacum officinale* L. and of *G. sanctum* L. (fam. *Zygophyllaceæ*)" (U. S. P.), and GUAIAC, GUAIAC RESIN, GUAIACI RESINA, or "*Gum Guaiac*." "The resin of the wood of *Guaiacum officinale* L." (U. S. P.). These are small evergreen trees of northern South America and the West Indies, having the habit of a small apple-tree, and forming a brilliant mass of bright blue, when in full bloom.

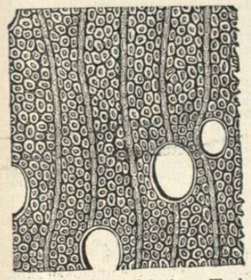

FIG. 2351.—Section of Guaiacum Wood. (Baillon.)

Guaiacum wood was carried to Europe soon after the discovery of the West Indies (early in the sixteenth century), and made a rapid reputation for itself as a remedy for syphilis and gout, a reputation that it unfortunately very soon lost again in great measure. Two products of the tree are imported—the wood, which if of fair size and soundness, goes to the turners to be made into pulley-sheaves, mallets, mortars, tool handles, etc., and the crude resin, rudely obtained from the living tree or fresh wood.

The wood comes in logs several feet in length, and from two to six or eight or more inches in diameter, often irregularly crooked and branching; they consist, excepting the smallest, of a bright yellow, hard *alburnum*, and a very dark greenish-brown, exceedingly hard and heavy heart, consisting of very much thickened wood cells, and an abundance of a peculiar composite resin. This wood is almost as hard and heavy as ivory, and turns the edges of tools not especially sharpened for it. That which reaches the drug market consists principally of the turnings and refuse of what is manufactured for the purposes above named. It should consist only of the brown or green heart-wood, which is heavier than water, to which it does not impart its color. Upon the addition of nitric acid, if it has not been deprived of its resin, it should give a dark, bottle-green color. The resin, of which there should be about 25 per cent., is the only active constituent, so that its properties are also those of the wood.

The resin, which is obtained partly by incising the trees, and partly as a spontaneous exudation, also sometimes forced out from the wood by heat, is a crude and impure substance. The officinal description is as follows: In irregular masses, or subglobular pieces, externally greenish-brown, internally of a glassy lustre, and, in recent guaiac, usually reddish-brown, transparent in thin splinters, fusible, feebly aromatic, the odor becoming stronger on heating; taste somewhat acrid; powder grayish, turning green on exposure to air.

Soluble in potassium or sodium hydrate T. S. and in alcohol; the alcoholic solution is colored blue on the addition of tincture of ferric chloride.

It is very brittle when cold, plastic with slight heat.

COMPOSITION.—It contains about seventy per cent. of *guaiaconic acid*, a yellow or brown, brittle, amorphous resin; ten of *guaiaretic acid*, which is crystalline; nine or ten of *guaiacic acid*, something like guaiaconic acid, and three or four of gum, besides a little volatile oil, ash, coloring matter, and various impurities.

ACTION AND USE.—The reputation of guaiac depends upon clinical evidence entirely, and has had spells of waxing and waning. It is stimulating, or in large doses irritating to mucous membranes and markedly increases their secretions, thus acting as a laxative. The high estimate early placed upon it in syphilis has disappeared since the real efficiency of mercury and iodine has been established. In gout, although perhaps useful, it is certainly no specific; as an emmenagogue it is no better nor worse than many others. In chronic and mild subacute rheumatism, and in rheumatic arthritis, the evidence in its favor is strong. It is perhaps one of the best remedies for these intractable maladies. It is considerably used in inflammatory conditions of the throat and fauces, especially when there is deficient secretion.

ADMINISTRATION.—The dose of guaiac (resin) is from 0.5 to 2 gm. (gr. viij.–xxx.). It may be given in pill or powder, but the tinctures, of which there are two,—one simple (*Tinctura Guaiaci*, U. S. P., strength 20 per cent.), made with alcohol, and one associated with ammonia (*Tinctura Guaiaci Ammoniata*, U. S. P., strength 20 per cent.), made with aromatic spirit of ammonia,—are more generally used in doses of 2 to 4 c.c. (fl ʒss.–f.). Both become turbid upon mixing with water, and are oftenest given in milk. Guaiac wood is used as an adjuvant in the Compound Syrup of Sarsaparilla.

