Mr.	Sugar.	Quinine.	Acetic acid.	Salt.
G.....	333	400,000	6,000	....
H.....	500	400,000	4,500	480
I.....	500	450,000	6,000	325
J.....	650	200,000	7,500	325
Average.....	1 to 520	1 to 444,000	1 to 5640	1 to 469

Besides the results here recorded, numerous data were furnished by other observers.

This table and the supplementary data justify the following conclusions:

1. The acuteness of taste for sugar varies from 1 part of pure cane sugar in 300 parts of water to 1 in 708, with an average of 1 in 520.

2. The acuteness of taste for salt varies from 1 in 325 to 1 in 700, with an average of 1 in 469.

3. The acuteness of taste for acetic acid varies from 1 in 3,000 to 1 in 8,000, or an average of 1 in 5,640.

4. The acuteness of taste for sulphate of quinine varies from 1 in 200,000 to 1 in 1,000,000, with an average of 1 in 444,000.

From these results it is evident:

5. That there is considerable individual variation.

6. That the taste is most acute for the less common stimuli of bitter and acid than for the more common stimuli of salt and sweet.

7. Several subjects recorded a marked decrease in the acuteness after the use of tobacco.

8. One subject recorded a noticeable increase in the stimulation when the solutions were warmed from 20° to 40° C.

9. One observer found that the tip and edge of the tongue were more acute than other parts of the tongue in detecting slight differences in the strength of the solutions.

10. One observer, reporting a series of very careful experiments upon four individuals, three of whom are members of the same family and accustomed to the free use of salt and vinegar in their regular diet, concluded that the fourth individual, not accustomed to the free use of salt and vinegar, has a greater sensitiveness for saline and sour substances than have the three individuals who are so accustomed.

As to the interval of time between the application of the stimuli and the taste perception, the observations seem to justify the following conclusions:

11. The interval between stimulation and sensation (latent interval) varies inversely as the number of papillæ per unit area in the portion of the gustatory apparatus stimulated.

12. The interval between stimulation and sensation varies directly as the blood supply of the part at the time of stimulation.

II. *To Determine Localization of the Sense of Taste, i.e.,* to find whether there are areas of gustatory region which are especially sensitive to particular stimuli—quinine, for example.

Solution.—Through the aid of a probang or a camel's-hair brush apply to different limited areas of the tongue, palate, or fauces either the standard solutions given above or somewhat stronger solutions of the same substances.

Results.—The accompanying figure gives the results which coincide substantially with those of other observers: Outline of tongue showing location of tonsils (*T*), foramen cæcum (*F.C.*), circumvallate papillæ (*C.P.*), and fungiform papillæ (*F.P.*) upon the left side, while the right side shows the outline of the area particularly sensitive to quinine (——), acid (....), salt (—.—.—), and sugar (- - - -) respectively.

"O. Ehrwall has examined the different fungiform papillæ over the tongue with reference to their sensitiveness to taste stimuli. One hundred and twenty-five separate papillæ were tested with succinic acid, quinine, and sugar. Twenty-seven of the papillæ gave no response at all, indicating that they were devoid of taste fibres."

[It may be suggested in passing that perhaps the twenty-seven papillæ were sensitive to salt alone.—W. S. H.]

"Of the remaining ninety-eight, twelve perceived acid alone, three perceived sugar alone, while none was found which reacted to quinine alone. The fact that

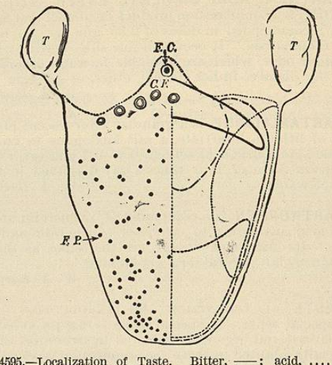

FIG. 4595.—Localization of Taste. Bitter, ——; acid, ...; salt, —.—.—; sweet, - - - -; *T*, Tonsils; *F.C.*, Foramen cæcum; *C.P.*, Circumvallate papillæ; *F.P.*, Fungiform papillæ. (Hall: "Text-book of Physiology." Lea Bros., Philadelphia.)

some papillæ respond to only one form of taste sensation is evidence in favor of the view that there are separate nerve fibres and endings for each fundamental sensation, but a majority of the papillæ (eighty-three) are provided with more than one variety of taste fibres." (Henry Sewall, in "American Text-book of Physiology.")

