

has been successful. In the majority of cases incision and drainage are required. In some few cases splenectomy has been performed for this condition.

SPLENIC ANÆMIA.—Clinical interest in affections of the spleen at present centres in the question whether there is a definite symptom-group which can be denoted by the title splenic anæmia. After a thorough consideration of all the data obtainable Osler concludes that from among the conditions with which anæmia and enlarged spleen are associated a well-defined disease may be separated and may well be designated as chronic splenic anæmia. Various other names—splenic pseudoleukæmia, splenic lymphadenoma, splenic cachexia, primitive splenomegaly, and Banti's disease—have been proposed for the disease, but for many reasons the simplest designation seems the best. The description which follows is taken from Osler's recent review of the subject.

Incidence.—The affection is a relatively rare one. Rolleston records thirty-seven cases. Osler by inquiry among the members of the American Association of Physicians secured the details of twenty-six cases which could be grouped under this title, and has reported fifteen cases which he himself has observed. A few other cases which possibly belong in this category have been reported by Harris and Herzog, Brill, Field, and the writer.

Etiology.—In this relation the striking thing is that no adequate explanation of the affection can be had. There is no malaria, no syphilis, no tuberculosis, no leukæmia, in short, no apparent cause for the splenic enlargement.

C. Wilson has reported a family in which in three generations six members had enlarged spleen. Collier and the writer have each reported two cases in sisters, and Brill three cases in one family. In none of the other reported cases is there any family history.

Symptomatology.—The symptoms of the affection may be briefly summarized as a remarkably chronic and often enormous enlargement of the spleen, associated with more or less marked anæmia, frequently accompanied by hæmatemesis and pigmentation of the skin, and in a few cases showing jaundice or ascites at a late stage. The splenic enlargement may exist for five, ten, even twenty-five years. The size of the spleen varies greatly, but in many instances the spleen is huge. In one of the writer's cases a girl, weighing seventy-two pounds, had a spleen weighing twelve and a half pounds. With this enormous enlargement the spleen retains its general shape, the edge remains distinct, and the notches in the anterior margin can be readily felt. Even with very large spleens the patients, as a rule, have no great pain, but complain only of a sense of weight and pressure or occasional dragging in the left side. As the organ enlarges, it emerges from beneath the left costal arch, gradually fills the left hypochondrium, then extends downward, filling the whole left half of the abdomen, and finally may pass the middle line and fill the right iliac fossa.

The anæmia which accompanies the condition is usually of a moderate grade. Of Osler's cases the average count of the red cells was 3,425,000 per cubic millimetre, the average hæmoglobin estimation forty-seven per cent. The hæmoglobin is relatively lower than the count of the red cells. The leucocytes occasionally show an increase, but are generally below normal. The differential count of the leucocytes shows nothing characteristic.

The pigmentation of the skin occurs in most of the cases, especially those of long standing. It is a general diffuse bronzing, especially upon the exposed parts of the body, very closely resembling that seen in Addison's disease.

In many of the cases the liver is notably enlarged, but without definite disturbance of its functions; in other cases the enlargement is associated with signs of obstruction and the cases suggest cirrhosis of the liver with secondary enlargement of the spleen. Ascites and jaundice, when they do occur, are terminal events in the development of the disease.

Pathology.—In this regard two quite distinct conditions have been observed. In one there is a chronic hyper-

plasia of the spleen with increase of connective tissue, atrophy of the pulp, and degeneration of the Malpighian bodies. In the other group, which has usually been described under the title of primary splenomegaly, the spleen is enormously enlarged, the fibrous hyperplasia is excessive, but in addition there are irregular spaces, apparently the enlarged and deformed spaces of the splenic pulp, filled more or less completely with very large endothelial cells, having clear protoplasm and two or more nuclei, with occasional giant cells. In the original description of Gaucher the condition was termed a primary epithelioma. The writer, after careful study of many sections from his case, concluded that the condition could not be regarded as a new growth, but was an unusual form of hyperplasia of the organ. In this view he has been supported by Harris and Herzog, although these observers do not agree in the view that the endothelial cells, which form so striking a feature of the picture, may later undergo transformation into fibrous tissue. A similar structure has been observed by Picou and Raymond, Collier, Harris and Herzog, and Banta. A remarkable feature of the writer's case was the marked pigmentation found in the spleen, retroperitoneal lymph nodes, and the liver. The lymph nodes also showed changes analogous to those in the spleen, and in the intralobular connective tissue of the liver there were groups of cells closely resembling the large endothelial cells of the spleen. As a rule the changes observed in the liver are those of a simple cirrhosis. The enlargement of this organ may be marked, but is not nearly so striking as that of the spleen.

Moderate enlargement of both external and internal lymph nodes is found in some of the cases, but this enlargement is not comparable to that of leukæmia or pseudoleukæmia.

Treatment.—The only treatment so far found effective in these cases is the removal of the spleen. Sippy tabulated seven splenectomies for this condition, to which Harris and Herzog have added twelve. Out of the total of nineteen, fourteen recovered and five died. In the majority, at least, of the recoveries the condition has been completely relieved by the splenectomy. Osler regards recurrent hæmatemesis as the most important indication for operation.

