

*Fractures of the Lower Ends.*—Separation of the tibial epiphysis is caused by eversion or inversion of the foot. The line of fracture runs well above the articular surface. The foot is to be immobilized in such a position as to retain the fragment in place. Union may be followed by cessation of growth in the tibia and inversion of the foot from overgrowth of the fibula.

*Supramalleolar fractures* usually show the same features as epiphyseal separation, but if there is extensive comminution there is the added danger of a stiff ankle.

The fibular epiphysis is often separated in Pott's fracture.

*Pott's Fracture.*—This is by far the commonest fracture of this region. It is the injury of the ankle quite as Colles fracture is the injury of the wrist, and yet the rational principles upon which the treatment of this fracture must be based are commonly misunderstood, and Pott's fracture is casually spoken of as an injury from which a perfect recovery is not to be expected. On the contrary, it has been my experience that a good result may and should be expected, and will be obtained by appropriate treatment.

Pott's fracture is caused by indirect violence, a twist of the foot. The twist is outward, causing a "fracture by eversion and abduction." Inversion and adduction cause a simple "malleolar fracture" (see below).

The lesions of Pott's fracture (Plate XXVIII., Figs. 10 and 11) are: (1) fracture of the internal malleolus or rupture of the internal lateral ligament; (2) diastasis of the tibio-fibular joint caused by the rupture of the tibio-fibular ligament with perhaps avulsion of the adjoining bone; (3) fracture or epiphyseal separation of the external malleolus; and (4) an outward and backward displacement of the foot. This displacement is due to the tibio-fibular diastasis, which allows the powerful tendo Achillis to draw the foot backward while the lack of support on each side allows the peroneal muscles to hold the foot in the position of eversion and outward displacement into which it has been forced. Compound fracture, which is rare, is usually the result of excessive or prolonged violence, which forces the internal malleolus through the tense skin of the inner side of the ankle while the foot is held abducted. The fragment of the internal malleolus may be so rotated as to require operative reposition.

The symptoms of Pott's fracture vary between the limits of acute continuous pain with entire disability and a mere aching and soreness without any great loss of function during the first hours after injury. The physical signs are, however, constant and definite. There is more or less contusion about the ankle, and in many cases the outward (Plate XXVIII., Fig. 10) and backward displacement of the foot is so marked that the nature of the injury is manifest. There are, moreover, several pathognomonic signs. Three points of tenderness are always present: one over the line of fracture of the internal malleolus, usually near the tip; a second over the fracture of the fibula, usually at the junction of the shaft and malleolus; and a third in front of the ankle between the bones of the leg marking the site of the ruptured tibio-fibular ligament. Another characteristic sign is lateral mobility in the ankle joint. This is elicited by grasping the foot firmly with one hand (the palm of the hand beneath the sole, the thumb under one malleolus, and the fingers under the other) and moving it bodily from side to side, while the leg is steadied by the surgeon's other hand. If there is lateral mobility the astragalus may be felt to glide smoothly from side to side, and may usually be brought up against one or other malleolus with a distinct click. Abnormal forward and backward mobility may also be elicited. It may be impossible to produce crepitus. Extension and flexion of the ankle is painful, but upward pressure on the heel is not.

*Treatment.*—The backward displacement and eversion are overcome by drawing the foot forward and inverting it sharply. Comparison with the sound limb will readily determine whether the backward displacement has been corrected; the eversion should, however, be overcorrected, for while there is no danger of the foot becoming

fixed in abnormal inversion, hyperinversion pulls the fibular fragment downward and inward into place and at the same time leaves no possibility of any permanent eversion. The foot must be kept at a right angle with the leg.

In splinting care must be taken to maintain the reduction inward and forward and at the same time to prevent a drooping of the foot from traction by the tendo Achillis. Stimson's posterior and lateral plaster splints are admirably suited to this purpose. The posterior splint runs from just below and behind the knee down over calf, ankle, heel and sole, to the toes. The lateral "stirrup" splint begins just below the head of the fibula, and runs down the outer side of the leg, over the sole of the foot (and the posterior splint) and around to the outer side of the dorsum of the foot. The foot is held in proper position while the splints are applied. This apparatus is more secure than wooden splints and allows inspection and correction of the deformity better than the familiar plaster encasement. The patient should be kept in bed a few days with the leg elevated on pillows. He may be allowed about as soon as the primary reaction has subsided (at which time a new splint is usually required). If the splints are not sufficiently strong or are loosely applied, the foot will sag. This is not likely to occur before the second week, when the splints have begun to wear out. The tendency is overcome by applying a new moulded splint, or an orthopaedic splint made with a movable foot-piece on two lateral braces of metal, or even a plaster encasement or by dividing the tendo Achillis.

Union is firm at the end of six weeks, but six weeks more are usually required to limber up the ankle joint and to overcome passive edema. When reduction is properly maintained, a perfect ultimate result may be predicted, if due allowance be made for extreme old age, rheumatism, gout, etc.

Old unreduced or imperfectly reduced fractures are very disabling. The eversion causes a constant drag on the ligaments of the inner side of the ankle, while the backward displacement limits dorsal flexion and makes the gait stilted. The eversion may be corrected by supramalleolar osteotomy, but the backward displacement can be corrected only by opening up the old lines of fracture in the tibia and fibula, chiselling away any exuberant callus, and reducing the fracture as though it were a recent one.

*Malleolar Fracture.*—The malleoli may be broken by direct violence; but the fracture is commonly caused by inversion of the foot. Only the external malleolus may be broken, usually near its tip, or the internal malleolus as well may be fractured. There is no tibio-fibular diastasis, nor any dislocation of the astragalus, as in Pott's fracture.