Winfield Scott Hall.

TATE SPRING.—Grainger County, Tennessee.

POST-OFFICE.—Tate Spring. Hotel and cottages.

ACCESS.—Viâ Morristown and Cumberland Gap Railroad to Morristown; thence ten miles by carriage to spring.

This resort is 1,400 feet above the sea-level, and is located in a charming valley environed by mountains 3,000 feet in height. It may be regarded as one of the strictly first-class summering places of the Tennessee Mountains. The beautiful and picturesque scenery and genial climate are supplemented by the addition of two excellent modern hotels and numerous cottages. There is but one spring, which yields one hundred and twenty gallons per hour. The following analysis was made in 1872 by T. S. Antisill, professor of chemistry in the National Medical College and chemist to the United States Department of Agriculture: One United States gallon contains (solids): Calcium sulphate, gr. 160.66; magnesium sulphate, gr. 32.91; sodium sulphate, gr. 8.50; potassium sulphate, gr. 1.54; sodium chloride, gr. 40.27; iron chloride, gr. 2.99; magnesium chloride, gr. 0.62; sodium iodide, a trace; calcium phosphate, gr. 1.14; calcium carbonate, gr. 21.56; silica, gr. 2.70; nitric acid, gr. 0.02. Total, 272.91 grains. The analysis shows a saline purgative water with tonic and alterative properties. It has been found beneficial in functional disorders of the nervous system induced by overwork and mental worry, in cases of hypochondria and insomnia, and in chronic metallic poisoning. Some forms of dyspepsia and liver disorders are also improved by its use. The water is now used commercially and shipped by the bottle, case, or barrel to any desired point.

James K. Crook.

TATTOO MARKS.—Tattooing consists in the introduction into the skin of insoluble colored substances which become encapsulated and thus form permanent

stains. Microscopical examination of sections from tattoo marks shows that they consist of relatively large particles of pigment, situated part of them in the corium, but the larger part in the subcutaneous connective tissue. Particles of pigment are found also in the contiguous lymphatic ganglia. Powder stains, coal-dust stains, and similar stains produced by the accidental embedding in the skin of particles of colored substances, usually carbon, are in all essential characteristics identical with tattoo marks. One form of accidental marking of the skin to which attention should be called is the whitish marks which occasionally result from the precipitation of lead in the tissues during the use of subacetate-of-lead solution or lead and opium wash upon superficial wounds involving the connective tissue. The danger of these stains on the cornea from the use of subacetate of lead in the eye is well known. A staining of the skin which is in all essentials of the same character as these we are considering, but which is produced from within, is argyria, in which there is a precipitation of silver in the derma and subcutaneous tissue after the long-continued internal use of silver. The writer has seen a marked argyria in one case in which the silver was not being taken internally, but had been used daily during more than a year in the form of a solution of the nitrate for painting patches of leukoplakia buccalis.

Tattooing is one of the most primitive efforts of man at personal adornment. Like many other things that have their origin in vanity, various kinds of significance are attached to the practice, but the underlying reason for tattooing, not only among the primitive races, but among the civilized, rests probably upon an inherent barbaric taste for distinctive personal decoration. Among uncivilized peoples and among nations in a relatively low state of civilization, like the Orientals, the practice is general, and is often carried to the most extravagant extent. Among Caucasians, aside from its general use among sailors, it is largely confined to those individuals of both the lower and the higher classes who readily accept anything that is bizarre or that gives them a fancied distinction.