TUMORS OF THE SPLEEN.—Although the spleen is frequently involved secondarily in cancer and sarcoma, primary tumors of the spleen of any form are exceedingly rare. Both solid and cystic tumors have, however, been met with. Among the cystic tumors Litten distinguishes three groups: (1) Uni- or multilocular cysts of non-parasitic origin, including serous, blood, and lymph cysts; (2) echinococcus cysts; (3) dermoid and atheromatous cysts. These are very rare. Among 235 cases of echinococcus of the abdominal organs Finsen found the spleen the seat of the parasite in only 2, and Neisser in 900 cases of echinococcus collected from literature found 28 cases of echinococcus of the spleen. The only peculiarity of these cystic tumors is the sense of fluctuation which may be obtained upon palpation. Naturally this can be had only when the cyst has reached a considerable size. In the case of echinococcus it is claimed by some that a peculiar hydatid crepitation may be obtained upon palpation, but so great differences of opinion as to its occurrence exist, even among those who have had opportunity to study these cases, that one must doubt the value of the phenomenon in diagnosis.

Fibroma, cavernous angioma, and lymphangioma of the spleen have all been observed, but are all exceedingly rare. Carcinoma, so frequent secondarily in the spleen, is almost unknown as a primary growth. Litten says that there are ten primary cases recorded in literature.

Primary sarcoma is also very rare, secondary sarcoma of the spleen not very uncommon. A number of cases of removal of sarcomata of the spleen are on record.

The symptoms and diagnosis of these various tumors present no unusual features by reason of their occurrence in the spleen.

The only treatment must be the removal of the organ.

With the recent advances of surgery removal of the spleen has become much more frequent, and has been attended with much greater success than was formerly had. For the details of the operation and its results one may refer to the elaborate articles of Jonnesco, Bessel Hagen, Warbasse, Bolton, and Warren. From the standpoint of medicine the interest of splenectomy lies in the effects produced upon the organism by the operation, and the light which is thereby thrown upon the function or lack of function of the spleen. (Cf. also the following article.)

Effects of the Splenectomy in Animals.—Ewing briefly summarizes the results of the work of several observers as follows: Splenectomy in animals is followed by moderate reduction in red cells lasting for from one to twelve months, by relatively greater loss of hæmoglobin more slowly restored, and in some cases by the appearance, during the first year, of megalocytes. Leucocytosis follows the operation, but its extent and duration are very variable. A polynuclear leucocytosis is observed during the first days or weeks, followed by relative or absolute lymphocytosis during the first year, while during the second year distinct eosinophilia may be observed.

With these changes in the blood are associated marked cellular hyperplasia of the marrow, approaching at times that of leukæmia, and often also affecting the lymph nodes. In the swollen nodes an excessive number of nucleated red cells have been found by Winogradoff, Tizzoni, Gibson, Komloff, and Grünberg.

Effects of Splenectomy in Man.—Ewing also gives a résumé of this subject. In comparatively healthy subjects splenectomy has often been performed without affecting the blood more than does any other laparotomy. In many graver cases the loss of blood and the shock of operation give rise to a considerable grade of secondary anæmia. The red cells in favorable cases are restored in from one to three months, but in less favorable cases there may be more persistent anæmia. The restoration of hæmoglobin seems to fall behind the improvement in cells rather more than in most secondary anæmias. The operation is usually followed by considerable polynuclear leucocytosis (15,000 to 50,000) which commonly lasts from two to six weeks, but may continue for months, in which case the polynuclear cells may be largely replaced by lymphocytes. Eosinophilia has been observed in a few cases in the second and third years.

In traumatic cases suffering from large hemorrhages splenectomy, especially when complicated by infection, may lead to very profound anæmia, marked by extreme loss of red cells, the presence of very many large, pale, sometimes polychromatic, and dissolving red cells, nucleated red cells, and to a high grade of leucocytosis. Among the leucocytes there may be a considerable proportion of large, pale mononuclear cells and myelocytes, so that the blood resembles that of acute leukæmia. This condition, however, is transitory and the blood may improve rapidly.

Leukæmia and amyloid degeneration of the spleen are contraindications to splenectomy. In other conditions the choice of operation may depend entirely upon the general condition of the patient. Beyond a moderate persistent leucocytosis or lymphocytosis, and possibly a slight delay in the restoration of hæmoglobin, there are no specific effects of splenectomy in man.

It therefore appears that whatever the function of the spleen, the organ is not indispensable, and its functions may, in case of need, be performed by other parts or organs. The changes found in the bone marrow and in the lymph nodes of animals after splenectomy suggest that it is these parts that are called upon for extra work, and indicate in this way that the functions of the spleen must be, in part at least, those of the marrow and lymph nodes.

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SPLEEN, SURGICAL AFFECTIONS OF THE.—Surgical interest in the spleen is increasing, for of late years quite a number of operations have been performed upon it on account of traumatism, abscess, inflammatory enlargement, tumor, or displacement.