The symptoms of disability, pain, and ecchymosis, point to some injury about the ankle joint. Examination reveals one or two points of local tenderness over the external or both malleoli; but there is no tender spot in front of the ankle and the lateral mobility characteristic of Pott's fracture can rarely be demonstrated. Independent mobility of the fragments may sometimes be elicited. In a few cases the fracture of the tibia has been so high as to carry away a large part of the articular surface with the fragment. In such cases lateral mobility and backward displacement of the foot are possible; but the condition may still be differentiated from Pott's fracture by the absence of the anterior tender point, and by recognition of the large tibial fragment, which is displaced upward and inward.

The foot usually requires only fixation at a right angle for five weeks while the fragments unite. When there is any tendency to displacement the foot must be well drawn forward and immobilized in a position of natural right-angled flexion. Hyperinversion would be liable to cause mal-union of the tibial fragment.

The prognosis is generally good, though when the tibial fragment is large the usefulness of the joint may be imperilled by exuberant callus.

*Fracture of the Bones of the Foot.*—*Tarsal Fractures:* The bones of the tarsus are rarely broken. The only fractures of any clinical importance are those of the astragalus and os calcis. A compound fracture of either or both is readily diagnosed and is treated according to the surgical and mechanical requirements of the case by antiseptics and excision or reposition of fragments. When the fracture is a simple one, the diagnosis may be impossible without the aid of the x-rays. Such cases do well under simple immobilization and massage until the foot will again bear the weight of the body. If a fragment is irreducible it may be excised or replaced by operation. Avulsion of the tendo Achillis does well under expectant treatment. Even when there is marked separation satisfactory union may be anticipated within six or eight weeks.

*Metatarsal and Phalangeal Fractures.*—These present the same features as the homologous fractures of the hand.

*FRACTURE OF THE RIBS AND STERNUM.*—*Fracture of the Ribs:* This is one of the commonest of all fractures. It is usually caused by a crushing force, such as a fall upon the chest or a heavy blow. The ribs give and then break. Fractures by direct violence are not uncommon. Multiple fractures are frequent, although the two upper and lower ribs almost always escape. Green-stick fractures occur but usually pass unrecognized. The rib is usually broken between the mammary and mid-axillary lines. Displacement is unusual unless the whole side is caved in. There is localized pain at the point of fracture, which may be elicited by compressing the chest sharply from before backward. Crepitus may be elicited by gentle manipulation of the fragments, and by deep inspiration. It may be inaudible unless a stethoscope is used.

The fracture of a rib is not a matter of great importance. There is usually severe persistent pain for several weeks; yet a contusion may cause as much. There may be puncture of the lung, mediastinum, or heart, resulting in any one of the many conditions due to wounds and contusions of these viscera (*q. v.*); but these internal injuries can and do occur as a result of simple contusion without any fracture, and hence when they occur in connection with fracture it is by no means proved that they are caused by the broken bone. They are not necessarily complications of the fracture, and their symptoms and treatment are not modified by the presence of a broken rib.

*Treatment:* A strip of adhesive plaster five inches wide and eighteen inches long having been prepared, the patient is instructed to take a deep inspiration followed by a deep expiration. At the depth of expiration the adhesive strap is rapidly applied, beginning at a point close to the spine, on the sound side, and following the curve of the broken bone around nearly to the opposite nipple. This strap, applied as tightly as possible, splints the side and minimizes the movements of respiration which constitute one of the chief causes of pain. Several overlapping straps increase the support. Rest in bed adds to the patient's comfort but is by no means necessary. Union is firm in four weeks.

*Fracture of the Sternum:* These fractures are rare at best. They are most often breaks at or near the junction of the manubrium and the body of the bone. The lower fragment is displaced forward as a rule. The fracture has been caused by muscular effort. The prognosis depends upon the shock and the internal injuries. Uncomplicated cases do well.

Reduction is accomplished by direct pressure on the displaced fragment aided by hyperextension of the spine, the patient lying over a block or box, and breathing deeply. When manipulative efforts fail, operative reduction may be attempted by such means as drawing the depressed fragment forward with a small corkscrew, or removing the overlapping portion of the anterior fragment. Such operations only may be undertaken with due respect for the vital organs lying directly beneath the bone.

Edward L. Keyes, Jr.

FRAMBESIA. See *Yaws*.

FRANGULA. See *Buckthorn*.

FRANKLIN SPRING.—Franklin County, Georgia.

POST-OFFICE.—Royston.

ACCESS.—Via Elberton Air-line Railroad to Royston, thence two miles by hack line to springs. This spring has had considerable reputation as a resort for invalids as far back as the oldest citizen can remember. Qualitative analysis: Iron carbonate, calcium sulphate, magnesium sulphate, sodium chloride, aluminum sulphate, potassium sulphate, iron protosulphate, sulphuretted hydrogen gas.

This water contains sufficient aluminum to render it valuable in chronic diarrhoea and dysentery and useful as a local application in ulcerative skin diseases. The deposit of iron in the spring was used to some extent during the late war to supply the place of coppers. The temperature of the water is 60° F. and the flow two and one-half gallons per minute. The climate is good and near by is some very fine mountain scenery. There are facilities for bathing and the neighborhood offers numerous features of interest. James K. Crook.

FRANZENSBAD.—An Austrian village on the frontier of Bohemia, 1,300 feet above sea-level, renowned for its mineral springs and baths, ranking next in popularity to Marienbad, and at present resorted to chiefly by women. The climate is mild, but is subject to sudden change.

The springs are eleven in number, namely: (1) Wiesenquelle; (2) Kalter Sprudel; (3) Franzensquelle; (4) Louisenquelle; (5) Neuquelle; (6) Loimannsquelle; (7) Stahlquelle; (8) Mineral Sprudel; (9) Salzquelle; (10) Oestliche, and (11) Westliche. Of the numerous gas springs in the vicinity, several are used for charging mineral water and to supply the gas baths. The chemical composition of the principal springs varies so little as to hardly justify the usual division of them into four classes.

