gan. Hildebrandt narrates the case of a woman in whom this power was developed to such a degree that she was able voluntarily to grasp the penis below the glans so firmly as to make its withdrawal impossible. The levator ani was the constricting muscle.

The diagnosis of vaginismus is not difficult. The labia majora and minora may be gently drawn apart, but the

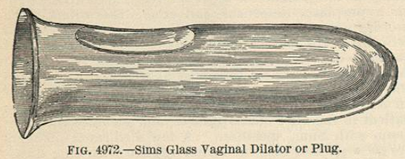

FIG. 4972.—Sims Glass Vaginal Dilator or Plug.

moment an effort is made to pass the finger into the vagina the pain, the spasm, and the wriggling of the patient may forbid any further examination without an anæsthetic. If the finger should overcome the resistance and find entrance, it may be so tightly grasped by the contracting muscles as to be benumbed. Frequently the patient is so hysterical that it is useless to make any attempt at an examination without the aid of an anæsthetic. As a rule, the anæsthesia must be very profound to permit of a thorough examination. In such cases it is best not to undertake the examination until arrangements have been made for operative interference, if such should prove to be necessary.

The treatment of vaginismus consists in absolute rest of the genital organs, all attempts at coitus being strictly forbidden. The hyperæsthesia of the parts may in some cases be relieved by hot sitz-baths or by applications of nitrate of silver (ten grains to the ounce), of a solution of chloral (four per cent.), or of carbolic acid (1 in 40). A four-per-cent. solution of cocaine is generally effective, but it must be used with caution. Ointments of belladonna or ichthyol sometimes afford relief. In fissure of the vagina or anus the base must be divided or touched with the thermo-cautery. Ulcers should receive appropriate attention, urethral caruncles removed, and irritable carunculæ myrtiformes snipped off. It may be necessary in some instances to excise the entire hymen and adjacent tissue. The edges of the wound thus made are then stitched with chromicized gut to secure primary union. As a matter of course an anæsthetic is necessary. In fissure of the neck of the bladder the urethra should be dilated to an extreme degree, the base of the fissure touched with a pencil of nitrate of silver or with the actual cautery, and a self-retaining catheter applied and left open for continuous drainage. In cases of obstinate spasm it becomes necessary to dilate the ostium vaginæ and its canal beyond the constrictor muscle. Such dilatation may be forcible and abrupt or gradual. The former is accomplished by introducing the thumbs into the vagina, the patient being anæsthetized, and separating the vaginal walls until the resistance is overcome by the rupture of some of the underlying structures, of which the most important is the sphincter vaginæ. Another method is to use a bivalve or trivalve or quadrivalve speculum as a dilator. The instrument is introduced closed into the vagina and then, after the blades have been opened, it is forcibly withdrawn.

Gradual dilatation without anæsthesia may be accomplished in many cases by means of the Sims glass plug or dilator (Fig. 4972). The parts are benumbed by the application of cocaine and the dilator is introduced. It is retained for an hour night and morning. The pain caused by its introduction soon ceases and may be mitigated by anointing the plug before introduction with a medicated ointment. The presence of the plug helps to obtund the sensibility. Day by day an instrument of larger size may be substituted until the vagina is overstretched.

When the dilator cannot be borne by the patient, an operation is the only recourse. With the patient anæsthetized the surgeon introduses two fingers of the left hand into the vagina and then firmly stretches the parts. With the scalpel he next makes an oblique incision about two inches long through the vaginal tissue on each side, extending from half an inch inside the ostium to the raphe of the perineum. More pressure is then made to distend further the vagina. Finally, the vagina is firmly packed with sterile gauze and a **T**-binder applied. Should there be little or no hemorrhage, the glass plug may be inserted at once; otherwise the gauze is left in place until the following day when it is removed and the glass dilator substituted. This instrument is then to be worn for a short time every day for several weeks, *i.e.*, during the healing of the wounds. The constitutional treatment, which should always accompany the local measures, consists in tonics of arsenic, strychnine, and glycero-phosphates, in outdoor exercise, and in change of scene. Complete sexual rest should be enjoined.

J. Riddle Goffe.

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VALERIAN.—(*Valeriana*, U. S. P.; *Valerianæ Radix*, B. P.; *Radix Valerianæ*, P. G.) The dried rhizome and roots of *Valeriana officinalis* L. (fam. *Valerianaceæ*).