ANATOMY.—The spleen is placed between the ninth, tenth, and eleventh ribs, being separated from them by the diaphragm, and in its upper portion also by the lung. In gunshot wounds of the spleen, therefore, the pleural cavity is frequently opened, and an abscess of the spleen may easily break into the pleural cavity. It is held in position by a suspensory ligament which attaches it to the diaphragm, and also by an extension of the greater omentum from the spleen to the stomach, which is called the gastro-splenic omentum. Behind this membrane is situated the splenic artery with its numerous branches and the splenic vein. Any incision which is made use of to expose the spleen should give the surgeon easy access to these ligaments, in order that he may control hemorrhage when the ligaments are cut. Various incisions have been employed: for example, a vertical incision along the outer border of the rectus muscle, combined if necessary with a transverse incision parallel to the costal margin; or a lumbar incision similar to that employed for operations upon the kidney. In some cases it is necessary to resect portions of the ribs and reach the upper end of the spleen through the pleural cavity.

Traumatism.—The spleen, especially if enlarged by disease, may be ruptured subcutaneously. It may also be injured by incised, gunshot, and stab wounds. If the capsule is not torn there may be hemorrhage into the substance of the spleen, producing a large hæmatoma with subsequent cyst formation. But usually the capsule is also ruptured and there is profuse bleeding into the peritoneal cavity. The chief symptoms are those of internal hemorrhage, the source of which is not likely to be suspected except in case of open wounds. A portion or the whole of the spleen may prolapse into an open wound.

The treatment is free exposure of the organ, repair of its injuries, if slight, and removal of the spleen if the injuries are extensive. Partial splenectomy has been performed, but in most cases it is more dangerous than total splenectomy; and, since the removal of the spleen has little or no permanent effect upon the health of the individual, partial resection of the organ should generally not be performed.

The mortality following removal of the spleen after traumatism is about forty per cent. for one hundred and thirty operations, two-thirds of which were performed previous to 1900. The mortality of forty-five cases treated in 1900-1901 was only twenty-eight per cent.

Abscess.—Abscess of the spleen is usually secondary, occurring in connection with endocarditis, pyæmia, typhoid fever, acute rheumatism, malaria, etc. Primary abscess may develop in a contusion of the spleen due to traumatism. Some splenic abscesses produce marked septic symptoms and terminate fatally in a short time. Others run a chronic course, the pus breaking through the capsule of the spleen and burrowing in various directions.

The proper treatment, if a diagnosis can be made, is to expose the spleen and open the abscess. If one has to pass through the peritoneal cavity to reach the spleen, it is better to fix the organ in the abdominal wound and to wait the formation of adhesions before opening the ab-

scens. The pleural cavity should be protected in a similar way if the incision is made high up. If the spleen is in large part destroyed it should be removed.

Cysts.—A blood clot in the spleen may become transformed into a serous cyst and the spleen may be the seat of an echinococcus cyst. Such cysts should be incised and drained, or, if the spleen is badly affected, it should be removed.

Solid Tumors.—Benign tumors of the spleen are extremely rare. The occurrence of primary carcinoma is doubtful. Metastatic carcinomatous nodules occur in the spleen, but are without surgical interest. Melano- and lympho-sarcoma are the two forms of solid tumor oftenest found. The chief symptoms are a rapid increase in the size of the spleen, with pain, in a person with no history of malaria and whose blood is unaltered. The treatment is splenectomy, which, in nine cases recently reported, had a mortality of thirty-three and one-third per cent.

Enlargements from Leukæmia, etc.—The spleen may become so hypertrophied in leukæmia, malaria, syphilis, tuberculosis, amyloid disease, interstitial hepatitis, etc., that by its very size it causes the patient great inconvenience. The removal of a leukæmic spleen is usually followed by death from hemorrhage, while the few patients who have survived the operation have not been benefited by it. In the other diseases mentioned the spleen has been successfully removed. But little benefit is to be expected from this operation if the patient is greatly weakened by a serious constitutional disorder.

Splenectomy performed upon malarial patients whose general condition is fairly good is an operation which, according to Bessel-Hagen, has a mortality of less than nine per cent., and by which many patients have been improved, although they are not protected from further malarial attacks.

Movable Spleen.—Like the other abdominal organs, the spleen may acquire an undue amount of mobility. Hypertrophy usually accompanies this condition. Like a movable kidney, it can usually be replaced, but it will not remain permanently in its proper position unless it is fixed there by adhesions. It may be found in the left iliac fossa, or even in the right iliac fossa or pelvis. It does not usually produce symptoms sufficient to render operation advisable.

A movable spleen may be sutured to the abdominal wall or it may be removed. Sutures do not hold well in its capsule, and for this reason Rydygier makes a pocket between the anterior parietal peritoneum and abdominal muscles into which he slips the movable spleen. If the movable spleen is diseased or its pedicle has become twisted it is better to remove it, since splenectomy under such circumstances has only a slight mortality and produces a radical cure.

Edward Milton Foote.