The Wiesenquelle, Kalter Sprudel, and Franzensquelle are considered therapeutically most important, resembling in composition the springs of Carlsbad and Marienbad. The Franzquelle, "the mineral spring of Egra," is enclosed in a temple-like building. The fount contains 20,000 cubic inches of clear, sparkling water, of about 50° F. the year round, which is, with slight variation, the temperature of the other springs. Exposed for several hours to the atmosphere, the water becomes turbid from precipitation of carbonate of iron. Its taste is agreeable, though slightly ferruginous. The other springs are provided with equally elegant surroundings. The Kalter Sprudel produces 3,648 cubic inches of water a minute, accompanied by an escape of free carbonic acid so abundant as to produce the sound of a boiling caldron. The Louisenquelle is the largest in water supply. Its fount contains 6,861,738 cubic inches, flowing 27,000 cubic inches a minute, and the escape of free carbonic acid is tumultuous.

COMPOSITION.—Sodium sulphate predominates in all the springs, varying from 10.897 grains in a pint of the Mineral Sprudel to 26.926 grains in the Kalter Sprudel; the Wiesenquelle containing 25.643 grains. The other ingredients are the carbonates of iron, manganese, sodium, calcium, magnesium and lithium, sodium chloride, calcium phosphate, and traces of silicates.

INDICATIONS.—The Franzensbad waters, especially those of the Salzquelle, Wiesenquelle, and Kalter Sprudel, are recommended for: (1) Chronic catarrhs, especially chronic gastritis, constipation and cystitis; (2) hyperæmia and moderate hypertrophy of the liver and spleen; (3) disorders of the uterine system; (4) scrofulous affections and gout; and (5) as an after-treatment to Carlsbad and Marienbad.

The Franzensbad and Stahlquelle have been recommended chiefly for: (1) anæmia after hemorrhage, notably that following repeated miscarriages, and exhausting diseases in scrofulous, rachitic, or scorbutic constitutions; (2) diseases of the abdominal or sexual organs with anæ-

mia; (3) slow development of puberty, chronic uterine or vaginal catarrhs, abnormal menstruation, and (4) nervous diseases, especially the neuroses.

**Peat Baths.**—These are among the most noted in Europe. The fresh peat has a gray or yellowish-gray color, acid reaction, and an odor of sulphurous acid. It is dug up in the autumn and placed in heaps, where chemical changes occur, forming a large number of sulphates, and the mass becomes jet-black, smooth, and homogeneous. In the bath-house, it is diluted with water from the Louisenquelle and heated by steam to 70° or 80° F. The bath is said to be invigorating to the system as well as stimulating to the skin.

The peat baths are recommended for: (1) anæmia and chlorosis, chronic rheumatism, gout, scrofula, and rickets; (2) various neuroses, paralysis not of cerebral origin, the early stages of progressive muscular atrophy, concussion of the spine; (3) sexual disturbances, a tendency to abortion, prolapsus uteri, loss of virility; (4) to aid the absorption of exudates and the infiltrations of intermuscular connective tissue, synovial sacs, ligamentous structures and glands.

**Gas baths** are also administered, the entire body, except the head, being enclosed in a chamber resembling the ordinary vapor-bath cabinet. *James M. French.*

**FRAXINELLA.** See *Rutaceæ*.

**FRAXINUS.** See *Ash Bark*.

**FRENCH LICK SPRINGS.**—Orange County, Indiana. POST-OFFICE.—French Lick Springs. Hotel at West Baden, one mile distant.

This is one of the old spring resorts of Indiana. The springs are thirteen in number, of which several have been analyzed. The flow of water amounts to about eleven hundred gallons per minute. The following analyses are supplied by the United States Geological Reports, and were made by J. G. Rogers, analyst:

ONE UNITED STATES GALLON CONTAINS:

Solids.	Grains.	
	Proserpine Springs.	Pluto's Well.
Sodium carbonate.....	10.52	1.59
Magnesium carbonate.....	4.50	6.95
Calcium carbonate.....	20.29	6.95
Iron carbonate.....	2.49	Trace.
Aluminum carbonate.....	36.72	22.37
Sodium sulphate.....	29.33	18.12
Magnesium sulphate.....	141.00	60.59
Calcium sulphate.....	90.92	140.54
Sodium chloride.....	5.91	5.35
Potassium chloride.....	8.05	
Magnesium chloride.....	1.69	
Silica.....		Trace.
Alumina.....		.54
Undetermined matter.....		
Total.....	350.52	256.05
Gases.	Cu. in.	
	Proserpine Springs.	Pluto's Well.
Carbonic acid.....	10.116	Not determined.
Sulphuretted hydrogen.....	17.000	

These are very good examples of sulphuretted saline waters, and are useful in those diseases to which that class of water is applicable. They are used commercially at the present time. *James K. Crook.*

**FRONTAL SINUSES, DISEASES AND INJURIES OF.**—ANATOMY.—The frontal sinuses are two irregular-shaped cavities, which extend upward and outward a variable distance between the two tables of the frontal bone, upon the vertical portion of its internal surface. They are situated one upon either side of the base of the nasal spine, between the latter and the orbital plate.