Brault divides tattooing among primitive peoples according to its significance, as follows: First, religious tattooing, as in the priests among the Polynesians; second, ornamental tattooing, seen in the Algerians, Tunisians, and in the inhabitants of Oceanica and Japan; third, therapeutic tattooing, practised in Tunis, in Egypt, and in the Congo region; fourth, distinctive tattooing, practised amorg the Arabs and negroes of Africa, for the purpose of defining not only different tribes, but also certain callings; fifth, obscene tattooing, which is found only rarely among savages, but which is very common among sailors and criminals.

Practical uses of tattooing are very limited. As a means of identification tattoo marks are of course valuable, and the tattooing of habitual criminals has been suggested as a means of their ready identification. Several years ago de Wecker suggested the tattooing in black of leucomatous areas on the cornea. The method has not had very wide application, and is of course not free from danger. Very recently the highly artificial suggestion has been made of tattooing the flush area of the cheeks to represent a healthy blush. It is interesting to try to imagine how this healthy blush would appear on the faded skin of later life.

Designs of the most elaborate character are often seen in tattoo marks, many of them showing some artistic taste and considerable technical skill. The extent to which tattooing has been carried in some individuals has been limited only by the cutaneous surface. In the well-known case of the tattooed man from Burmah, illustrated in Hebra's Atlas, the entire surface was occupied by tattoo marks. Numerous other cases of almost as great extent have been seen.

The usual method of tattooing is first to outline upon the surface the design, and then to prick out this design with a needle or a bundle of needles, and after that to rub in the pigments. For dark blues and blacks, carbon in some form is used, charcoal, lampblack, India ink; other pigments used for various colors are cinnabar, carmine, indigo, Prussian blue. The dangers of tattooing, at the hands of the unskilled persons by whom it is usually practised, are by no means small. All sorts of infections are possible: lymphangitis, erysipelas, chancroid, tetanus, tuberculosis, leprosy, and syphilis. Many cases of syphilis transmitted by this method are recorded in the literature. The means of transmission—by the saliva of the operator, the use of an infected needle, subsequent infection of the unhealed wound—are manifest.

Much ingenuity has been exercised in attempts successfully to remove these marks. The treatment of powder stains and similar stains is largely a matter of mechanical removal, and to be successful this must be done immediately after the production of the marks, before the particles of pigment have become so disintegrated that their mechanical removal is impossible. The individual masses of pigment have to be patiently picked out, for which purpose an iris needle or a small sharp-pointed knife is most convenient. The method requires great patience both on the part of the operator and on that of the patient, but if thoroughly done immediately after the injury it gives satisfactory results. A certain amount of anæsthesia may be obtained by the application of small quantities of weak cocaine solution or by the use of an ointment of ten- to twenty-per-cent. orthoform in lanolin. In connection with the mechanical removal of the particles of pigment, the use of a strong solution of H_2O_2 as a bleaching agent has been suggested, and it is perhaps the best antiseptic for use in these cases; but it is hardly possible that powder stains or coal-dust stains could be bleached by this means, since at the body temperature carbon (which causes most of the discoloration) cannot be bleached with oxygen.

The principle of almost all of the methods for the removal of tattoo marks is their destruction by mechanical means or by the production of a destructive inflammatory process which causes a superficial eschar. Very small stains can be destroyed by the use of the cutaneous punch or by electrolysis or by excision. In using electrolysis the needle attached to the negative pole of a battery with a current of from two to ten milliampères is inserted at various points around the periphery of the marks, and a sufficient reaction is produced to cause the destruction of the involved tissue. In a few days after the application a dry superficial eschar forms, which is thrown off, leaving a white scar. Of course these mechanical methods can only be applied to very small lesions on account of the scars which they produce. The various methods for the treatment of larger lesions depend upon the application of some chemical irritant which sets up an acute inflammatory process sufficiently intense to cause destruction of the superficial layers of the skin. Many irritants have been suggested for this purpose: chromic acid, carbolic acid, acetic acid, tincture of cantharides, potassium nitrate, etc. The two methods of treatment after this principle which have been most definitely worked out are those of Variot and Brault.