W. P. Bolles.

GUAIACETIN, pyrocatechin-mono-acetic acid (C_6H_4.OCH_2.$COOH$.OH), is a white, odorless, crystalline powder, readily soluble in water. Nièd and Meitner have used it with benefit in tuberculosis, claiming for it the special advantages that it promptly lowers temperature, lessens the mucous secretion, and diminishes the night sweats. It is an admirable stomachic (Meitner), and so may be continued even when chronic gastritis exists. The dose is 0.5 gm. (gr. viij.) three times a day in solution or capsule.

W. A. Bastedo.

GUAIACOL.—*Methyl-pyrocatechin.* $C_6H_4.OCH_3.OH$. Guaiacol constitutes from sixty to ninety per cent. of wood creosote, from which it is separated by fractional distillation, the boiling point of guaiacol being 206° to 207° C. Specific gravity, at 15° C., 1.33. It is a colorless liquid, with a strong aromatic odor, slightly soluble in water, 1 part to 85, readily soluble in alcohol, ether, glycerin, and oil. Guaiacol may also be prepared synthetically from catechin, and by the dry distillation of guaiacum resin. From these sources it is obtained in colorless, prismatic crystals. These are considered to be absolutely pure guaiacol, and are official in the Paris Codex. The guaiacol of commerce is very variable in strength and often very impure, the impurities being such as are common in creosote and are the result of careless distillation. The adulteration is evident by the lower specific gravity, the stronger odor, and by becoming darker upon exposure. The pure guaiacol, with concentrated sulphuric acid, gives a faint yellow coloration which is changed to a cherry-red by the addition of acetone; the impure article gives a more or less red color with the acid alone.

Guaiacol is absorbed from the stomach or intestines, from the unbroken skin, and by inhalation. It is rapidly excreted and may be detected in the urine, saliva, or perspiration within fifteen minutes. In twenty-four hours it is entirely excreted. Guaiacol may be detected by distilling the solution with dilute sulphuric acid, and adding to the distillate a small quantity of a dilute solution of liquor ferri sesquichlorati (two or three drops to a test tube of water). If guaiacol is present a reddish-brown color is developed, the intensity of which depends upon the amount of guaiacol.

The action of guaiacol is the same as that of creosote, the advantages claimed for it being its greater purity and more definite composition. Locally, it is antiseptic and analgesic, and when administered by the mouth it exercises the same effect upon the stomach and intestinal tract. Its action after absorption is as yet not well understood. Many consider that its beneficial effects are produced simply by its tonic and stomachic action; others, including Schueller who brought it to the notice of the profession, ascribe its virtues to a direct antiseptic action which destroys all bacterial growth that comes under its influence. Another and more recent view is that it combines with the toxins of the pathogenic bacilli, forming soluble compounds which are rapidly eliminated by the excretions.

The superiority of guaiacol over creosote, in the treatment of tuberculous conditions, was first advocated by Prof. Max Schueller, of Berlin, in 1880.[1] In his work, the author relates the experience which he derived from administering various drugs to animals affected with tuberculosis. Creosote, guaiacol, benzoate of soda, and many similar drugs had been experimented with and he had selected guaiacol as the most effective. In 1891[2] he published a second treatise in which he reviewed the work which he had carried on during the intervening years, and explained in detail his method of employing it. In all forms of tuberculosis he administers it continuously in small doses, as in his experience large doses were not of any special value. He particularly insists upon its continued use, which should be followed for some months after the bacilli have disappeared. He advocates, for children, a dose of two or three drops, and for adults one of from three to five drops, four times daily. He gives it in plain water, to which a little table salt has been added, and sometimes in milk, wine, or spirits. In surgical tuberculosis, in addition to its internal use, he also injects it directly into the diseased part, or, if the surface of the skin has already been destroyed, he curettes the tissues and applies the guaiacol directly to the denuded surface.

Although guaiacol has not replaced creosote in the treatment of tuberculosis, it is very extensively employed and is one of the drugs looked upon with favor in this disease. Experience has shown that it does not possess all the virtues which were originally attributed to it, but reports indicate that it is used with much success and by many it is thought to be of great value. Its use is not limited to tuberculous conditions. It has been employed with favorable results in all septic diseases, in puerperal and typhoid fevers, erysipelas, pleurisy, bronchial catarrh, whooping-cough, and many local inflammatory conditions.