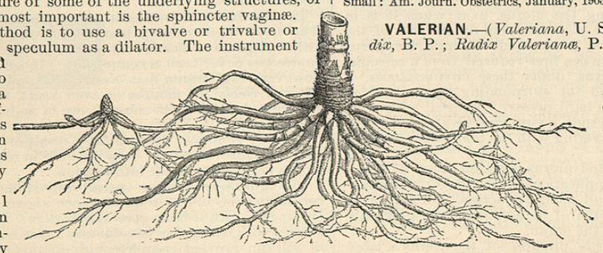

FIG. 4973.—Valerian Rhizome and Roots, about two-thirds natural size.

This perennial herb, native of the temperate parts of Europe and Asia, is a familiar object in our gardens, where it is grown partly as an ornament, partly for medicinal purposes. It is largely grown as a drug in England, Holland, and other parts of Europe, though the product of wild plants is said to be superior. It should be collected and dried in the autumn. The rhizome is from 2 to 4 cm. (about 1 to 1.5 in.) long, and 1 to 2 cm. (about 0.5 to nearly 1 in.) thick, upright, subglobular or obconical, truncate at both ends, light-brown or yellowish-brown, internally whitish or pale-brownish, with a narrow circle of white wood under the thin bark; roots numerous, rather coarse, brittle, brown, with a thick bark and slender, ligneous cord; odor peculiar, becoming stronger and unpleasant on keeping; taste camphoraceous and somewhat bitter.

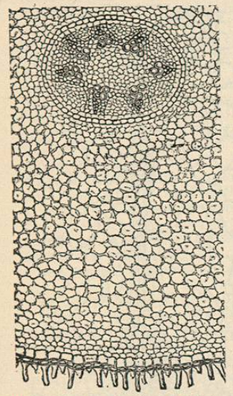

FIG. 4974.—Cross Section of Valerian Root. (Baillon.)

Small, stunted rhizomes, grown upon dry, stony soil, are commonly superior to those of finer appearance.

The important constituents of valerian are: from one-half to two per cent. of volatile oil, and variable amounts of valerianic acid, of a camphor-like body very similar to borneol, and of resin. Both the volatile oil and the resin are mixtures, containing the camphor and valerianic acid. The oil consists chiefly of the terpene *valerin*. The proportion of these different substances varies greatly, according to the age of the drug after collection, the percentage of the oil thus usually decreasing, that of valerianic acid increasing.

Oil of valerian suitable for medical use is described in the Pharmacopœia as follows: "A greenish, or yellowish, thin liquid, becoming darker and thicker by age and exposure to air, having the characteristic odor of valerian, an aromatic, somewhat camphoraceous taste, and a slightly acid reaction. Specific gravity about 0.950. It is readily soluble in alcohol." Valerianic acid is also liquid, but thicker than the oil, colorless, of a strong valerian-like, but also sour and cheesy, odor, and a sour, burning taste. It is an active acid, forming salts with the metals and alkaloids, several of which are in use.

The intoxicating action of valerian on cats, which seem to have an irresistible craving for it, is well known. In very large doses, several drachms several times a day, it may produce, in man, dizziness, disturbance of vision, hallucinations, or active delirium. Nausea and vomiting are also likely to occur from such doses. It appears to be eliminated by the kidneys, which it stimulates slightly.

Its medicinal action is that of an antispasmodic, like musk, asafœtida, chamomile, lavender, etc., as well as ether and the bromides. Like most essential oils, it is also a general and digestive stimulant in moderate doses.

Valerian is frequently given to patients suffering from emotional unbalance, hysterical and "nervous" (in the popular sense) disturbances, headaches, and other pains due to the same causes, as well as wakefulness, with considerable benefit. It is also given in some more serious and obstinate diseases, as chorea or epilepsy, especially petit mal, with occasional benefit.

The most advantageous way of employing valerian is to give either one of the galenical preparations of the drug, or the oil.

The dose of the root is 1–2 gm. (gr. xv.–xxx.), of the official fluid extract an equal number of cubic centimetres or of minims. There is also an official tincture, strength one-fifth, and an ammoniated tincture, of the same strength in aromatic spirit of ammonia.

Henry H. Rusby.