They are separated from each other by a thin, bony partition. In size they vary in different individuals, and are, as a rule, larger in the male than in the female sex. The frontal sinus of the left side is commonly the larger of the two. They are sometimes subdivided by incomplete bony laminae. They open into the middle meatus of the nose through the infundibula, and occasionally communicate with each other by apertures in the septum. They are absent at birth, but appear during the first year of childhood, and remain of small size up to puberty, at which time they undergo considerable enlargement from the recession of the brain. In advanced life they increase in size by absorption of the cancellated tissue in their vicinity. In their development they are practically formed from the diploë. Large frontal sinuses do not necessarily imply large external prominences over

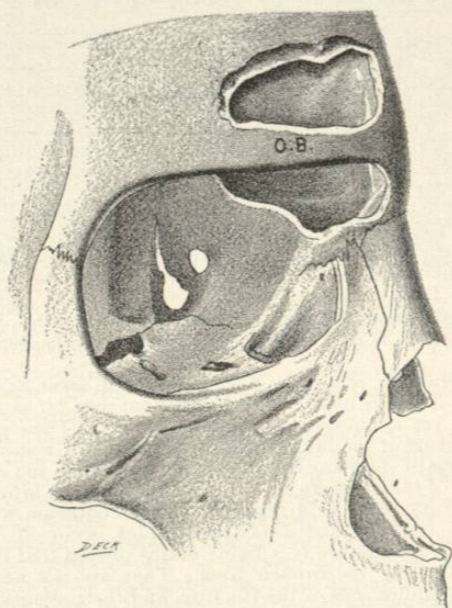


FIG. 2227.—Frontal Sinus, the Anterior and Inferior Walls of which have been Removed, with the Exception of an Osseous Bridge, Corresponding to the Orbital Margin. (After Killian, in Heymann's "Handbuch der Laryngologie," etc.)

the glabella and superciliary eminences. They are lined by mucous membrane, this being continuous with that lining the middle meatus of the nose through the infundibula. This mucous membrane, like that which lines the antrum of Highmore, is notably thin and pale. Its blood supply is derived chiefly from the internal maxillary and ophthalmic arteries, and by anastomosis of these with the lateralis nasi branch of the facial artery. Its nerve supply is principally from the first and second divisions of the fifth cranial nerve. In the middle meatus of the nose the communication through the infundibulum of either side with the frontal sinus is partially hidden, and sometimes practically closed by a projecting fold of mucous membrane.

**DISEASES AND INJURIES.**—Owing to the continuity of tissue and similarity of anatomical structure, the affections of this sinus, like those of the other accessory cavities of the nose, resemble to a greater or less degree those of the nasal fossæ proper. They may be conveniently grouped, for purposes of study, under the general headings of inflammations, acute and chronic (frontal sinusitis), and their sequelæ; tumors, the only primary forms described by modern authorities being osteoma and sarcoma; trauma of the sinus wall, which comprises fissure, fracture, impressions, etc., usually associated with hæmatoma of the sinus; and foreign bodies, which are nearly

always projectile, but which also comprise insects and their larvæ. Generally speaking, the diseases of these sinuses occur with great infrequency, although trauma

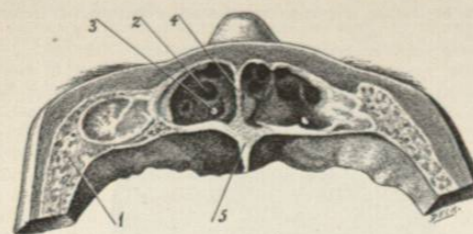


FIG. 2228.—Horizontal Section through the Frontal Sinus. (One-half actual size.) 1, Frontal bone; 2, frontal sinus; 3, aperture of the frontal sinus; 4, septum between the frontal sinuses; 5, frontal crest. (After von Mikalkevich, in Heymann's "Handbuch der Laryngologie," etc.)

is of somewhat common occurrence, by reason of the exposed situation of the anterior sinus wall.

**Sinusitis Frontalis.**—The acute form of this disease generally results from the extension, by continuity, of a coryza, especially when the latter accompanies influenza. Acute sinusitis is frequently found in autopsies upon those who have died of acute infectious diseases. In this affection the mucosa becomes congested and œdematous, often to the extent of obliteration of the cavity. The exudate is usually purulent, but may be mucous or even serous. A fibrinous exudate is not known to occur.

Of the symptoms headache is the most constant. Constitutional reaction is indicated at times by the presence of fever, vertigo, vomiting, etc. Ocular reflexes are often seen, consisting of lachrymation, photophobia, colored vision, spectra, sense of pressure, etc. Edema of the upper eyelid and exophthalmus are now known to occur at times.

The secretions, while they may escape to a greater or less extent into the nose, tend to accumulate, by reason of œdematous obstruction of the sinus outlet.

The disease supervenes suddenly in the majority of cases. Its course is brief and usually terminates at the end of the first week in the evacuation of the sinus and the subsidence of the inflammatory œdema which has produced more or less retention of the effusion within the cavity. In a certain proportion of cases, however, this favorable termination does not transpire and the disease then becomes chronic.

Acute sinusitis is often complicated by serious affections due to direct extension of the original malady. Periostitis is common, the orbital wall of the sinus being the principal sufferer in this respect. While this process may terminate in ulceration or necrosis of the bone, with resulting infection of the orbit, the fact is now well attested that the latter cavity may become inflamed without previous organic disease of the bony wall. This extension through osseous tissue without the serious participation of the latter is also seen in the endocranial lesions which occasionally follow acute frontal sinusitis. This mode of termination of the latter affection is attributable in most cases to phlebitis and thrombosis of the veins which traverse the walls of the sinus. In this manner the brain may be imperilled long before sufficient time has elapsed for organic perforation of the bone. Endocranial infection having once occurred, a variety of pathological processes may be set up, including extra- and intradural abscess, meningitis, encephalitis and cerebral abscess, thrombosis of the superior longitudinal sinus, etc.