The method of administering guaiacol varies. Many prefer to give it in continuous small doses, from three to five minims three times a day, as advised by Schueller, while others adopt the ideas of Sommerbrodt in the use of creosote, and give it in rapidly increasing doses for the purpose of saturating the system and acting directly upon the pathological processes. With this in view the quantity may be increased by one drop at each dose until fifteen drops, three times a day, are given, and this dose is to be maintained for an indefinite period. It has been demonstrated that as much as sixty minims three times a day may be given without ill effect.[3] When the remedy is given in large doses or when its use is continued for a prolonged period, the action of the kidneys should be watched, as any interference with this function would cause an unexpected retention of the drug in the system.

It should always be administered well diluted, in milk, wine, spirits, or water. The addition of a vegetable bitter, as tincture of orange, gentian, or cardamoms, serves to disguise its taste and to add to its stomachic properties. If capsules are selected they should always be followed with draughts of water or some diluent.

If for any reason the remedy cannot be given by the mouth, enemata may be adopted, and the following formula has proved satisfactory: guaiacol, gr. vij.; sweet almond oil, ʒ iss.; gum acacia, ʒ i.; water, ʒ viij.

With a view of increasing its therapeutic action its use subcutaneously has been advocated. At the International Congress of Medicine, Paris, 1890, Dr. Weill reported an experience extending over eleven years. He dwells upon the importance of using the crystals and saturating the system. The formula is as follows: Crystalline guaiacol, oil of sweet almonds sterilized, each 10 gm.; hydrochlorate of cocaine, 2 cgm.; to be dissolved in an equal quantity of water. This is kept in a dark bottle and 1 c.c. is injected into the gluteal region daily. Other methods of giving the guaiacol are adopted at the same time, and they furnish a good example of "intensive guaiacolization." Thus, for example, every night the same solution is applied to the skin over the chest, and enemata of milk, containing forty drops of the solution, are employed. The drug is also given internally. Weill advises that this treatment should be continued for several months, with intervals of eight or ten days every three weeks.

Iodoform, eucalyptol, and other similar drugs have been combined with guaiacol for use subcutaneously. Of these iodoform is the most favored.[4] The drugs are dissolved in sterilized oil and injections of iodoform, one-sixth grain, with guaiacol, one grain, are given daily.

The submucous injections have been advised in laryngeal tuberculosis; and inhalations from respirators, or from heated water, have proved of much service.

The local use of guaiacol has not been adopted to any extent, but favorable reports of its employment in this manner are met with. A five to ten per cent. solution in sterilized olive oil is used with rigid antiseptic precautions. From ten to fifteen minims are injected deeply into the diseased tissue, in two or three places, and the operation is repeated once or twice a week. In addition to its action upon the disease, guaiacol is thought to promote the formation of fibrous tissue by its astringent and congestive properties. It must, however, be used with care, as it may produce much local irritation.

The absorption of guaiacol through the unbroken skin is very rapid, and advantage is taken of this to obtain its physiological effects. Fifty to sixty minims are applied to the surface, and the part is covered with oil silk. Within fifteen minutes, the pulse relaxes, the skin becomes cool and moist, and the temperature begins to fall. The effect lasts for four or five hours. The application may be repeated night and morning according to the course of the fever. This method of employing the remedy calls for the exercise of care, as the reports of ill effects show that they generally occur when it is used in this way. On account of the rapid absorption of the drug, the fall of temperature may be rapid, descending below normal, with cold extremities, clammy skin, feeble pulse, and other indications of threatened collapse.

Guaiacol combines with the metals to form crystalline salts, but these are not of therapeutic value, owing to their being very unstable. With acid radicles it forms permanent salts and many of these have been prepared as agreeable substitutes for the crude drug. Most of them have been issued under registered trade names and freely advertised.

Guaiacol Benzoate, "Benzosol": $C_6H_4OCH_3OCOC_6H_5$. A crystalline salt in which one atom of hydrogen is replaced by a benzoyl radicle. It occurs in small colorless, tasteless, and odorless crystals, nearly insoluble in water. It contains fifty-four per cent. of guaiacol, and after administration it slowly breaks up into its constituent elements, guaiacol and benzoic acid.

It is given in doses of from five to ten grains, three times a day. It is used in all conditions in which guaiacol is indicated, and is thought to be particularly serviceable in intestinal tuberculosis and diarrhœa.