VALERIANIC OR VALERIC ACID ($HC_5H_9O_2$).—Valerianic acid is the active constituent of valerian, whence it was first obtained for study. It is also the chief active constituent of cypripedium, and is found in various other aromatic drugs, such as angelica. Besides these natural sources, it is readily obtained by the chemical change of many organic substances, and is very largely manufactured by the oxidation of amylic alcohol with bichromate of potassium. Thus we have in the market a natural and an artificial acid. The natural acid is obtained by the distillation of valerian with water. The distillate is a mixture of volatile oil of valerian and valerianic acid, and a portion of the oil can be converted into the acid. This acid is divisible into the normal valeric and the iso-valeric acids. The artificial acid produced from amylic alcohol is combined with sodium, from which it is then freed by sulphuric acid. This form is therefore more prone to impurity. If strictly pure, it is the practical equivalent of the natural acid. Valerianic acid occurs as a colorless, transparent, thin, oily, volatile, combustible liquid, with a strong odor, much like that of valerian, and an acrid, burning taste. It is soluble in both alcohol and water, the artificial pure iso-acid being much less soluble in water. The specific gravity of the pure natural acid is 0.940. Acetic acid has been used as an adulterant.

Valerianic acid shares the antispasmodic properties of oil of valerian, but is usually distinctly inferior to it. Its stimulating effect is spurious, it being distinctly weakening. It is capable of poisoning by cardiac and respiratory paralysis, the latter indicated by convulsions. It is used in hysteria and mania, in doses of three to ten minims. It is largely used for the administration of certain bases in the form of valerianates, and the valerianates of ammonium, quinine, iron, and zinc are official.

Henry H. Rusby.

VALERIDIN.—A synonym for sedatin (*q. v.*).

VALIDOL, menthol valerianate, a menthol ester of valerianic acid, is a clear oily liquid of mild aromatic odor and a not unpleasant cooling taste. It contains about thirty per cent. of menthol.

Neustatter gave the remedy in five cases of scintillating scotoma, with prompt disappearance of the flashing and the accompanying headache. Cipriani has employed it as an expectorant in bronchitis, as an anti-emetic in the vomiting of tuberculosis, and in pharyngeal or nasal catarrh as a spray or local application.

Goldmann recommends it in the treatment of nervous headache, migraine, neuralgia, and neurasthenia, and as a stimulating stomachic. Applied externally in hemicrania and such conditions, it exerts a sedative and analgesic action. Dose ten to thirty drops on sugar or in capsule.

W. A. Bastedo.

VANILLA.—U. S. P. (*Fructus Vanillæ*, P. G.) The fruit of *Vanilla planifolia* Andrews (fam. *Orchidaceæ*) peculiarly cured and dried.

The vanilla plant is an epiphytic climber, with fleshy stems and foliage, native of the forest regions of eastern Mexico. It is very extensively cultivated there, as well as in many parts of the Old-World tropics. As grown in these different regions it exhibits distinct varieties, and the products differ considerably in quality and in commercial value. The Mexican variety is still generally preferred in the United States, but the Bourbon article, as improved during recent years, is fast overtaking it in popular estimation.

Natural pollination of the flowers is so scanty that artificial pollination by hand labor is an important industry. Green vanilla fruits are very similar in appearance to green bananas, but relatively only about one-third as stout. They are gathered just when they begin to turn yellow. If left longer, they are apt to split at the

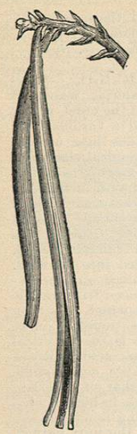

FIG. 4975.—Fruit of "split" Vanilla, one-fourth natural size.

ends in drying, which renders them less salable; though some good judges believe that these "splits," as they are commercially termed, are not inferior. The details of the curing process vary greatly in different countries, and even among different operators, but its essential features depend upon the fact that the odorous principle, vanillin, does not exist in the natural fruit and must be developed in the curing process. This usually consists of a sweating or steaming operation in a closed space, followed by alternating exposures in closed containers, or between woollen blankets. The "beans" thus treated gradually shrink in thickness and become darker until they assume the characteristic appearance described below. They are assorted into lengths, the more long and slender ones being preferred and selling higher. They are tied tightly into bundles, wrapped in paraffin paper, and packed in tight tin cans. Because of the loss in weight from over-drying, there is a temptation to underdry them, and many bundles, owing to this mistake, are found mouldy within, on being opened. The finest product is thus described: Bean-shaped fruits, from 20 to 25 cm. (8 to 10 in.) long and 5 to 8 mm. ($\frac{1}{3}$ to $\frac{1}{4}$ in.) thick, straight, except for the short-hooked base, flexible, longitudinally wrinkled, dark chocolate-brown, shining or covered with white crystals of vanillin, giving them a frosted appearance; one-celled, with three fleshy placentæ and innumerable minute seeds; having a strong, pleasant, and characteristic fragrance, and a sweetish, aromatic, and slightly fruity taste.

