

**Pulmonary Tuberculosis.**—In the acute miliary form, as in early acute bronchitis, the sputum is scanty and mucoid, tubercle bacilli usually not being found, certainly not till softening of the tubercles occurs. In

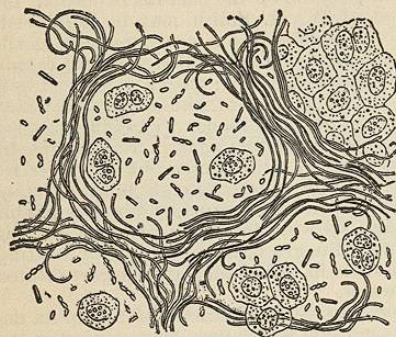


FIG. 4472.—Elastic Fibres Occurring in the Sputum. (Magnified.)

acute pulmonary phthisis tubercle bacilli may be present in enormous numbers, the expectoration being rusty and then mucopurulent, and containing elastic fibres when a process of softening has set in; these features and the presence of the tubercle bacilli constituting the marks which distinguish the disease from ordinary pneumonia. In chronic phthisis the expectoration is variable, the variations in its amount and nature from time to time giving some indication of the activity of the disease. Its heterogeneity is characteristic, some portions being but slightly purulent, others yellowish, purulent, and forming nummular with here and there cheesy masses and possibly even calcareous particles. Microscopically, the important features are the tubercle bacilli and elastic fibres, together with the presence of the purulent organisms that are secondary invaders. Occasionally Curschmann's spirals are present. Nuttall estimates that four billion individual tubercle bacilli may be present in the expectoration in twenty-four hours. Lartigau states that only from ten to fifteen per cent. of those present are ordinarily alive, and that dead bacilli alone may be present and persist in the sputum for weeks. It is generally believed that the forms that take the stain irregularly, presenting a beaded appearance from the presence of unstained spaces, are attenuated in their virulence. *E. E. Smith.*

**SQUILL.**—(*Scilla*, U. S. P.; *Bulbus Scilla*, P. G.; *Scilla*, Cod. Med.) The bulb of *Urginea maritima* (L.) Baker (fam. *Liliaceae*), deprived of its dry, membranaceous outer scales, and cut into thin slices and dried, the central portions being rejected.

Squill is derived from a perennial herb of the Mediterranean coast region, especially in Spain. The bulb is large, four or five inches long, globular-ovoid, covered with two or three dry, reddish or gray, papery scales, and made up within of numerous thick fleshy ones. There are two varieties, the white and the red, distinguished by the color of the outer tunics of the bulbs. For medicinal use, the bulbs are collected in the latter part of summer, sliced transversely, dried in the sun, and the papery scales winnowed out. To produce the best article, only the outer scales should be preserved. The presence in the drug of the less valuable central portion is indicated by the relative shortness and thinness of the strips, and their higher degree of curvature. Squill occurs in irregular, more or less curved segments several centimetres (about one to two inches) long and 4-8 mm. ( $\frac{1}{4}$ - $\frac{1}{2}$  in.) broad, thinner in one direction, with two to four sharp edges; yellowish-white or somewhat reddish, slightly translucent, brittle, and pulverizable when dry, tough and flexible when damp; inodorous and of a mucilaginous, bitter, and acrid taste.

When consisting of very narrow, short, closely curved or coiled segments, from the inner portion of the bulbs, the product should be rejected.

Structurally, it consists of a simple parenchymatous tissue, loaded with mucilage and containing numerous

oxalate-of-lime crystals, and traversed by occasional vascular bundles.

**CONSTITUENTS.**—Besides a large amount of gum, some sugar, the unimportant dextrin-like substance sinistrin, etc., squill contains as its active constituents several glucosides, the constitution and relations of which are not yet well known.

*Scillitoxin* is amorphous, light brown, soluble in alcohol, not in ether or water, a cardiac poison resembling digitalis; *scillipikrin*, a yellowish-white, amorphous, hygroscopic powder, similar to the above but less active; and finally *scillin*, of no medicinal qualities.

**ACTION AND USE.**—Few medicines outrank squill in antiquity, it being mentioned by nearly all medical writers from the earliest down. It possesses in a measure the heart-slowing and diuretic action of digitalis, for which it is occasionally substituted and with which it is more frequently given as an adjuvant. As a slightly depressing expectorant it is a common ingredient of cough preparations. Large doses (from six to twelve grains) occasion vomiting and purging.

It is stimulant, or in overdoses irritant, to mucous membranes; hence it acts as a direct diuretic in its passage through the kidney, in addition to its indirect diuretic effect through increased blood pressure. Hence, also, the frequent production of bloody or suppressed urine, and bloody stools and other indications of intestinal inflammation, in cases of poisoning.