Chronic frontal sinusitis, while a sequela, as a rule, of the acute affection, may be due exceptionally to one form or there may be several causes. It may undoubtedly result from the extension of an ozæna; or it may be due to a trauma affecting the sinus or its immediate vicinity. Syphilis, tuberculosis, and carcinomata which develop near the sinus may readily implicate the latter, although the present state of our knowledge enables us to state that

these serious affections seldom or never originate in this cavity.

There is evidently some special principle involved in virtue of which an acute sinusitis may become chronic. When the sinus first becomes inflamed the anterior ethmoidal cells are usually implicated. When the sinusitis proper undergoes resolution, these accessory cavities may remain inflamed; and from this focus the chronic œdema and polypoid hypertrophy which characterize chronic sinusitis may readily develop. The irregularities which occur in the anatomy of these accessory cells should be reckoned with as factors in individual cases. Finally, one frontal sinus may infect its fellow through perforation of the septum, or this may occur even without any previous solution of continuity in the latter.

The constant pathological features of chronic sinusitis consist of œdema with a certain amount of polypoid hypertrophy. Fibrinous exudation, non-existent in acute sinusitis, may develop in time in the course of the evolution of the chronic type of inflammation.

From the clinical point of view, chronic frontal sinusitis presents two phases, according as the inflammation terminates in dilatation or in destruction of the bony walls and abscess. In the earlier stages of the process symptoms may fail entirely or they may be of the same character as those of the acute type (headache and numerous ocular disturbances of a reflex character).

In regard to chronic sinusitis with termination in dilatation, Killian<sup>1</sup> has collected and analyzed the entire recorded material (some sixty-four cases), with the following results: Dilatation of the sinus may develop at any time from the first to the twentieth year of the disease. The resulting cavity usually attains the size of a pigeon's egg, although it may exceptionally have the capacity of half a pint or more. The orbital wall is the one most disposed to yield to the pressure from within, although the entire bony capsule may suffer. The osseous structures may come to assume the thinness of parchment.

The secretions, the accumulation of which distends the sinus, are usually mucous or muco-purulent, while in rare instances they are serous in quality. The mucous variety is of especial interest, as it represents the condition often described under the name of *mucocele*. The idea of a separate disease with the latter designation appears to have originated in the peculiar qualities of the fluid, which is very tenacious and gelatinous and of variable

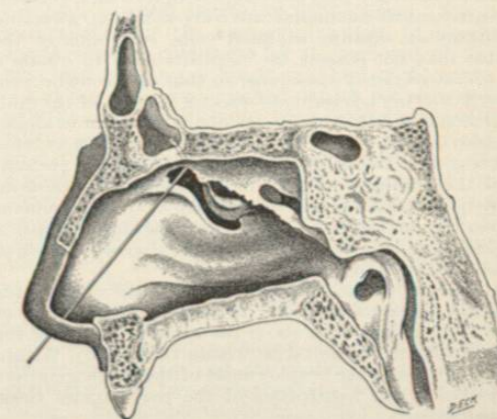


FIG. 2229.—Sagittal Section through the Frontal Sinus, Showing Probe Passed into the Sinus from the Middle Meatus. (After Lichtwitz.)

color. Cholesterol crystals are sometimes obtainable from these collections. "Mucocele" has been held to be of cystic nature, and its inflammatory origin has been unsuspected by many writers. In about three-fourths of the cases of mucocele examined, the outlet of the sinus was accurately closed. Dilatation can occur in sinusitis

only in connection with the molecular absorption of bone.

The other mode of termination of chronic sinusitis, viz., in abscess and destruction of the sinus wall, appears to be nearly twice as common as that which is characterized by dilatation. Our knowledge of this destructive type is largely derived from Killian's analysis of the one hundred or more recorded cases. This aspect of sinusitis is eminently chronic, and in not more than a sixth of the cases did the destructive process manifest itself within the first year of the disease. We know that in these cases the sinus must have become infected in connection with an acute sinusitis; and thus the old "retention" hypothesis is rendered untenable.

The first organic change which takes place is ulceration of the lining membrane of the sinus. The denuded bone either becomes carious or secondary periostitis leads to necrosis, with expulsion of sequestra. In the majority of cases these organic changes affect the orbital wall of the sinus. Killian gives the localization as follows: Orbital wall, 66½ per cent.; cranial wall, 16½ per cent.; frontal wall, 16½ per cent.

As in acute sinusitis, a considerable percentage of cases of infection of the orbit and encephalon occur without demonstrable lesion of the bony wall. Of twenty cases of endocranial infection, the bone was perforated in seventeen. The lesion most commonly produced in these cases was cerebral abscess.

The symptoms of the destructive and purulent form of chronic sinusitis vary greatly. Pyorrhœa nasalis may be abundant and fœtid. Pain is often a conspicuous feature. Infection of the orbit, with or without perforation of the orbital wall, tends to the formation of an abscess. Swelling of the lids results, and displacement of the bulbus oculi produces diplopia. Rupture of the abscess produces a fistulous opening, the pus tending to accumulate in the conjunctival sac. The fistula causes shortening of the upper lid. Optic neuritis is occasionally seen as a complication.

The symptoms of endocranial infection closely resemble those which supervene in disease of the middle ear.

In the diagnosis of suspected dilating sinusitis—equivalent to the "latent" sinusitis of some authors—the practitioner should first cocaineize the middle turbinate. A nasal speculum with blades adapted for inspection of the middle meatus will render good service in the hands of an expert. But the middle meatus may itself be the seat of inflammation and polypoid hypertrophy; and, furthermore, anatomical anomalies are very common, affecting the turbinates, septum, ethmoid cells, etc.; finally, the operator may not possess the requisite skill to obtain a view of the outlet of the sinus, so that as a routine procedure it is often advisable to resect a portion of the middle turbinate and then make use of the probe or cannula. In employing the probe we must bear in mind that there are at least two fatalities upon record, due to the perforation of the cranial floor by the instrument in question. Experienced operators advise practice upon the cadaver or upon an anatomical preparation, the instrument, a flexible silver probe, being bent at every possible angle to facilitate its introduction.