Variot's plan of treatment, according to Brocq, is as follows: First, he places on the tattoo marks a concentrated solution of tannin, and tattoos this in. Then a silver-nitrate pencil is rubbed vigorously over the surface. The action of the silver nitrate is allowed to go on for some moments until the surface becomes black from the formation of silver tannate in the superficial layers of the skin. In the next few days a slight inflammatory reaction occurs, and over the surface treated a closely adherent dark crust forms. After the third or fourth day there is no pain except when there is movement of the muscles under a large crust. Occasionally there is a little suppuration under the crusts, but if secondary infection is avoided no severe inflammation occurs. After fourteen or sixteen days the crust comes off spontaneously, the corium and the epidermis underneath have been repaired, and the locality of the mark is recognizable only by a superficial pink cicatrix which gradually be-

comes of normal color. A couple of months after the operation the scar is hardly noticeable.

In Brault's plan the irritant used is a solution of chloride of zinc, 30 gm., to 40 gm. of water. The mark is tattooed with needles dipped in this solution, and in addition the surface is lightly moistened with the same solution after the tattooing. A mild inflammatory reaction is produced, followed by the formation of a crust which subsequently exfoliates, leaving a pinkish, slightly scarred surface similar to that after Variot's operation.

In the use of either of these methods several attempts may be necessary. The surface treated at one time should not exceed one or two square inches, and of course ordinary surgical precautions as regards the cleanliness of the surface, both before the operation and during the subsidence of the inflammatory process, should be observed. Both of these methods are founded upon correct pathology and are worthy of trial. Variot's method would seem the one of preference, as the action of silver nitrate can be more accurately controlled than that of zinc chloride.

Ohmann-Dumesnil has proposed a method of removing these marks by digesting with digestive ferment the connective tissue which encapsulates the pigment particles and thus liberating them, so that they can be carried away by the lymphatics. For this purpose he uses glycerole of papoid or of caroid. His method is as follows: The skin is made surgically clean and then anæsthetized with a spray of ethyl chloride. The surface is then covered with glycerole of papoid or of caroid and tattooed with a bunch of six to ten very fine needles which have been dipped in the solution. The tattooing should be firmly done, but the needles should be driven in just far enough to draw the least possible blood. Glycerole of papoid or of caroid is then poured over the area and it is covered with gauze. On the removal of this after two or three days the tattoo marks present a hazy appearance. Shortly after, a crust forms which later falls off, and with it the marks disappear. If any trace remains the process is to be repeated. This idea is ingenious, but the results have not been satisfactory in the hands of some workers. It is questionable whether the results obtained are not those due simply to a destructive inflammatory process, as in the other methods.

William Allen Pusey.

TEA.—(*Thé*, Codex Med.) The prepared and dried leaves of *Thea sinensis* L. (*Camellia Thea* Link, etc. Fam. *Theaceæ*). This definition includes, as varieties, *Thea* (*Camellia*) *viridis*, *T. Bohea*, and others, as well as the wild Assam tea tree, supposed to be the origin of them all. The tea plant as seen under cultivation is a shrub, a metre or so in height (from two to five feet), but in the wild state it becomes a small tree of from five to ten metres. The leaves are alternate, evergreen, rather thick and leathery, smooth when mature, short-petioled, lanceolate, of varying bluntness, serrate, feather-veined, the veins not reaching the margins, and from 5 to 10 cm., or in the much larger wild plant, from 15 to 20 cm. long (Fig. 4596).

Tea is a native of Asia, and grows in a semi-wild state in many of the districts where it is cultivated, but has only been found in an unquestionably indigenous condition in Assam, where it was discovered, some fifty years ago, by Mr. Robert Bruce, as a good-sized tree with very large leaves. It is now cultivated in many parts of the world; first in importance in China, where it is said to have been domesticated more than a thousand years ago, also in great quantity in Japan, Java, and India, to a slight extent in South America and elsewhere, and finally in the United States, experimentally. Although it grows pretty well in many places and is comparatively hardy, the higher price of labor is a bar to its profitable production in most civilized countries.