SPLINTS. See *Dressings, Surgical.*

SPONDYLOLISTHESIS. See *Spine, Diseases of.*

SPONGE.—(*Sponge fine*, Codex Med.) The household articles known by this name are the horny or silky skeletons of several species of invertebrate animals belonging to the order *Ceratosa*, in the great group *Parazoa* or *Spongia*. The commercial sponges are colonial in their composition, although the outlines of individuality are very obscure. They are soft, porous, gelatinous bodies, perforated by numerous openings communicating with irregular, ramifying cavities within them, as well as with digestive and respiratory chambers, and more or less regular tubes or canals. These minute chambers are lined with flagellated cells, which are probably the organs of nutrition as well as those by whose movements a constant stream of water is kept flowing into the sponge through the fine pores and out through the larger openings. Sponges are all aquatic, and those of commerce all of marine origin, growing upon rocks or other firm foundation, at a depth of from six to a hundred or more feet below the surface of the water. They are of

slow growth, requiring from three to six years to attain a useful size. The mode of collection varies with the depth at which they are found, as well as with the habit and outfit of the collector; sometimes they are torn off the rocks by tongs or hooks, sometimes dredged for, but more generally they are gathered by divers from boats; these again may go down unprotected for three or four minutes at a time, or, equipped with modern diving-suits, make longer and deeper searches. Finally, the cultivation of sponges by fastening bits upon boards or sticks, and then sinking them to the bottom, has been proved practicable. When the sponges have been brought to land they are rubbed with sand or bruised to break up the soft parts, or exposed to the air until decomposition sets in, and then repeatedly washed and squeezed until they are clean and dried. Upon being marketed, they are carefully trimmed and assorted, according to kind, fineness, size, and shape, into numerous grades.

There are several distinct kinds, dependent upon the species producing them:

1. The *Levant* or *Turkey Sponge*, from *Euspongia (Spongia) officinalis* Linn., the finest and most expensive of all, from the waters surrounding the Grecian Islands, Asia Minor, Syria, etc. It has a soft, fine, very elastic texture, a light color, and great toughness of fibre. In shape it is rounded, tuberculated, lobed, hemispherical, cup-shaped, or irregular; it is very free from its gelatinous flesh when prepared for the market.

2. The *Zimocca Sponge*, from *Euspongia Zimocca* O. Schmidt; also a fine, strong, valuable sponge, but harsher to the feeling than the preceding, and not nearly so expensive.

3. The *Mediterranean Bath Sponge*, from *Hippospongia equina* O. Schmidt; in large, soft, rounded masses, with a loose texture and very large reticulating canals.

Besides these, this country is supplied in great abundance with cheap sponges from the West Indies; they are very inferior in texture and durability to the Mediterranean products; they are:

4. The *Reef Sponge*, *Euspongia officinalis tubulifera*, the common, cheap, fine "slate sponge." It is coarser, less elastic, and very much more tender than the Turkey sponge, and is of more or less conical shape, with a broad, cut base.

5. The *Sheepswool, Velvet, and Grass Sponges*, from various species of *Hippospongia*.

COMPOSITION.—Sponges contain a considerable quantity of fine sand, and sometimes pebbles, entangled in their meshes, which can generally be removed by mechanical means; there is also a varying amount of calcareous concretions or fragments, which stick more tenaciously and often have to be dissolved by dilute acid. These being removed, the remainder is nearly all a peculiar elastic, durable, nitrogenous substance called *spongin*, closely related in composition and texture to silk. Besides this, there are a little iodine, bromine, salt, etc.

USES.—These are mostly mechanical, and familiar to every one. Carbonized sponge, *Spongia usta*, now obsolete, used to be given for the same conditions for which iodide of potassium is now used, and owed its value to the presence of that element.

In surgery, sponges were for a long time used for packing and dilating cavities, and as absorbers of blood in operations, but the general acceptance of aseptic methods in surgery has caused them to be looked upon less favorably than formerly. For surgical operations the fine, soft, Turkey sponges, though dear, are the best.

Sponge tents, now but little used, are made by soaking fine, tough sponge in melted cacao butter, or in mucilage or alcohol, and winding very hard to a cylindrical shape with strong twine; when dry or cold the cord is removed and the surface is filed or pared to shape.

Ether sponges are fine Turkey sponges of large size, requisite fineness, and of a regular cup-shape. No inhaler has yet been made so safe or comfortable to the patient as these, but they are wasteful of ether.

W. P. Bolles.

SPRAINS. See *Joints, Injuries to.*

SPRENGEL'S DISEASE. See *Chest, Deformities of.*

SPRING LAKE WELL.—Ottawa County, Michigan. Post-Office.—Spring Lake. Hotel.

Spring Lake is a station on the Detroit and Milwaukee Railroad, three miles east of Grand Haven. The town is located on a beautiful sheet of water of the same name, five miles long and one mile wide. The resort owes its rise to the citizens of Chicago, who frequent it in considerable numbers (Walton). The following analysis was made by Prof. C. G. Wheeler: One United States gallon contains (solids): Sodium bicarbonate, gr. 0.05; calcium bicarbonate, gr. 0.13; magnesium bicarbonate, gr. 0.01; iron bicarbonate, gr. 1.01; sodium sulphate, gr. 46.70; sodium chloride, gr. 405.53; potassium chloride, gr. 4.29; manganese bicarbonate, gr. 0.05; calcium chloride, gr. 113.42; magnesium chloride, gr. 36.20; bromides, gr. 2.17; organic matter, gr. 18.29; and small quantities of lithia, alumina, silica, and ammonia. Total, 628.37 grains. In chemical composition this water resembles that of the Elisenquelle, of Kreutznach.

James K. Crook.