The old test for the presence of the probe in the sinus was one of mensuration, viz., as soon as the bent end of the instrument is an inch above the anterior process of the middle turbinate, it should be within the sinus. Within the past few years the employment of the Roentgen rays has assisted in the localization of the probe under these circumstances.

If a gush of pus follows the penetration of the probe into the outlet of the sinus, this occurrence might be regarded as *prima facie* evidence of latent empyema, were it not for the fact that certain anomalies of the ethmoid cells are known to occur, in consequence of which we may have to distinguish between frontal sinusitis and anterior ethmoiditis, which affections, more frequently than not, coexist.

If an escape of pus does not take place from probing, the fluid may sometimes be flushed out by substituting

a fine cannula for the probe, and forcing air into the sinus.

Second only to the foregoing as a diagnostic resource is the presence of induced tenderness over the sinus. Headache, being a symptom of such common occurrence,

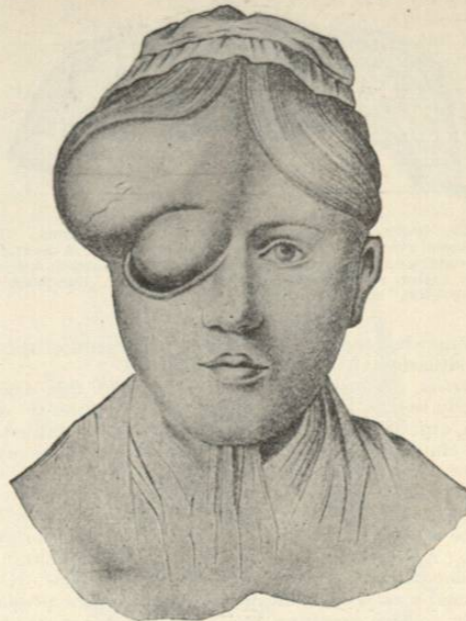


FIG. 2230.—Mucocoele of the Right Frontal Sinus. Case of a girl seventeen years of age. (From Gerber's "Atlas der Krankheiten der Nase," Berlin, 1901.)

is of little value in diagnosis. Tenderness may be elicited at the external and orbital walls of the sinus by percussion and palpation; but simple hypersensitiveness is not pathognomonic, because it has been encountered in hysteria. When tenderness of the orbital wall is associated with thickening due to periostitis, and when orbital cellulitis has already set in, the diagnosis is placed beyond doubt.

Chronic empyema of the frontal sinus may lurk beneath the picture of trigeminal neuralgia. Hajek<sup>2</sup> has especially noted this source of confusion in connection with influenza.

In dilatation of the sinus with resulting attenuation of its walls, a yielding and peculiar crackling sound have occasionally been elicited on pressure; these effects resembling those which result from compressing the lid of a tin box.

If the sinus cannot be probed through its outlet, the question of exploratory puncture of the sinus wall must be considered. Opening the floor of the sinus through the nose with an electric drill controlled by lateral illumination of the forehead with Roentgen rays (as advocated by Spiess) appears to be too hazardous a procedure. It is sometimes possible to open an infundibular cell which communicates with the sinus, and an exploratory puncture for this purpose may be safely essayed just in front of the middle turbinate. The method of transillumination of the sinus, while not trustworthy, has exceptionally proved of great diagnostic value. The establishment of an opening from without, for diagnostic purposes, is sometimes justifiable, especially if there is a prospect that the radical operation will be required.

Killian's diagnostic summary is as follows: Simple dilatation is recognized by the local deformity and displacement of the eye, the absence of pain, slow evolution, and parchment-like crackling or fluctuation. Exploratory puncture may be required to differentiate between dilatation and osteoma.

Ulceration is usually announced by circumscribed peri-

ostitis, abscess, perforation, fistula, or caries. Pressure over the sinus is often followed by an escape of pus into the nose. Liquids may be forced into the sinus through its intranasal outlet, and they may then escape by the fistulous opening.

Cerebral implication should be easy of recognition; but if this secondary disease pursues a latent course, diagnosis is impossible without laying open and inspecting the sinus cavity. Since the encephalon may be infected without the existence of a perforation, it is often necessary to expose the dura before coming to a definite conclusion. If the dura is healthy, it is extremely likely that the parts beneath are quite intact. If the dura is not in a healthy condition it must be laid open, unless spontaneous improvement follows its exposure. The presence of intrameningeal pus may then be discovered, and a fistula may show that the pus proceeds from a cerebral abscess. In any case the cerebral cortex should be carefully studied, and it may be advisable to puncture the brain for supposed abscess.

Treatment.—Acute sinusitis requires, as a rule, only expectant treatment, consisting of rest in bed; diaphoresis; warm applications to the brow; inhalation of steam; and the administration of such remedies as phenacetin, salol, etc. To the preceding may be added Politzerization and cocaineization of the nose.

If these measures do not give relief, the middle turbinate should be resected and the sinus irrigated with warm saline solution. In those rare cases in which the acute formation of pus threatens the encephalon, the sinus should be laid open through its outer wall. It may also be necessary to enter the cranial cavity through the posterior wall of the sinus, split the dura, and give vent to an abscess in the frontal lobe of the brain; or even to extirpate a portion of the cortex. After intervention of this sort, thorough external drainage is all-important.