The earliest knowledge of the use of tea is from the Chinese, to whom it was familiar one thousand and perhaps two thousand years ago. It was introduced into Japan in the thirteenth century A.D., and into Java and India in recent times. It was first used in Europe near the middle of the seventeenth century.

Tea is planted in gardens and tended without gathering until two or three years old; then the leaves and buds are plucked for two or three successive crops each season. If green tea is to be made, they are immediately dried over a heated stove, and afterward colored more or less. For black tea the leaves are pressed in little heaps, and allowed to wilt and ferment a little before drying, which

FIG. 4596.—Tea Plant, Flowering Branch. (Baillon.)

is effected in the same way as above; by this process some of the tannin is decomposed, and the essential oil altered so as to modify the taste and smell a little; its color is also very much darkened, as well as that of the infusion made from it. The principal varieties of tea are: Black—flowery pekoe, orange pekoe, souchong, congou, bohea, etc. Green—gunpowder, imperial, hyson, young hyson, etc. The teas of our market are nearly always "blends," made by mixing several grades together.

The usual shape of tea is attained by compressing and rolling the leaves in the hand or upon a table until they are crumpled into the little rolls or wads of which commercial tea consists; in the nicer sorts each leaf is rolled by itself.

COMPOSITION.—In the proportions of the ingredients there is considerable variation, but the following are the principal ones: *Essential oil* from one-half to one per cent., which is the source of its flavor; *caffeine* (theine) from one-half to two or three per cent., which gives it bitterness. This alkaloid is found in half a dozen other plants, most of which are used somewhere as stimulating food adjuncts (see *Caffeine*, *Guarana*, *Cola Nuts*, etc.). It is also related to cocaine and theobroma. The amount of *tannin* in tea is large (from twelve to seventeen per cent.).

ACTION AND USE.—The large amount of tannin found in tea makes it an active astringent, especially to those unaccustomed to its use. It constipates the bowels, impairs the digestion, and reduces intestinal secretion when taken in large quantity; locally it makes tea a mild hæmostatic, and a useful wash for indolent ulcers, exuber-

ant granulations, etc. The essential oil gives to tea its agreeable flavor and a good part of its exhilarating character; it relieves fatigue, stimulates thought, postpones sleepiness, and cheers the mind. The *caffeine* is the chief mental and nervous stimulant and cardiac tonic element. By long-continued, habitual use neither of the above effects is much felt, unless carried to the extent of diminishing the appetite and developing dyspeptic troubles.

The least desirable of the constituents of tea is the *tannin;* it is also one of the slowest to dissolve out, and can, therefore, with a little care, be largely left with the dregs. The quicker an infusion of tea is made, the more fragrance and less bitterness and astringency it has; and the more slowly, the more tannin. Tea for drinking should be made by pouring *boiling* water into a suitable vessel containing the tea and allowing it to stand for from five to ten minutes, no longer. A better way is to rinse the cup in boiling or very hot water until it is heated through, then put in a teaspoonful of dry tea, fill the cup with boiling water, and allow to stand a few minutes. Tea should never be boiled or stand long unless the *tannin* is wanted. If made in an iron vessel or in a tin one which has begun to wear, it will become dark from the formation of a bitter tannate of iron. On account of its almost universal use over the entire world, tea is not often available as a medicine; its effects are identical with those of coffee, but perhaps more astringent and less stimulating than that article. As is the case with coffee, the commercial value of tea depends more upon its aroma than on the amount of caffeine it contains.

ALLIED PLANTS.—There are a dozen or more species of *Thea*, one of which is *Thea Japonica*, the beautiful camellia of the gardens. Besides this there is nothing of economic importance in the order. *W. P. Bolles.*

TEETH.—ANATOMY.—The teeth are commonly divided into two sets, according to the period of their eruption. The teeth which erupt first are variously designated as the deciduous, the temporary, the milk, or the primary teeth. The teeth erupting subsequently to the first set are called the permanent or secondary teeth. In addition to these there are supernumerary teeth, which usually occur in connection with the permanent, but may, in rare instances, be found with the temporary teeth; and there are so-called third dentitions, the genuineness of which, though fairly well established, is not without question.