Guaiacol Carbonate, "Duotol": $(C_6H_4OCH_3O)_2CO$, a neutral, white, tasteless, odorless powder. Insoluble in water, containing ninety-one per cent. of guaiacol. In contact with the alkaline secretions of the intestines it breaks up into guaiacol and carbonic acid. The minimum dose is eight grains three times a day. Guaiacol carbonate is the most popular of the guaiacolates, probably from its being extensively advertised as duotol. It has been much used in tuberculosis and in typhoid fever, and as an antiseptic in various intestinal disorders. Reference may here be made to *creosotol* which closely resembles guaiacol carbonate, it being the carbonate of creosote, including guaiacol as well as the other constituents. It was introduced by von Leyden[5] and has been very much employed in the same conditions for which guaiacol has been used. It is a transparent liquid, odorless, but having a bitter taste. The dose at first should be five minims, and then it should be gradually increased. Doses as large as a teaspoonful have been given for a prolonged period without ill effects.[6] Professor von Leyden advised that five minims be given three times a day, and that the dose should be increased from day to day by three drops until twenty-five drops were reached; this to be continued for a few weeks and then gradually reduced to the original dose. Such a course should be repeated if necessary.

Guaiacol Cinnamate, "Styracol": $C_6H_4OCH_3OC_9H_7O$. A German proprietary medicine patented under the latter name. In the intestines it is decomposed into its two constituents, and the beneficial effects of cinnamic acid, as well as those of guaiacol, are manifested. It, however, has not been much employed.

Guaiacol piperidin, "Guaiaperol." A compound occurring in granular crystals, soluble in thirty parts of water, with a slight odor of creosote. It has been employed in the treatment of pulmonary tuberculosis and it is thought to possess the stimulating properties of piperidin in addition to the action of guaiacol. Dose: from five to thirty grains.

Guaiacol Valerianate, "Geosote." A liquid combination of guaiacol and valerianic acid, having the characteristic odor of valerian. Dose: five minims in capsules. This preparation has received much attention and is thought to have a particular value as an application in local forms of tuberculosis. It has been used in the Loomis Sanatorium for consumptives and reported upon favorably.[7]

Guaiacol salicylate; g. phosphate; g. phosphite; potassium guaiacol-sulphonate or "thiocol"; *quinine guaiacol-sulphonate*, or "guaiaquin"; *calcium guaiacol sulphonate*, or "guaiacyl"; and many similar derivatives of guaiacol have been introduced as substitutes for the pure drug. Each one is supposed to add some special therapeutic value, and although all have had some favorable mention, none has attracted much attention or proved of any special value. *Beaumont Small.*

[1] F. Enke: Experimentelle und histologische Untersuchungen, etc., Stuttgart, 1880.
[2] Prof. Max Schueller: Eine neue Behandlungsmethodeder Tuberkulose, besonders chirurgischen Tuberkulosen, Wiesbaden, J. F. Bergmann, 1891.
[3] The London Lancet, 1891, vol. i., p. 993.
[4] La Semaine Médicale, March 4th, 1891. British Medical Journal, 1895, vol. ii., p. 1488; 1891, vol. ii., p. 1040.
[5] Charité-Annalen, Berlin, 1897.
[6] The London Lancet, 1898, vol. i., p. 222.
[7] New York Med. Journ., April 2d, 1898. Journ. Amer. Med. Assn., vol. xxxi., p. 821.

GUAIACOL CACODYLATE is a combination of cacodylic acid with guaiacol employed by Barbary hypodermically in dose of 0.03–0.05 gm. (gr. ½–¾) in tuberculosis. The injection is painless, and serves as a means of introducing arsenic into the system. *W. A. Bastedo.*

GUAIACOL-ETHYL, guēthol, homocresol, ajacol, thanatol, pyrocatechin-mono-ethyl ether ($C_6H_4.OC_2H_5.OH$), is a homologue of guaiacol in which the methyl group is replaced by ethyl. It is an oily liquid, insoluble in water or glycerin, and soluble in alcohol, ether, or chloroform. It resembles guaiacol physically and physiologically, but has a greater analgesic and sedative action. It has been used topically for neuralgia, neuritis, painful joints, epididymitis, etc., in ten to fifty per cent. ointment, or hypodermically in ten-per-cent. glycerin mixture. A case of painful tuberculous cystitis, with tenesmus, was relieved by the intravesical injection of 5 c.c. (ɱ lxxv.) of the ten-per-cent. glycerin preparation (Merck). Its internal dose in tuberculosis is 0.25–0.65 c.c. (ɱ iv.–x.) three times a day in milk or in capsule. Von Mering believes that this preparation is better than guaiacol *W. A. Bastedo.*