In chronic frontal sinusitis Hajek is a firm believer in the routine resection of the middle turbinate. He recommends this resource in any case of sinusitis, without regard to the degree or stage of the inflammation. Surgeons and ophthalmologists (and even many rhinologists) do not countenance such a radical procedure, save in special cases. Hajek believes that timely intervention through the nose would often prevent the occurrence of orbital and endocranial complications.

After suppurative complications have occurred, nothing of course is to be gained by resecting the turbinate.

In the majority of cases the operation of turbinectomy is tantamount to a radically curative procedure. Exceptions occur in those cases in which a high degree of destruction has transpired in the mucous lining or bony walls of the sinus.

The immediate results of extirpation of the middle turbinate is an increased amount of secretion. Not until one or two weeks have elapsed do we find a change in the character of

the discharge, which then tends to consist of mucus alone. Some secretion remains in evidence for a longer or shorter interval, but in many cases it ceases by the end of the second month.

Hajek has treated 27 cases of chronic empyema according to the principles just enunciated, and has been able



FIG. 2232.—Empyema of Both Frontal Sinuses, with the Formation of a Large Sequestrum of the Outer Plate of the Frontal Bone and of a Tumor Containing Air Beneath the Frontalis Muscle. (From Gerber's "Atlas der Krankheiten der Nase," Berlin, 1901.)

to follow up his material indefinitely. In 9 cases the discharge ceased absolutely, while in 11 others it persisted in a mild form. The remaining 7 cases continued to discharge pus, but 4 of these were materially benefited. Hajek regards these figures as equal to the results of complete surgical destruction of the sinus. The patients naturally prefer the conservative form of intervention. Hajek uses the cold snare for the removal of the turbinate, and takes away about one-third of the bone.

But the intranasal method, which requires special apparatus and skill in its use, has a limited range of applicability; and many surgeons are naturally disposed to regard it as inadequate to answer the indications. Certainly a great variety of procedures have been devised for entering the sinus from without. Originally surgeons had a natural repugnance to opening this cavity, and the earliest form of intervention consisted in following up a fistulous tract. Limited exposure, with application of the actual cautery, was the next step. To-day, the radical procedure of opening directly into the sinus is generally advocated.

Operative procedures have heretofore been divided into simple trephining and the radical operation. Kuhnt combines these two resources into two stages of one operation. For simple trephining, otherwise known as the preliminary or exploratory opening, for the sake of cosmetic effect, the preliminary incision should run from the naso-frontal suture for 3 or 4 cm. along the supraorbital margin, and should reach to the bone. The periosteum should then be pushed upward (often a very difficult procedure), and the sinus wall perforated with the aid of an electric drill and chisel. If the bone is healthy and the mucosa free from polypoid hypertrophy, it is sufficient to irrigate the sinus daily with antiseptics and dust it with iodoform until the opening has healed.



FIG. 2231.—Abscess of the Right Frontal Sinus. Case of a man, forty years of age. (From Gerber's "Atlas der Krankheiten der Nase," Berlin, 1901.)

On account of the occasional failure of this treatment, Kocher proposed to extirpate the mucosa of the sinus. This radical intervention may be performed by a number of comparatively new procedures, viz.:

**Nebinger-Praun Method.**—The anterior wall is opened by horizontal and vertical incisions and entirely removed. The mucosa is curetted, and the naso-frontal duct dilated. The wound is drained through the external opening.

**Jansen Method.**—The orbital wall of the sinus is removed and the cavity curetted.

**Killian's Method.**—This consists in opening the sinus through the frontal wall with temporary resection of the nasal bone. The infundibular cells are broken up to such an extent that free drainage of the sinus by way of the nasal fosse is insured.

**Luc-Ogston Method.**—Both frontal and ethmoidal sinuses are opened, and a wide communication is established between the former and the nose. A drain is then passed between these two cavities and the external wound closed.

**Cserny Method.**—Osteoplastic opening of the sinus. Operation finished as in preceding.

**Kuhnt's Method.**—The anterior wall of the sinus is removed, together with all the diseased mucous membrane and the upper portion of the fronto-nasal canal. This operation is preferred by most surgeons. According to Hajek, the only objection to its general employment is that it makes no provision for attacking the infundibular cells of the ethmoid, which are almost invariably diseased in empyema of the frontal sinus.

Killian sums up the subject of surgical intervention in chronic empyema of the frontal sinus as follows:

The supra-orbital margin must be preserved, even if only a narrow bridge remains; otherwise great disfigurement results. The general theory of most of these operations involves the opening up of a passage between the sinus and nose for the purpose of drainage through the latter. This passage may be natural or artificial. But these communications often heal up prematurely by granulation, and a permanent passage is insured only after resection of the nasal bone or nasal process of the superior maxillary. This form of intervention also gives access to the ethmoid labyrinth.

The technique of Winkler is representative of our modern knowledge of the treatment of chronic frontal-sinus disease. This procedure is as follows:

1. Tampon the posterior nares.
2. Make an incision through the eyebrow (do not shave the latter beforehand).
3. Exploratory puncture through the incision with probing. An alternative now presents itself, viz.: (a) Resect the anterior and orbital walls, leaving the orbital margin; or (b) perform temporary osteoplastic resection. If permanent resection is to be performed, the technique is as follows:
4. Remove the anterior wall of the sinus with bone forceps or Winkler's saw, the latter being preferable in fixing the upper limit of the orbital bridge.
5. The floor of the sinus is removed with chisel and forceps, the orbital margin being left as a bridge.
6. Extirpation of the mucous membrane of the sinus.
7. The original incision is prolonged beyond the bridge of the nose and beyond the extremity of the nasal bone.
8. The nasal bone and a small portion of the frontal bone are divided with the chisel; the nasal process of the superior maxillary is then divided with the saw.
9. The skin-bone flaps are now turned backward.
10. Diseased ethmoid cells are removed with bone forceps and curette, and a communication is established between the sinus and nose.
11. The flaps are replaced. Sutures may be applied at once or after two days. No irrigation is allowed until two or three weeks have elapsed.