The permanent teeth are thirty-two in number, sixteen being placed in the upper, and sixteen in the lower, jaw.

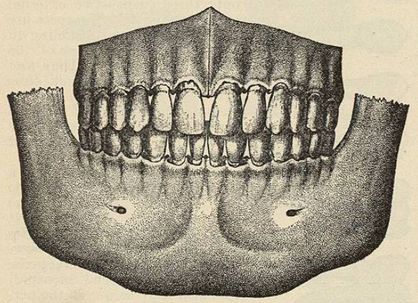

FIG. 4597.—The Permanent Teeth, natural size, showing their Method of Arrangement and Articulation. (Carabelli.)

In each jaw there are four incisors (two central and two lateral), two canines, four bicuspids, and six molars.

A formula to express the number of the various teeth in each jaw is written as follows: I $\frac{2}{2}$, C $\frac{1}{1}$, Bic. $\frac{2}{2}$, molars $\frac{3}{3} = 32$.

The teeth of the upper jaw are symmetrically arranged along the alveolar margin of the superior maxillary bones. When viewed from below, their crowns are found to describe a parabolic curve. This curve, however, varies according to nationality, heredity, and accidental circumstances. The teeth of the lower jaw are ar-

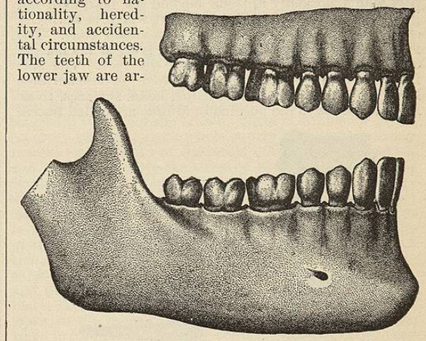

FIG. 4598.—The Permanent Teeth, natural size, showing the Curves in the Alignment of the Crowns. (Carabelli.)

ranged along the alveolar margin of the inferior maxillary bone, and their crowns describe a curve similar to that found in the upper jaw. This curve, however, is more pointed in front and more divergent behind. Speaking roughly, the masticating surfaces of the teeth of each jaw lie in a single plane, no crown projecting in a marked way beyond its neighbor. The teeth, also, when normally arranged, show no gap in the row, each tooth thus by its position giving and receiving support. In both these respects human teeth contrast strongly with those of the lower animals. In these it is common to find that certain teeth, as the canines in the carnivora, present a marked elongation, and also that between the teeth there occur intervals which allow of their interlocking.

The curve on which the upper teeth of the permanent set are arranged is normally somewhat larger than that of the lower teeth. In consequence, the anterior superior teeth overlap the anterior inferior teeth, as do also to a slight extent the superior bicuspids and first and second molars the corresponding lower teeth. The wisdom teeth, however, meet practically edge to edge. It is to be further noted that the superior teeth are not situated directly opposite corresponding inferior teeth. The superior centrals are opposite the inferior centrals and a portion of the inferior laterals; the superior laterals are opposite a part of the inferior laterals and a part of the inferior canines; the superior canine occludes between the inferior canine and the first inferior bicuspid; the first superior bicuspid occludes between the first and the second inferior bicuspids; the second superior bicuspid occludes between the second inferior bicuspid and the first molar; the first superior molar occludes with the first and the anterior portion of the second inferior molar; the second superior molar occludes with the second and the anterior part of the third inferior molar; the third superior molar occludes with the third inferior molar, and is the only tooth in the upper jaw having a single antagonist. While it has been stated that the masticating surfaces of the teeth of the upper and lower jaws are on a single plane, yet slight deviations from this rule are to be noticed. If we follow the lower edge of the upper teeth from a superior central around to the wisdom, we shall find that the line ascends gently from the central to the interval between the first and second bicuspids, then descends till past the first molar, when it ascends slightly to the end of the row. On the lower jaw the anterior teeth are slightly elevated above the posterior, and be-