SPUNK.—*Fungus Chirurgorum*, Ph. G.; *Agaric de Chêne*, Fr. Cod.; *Surgeons' Agaric, Touchwood*, E.; *Amadou*, Fr. The prepared tissue of *Polyporus fomentarius* or of *P. igniarius* Fries (fam. *Agaricinea*). These are rather large species of fungi, parasitic upon the trunks of forest trees, especially of oaks and beeches. They are attached by broad bases and expand horizontally in large, roundish, hoof-shaped masses of corky texture and reddish or grayish-brown color. The upper surface is convex and marked by a series of distinct concentric rings, each indicating a year's growth. The under side is flat. The first-named species is said to yield the best product. The fungus has its upper and lower surfaces trimmed off, is softened in water, beaten with a wooden mallet into a tough, soft, and flexible buckskin-like sheet, and dried. In this condition it will absorb more than twice its weight of water. The uses of spunk are purely surgical. Before the days of modern styptic and absorbent appliances, it was largely depended upon for checking hemorrhage, through its mechanical properties, as lint and similar substances are now used. Its softness and flexibility also adapted it well to use for padding purposes. In this country its use has almost entirely ceased.

Soaked in a solution of nitre or chlorate of potassium, it becomes very inflammable, and such a preparation was enormously used as tinder before the days of matches.

W. P. Bolles.

SPUTUM is the term employed to designate the portion of the expectoration that is derived from the trachea, bronchi, and their ramifications. It is sometimes used to include the secretions from the upper air passages, and even to include the saliva and buccal secretions; it is better, however, to employ the term expectoration to designate the collective material discharged from the mouth and to use the term sputum in the restricted sense above indicated.

For its collection, special receptacles are provided. The simple paper spit-cups are inexpensive and convenient; there are also metal cups adapted for carrying in the pocket. For the hospital ward a simple porcelain cup is much used. The principle to be observed in disease is that all the expectorations shall be collected and disinfected or destroyed by burning. This is particularly important in the case of tuberculous sputa, the dried particles of which are so apt to become mingled with the dust in the air and infect those who inhale them.

The amount of the sputum in health is very small, scarcely more than a few cubic centimetres in twenty-four hours, while in disease it may increase up to 1,000 c.c. or more. The amount and character are dependent on the nature and extent of the disease process, a fact

which renders observations of the sputum of value in clinical practice.

As regards appearance, sputa, if homogeneous, are recognized as mucoid, purulent, serous, or sanguineous, for reasons which these terms suggest. Most sputa, however, are admixtures of two or three of these types and are designated accordingly; e.g., the muco-purulent sputum in many cases of bronchitis.

The consistence varies from liquid to extremely tenacious, according to the amount of mucus; serous and hemorrhagic sputa and purulent sputum, when composed of pure pus, are liquid, while a pure mucoid sputum exhibits a high degree of tenacity. I do not know that it has been determined whether the albuminoid basis is true mucin, as in saliva, or a nucleo-proteid.

The color of sputa is subject to great variation. If mucoid in character, they are transparent and nearly colorless; when the number of leucocytes is considerable they are opaque, yellowish, or, in case of nearly pure pus, greenish at times from the presence of the *Bacillus pyocyaneus*. This latter color may also be imparted by bile pigment in icterus and in perforation of a liver abscess into the lung; if the abscess is amœbic, the sputa have the color of anchovy sauce; unchanged blood imparts various degrees of reddish coloration, which may be characterized as rusty, prune-juice, bright or dark red, according to the condition; methæmoglobin, hæmatin, and hæmatoidin formed by decomposition of the hæmoglobin, impart colors varying from bread crust to chocolate or brownish-red. Sometimes decomposed blood gives a greenish or yellowish hue.

Pure mucoid, serous or sanguineous sputa are usually without odor, but where there is admixture of purulent products a slightly sweetish odor is observed; while in sputa containing pure pus and products of putrefactive decomposition a fetid odor is present, sometimes exceedingly offensive.

Macroscopic examination may be conducted by observing the material, spread in a thin layer, either between glass plates or in a petri dish, against a dark background.

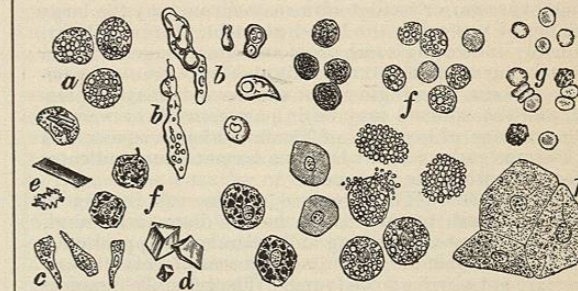


FIG. 4468.—Cells and Crystals of the Sputum. a, Alveolar epithelia; b, myeline drops; c, ciliated epithelia; d, calcium carbonate crystals; e, hæmatoidin; f, leucocytes; g, red blood corpuscles; h, squamous epithelia. (Magnified.)

In this way fragments of lung tissue, elastic fibres, fibrinous casts, spirals, and particularly the cheesy masses of tuberculosis and actinomycosis may be observed. For the recognition of spirals and casts of the bronchi it is also of service to observe the sputum when suspended in a considerable quantity of water.