GUAIAKINOL, the dibromguaiacolate of quinine, crystallizes in yellow, clinorhombic prisms. At 15° C. (59° F.) it dissolves in less than two parts of water, and on account of this solubility promises to be useful. Clinical data are wanting. *W. A. Bastedo.*

GUAIAMAR, the glycerol ester of guaiacol ($C_6H_4.OCH_3.OCH_2.CHOH.CH_2OH$), is formed by the action of anhydrous glycerin on guaiacol. It is a white, neutral, non-hygroscopic, crystalline powder, soluble in twelve parts of water, and in alcohol, chloroform, ether, and glycerin. It has a bitterish, aromatic taste, and is split in the alimentary tract into guaiacol and glycerin. George F. Butler has studied its action at the Cook's County Hospital, Chicago, and claims it to be antipyretic, diuretic, diaphoretic, and antiseptic. It stimulates the appetite and prevents gastric fermentation, deodorizes and loosens the bronchial excretions, and is a very efficient antiseptic to the alimentary or genito-urinary tract. It is less irritating than benzosol or guaiacol carbonate, though occasionally more so by idiosyncrasy. Butler recommends it in typhoid fever, tuberculosis, bronchitis, broncho-pneumonia, chronic cystitis, gonorrhœa, and the summer diarrhœas of children. Its dose is 0.2–1 gm. (gr. iij.–xv.). Locally, with belladonna and mercurial ointments, he applies it to rheumatic joints; and, with balsam of Peru and zinc ointment, to bedsores. *W. A. Bastedo.*

GUAIASANOL, di-ethyl-glycocoll-guaiacol hydrochloride, was introduced by E. Einhorn and Hütz as a soluble form of guaiacol. It crystallizes in white prisms, having a faint odor and a saline, bitter taste. It is neutral to litmus, and is freely soluble in water from which it is precipitated as a basic oil by the alkaline carbonates. Guaiasanol liberates guaiacol in the alimentary tract, and is used both externally and internally for the same purposes as guaiacol. Experiments show that it is without unpleasant effects in daily dosage of 3–12 gm. (gr. xlv.–clxxx.). It may be used hypodermically, and in two-per-cent. solution is unirritating to wounds. *W. A. Bastedo.*

GUARANA.—(Pronounced *Gwaw-rah-nah'.*) "A dried paste, consisting chiefly of the crushed or pounded seeds of *Paullinia Cupana* Kunth (fam. *Sapindaceæ*)" (U. S. P.).

FIG. 2352.—Paullinia Seed. Natural size. (Baillon.)

This is a climbing shrub, native of the hottest parts of South America, but the seeds are obtained wholly from cultivated plants.

The genus contains upward of one-hundred and twenty species, and its members are rich in saponin, also contained in guarana, on account of which parts of several of them are used as fish-poisons.

The guarana plant is very extensively cultivated, especially upon the banks of the Itenez River, a southern tributary of the Madeira. It is grown to stout stakes or poles and the plantation resembles an ordinary vineyard. The panicles of small white flowers are succeeded by fruit clusters looking not unlike large bunches of immense grapes. When ripe, the yellow fruit splits into three husks and the seeds are lost. They are gathered just previous to this time and the seeds are shelled and washed. The seed is large (1 cm. in diameter), globular or spheroidal, with a flattened base, and a slightly pointed apex. Its surface is dark-brown and very shiny, excepting the large chalaza at the base, which is light-colored, and, before it is disturbed, covered with a large aril. It is exalbuminous and entirely filled by the large fleshy embryo.

In general appearance and structure it may be described as a small horse-chestnut. After shelling, the seeds are lightly roasted, by which the testa is loosened. The latter is then broken off and winnowed out, and the kernels are coarsely broken up in a wooden mortar and with a wooden pestle. Just enough water is added to form an adhesive mass. This mass is then moulded by hand into cakes, balls, or, more commonly into sausage-shaped rolls, six to ten inches in length by one or two in diameter. The drying of these is the most delicate and critical part of the operation. It is conducted by artificial heat, in specially built houses, great care being taken to avoid a disagreeable flavor from the smoke or from the subsequent development of some variety of mould through imperfect or unequal drying. Adulteration occurs only occasionally. It consists in making various additions—usually tapioca starch—to the mass before it is subjected to the drying process.