**ADMINISTRATION.**—Squill is difficult to powder, apt to cake up when powdered, and seldom given in substance.

The following preparations are official: Fluid Extract (*Extractum Scilla Fluidum*, strength,  $\frac{1}{10}$ ), dose,  $\mathfrak{m}$  i.-ij.; Tincture (*Tinctura Scilla*, strength,  $\frac{1}{10}$ ), dose,  $\mathfrak{m}$  viij.-xxiv.; Vinegar (*Acetum Scilla*, strength,  $\frac{1}{10}$ ), dose,  $\mathfrak{m}$  xv.-lx.; Syrup of Squills (*Syrupus Scilla*), dose, 4-8 c.c. (3 i.-3 ij.). The Compound Syrup (*Syrupus Scilla Compositus*) is rather a preparation of antimony than of squill. *Henry H. Rusby.*

**STAFFORD MINERAL SPRING.**—Jasper County, Mississippi.

**POST-OFFICE.**—Vosburg. Small hotel.

**ACCESS.**—Via the "Queen and Crescent" route to Vosburg, thence one mile and a half southeast to spring.

The location is a romantic one, surrounded as it is by Indian mounds and relics, and shaded by graceful and towering gums, sycamores, poplars, and pines. The Choctaws gave the name of Bogohama ("Water of Life") to the spring; hence it is inferred that they used it for medicinal purposes. Its properties have been known to the whites, however, only during the last five or six years. At present there is, within one hundred yards of the spring, a large, well-kept boarding-house, where guests will find all arrangements for their comfort. It is the intention of the company controlling the spring to build a large and commodious hotel, with all modern conveniences, to accommodate the rapidly increasing number of guests. The many natural advantages of the spot in the way of charming scenery, salubrious climate, and mineral waters will no doubt serve to make it one of the popular spring resorts of the country in the near future. The following analysis of the water was made by Prof. A. L. Metz, of the Tulane University, New Orleans, in 1892: One United States gallon contains (solids): Sodium chloride, gr. 0.96; sodium carbonate, gr. 0.41; potassium sulphate, gr. 0.98; magnesium bicarbonate, gr. 0.97; calcium bicarbonate, gr. 13.69; calcium sulphate, gr. 0.56; ferrous (iron) bicarbonate, gr. 0.24; alumina, a trace; silica, gr. 1.99; no organic matter. Total, 19.80 grains.

The analysis shows a very good calcic water, with ferruginous properties. The entire absence of organic matter adapts it for table and domestic use. The water has tonic and diuretic properties, and ought to be useful in the diseased or disordered conditions to which this class of waters is applicable. It has been found to render excellent service in Bright's disease of the kidneys and in

diabetes, bladder disorders, and other conditions. The water is bottled and sold throughout the United States. *James K. Crook.*

**STAFFORD SPRINGS.**—Tolland County, Connecticut. **POST-OFFICE.**—Stafford Springs. Accommodation in private families.

**ACCESS.**—Via New London and Northern Railroad from junctions at Willimantic, Conn., and Palmer, Mass.

This historical old spring has been known as a resort since the year 1750, and its waters were celebrated among the aborigines for many years prior to that date. During the latter part of the eighteenth and for many years of the nineteenth century the place was held in high favor throughout New England and the neighboring States. The records of the guests of former days are filled with the names of people distinguished in all the walks of life. Among these names we find those of Dr., afterward General, Joseph Warren, and President John Adams. The development of other springs has detracted from the prestige of Stafford, but under an enterprising management the resort will no doubt again acquire a prominent place in public favor. Heretofore the water could be obtained only at the spring, but it is now bottled and shipped to any desired point. The country about Stafford Springs is diversified by hills and valleys, and the landscapes are very pleasing during the summer months. The flow of water from the spring amounts to about fifty-five gallons per hour. We are indebted to Dr. J. M. Sheehan for the following analysis by Lewis Norton, Ph.D., of the Massachusetts Institute of Technology. One United States gallon contains (solids): Sodium chloride, gr. 0.31; potassium sulphate, gr. 0.21; sodium sulphate, gr. 0.96; sodium bicarbonate, gr. 0.46; sodium phosphate, gr. 0.22; iron peroxide, gr. 0.67; iron protoxide, a trace; alumina, gr. 0.11; lime, gr. 0.41; silicic acid, gr. 2; magnesia, volatile matter, etc., gr. 1.75. Total, 7.10 grains. Carbonic-acid gas, 25 cubic inches.

The water is clear and sparkling and excellent for table purposes. It has attained its greatest reputation in the treatment of blood and skin affections. It is said to be actively diuretic. *James K. Crook.*

**STAMMERING AND STUTTERING** are terms often used to denote speech defects in general, without reference to their origin. Technically the word stuttering should be limited to tonic or clonic spasms of the muscles concerned in phonation and articulation. Stammering is imperfect articulation, not spastic, but due to malformation of the organs of speech, or to imperfect innervation of the muscles used in articulation.

Stammering has nothing to do with the joining together of sounds, but is the inability to render them properly, even when given alone. The terms stammering and stuttering are confused, always in the older writings, often in more recent ones.