Microscopic examinations are conducted: (a) By the direct examination of selected portions under the microscope, a procedure particularly valuable in examinations for crystals, the various epithelia, and for pus. (b) By the examination of the sediment obtained by centrifugalizing the sputum after it has been diluted with an aqueous solution of sodium hydroxide (about two- or three-per-cent. strength), and warmed. This sediment is especially adapted for the detection of elastic fibres. (c) By the examination of stained smears, which may be prepared as follows (W. H. Smith): Smear a selected portion thinly and uniformly on a cover-glass, fix by heat

(passing through the flame three times without burning), cover with aniline-gentian violet, heat to steaming, wash off with Gram's iodine solution, cover with the solution and steam, decolorize as much as possible with ninety-

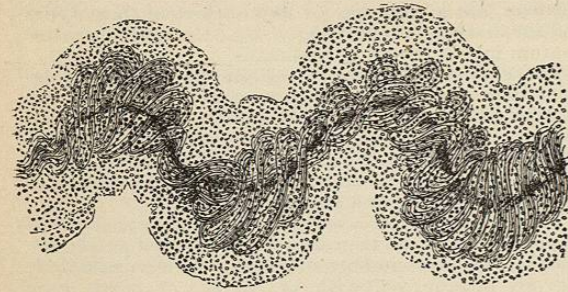


FIG. 4469.—Curschmann's Spirals. (Magnified.)

five-per-cent. alcohol, wash a few seconds in alcohol-ether, wash in water, stain for a few seconds in strong aqueous eosin, wash with Löffler's methylene-blue, cover with this, steam, decolorize slightly with ninety-five-per-cent. alcohol, wash in absolute alcohol, then in xylol, and mount in Canada balsam. In this preparation red blood corpuscles, cell protoplasm, eosin granules, cilia of epithelial cells and capsules of bacteria are stained red, nuclei blue, Gram-staining bacteria black or deep violet and Gram-decolorizing bacteria blue. Tubercle bacilli are not differentiated. (d) By the examination of smears stained for tubercle bacilli in the manner described in the article on *Bacteriological Technique* in the APPENDIX.

Abscess.—When the abscess empties itself through a bronchus there is likely to be a considerable quantity of liquid, purulent sputum with a more or less offensive odor. This same periodicity in the appearance of pus is observed in empyema and bronchiectasis, but elastic fibres, which are present in abscess, are usually absent in these conditions. Crystals of cholesterol, fatty acids, leucin, tyrosin, or hæmatoidin may accompany the large number of pus cells; the blood pigment, if intracellular, probably indicating some previous hemorrhage, if free a discharging abscess from a neighboring organ. In hepatic abscess, bile pigment or amœba coli may be present, and the sputum may be in part mucoid or watery. The presence of hooklets of *Tœnia echinococcus* or ova of *Distoma pulmonale* or *Distoma hæmatobium* indicates infection with these parasites.

Actinomyces.—The presence of the ray fungus in small (one-tenth to one-fortieth inch in diameter), round, yellowish masses, glistening and granular in appearance, is pathognomonic of the pulmonary seat of this disease. They are not always to be found. The general characters of the sputum are those of a chronic putrid bronchitis.

Asthma.—The amount of the sputum varies. It is apt to be more copious at the end of the attacks, and to be viscid, mucoid, and whitish, or pink from blood. Its occurrence in small pearl-like masses is quite characteristic. Unfolded, these masses are seen to be Curschmann's spirals, which are more common early in asthma than in any other disease, and aid in differentiating true asthma from the reflex type. Charcot-Leyden crystals are almost constantly present; eosinophiles are usually numerous, and free eosin granules may be present. Occasionally leucocytes and epithelial cells are found which contain yellow and brown masses of pigment, probably derived from the blood.

Bronchiectasis is accompanied by copious, intermittent expectoration which may be odorless, but ordinarily has a rancid factor, different from that of gangrene, is apt to be darker in color than in simple bronchitis, oily in consistency, has a tendency to form nummular masses appearing like coins (Dittrich's plugs), and casts of the minute bronchial tubes. Pus is usually present, and crystals of hæmatoidin, cholesterol and fatty acids, and Charcot-Leyden crystals may be found. Unless there is ulcer-

ation (abscess formation) elastic fibres are absent. Occasionally the sputa contain inspissated or even calcified portions.

Acute Catarrhal Bronchitis.—In the early stages the sputum is scanty and mucoid or sero-mucoid. Later, it becomes more abundant and muco-purulent, sometimes sanguineous, the change in character often being accompanied with a fall in temperature. After the lapse of two weeks the expectoration may take on the character seen in chronic bronchitis. When the bronchial capillaries are especially involved in the disease process, there is less admixture of air, and consequently a tendency for the sputa to sink in water; when the disease is limited to these smaller bronchial tubes the sputa may be scanty or absent. Microscopically, the muco-purulent sputum contains many pus cells, eosinophiles and ciliated, cuboidal, or alveolar epithelia, according to whether the larger or smaller bronchi or the alveoli are involved. The bacteria present usually include one or more of the pus organisms, and when the disease is secondary to some infective disease, e.g., influenza or typhoid, they may include the specific agent of this infection as well. Diphtheria bacilli are usually not present in the bronchitis which sometimes accompanies this disease.