As regards the home consumption of guarana, it is the exact equivalent of tea or coffee, except that it is grated off and taken suspended in cold water. It is the staple beverage of millions of people. Its excessive habitual use brings on nervous disorders similar to those from other caffeine-containing beverages, and ending in a kind of palsy.

Description.—In subglobular or elliptical cakes or cylindrical rolls, hard and heavy; outer surface somewhat shortly nodular, smooth, slightly lustrous, deep chocolate-brown; rather brittle, the fracture uneven, often fissured in the centre, of a deep flesh color or pale reddish-brown, showing numerous coarse, angular, lustrous fragments of seeds partly invested with blackish-brown integuments; odor slight, peculiar, a little resembling that of chocolate; taste very astringent, somewhat bitter, afterward sweet, especially when chewing is followed by the taking of a swallow of water.

Composition.—Guarana stands at the head of caffeine-yielders, containing four or five per cent. A quarter of its weight is tannin, and there are starch, saponin, resin, and small amounts of fixed and volatile oil. It should not yield more than two and one-half per cent. of ash. It should be remembered that the domestic value of guarana depends largely upon its flavor. Many lots defective in this particular are exported for medicinal use and are not necessarily inferior for this purpose. At the same time, adulterated lots are undoubtedly manufactured especially for such export, but only rarely.

Action and Medicinal Use.—Because of its tannin, guarana is to be compared rather with tea than with coffee. Caffeine is elsewhere so fully treated that its action cannot be here discussed.

As the contained dose of tannin is a small one, it is, in fact, a mode of giving caffeine, and little or nothing more. Its principal clinical reputation lies in its value in nervous and sick headaches, of which there is considerable evidence. It has been the foundation of several widely known secret remedies for these afflictions.

The powdered drug can be given in gram doses or more, repeated once an hour, until the headache is relieved, or until several doses have been given. The fluid extract (*Extractum Guaranæ Fluidum*, U. S. P.) is rather neater, and of the same theoretical strength. Milk is a good vehicle for either. *Henry H. Rusby.*

GUARANINE.—A name applied to *caffeine*, when derived from *guarana*. *Henry H. Rusby.*

GUERNSEY AND THE CHANNEL ISLANDS.—The Channel Islands, comprising Jersey, Guernsey, Alderney, Sark, and several smaller rocky islets, are situated in the bay of St. Michael, off the coast of Normandy, and lie between the latitude of 49° 10′ and 49° 42′ North and 2° 2′ and 2° 40′ West longitude. Guernsey and Jersey are the only two islands which require consideration as health resorts, and their claim as such is based upon the mild sunshiny nature of their climate, especially in the late autumn and winter. "Recent statistics show that Jersey receives more sunshine than any other part of the United Kingdom." In these islands "camelias and rhodendrons flower in the open in February, frost is rare, and lasting snow unknown."

St. Helier's in Jersey and St. Peter's Port in Guernsey are the chief towns. The following table gives the climatic characteristics of Guernsey, which are practically the same as those for Jersey.

Climate of Guernsey and Jersey. Means for Ten Years. Height Above Mean Sea-Level, 180 Feet.

	January to March.	April to June.	July to September.	October to December.	Year.
Temperature—					
Mean average	43.7° F.	53.0° F.	60.5° F.	48.8° F.	51.5° F.
" daily range	7.6	10.8	10.9	7.6	9.2
" of warmest	47.5	58.4	66.0	52.6	56.1
" of coldest	39.9	47.6	55.1	45.0	46.9
" relative humidity	87%	83%	83%	86%	85%
Precipitations—					
Average in inches	7.53	5.82	6.96	12.22	32.53
Wind—					W. and S. W.
Prevailing direction	....	....	....	....	
Weather—					
Amount of sunshine	304 hrs.	665 hrs.	648 hrs.	247 hrs.	1864 hrs.
Mean cloud	7.1%	6.0%	6.6%	7.2%	6.6%
Rainy days	47	34	39	59	179

From this table we see that the general climate of these two islands (Jersey and Guernsey) is a mild, moist, marine one. The diurnal range of temperature is small, and there is an average of five hours of daily sunshine. Of the total rainfall one-fourth occurs in the months of October and January. March and April are considered the most trying time of the year on account of the northeasterly winds.