Stammering must be distinguished from aphasia. That has to do with neither the production nor the joining together of sounds, but with the construction of syllables and words as a whole. It is caused by the disabling of those parts of the cerebral cortex which contain the sensory or motor speech memories, or of the fibres connecting these with other parts of the nervous system.

Aside from occasional faulty pronunciation, to which every one is more or less liable, there are many cases of stammering in which the trouble is due to carelessness and inattention, fixed by habit. These cases are important as well from a diagnostic as from an educational standpoint, as they may be mistaken for cases of acquired speech defect, especially when organic brain disease co-exists with them.

The capability of pronouncing different sounds is largely a matter of race and training. Every one stammers in a foreign language, if he undertakes to learn its new sounds after his habits of speech are formed. Thus the German *ch*, French nasals, and Italian *r* are seldom perfectly acquired by an adult. But, according to Kussmaul, "the most choking guttural of a Swiss throat

modestly retires before the vomiting throat sounds of an Arabian."

We may divide our subject into stammering from habit or carelessness, organic defect of the organs of speech, and disease of the nerve centres. The speech defects in all these cases may be identical, and in order to distinguish one from the other a careful examination and attention to the history are often necessary. A complete list of sounds which may be mispronounced is not possible. It will be sufficient to indicate a few of the more common ones.

The mispronunciation of the letter *r* is called rhotacism or burring. This letter has the same general sound, but is produced in various ways by different nations. In English-speaking countries it is formed by approximating the sides of the tongue to the roof of the mouth, but in certain localities it is often slurred. Its place is then taken by a *z* or *d* sound. In Southern England it is produced by the tip of the reverted tongue. In Italy it is made by a rather prolonged and rapid vibration of the tip of the direct tongue against the palate. The Italian nobility profess to be unable to produce this sound, and use the English *r*. In Northern Germany it is made by the uvula, in Sweden by the glottis. It is evident that correct speech in one country is stammering in another; e.g., the use of the uvula in pronouncing the English or Italian *r*. Again, the ordinary sound may be replaced by an entirely different one. In this case *l* or *v* is usually employed. This is commonly done by children, who acquire the *r* sound among the last.

*L* is often mispronounced, *r*, *d*, *t*, *y*, etc., being used instead. This is called lambdacism. *L* should be made by placing the tip of the tongue against the hard palate, and then phonating so as to make a continuous sound, the air escaping at the sides of the tongue. If the air does not escape, the explosive *d* is produced instead; if the tongue does not touch the palate, the half vowel *y* is made, and so on.

Lisping, or sigmatism, is the most common form of stammering. It consists in giving *s* a wrong sound, usually that of *th*, by carrying the tip of the tongue too far forward, so as to touch the upper teeth. In this way both the hard and soft sounds of *s* are replaced. This occurs even among the Germans, who have no *th* sound in their language.

Gammacism is the mispronunciation of the letter *g*. It is sometimes hardened into *k*, sometimes changed to *d*, especially by children.

Stammering of vowel sounds consists in slurring them so that they lose more or less of their individual character. A certain degree of this is in conformity with the spirit of the English language; in fact, many of our different vowels are, under certain circumstances, rendered in exactly the same way, e.g., in bird, burn, and father, and in bun and monkey. When carried beyond the degree sanctioned by general usage, this is stammering.

Hesitating speech with interpolation of a *u* sound is popularly called stammering, but usually is simply a device for gaining time.

All the above varieties are often simply the result of habit. Examination shows that the patient has always spoken in the same way, and reveals absence of other symptoms of disease.

Treatment is simply education. The patient should be carefully shown how to place his articulating apparatus so as to produce the required sound. Sometimes it will be found that he can readily do this when shown how. It is then only necessary to insist that he take the requisite amount of trouble every time he speaks. Other patients, especially adults, have the greatest difficulty in accustoming themselves to the change. The great point is to begin early. The acquiring of a new sound in his own or a foreign language is to an adult often an impossibility.

Organic defects of the organs of speech may be congenital or acquired, and lead to the same vices of articulation mentioned above, but often in a much higher degree; at the same time the voice may be changed in



quality, acquire a nasal twang, etc. The production of the normal sounds is then an impossibility, even if the patient is instructed how to do it.

Harelip interferes especially with the pronunciation of the labials, cleft palate and uvula with the gutturals, besides giving a nasal twang to all sounds.

The tongue may be bound to the floor of the mouth by a short frænum, causing thickness of speech and imperfect utterance of the linguals.

All these conditions must be ascertained by inspection. The treatment is surgical, followed at an appropriate interval by instruction in speaking.

Excision of the tongue for cancer interferes less with articulation than might be expected; *d*, *t*, and *l* are the only sounds which are lost, and the patient is able in a little while after the operation to make himself understood.

The larynx has little to do with articulation. Disease there causes aphonia. Even after its total extirpation patients have acquired the power to speak, setting in vibration the column of air contained in the pharynx.

Nervous diseases may cause literal as well as other defects of speech. The diagnosis must be based on a careful review of all the symptoms. The mode of development of the stammer is of the greatest importance.