Chronic Catarrhal Bronchitis.—The sputum is extremely variable, that of the dry type of the disease being scanty and perhaps occurring as tough pellets of mucus, while the expectoration of the moist type is more abundant, sometimes copious, and either serous (thin) or purulent (thick) in character. The purulent secretion is commonly yellowish-green in color. Microscopically there is commonly little of interest to be seen; numerous pus cells, a variable number of epithelia, usually cuboidal, bacteria, and ordinarily one or more of the various pus organisms, are present. In rare instances the fetid odor of the sputum justifies us in characterizing the disease as putrid bronchitis. The sputum is then usually thin, whitish, and may contain the yellow, dirty masses the size of peas which come from the smaller bronchi and are known as Dittrich's plugs. Microscopically these may contain fatty acid crystals, degenerated epithelia,

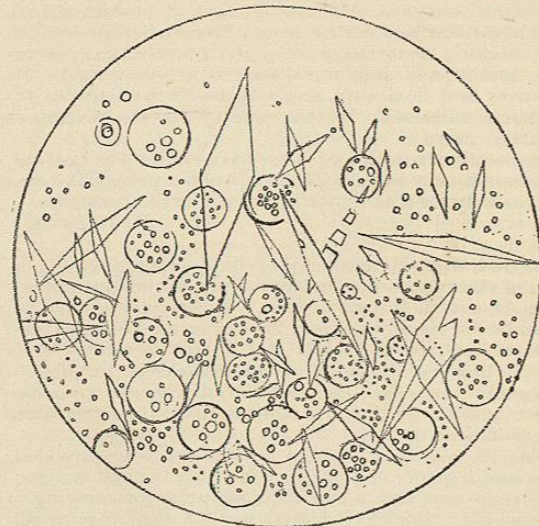


FIG. 4470.—Charcot-Leyden Crystals. (Magnified.)

spirals, and Charcot-Leyden crystals. Fetid sputum more frequently denotes bronchiectasis, gangrene, abscess, phthisical cavities, or empyema.

Plastic Bronchitis.—This is characterized by fibrinous masses, the recognition of which in the sputum forms the only means of diagnosis. If they come from the larger bronchi they do not necessarily present any recognizable form, but when they come from the smaller

tubes they appear as casts, corresponding to the ramifications of the tube. In the sputum they may be mere spherical masses more or less obscured by the mucus and pus, but when floated in water their true character may be recognized. Their presence should be suspected whenever expectoration is accomplished by severe effort.

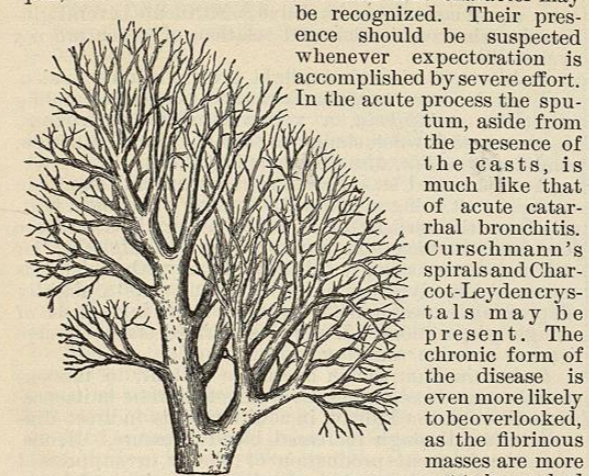


FIG. 4471.—Fibrinous Cast of Chronic Plastic Bronchitis. (Two-thirds actual size.)

presents the ordinary features of that which belongs to chronic catarrhal bronchitis.

An *empyema* that discharges into the bronchi gives rise to purulent sputa which may have an offensive odor. They differ from the sputa of bronchiectasis in the absence of oily appearance, mucous admixture, fatty acid crystals, and fibrinous casts of the minute tubes. The prevailing infecting agents are the *Streptococcus pyogenes* and the pneumococcus, the former being more frequent in children. The presence or absence of tuberculous infection is of importance.

Gangrene of the lung announces itself by a horribly fetid odor, less pungent than that observed in bronchiectasis. The sputum is apt to be tinged with blood, the color often suggesting prune juice, but being at times chocolate-colored from the development of hæmatoidin when the sputum is retained for some time before being discharged. It is frothy, in part liquid, in part muco-purulent, and may contain small portions of gangrenous lung, dark or greenish in appearance. The debris from the lung tissue does not always contain elastic fibres, as they apparently pass into solution under the strong solvent action of the ferments present. Putrefactive bacteria abound, and forms belonging to the other groups of fungi may be present. Even infusoria of the monad and cercomonad varieties are sometimes observed; they occur as minute, yellowish, slowly moving droplets. Robinowitsch in one case observed a bacillus not identical with, but morphologically resembling, the tubercle bacillus.

Active Hyperæmia of the Lungs.—The sputum is characteristic, being serous, not infrequently slightly sanguineo-serous, clear, containing the serum proteids in solution, and, in contrast to other sputa, having a high specific gravity (1.025-45).

Passive Hyperæmia of the Lungs.—As this is accompanied by a chronic catarrhal bronchitis, the sputum presents the characters of that disease plus two additional features induced by the chronic hyperæmia, namely, the presence of blood pigment, which may be in all stages of alteration, and many alveolar epithelia containing hæmatoidin crystals.