Of course the islands are exposed to the winds from all directions, which, coming from the ocean, are moist and salt-laden. The prevailing winds are westerly and southwesterly, especially the latter.

The following table of yearly averages of wind is given for Guernsey, for the period from 1845 to 1862, inclusive:

Northeast wind prevailed on 100 days.
Southwest wind prevailed on 104 days.
Northwest wind prevailed on 110 days.
Southeast wind prevailed on 51 days.

The drinking-water is obtained, for the most part, from wells. The drainage at St. Helier's and St. Peter's Port is by sewers into the sea.

The therapeutic effects of this climate arise from its mild sunshiny nature and its marine atmosphere. Elderly persons with low vitality and those with bronchial affections derive benefit from it. It is also of especial value for delicate scrofulous children and those of rachitic tendencies. It is unfavorable, on account of its moisture, for rheumatism, neuralgia, and renal diseases. Those with a tendency to respiratory troubles should not remain after the end of February. The Channel Islands are reached by boat from Southampton, Weymouth, or Plymouth in from six to ten hours, or from St. Malo or Granville, France, in two or three hours.

From a personal visit to Jersey the writer can testify to the delightful scenery of the island, both land and water, and the charm of the lovely drives through the winding roads, bordered by luxuriant vegetation. The air is fresh and invigorating and the sunshine most brilliant.

The writer desires to express his indebtedness in the preparation of this account of Guernsey and Jersey to "The Climates and Baths of Great Britain," by the Royal Medical and Chirurgical Society of London, 1895.
Edward O. Otis.

GUINEA WORM. See *Nematodes.*

GUINORAL (Chinoral) is an oleaginous, very bitter liquid, containing quinine and chloral. It is used as a hypnotic in doses of 0.5–1 gm. (gr. viij.–xv.), and also as an antiseptic. *W. A. Bastedo.*

GUM ARABIC.—Acacia. *Gum Acacia. Gum Senegal.* "A gummy exudation from Acacia Senegal Willd. (fam. *Leguminosæ*)" (U. S. P.). In roundish tears, often an inch or more in diameter, transparent, except for the whitish fissures, of a glassy fracture, ranging from nearly colorless to a deep reddish-yellow, nearly tasteless and odorless, wholly soluble in two parts of water, to form a thick mucilage of a faintly acid reaction. The presence of starch in powdered acacia is detected by a blue color on the addition of iodine, that of dextrin by a red color. A pure solution will not be affected by neutral lead acetate.

This gum was formerly yielded by other species of acacia, notably *A. vera* Willd., and the very finest gum of commerce, now scarce and high, still proceeds from this species. It is chiefly in smaller tears, which are more brittle and broken, and less translucent and glassy, owing to the much more numerous fissures. Both species are small thorny trees of northern Africa, *A. vera* more abundant in the eastern, *A. Senegal* in the western districts. The gum is a decomposition product from cellulose and is more abundantly produced by unhealthy trees. It exudes from natural fissures and artificial incisions. Gums practically equivalent to acacia are produced by species in related genera. An excellent article is produced by species of Prosopis, growing in the southwestern United States, and known as Mesquit Gum, but the supply is too irregular to be utilized. The varieties of acacia are now little known by the locality-names formerly applied to them, the grading being done almost wholly by number, the quality depending upon whiteness and solubility. The pure gum consists wholly of compounds of arabic acid with potassium, calcium, and magnesium. Acacia has no physiological action, except that of a mechanical demulcent. Its pharmaceutical uses, as an excipient, for emulsionizing, and for suspending insoluble substances or those the acridity of which it is desired to mitigate, are very numerous and important.
Henry H. Rusby.

GUMMA. See *Syphilis.*

GUMS. See *Active Principles.*

GUNSHOT WOUNDS.—No chapter in surgery has undergone such radical changes as that pertaining to gunshot wounds in war. The changes have been coincident with the introduction of antisepsis and the new armament in hand weapons which employ armored projectiles. The changes with reference to the latter concern the military surgeon mostly. His *confrères* in civil life will continue to observe gunshot injuries, as far as their mechanical effects are concerned, as formerly. The wounds of this class that come under his care are mostly from pistol shot, the missiles of which are made of soft lead, are propelled at comparatively low rates of speed, and show a marked tendency to lodge and to deform upon impact with resistant structures.