Most characteristic in this respect is the defect in bulbar paralysis. In this disease the ganglion cells in the medulla oblongata are destroyed one after the other. The process usually begins in the nucleus of the hypoglossal nerve, and extends to the facial, spinal accessory, and glosso-pharyngeal. Wherever it extends it is accompanied by a paralysis of the muscles supplied by the affected ganglion cells; and as the tongue, lips, and palate are successively involved, the sounds formed by these parts become indistinct and finally disappear. In this way the patient loses the power to form the linguals; paresis of the lips causes at first disappearance of *o* and *u*, later of the explosives *b*, *p*, and *m*; when the disease extends to the uvula the nasal cavity is not properly shut off, and, besides the nasal quality which is given to it, the voice becomes much weaker from the large quantity of air which escapes through the nose. At the same time the lips, tongue, and palate are paralyzed for ordinary movements to a corresponding degree; whistling is impossible, swallowing difficult, and there is marked atrophy of the muscles with reaction of degeneration. There is no true aphasia nor amnesia, but speech may finally be entirely lost by the successive elimination of its component sounds. These changes are eminently progressive in character and usually slow; the symptoms may appear rapidly, from hemorrhage or embolism. During the prodromal stage, with heaviness of speech and occasional difficulty of articulation, diagnosis is not easy.

In parietic dementia the symptoms are more complicated. The disease process is scattered through the greater part of the nervous system. If the medulla is involved there may be much the same defects of articulation as in bulbar palsy, but they never reach so high a degree. At the same time there is apt to be marked tremor of the face and tongue, elision of syllables, loss and misapplication of words, and weakening of the logical powers. In typical cases it may be possible to make the diagnosis from the speech alone. It should be remembered, however, that stammering and stuttering may co-exist with congenital mental defect and simulate this condition closely. The occurrence of delusions of grandeur and the somatic symptoms will then decide.

Multiple sclerosis may or may not cause disturbances of speech, according to the location of the areas of induration. When the cerebrum is affected it is apt to be so in the subcortical portion, and the fibres coming from the left third frontal convolution may be involved. If they are involved, they may be cut across, and aphasia will then result. Usually they persist, altered more or less by the sclerosed tissue around them, motor impulses are transmitted through them with difficulty, and speech becomes measured and slow. This is called scanning.

At the same time there is irregularity in the force with which syllables are brought out. The voice is monotonous and on a high key. But areas of sclerosis may occur below the basal ganglia and cause true stammering.

In ordinary right-sided hemiplegia speech may suffer from implication of the fibres of the knee of the internal capsule, and possibly from affection of the basal ganglia. Clinically, when aphasia of this origin passes off there is generally left an indistinctness of articulation which co-exists with partial paralysis of the tongue and lips. This is not observed with aphasia of purely cortical origin.

The treatment of these forms of stammering is simply the treatment of the diseases which cause them.

Functional diseases are not often the cause of a literal dysarthria. In chorea, if the lips and tongue are affected, speech is irregular or absent during the spasm. This, however, is not the result of any disorder of the central speech mechanism.

Stuttering is a functional speech defect, consisting of clonic or tonic spasm of the muscles of respiration, phonation, and articulation, induced by the attempt to utter articulate sounds.

The intensity of the spasm varies greatly in different cases, from a scarcely noticeable impediment in speaking to an attack which renders speech for the moment impossible. The disturbance results in closure of the air passages, which is with difficulty overcome by the patient, and usually occurs in connection with the explosive consonants, in producing which there is normally a closure either by the lips, by the tongue, or by the soft palate. It may, however, occur with the pure open sounds, or before a sound has been uttered, in which case the spasm originates at the glottis. There may or may not be repetition of the offending sound, but there is likely to be when it is one of the explosives.

The attacks occur irregularly, and are much influenced by circumstances. Thus a stutterer may be able to converse easily with his friends, may be able to carry on an ordinary conversation, but have trouble in telling a story or in making any prolonged effort at speech. One may stutter only when tired or slightly out of health. Stutterers are usually exempt when whispering or singing, but this rule has frequent exceptions.

Stuttering has been known from the earliest times, but has been generally confused with other speech defects, so that it is often impossible to tell whether an account relates to this or to aphasia, or to stammering. It differs from the latter in origin, is never due to organic defect, nor entirely to carelessness, is intensified when the patient's attention is directed to his speech, or when he is embarrassed, and it is only occasional, while stammering is regular. Under favorable circumstances the stutterer's enunciation is perfect. It is evident, then, that it is no mere defect of articulation nor of co-ordination, for the muscles at times harmonize perfectly in their action.

Stuttering is mentioned by Hippocrates, Aristotle, and Galen, but in a somewhat indefinite way. We are told by Plutarch that Demosthenes had a difficulty of enunciation, which he overcame by declaiming as he walked uphill, and by holding pebbles in his mouth as he rehearsed his speeches. The latter plan has points of resemblance with modern devices, as we shall see; but it is not at all certain, from the account, whether the defect which it removed was really a stutter, or some form of stammer. At any rate, he adopted an excellent form of respiratory gymnastics, which are the foundation of most of the modern systems of treatment. During the Middle Ages writings on the subject appeared occasionally, imputing the trouble to malformation of the tongue, cerebral disease, etc., but no work of importance was done until the beginning of the present century.