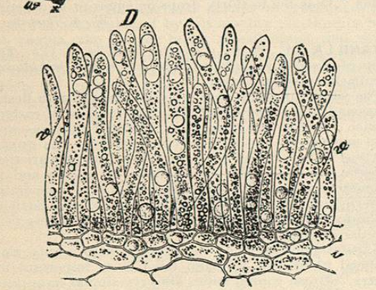

FIG. 4976.—*A*, Transverse section of Vanilla Pod, enlarged; *E*, seed, natural size; *F*, the same, magnified; *G*, section of same; *D*, the papillary gland hairs lining the cavity of the pod. (Berg.)

CONSTITUENTS.—The important constituent of vanilla, and that which represents its odor and taste, is from 1.5 to 2.5 per cent. of *vanillin*, *vanillic aldehyde*, or *methyl-protocatechuic aldehyde*, ($C_8H_8O_3$), which occurs in colorless prisms having the characteristic odor and taste of vanilla in intense degree; they melt at 80° to 81° C., and are soluble in alcohol, ether, and chloroform, and less so in water. With the vanillin, occur a little volatile and about ten per cent. of fixed oil, sugar, and other unimportant constituents.

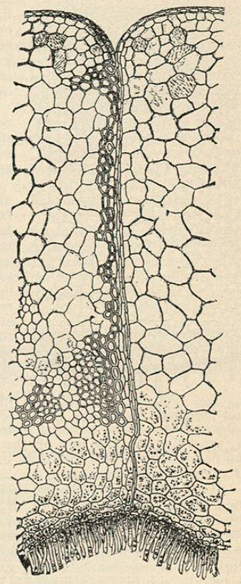

FIG. 4977.—Section of Vanilla through the Commissure where the Fruit splits. (Berg.)

SUBSTITUTES AND ADULTERANTS.—On account of the high price of vanilla and vanillin, both have been enormously substituted and adulterated. The use of inferior fruits of other species of vanilla, short, broad, flat, and of a strong fruity odor, must be classed as substitution. These usually cost only from one-tenth to one-twelfth as much as the best. The use of tonka beans and other substances containing cumarin is even more extensive. Finally, various compounds of prunes, raisins, and other substances are sold as vanilla substitutes. Cumarin is itself substituted for vanillin. Artificial vanillin is largely prepared from coniferin and eugenol, and, although apparently identical chemically with the natural, it has not been found equal to it in useful properties.

USES.—Vanilla has no active properties as a medicine, though the official ten-per-cent. tincture is sometimes used as an antispasmodic in fluidrachm doses. As an adjuvant for perfuming and flavoring, it has many uses in the pharmacy, as well as in confectionery and pastry.

Henry H. Rusby.

VANILLIN PARAPHENETIDIN, $C_6H_3.OH.OCH_3.CH.N.C_6H_4.OC_2H_5$ is formed by heating vanillin with paraphenetidin. It occurs in the form of crystals which are soluble in water, and in dose of 1 to 2 gm. (gr. xv.–xxx.) it has a hypnotic and antineuralgic action.

W. A. Bastedo.

VARIATION.—In its modern biological sense, *variation* is used to signify a difference or the presence of differences from some *type* taken as the standard of comparison. With a somewhat more limited meaning, the word *deviation* also is used as the name for a difference from the type of any organ or character. By *variability* is meant the extent of the deviations, together with the relative

number of individuals possessing each degrees of variation.

What Variation is Not.—Much confusion in regard to variation has arisen from the word having been employed loosely with meanings not in accord with the present usage. Therefore it may be well at the outset to call attention to the more important variations in the use of the word.

In the first place, it is necessary to distinguish between variation and *modification*. Following the suggestion of C. L. Morgan (1897), which has been adopted largely by biologists, we may employ the word *modification* as a technical term, to signify a change in any characteristic of an individual organism in response to some condition of its environment or the process by which such a change is brought about. Modifications were spoken of formerly as *acquired characters*, but the term *acquired* has frequently led to confusion in the minds of persons not perfectly familiar with the facts. It seems best, therefore, to abandon that term. A modification is a change produced in an individual. A variation is any difference in the individual from a certain ideal condition taken as the type. Thus a modification may produce or modify a variation, but modification and variation are two entirely distinct and independent concepts. An electric discharge may produce sound, but sound and electricity are not the same thing, and sound may be produced by other causes. Likewise, modification may produce variation, but they are not the same thing and variation may be due to other causes.