Influenza.—The pulmonary invasion is characterized by the presence of the specific bacillus in the sputum. Early in the acute stage it will be found free in the sputum, but later it is found only in the pus corpuscles. The clinical manifestations are those of bronchitis, either acute or chronic, or of bronchopneumonia. It may be a secondary invader in lobar pneumonia and even in phthisis. The

general characters of the sputum, aside from the presence of the influenza bacillus, are in general those common to the particular clinical type of the disease, though in pneumonia it is bronchitic rather than pneumonic in character. When isolation of the bacillus is desired, the following method of W. H. Smith may be employed: A small portion of the fresh sputum is suspended in sterile bouillon, and one loopful of this bouillon is spread evenly over the surface of an agar slant; then a second drop is likewise spread on an agar slant, the surface of which has been smeared with human blood. The influenza bacillus does not grow on the first agar slant, but appears on that which is smeared with human blood—after remaining at 37° C. (98.6° F.) for forty-eight hours or less—in the form of minute colonies, frequently unrecognizable without a lens, and showing in smear preparations the morphology of the influenza bacillus. Stain by floating for five to ten minutes in carbol-fuchsin, one part diluted with twenty of water.

Malignant Neoplasms.—The character of the sputa depends upon the condition which may be produced in the lung by the disease process—i.e., upon the bronchitis, bronchiectasis, œdema, ulceration or gangrene, that may be present. It may contain lung debris, including pieces of the neoplasm, and may present peculiar appearances, sometimes resembling red currant jelly, while in some forms of sarcoma it appears bright green.

Catarrhal Pneumonia.—In this disease the sputum is less characteristic than in lobar pneumonia. It may present the character of the expectoration of an acute bronchitis, with which the disease is frequently associated, or it may be scanty and mucoid. It may be tinged with blood, generally an unfavorable sign, but it has not the characteristic sanguineous character seen in lobar pneumonia. Mixed infection being the rule, more than one organism is to be expected in the sputum, though early in the disease the primary agent, most commonly the pneumococcus, streptococcus, staphylococcus, or the pneumobacillus, in the order named, is the only or chief intruder. Broncho-pneumonias, which are pulmonary complications in specific diseases, are apt to have the organism causing the disease as the primary agent, and accordingly this organism appears in the sputum; but the specific organism may be a secondary invader.

Croupous Pneumonia.—During the first twenty-four hours the sputum may be wanting, or it may consist only of small mucoid masses. In the stage of red hepatization it presents pathognomonic characters, appearing "rusty" from blood and being exceedingly viscid and tenacious. As regards the quantity of the sputum, as much as from 100 to 300 c.c. is commonly raised in a day. Microscopically it shows red blood corpuscles in all stages of degeneration, alveolar epithelia, which are in large number in desquamative pneumonia, and sometimes small fibrinous casts. The stained smears show the infecting organisms if they are the exciting cause of the disease. The presence of the pneumococcus in abundance is presumptive evidence of the disease, and is an especially valuable indication in central pneumonia. The sputum is to be watched for complications. A sudden increase of serous fluid indicates œdema; a large quantity, dark brown in color, perhaps with elastic fibres, indicates necrosis; while a copious purulent discharge points to the existence of an abscess or a bronchiectasis and the fetid character to gangrene.

Pneumonokoniosis is usually recognized from the characteristic expectoration. The general nature of the sputum is that due to the associated condition, viz., chronic bronchitis, or chronic interstitial pneumonia with its usually copious, muco-purulent, or sero-purulent sputum, not infrequently hemorrhagic and sometimes fetid, or tuberculous. The inhaled dust particles may be free or may be lodged within the leucocytes or mucous and epithelial cells. In anthracosis the color is so dark as to lead to the characterization "black spit"; in siderosis the oxide-of-iron color is seen; while in chalicosis the condition is recognized by the angular particles of silica seen under the microscope.

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

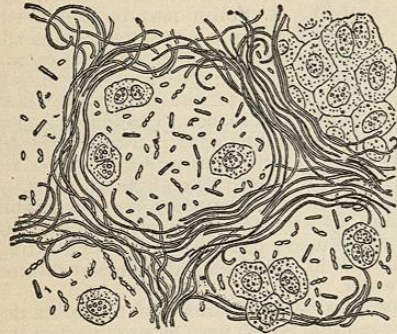


FIG. 4472.—Elastic Fibres Occurring in the Sputum. (Magnified.)

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 Scillæ*, P. G.; *Scilla*, Cod. Med.) The bulb of *Urginea maritima* (L.) Baker (fam. *Liliaceæ*), 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. ($\frac{1}{4}$ to $\frac{1}{2}$ 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 Scillæ Fluidum*, strength, $\frac{1}{10}$), dose, ℥ i.-ij.; Tincture (*Tinctura Scillæ*, strength, $\frac{1}{100}$), dose, ℥ viij.-xxiv.; Vinegar (*Acetum Scillæ*, strength, $\frac{1}{10}$), dose, ℥ xv.-lx.; Syrup of Squills (*Syrupus Scillæ*), dose, 4-8 c.c. (3 i.-3 ij.). The Compound Syrup (*Syrupus Scillæ 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