Itard (1817) divided stuttering into two classes, congenital and accidental. Under the latter head he included speech defects due to cerebral lesion or organic disease of the tongue. He recommends beginning treatment early, and teaching the child slowly and carefully the pronunciation of a foreign language, dropping for a time his own. In this way he is taught, from the very

first, to combine sounds properly, and to give prominence to the vowel sounds rather than to the consonants.

In 1825 Mrs. Leigh, of New York, discovered a method of treatment which was kept for a long time secret. She thought the trouble due to a faulty position of the tongue, which is spasmodically depressed during the attack. To overcome this, she taught her patients to voluntarily raise the tip of the tongue, and keep it in this position while speaking. Her results were at first surprisingly good and attracted much attention, as well throughout Europe as in this country.

M. Serres d'Alais (1829) published a more scientific résumé of the subject, in which he divided the cases into two classes:

1. Those due to a stiffness, as if tetanic in character, of the muscles of the voice and respiration.

2. Those due to a chorea of the muscles of articulation.

He recommended in severe cases gymnastic movements of the arms while speaking; in light cases he considered it sufficient to pronounce the syllables in a short and brusque way, at the same time making the movements of articulation as extended as possible. He admitted that recovery is never quite complete, differing in this respect from most writers of the time, who, sceptical as to the statistics of others, claimed infallible results from their own particular method of treatment.

Arnolt (1830) ascribed the difficulty to spasmodic closure of the glottis. To overcome this he caused his patients to make a *u* sound between the words, so as to bind the consonant rather with the preceding than with the following vowel sound. In this way he threw the consonant into the background, as one does in singing.

At about this time Colombat, in France, attracted a good deal of attention by his brilliant success in treatment. He claimed to have cured one case in a single sitting of three hours, but, in a later edition of his work, he considerably modified this statement, and other authorities say the case relapsed several times. In fact, so many tables of statistics have been compiled from the immediate results of treatment, without waiting to see whether relapse occurred, that they are almost entirely worthless. Colombat gives a classification of cases much like that of Serres d'Alais into:

1. Repetition of syllables due to convulsive movements of the tongue and lips, or labio-choreic form.

2. Tetanic stiffness of the muscles of respiration, or gutturo-tetanic form.

For the first form he recommends the use of a rhythmic movement of the thumb and index finger during speech, and an instrument for beating time, of his own invention, called the muthonome. If the case is complicated by gutturo-tetanic spasm, he adds "lingual and guttural gymnastics, which consist in taking a deep breath before difficult words and phrases, and bringing the tongue into the pharynx, at the same time raising the point well toward the velum palati." His method is, after all, only a combination of preceding ones, but seems to have been effectual in producing, for a time at least, very good results.

The year 1841 is unique in the annals of this affection. In that year operation was proposed, and hundreds of stutterers were operated on, but before the end of the year the surgeons themselves were convinced of the uselessness of operation. The idea was suggested to the mind of Dieffenbach, of Berlin, by the frequency with which stuttering and strabismus exist in the same patient, and occurred to him, he says, when a man asked, with a marked stutter, to be operated on for strabismus. The operation which he usually performed was section of the root of the tongue, sometimes with excision of a triangular piece throughout its entire length and breadth. This proceeding was based on the theory that stuttering is purely a local affection. At about the same time several other operations were invented, *e.g.*, cutting the hyoglossi, genioglossi, etc., varying with the different theories of the surgeons as to the cause of the trouble. At first, cases were reported as cured by each of these methods. Later, relapses were said to have occurred.

Then several deaths were reported, and operation was soon, by common consent, abandoned as useless. Dieffenbach himself admitted the extreme danger of the proceeding. The deaths were the result of secondary hemorrhage and gangrene. The results attained immediately after operation seem to have been due to the impression on the nervous system of the patient, which wore off as soon as the effects of the operation subsided.

Since that time a good deal has been written on the subject of stuttering, largely by stutterers themselves, both in and out of the profession; by Guillaume in France, Merkel, Klencke, and Kussmaul in Germany, and Potter in America, and many others.

Guillaume lays especial stress on the disturbances of respiration.

Merkel thinks that the difficulty lies in combining a consonant with the following vowel sound. He locates the trouble, not in the articulation, but in the vocalizing apparatus, or, farther back still, in the nerve centres which govern that apparatus.

Bristowe likens stuttering to chorea.

CAUSATION.—Among the many theories which have been propounded to account for the symptom under discussion, that which ascribes it to malformation or disease of the organs of articulation is one of the oldest, and one which held its ground longest. It is the foundation of all operative interference, and is readily disposed of. In many pronounced cases of stuttering the tongue and lips execute ordinary movements perfectly. No abnormality is noticed except during speech; and when organic trouble coexists, its removal does not entirely cure the affection. Any conceivable degree of deformity may exist and cause nothing but stammering, which is then proportional to the amount of the lesion.