In order to obtain a correct understanding of gunshot wounds a consideration of the implements which are concerned in their production is necessarily of much importance.

Portable Firearms.—Arms of this class are often referred to as portable hand weapons. They include the firearms that are carried by hand in contradistinction to the larger guns of the artillery class. They are the pistol, shotgun, the smooth-bore muzzle-loading musket, and the rifle. A knowledge of the development of portable firearms as a whole, and of ballistics in particular, is indispensable to a correct appreciation of the subject of gunshot injuries. For all practical purposes a study of the evolution of the military rifle as it presents itself to the military surgeon will be quite sufficient to a general understanding of the subject.

Military Rifle.—A study of the guns concerned in the evolution of the small arms which culminated in the present military rifle deals with: (1) smoothbores like the flintlock and musket; (2) the percussion-cap, muzzle loading rifle; (3) the breech-loading rifles; and (4) the breech loading magazine rifle with small calibre.

1. The smoothbores of the first class are represented by the old-time flint lock and later by the Spanish musket, whose calibre varied from .63 to .75. They fired a bullet made of soft lead weighing from 465 to 555 grains; the explosive was loose black powder in charges varying from 270 to 345 grains. The projectile was spherical in shape, with an initial velocity of from 540 to 690 foot seconds, while the maximum effective range was never more than 350 yards.

Our first three wars—the Revolutionary War, the War of 1812–14, and the Mexican War—were fought with weapons represented by this class. As implements of war they were considered very effective in their day, and yet at no time could the best type of them be loaded at greater speed than thrice per minute.

2. The percussion-cap, muzzle-loading rifles were first used in the Italian War of 1859; they were subsequently used in our Civil War, and in all European wars up to 1866. Instead of igniting the powder charge by means of a taper as in the old match-lock, or by the spark of a flint as with the flintlock, it made use of a small cap containing a detonating substance. The cap was placed over a hollow piece, the cavity of which led to the powder charge. The latter was ignited by causing the hammer to strike the cap.

In the earlier patterns of these guns there was so much escape of the powder gases through the inequalities between the ball and sides of the weapon, with consequent loss of energy, that the practice of slightly reducing the calibre of the gun as compared to that of the diameter of the ball, and grooving the interior of the former, was resorted to. This was done to insure greater accuracy in the fit of the ball. In order to allow more of the surface of the ball to come in contact with the barrel, it was elongated. The fit of the ball was so tight that it was necessary to drive it down with a ramrod and hammer, both of which formed part of the equipment of the soldier at that time. This gave greater exactness of fit between the ball and barrel and both added to the energy and extended the range by retaining the projectile a trifle longer in the barrel, while the explosive was generating a greater volume of gas. It was noticed that the elongated bullet fired from such a gun was apt to tumble or lose its balance, and this was overcome in a measure by giving the grooves in the barrel a spiral turn, at the rate, in the earlier guns, of one complete turn in about seventy-eight inches. This added much to the stability of the bullet, keeping its point foremost for a longer time in its flight, thereby adding to its range and effectiveness. This principle in ballistics should be specially remembered, aside from the development in the use of explosives, because it is really the initial point in the great strides that have been made in the effectiveness of bullets. The act of loading with the ramrod and hammer was very laborious. To overcome the difficulty Delvigne, a French army officer, hollowed out the base of the projectile next to the powder. The expanding gases pressed the sides of the cup so formed into the metal grooves in the barrel, thus causing the bullet to take the rifling. Later, in 1847, Captain Minié made a still further advance by suggesting the use of an iron disc in the cup. The harder metal being forced against the sides of the cup insured greater expansion than the gases alone, so that the accuracy of fit between the ball and the barrel was more completely secured. The so-called Minié rifle used in the Crimean War, and our own Springfield used in the Civil War, were loaded with such bullets. The following were the principal features of the Minié rifle which correspond with those of our earlier make of the Springfield rifle.

Minié-Rifle, 1851 to 1866.

Weight with bayonet	10 pounds 8¾ ounces.
Diameter of bore	.702 inches.
Number of grooves	4
Twist	1 turn in 78 inches.
Diameter of bullet	.690 inch.
Weight of bullet	680 grains.
Charge of powder	150 "
Sighted for 100 to 1,000 yards.	