Theoretically we may follow Weismann in making a distinction between blastogenic and somatogenic variations; *blastogenic* variations being those due to differences in the constitution of the germs from which the group of individuals under consideration have developed, while *somatogenic* variations are differences which have arisen in the bodies (*somata*) of the individuals as the result of modification following exposure to different environmental conditions. But as has been pointed out by Vernon (1903), in the practical study of variation by statistical methods, it is generally impossible to make this distinction. This is due, in the first place, to the fact that blastogenic and somatogenic variations may be of the same kind and degree. Thus deafness may result from a pathological lesion, as in scarlet fever, or it may be due to a congenital malformation, which, owing to observed parental correlations, we must suppose to be of blastogenic origin. But even in such an extreme variation as this Fay (1898) found it impossible to determine in many cases to which class a given individual should be assigned. In the second place, every individual and even parts of individuals, are subject to constantly fluctuating environmental conditions from the moment of conception until death. These changes of surrounding conditions are met by corresponding responses, functional or structural, or both, on the part of the organism, but these reactions are themselves probably subject to variations independent of the exciting stimuli, and who can tell, therefore, how much of the similarities and differences in any group of organisms is due to similarities and differences in the structure of their germs, and how much to the various conditions of the environment to which they have been subjected? The importance of modifications in the normal development of organisms has been discussed in another article (see *Differentiation*).

The clearest examples of purely blastogenic variation are to be found in such mammalia as give birth to a considerable number of offspring at one time. For example, in a litter of puppies or kittens, all sired by the same male, all developed at the same time in the same uterus, we have a group of organisms where the conditions of parentage and environment are as uniform as possible, and yet variations in color, form, and mental traits will be readily apparent. These differences appear to be clearly blastogenic in origin, but the very general presence of a "runt" in such a litter indicates that the conditions of nutrition at least have not been quite uniform. Variation, then, as we understand the term at present, is not a broader term than modification, as Vernon (1903) would have it, but is an entirely distinct concept. Modification, on the other hand, may stand toward variation in the relation of cause to effect. Variations so effected are classed as somatogenic, as distinguished from blastogenic variations of purely germinal origin.

Moreover, our idea of variation does not include any change in the individual taking place during the course of its life, no matter whether that change be of blastogenic or somatogenic origin. Thus the changes which an individual insect undergoes in the course of its metamorphosis would not come within our definition of variation. But a group of insects, say the potato beetles in a certain field, would exhibit in each stage of their development variations from the type of that stage, and the degree of variability might differ in the successive stages.

Finally, the idea of variation does not necessarily include the parental relation. It is true that we may select one or the other parent, or both parents combined in an imaginary mid-parent (see *Heredity*) as the type, when dealing with the characters of offspring of identical or like parents. This is done in the study of heredity. But in the ordinary study of variation the investigator is usually ignorant of the parentage of his material. So a variation is not a difference from the parental type necessarily, but is a difference from any type that may be selected.

In fact, variation is a phenomenon by no means confined to organisms. It is shown as well by lifeless objects and events. Thus we may, if we choose, study the variability of the stones on the beach, of snow crystals, of the forms of clouds, of rainfall, of the height of the barometer, or of the price of wheat.

Aim and Method of Study.—Having now clearly in mind what is meant by variation, let us consider what it is that we may expect to gain by the study of this subject and the method to be pursued in such an investigation.

Every one who is at all familiar with modern theories of organic evolution knows that variation is of very great and very fundamental importance from the theoretical points of view. Variation is at the basis of every theory of evolution. Therefore, in order to understand evolution, we must know the facts of variation. (See *Evolution*.)

Variation is an important factor in the classification of animals and plants. Formerly the systematist simply took as the type of a species the individual that was first described. The modern methods enable him, when provided with sufficient material, to define the limits of a species with much greater accuracy and to select as the type a form that is truly representative.

To the physician the study of variation is of great importance. Every practitioner knows that the same disease may be manifested in diverse forms, and that patients vary in their reactions to treatment. A study of the types and variability of diseases and of the effects of treatment may be expected to add much toward a true appreciation of these subjects.

For the surgeon, variation is still more important. He must know what anomalies are likely to be met with and their relative frequency.

Variation has been studied extensively by teachers of gymnastics and the results have had practical application in the determination of the relative rank of the pupils and their degrees of improvement.

The method employed in the modern study of variation is statistical. This, as Pearson (1902*c*, p. 320) has well said, is "because the whole problem of evolution is a problem in vital statistics—a problem of longevity, of fertility, of health, and of disease, and it is as impossible for the evolutionist to proceed without statistics as it would be for the registrar-general to discuss the national mortality without an enumeration of the population, a classification of deaths, and a knowledge of statistical theory." This is true, not only for the problem of evolution, but also for all problems for which a solu-