Stuttering is not due to a faulty position of the tongue, as is shown by the constant relapses which occurred after treatment by Mrs. Leigh's method. It is true that in many cases the tongue is pressed against the floor of the mouth, and is affected with clonic spasm in this position. This is, however, not always the case, and when it exists it is a result, not the cause, of the malady.

The trouble is not a chorea of the muscles of articulation. The characteristic of choreic spasm is that it is irregular and jerky and occurs during rest. The spasm of stuttering occurs only during voluntary excitation of the speech mechanism. Again, chorea, when it affects the lips and tongue, causes marked stammering, never stuttering. Chorea of the speech centre, or coprolalia, causes a spasmodic ejaculation of words or phrases independently of volition, and the words are perfectly articulated.

That the trouble is due to confusion of ideas, or disproportion of words and ideas, is obviously false. Stuttering occurs in persons of every grade of mental power. The greatest disproportion between words and ideas occurs in acute mania, and leads, not to stuttering, but to a chaotic mixture of words and syllables. In most persons failure of ideas is marked by a drawl, not a stutter.

It is not due to a simple ataxia of the muscles used in speech. If it were, the patient could at once control the irregular movements by ceasing to speak. But when he does this, the spasm invariably persists for a short time. Again, stuttering is only occasional, and made worse when the patient's attention is directed to his speech; ataxia is constant, and is diminished by attention.

The theory that it is an inability to combine the consonant and vowel sounds is inadequate to explain the symptoms. The occasion of so combining them is often the proximate cause of an attack, somewhat as general convulsions are caused by teething or other peripheral irritation; but stuttering may occur on an attempt to utter a pure vowel sound entirely apart from a consonant.

In order to understand the phenomena presented, it will be necessary to review briefly the structure and physiology of that part of the motor speech centres which serves for the production of articulate sounds. The motor impulse travels from the motor speech centre



in the left third frontal convolution, downward through the knee of the internal capsule, and reaches the medulla. The nerves carrying it here communicate with the articulo-respiratory centre. These nuclei lie close together, and constitute practically one collection of cells bound together by fibres running in every direction. Here, and possibly also in the cerebellum, is effected the exact degree of innervation of all the muscles of articulation, so as together to produce the vowel and consonant sounds and at the same time to approximate the vocal cords, and so regulate the respiration as to cause exactly the necessary amount of air to pass through the glottis. This exceedingly complex action is entirely apart from the conscious act of speech, and is only known to the sensorium through the intervention of the sensory nerves supplying the mucous membranes and deeper parts of the lips, tongue, and palate. The amount of innervation of each muscle is determined by lines of least resistance in the connecting fibres, which are formed as a result of repeated transmission of motor impulses. This whole system is probably under the influence of one or more controlling centres, which serve to check over-action, or the undue diffusion of nerve force.

Stuttering is a disturbance of this co-ordinating mechanism. It may be due to abnormal excitability of the primary system, or to weakness of the inhibiting centre. The result is an overaction of the muscles innervated, and transmission of the impulse to other muscles more or less distant, sometimes even to those of the arms and trunk; the attempts of the patient to overcome the spasm only serve to intensify it, until the controlling centre resumes its function or the patient ceases the effort to speak.

Several facts tend to show that the trouble is adynamic in origin—e.g., the fact that patients usually stutter worst when tired; that persons sometimes stutter when exhausted, or during sickness, who do not otherwise; that stutters are often, though not always, of weak or scrofulous constitution.

This disturbance of equilibrium between the centres is often the result of an inherited tendency. It may follow severe illness, fright, or any shock to the nervous system. In such cases the trouble may pass off when the depressing influence ceases, or may persist for a long time, or through life. In any case the intensity of the disturbance depends much on the treatment and surroundings of the patient, anything like ridicule or punishment aggravating it tenfold.

**OCCURRENCE.**—Stuttering occurs in all ranks of society and in most nations. The Chinese are said to be exempt, on account of the peculiar intonation of their language. It affects men much oftener than women, although trustworthy statistics on this point are lacking. Some authorities have thought that women do not stutter; others place the proportion of women affected as high as thirty-five per cent. Kussmaul believes the fact to be due to the greater tact and delicacy of women.

**SYMPTOMS.**—These vary much in point of severity and mode of sequence of the spasm. In lighter cases, which are fairly under control, when one of the explosive consonants is met with, the organs of articulation remain fixed in their closed position for a moment, there is slight choking and tremor of the facial muscles, an effort of the will is made, and the parts resume their functions.

In rather more severe cases there may be added a good deal of thickening and tremulous movement of the tongue and tonic spasm of the glottis. The breathing is then apt to be irregular, and the approximation of the vocal cords causes a crowing sound on inspiration, which is sometimes utilized for speech.

When the spasm occurs before speech has actually commenced, the trouble begins with tonic spasm of the glottis, there is tonic and clonic spasm of the tongue, lips, and face, and the diaphragm acts irregularly in its efforts to overcome the resistance at the rima glottidis.

In severe cases the attack may be brought on by any sounds, less frequently the open vowel sounds; the closure may be effected by the lips, tongue, or palate; the

under jaw is set; there is marked tremor of the facial muscles, and sometimes even of the arms; the glottis may be closed so as almost or entirely to prevent respiration, or it may be opened at the same time that there is spasm of the respiratory muscles. In the latter case the lungs are emptied of air, and the patient must pause for a deep breath before he can proceed with his sentence. At the same time the face becomes flushed, the flow of saliva is increased, and the mental torture of the patient tends to prolong rather than cut short the attack.

**DIAGNOSIS.**—The diagnosis is usually easy. In addition to the clinical features given above, the duration of the malady should be carefully ascertained. Its diagnostic features have already been considered.

The speech defect which occurs in parietic dementia may simulate stuttering quite closely.

In clergymen and other public speakers there sometimes occurs a difficulty in speaking, which may be mistaken for stuttering. It is one of the occupation neuroses, of which the type is writer's cramp, and is due to exhaustion of the co-ordinating mechanism of respiration. Some speakers entirely empty their lungs before taking breath; the action of the reflex mechanism is then kept too long in abeyance. When this is habitual, the centres become exhausted and fail to respond to the reflex stimulus. The trouble usually begins in the glottis, which fails to open on inspiration; a crowing sound is produced when the speaker takes breath; the diaphragm cannot be promptly filled for the next sentence. This may happen only toward the end of the discourse, when the speaker is tired, but may become so marked that any attempt to speak causes great distress, and rest is then an imperative necessity. This affection differs from stuttering by occurring comparatively late in life, not involving the muscles of articulation, and being rather of a paralytic than of a spastic nature. It ordinarily yields to rest and respiratory gymnastics.

Another rare affection, aphthongia, is probably allied to the preceding. Here the spasm occurs in the muscles supplied by the hypoglossal nerve, and is brought on by any attempt to speak, so that articulation is rendered impossible. In the few cases recorded the disease has been caused by emotion or fright. During the attack the jaws and tongue are fixed; the sterno-thyroid, sterno-hyoid, and thyro-hyoid muscles may be in a state of clonic spasm, which begins and ceases with the attempt to speak. The prognosis seems to be good. Too little is known of the disease to speak of its probable relation to stuttering. It may be distinguished by the character and history of the attacks.

**PROGNOSIS.**—There is no doubt that sufferers from this affection may be aided by treatment, especially if the latter is vigorous and instituted early. The prognosis is better in non-hereditary cases, and in patients of strong will power. Almost all writers on the subject have a favorite method of treatment, especially those who are connected with an institute for voice-training, and claim a large percentage of cures. Investigation shows that in most cases relapse takes place after an even brilliant result. This should not discourage patients from effort, but it is necessary to bear in mind that only constant and long-continued exertion will overcome a vicious tendency fixed by habit. The difficulty tends to decrease with time, and many stutters are able to master their defect at forty or fifty years of age. They are apt to ascribe this to some particular form of treatment, which they then ardently recommend.

**TREATMENT.**—Too much stress cannot be laid on beginning treatment early. The child should be kept as much as possible from association with stutters. It should be remembered that he is sensitive as well to sympathy as to blame for his malady, and as little notice should be taken of it as possible, except in connection with stated lessons. He should be taught, when he has an attack, to stop speaking at once until he has mastered it.

Breathing exercises are very important. They may be given, following Guillaume, by causing the patient to

take a long breath, hold it for a moment, and then let it out slowly, with occasional stops, but without sound. He should especially be made to take a deep breath at frequent intervals, and never to speak with nearly empty lungs.

After breathing exercises have been continued for some time, the patient may proceed to the vowel sounds, first the most open one, *a*, then *ā, ā, ē, ē, ē, ē, ō, ō*, and so on; then the aspirates, *hā, hā, etc.*; next the easier consonants in combination, *lā, lā, lē, lē, lā, mā, mā, etc.* Sentences may then be used in which the difficult sounds do not occur. Lastly, the explosives *āā, āā, bā, bā, etc.*, may be tried. With all of these the patient should be taught to lay the stress on the vowel sounds, so as to avoid the slight overaction with the consonants, which is usually the beginning of the spasm. One must be sure that the pupil has mastered each of the above classes before he is permitted to go on to the next.

We have a mass of evidence from stutters, in the profession and out of it, testifying to the efficacy of rhythmical movements accompanying speech. They serve a twofold purpose—they divert the patient's attention, and give his sentences something of a sing-song character. They are aids, but are in no sense curative. The thumb and fingers may be opened and closed, or any other movement made which is convenient to the patient. Somewhat the same effect is produced by elevating the tip of the tongue, as recommended by Mrs. Leigh, but it will be better, in most cases, to draw the patient's attention to a more distant part of his body.

Hypnotism has been tried of late as an aid in treatment. If it is ever of use as an educational measure it should be so here. Good results are claimed for it. Whether they will prove to be permanent, and without accompanying injury to the patient, it is possibly too early to judge.

Drugs are of little value. Stimulants should be used moderately, if at all. Scrofulous and anæmic tendencies should be corrected, and the patients should be kept in good general health by exercise, cold sponging, and like measures.

The question is often asked, whether it is possible for an adult to master his defect without assistance from a teacher. That is entirely an individual matter. Some men have perseverance enough to educate themselves in this as in other respects. Proper teaching, however, saves much time and disappointment.

Henry S. Upson.

**STAPHYLORRHAPHY.** See *Cleft Palate*.

**STARCH.**—(*Amylum*, U. S. P.) (C<sub>6</sub>H<sub>10</sub>O<sub>5</sub>, or multiple). "The fecula of the seed of *Zea Mays* L. (fam. *Gramineæ*)." *Fig. 4473.*

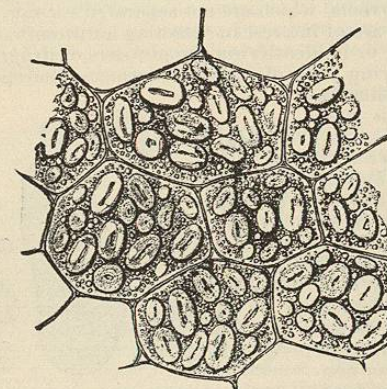


FIG. 4473.—Section of Seed of Vetch, *Vicia sativa* Linn., showing rounded granules of starch in cells otherwise filled with granular nitrogenous substance.  $\times 425$ .

U. S. P. There appears to be no special reason why the Pharmacopœia should thus restrict its requirements to corn-starch, except that this variety is cheap and abundant

and readily defined and described. Our account of starch, therefore, will apply to the entire class, and will be followed by the differential characters of the more important varieties.

Starch is the ordinary form of reserve carbohydrate nutriment in plants, at least in most of those of the higher

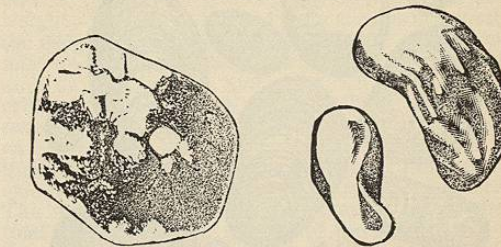


FIG. 4474. FIG. 4475.

FIGS. 4474 AND 4475.—Granules of Potato Starch Swollen by Boiling; those shown in Fig. 4475 afterward shrivelled as they cooled, or they may have lost some of their contents.

classes, and in many of those of the lower classes. It may be reserved for but a brief period, at the point where it is produced, or it may, after production, be changed into diffusible forms and transported to special storage reservoirs, where it is again transformed into starch, and may remain for months or even for years. For example, being produced only under the influence of light, it may be consumed during the succeeding hours of darkness, or, upon the other hand, it may be transported to the bulb or tuber of a desert plant, which may exist dormant in the sand for several years, consuming this starch supply upon the recurrence of a period of activity. In the most highly developed and largest family of plants, the *Compositæ*, and in some others, inulin, a related compound, altogether replaces starch as a reserve food. The amount of starch present in vegetable tissues is often very great, being about seventy per cent.

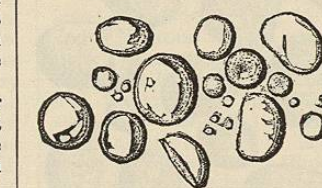


FIG. 4476.—Wheat Starch.

in dried potato, and about the same in corn meal and wheat flour. With the exception of some rare cases in which special forms are found, starch occurs in peculiar grains, which are free in the cell cavity. It originates in a small colorless body known as the amylogenic body, upon which the starch gathers in layers, the central body becoming the *nucleus*, and being located in the grain at the *hilum*. The numerous layers of the grain are discernible under the microscope by their different degrees of refraction, due apparently to different amounts of water, as they disappear under the effect of drying heat. The grains may exist singly, or coherent in masses containing a variable number. The limits of this numerical variation are often fairly constant in a given plant, and may thus be utilized as a characteristic. This cohesion often produces peculiar forms of the grains, which forms also become characteristic. Even if this is not the case, the form of the grains in a given plant is usually characteristic, as is the position of the hilum. The larger grains usually become ruptured or fissured at the hilum. This fissure may be simple or in various ways compound, and the forms so resulting are also characteristic. In all starches in the living plant there must be small grains of various sizes in process of formation, but the largest of them usually fall fairly well within certain limits, so that

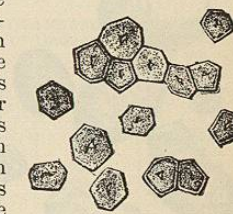


FIG. 4477.—Maize Starch.