If an osteoplastic procedure has been chosen, the technique is as follows: The skin is pushed back beneath the orbital margin, and the bone separated from the latter with the chisel. At the outer and middle limits of the sinus this margin is chiselled through. The flap of bone

and integument is turned upward and outward. All oedematous and fibrous proliferation, carious bone, etc., are removed with the curette.

**INJURIES.**—In traumatism of the frontal sinus the violence is always direct. Sharp violence is usually due to knife thrusts and sword cuts; while blunt traumatism proceeds from a great variety of objects, including projectiles, flying fragments, etc. The frontal sinus is occasionally injured by horse kicks, blows of the fist, falls upon the face, and the like. The external wall is almost invariably the part injured. Autopsies occasionally reveal the presence of injury of the cranial wall, such accidents being quite generally fatal. The character of the injury varies from simple fissure or indentation to compound fracture and comminution. Hæmatoma of the sinus usually coexists.

The symptoms of injury of this sinus are either local or cerebral. If the violence does not lay open the sinus, the blood escapes by the nose. Epistaxis and pain are practically the sole symptoms of this type of fracture. While these traumatisms tend to recover without sequelæ, the injury doubtless produces sinusitis in certain cases. A peculiar type of traumatism sometimes seen is detachment of the lining membrane of the sinus.

If the cavity is opened subcutaneously by the violence, respiratory movements are seen in the superjacent skin, and subcutaneous emphysema is readily produced, which may extend indefinitely. It tends to subside spontaneously in a few days.

Trauma with complete exposure of the cavity is of frequent occurrence. This class of wounds is readily infected either at the time of the injury or afterward, so that abscess, periostitis, necrosis, fistula, and endocranial complications may result. If infection does not occur, these compound wounds heal readily. One sequela which may occur independently of infection, however, is pneumatocele.

Diagnosis is usually made without any difficulty. In fracture, emphysema readily occurs. Rhinoscopy is useful in detecting hemorrhage from the sinus.

After injury has occurred infection may be prevented by antiseptic irrigation. The possibility of latent injury of the cranial wall must always be borne in mind. As a general rule the treatment of all subcutaneous injuries is expectant, save when cerebral complications are to be feared or when sinusitis develops. On the other hand, open wounds always require active surgical intervention. The opening should be enlarged, the sinus cleaned, spicula of bone and foreign bodies removed, the cranial wall carefully scrutinized for possible injury, and the cavity well drained. Antisepsis will certainly prevent grave endocranial complications. In very extensive wounds a plastic operation is required.

**FOREIGN BODIES.**—With a very few exceptions all recorded cases of foreign bodies in the frontal sinus have consisted of projectiles, chiefly from old-fashioned weapons. The velocity of modern projectiles, aside from revolver shots, is too considerable for them to be arrested within the sinus.

These projectiles may heal in the sinus, but as a rule a fistula results. Sinusitis is almost invariably set up. These foreign bodies may remain in the sinus for an indefinite period, even amounting to twenty-five years.

Diagnosis was formerly by no means easy, and exploratory incisions were occasionally necessary. To-day the employment of the Roentgen rays insures rapid recognition of foreign bodies in this locality.

A special type of foreign body in the frontal sinus is the animate, consisting of mature insects or larvæ which reach this cavity by way of the nasal chambers. The recorded material, however, is almost all ancient.

**NEW FORMATIONS.**—Of benign tumors of the sinus, osteoma is the only one which receives consideration from modern authorities, for polypi and cysts are now regarded as incidental features of chronic sinusitis. Even osteomata are held by some to be of inflammatory origin. They may be attached to the bone by a broad base or peduncle, or they may be simply embedded in the mucosa.

They may even lie loose in the sinus. These formations are practically confined to the periods of childhood and adolescence.

In structure the nucleus and peduncle are cancellous and the rest of the mass of ivory-like hardness. The osteoma may attain the size of an apple. Its growth beyond a certain limit expands the walls of the sinus. The cranial cavity is often encroached upon, as are also the opposite sinus and orbit; but so gradual is the enlargement that little functional disturbance results. Exceptionally, severe ocular disturbances, cerebral compression, etc., are produced.

Osteoma may be complicated with sinusitis in all its phases. It also closely simulates dilating sinusitis, so that exploratory puncture may be necessary for differentiation.

The indication in osteoma is immediate extirpation. In former years the mortality from this intervention was very great. As the operation itself is not difficult, the danger must lie solely in the possibility of infection.

Of malignant growths originating in the frontal sinus such a small number are upon record that hardly anything need be said on the subject. The few cases in literature were all sarcomata, which grew rapidly and broke into the contiguous cavities. Carcinoma has never been known to originate in the sinus, and even the cases of secondary invasion are of extremely rare occurrence.

George Ryerson Fowler.

<sup>1</sup> Killian: Heymann's Handbuch der Laryngologie und Rhinologie, Bd. iii., 1900.

<sup>2</sup> Hajek: Pathologie und Therapie der entzündlichen Erkrankungen der Nebenhöhlen der Nase, Leipzig u. Wien, 1899.

**FRY'S MINERAL SPRING.**—Jasper County, Iowa.

POST-OFFICE.—Colfax. Hotels: Fry's and five others.

This is one of a group of ten well-known mineral springs located at Colfax, on the line of the Chicago, Rock Island and Pacific Railroad. Like all the others of the group, this spring has an artesian flow and proceeds from a depth of between 300 and 400 feet. The water of this spring has been analyzed by Dr. Heinrichs, Professor of Chemistry, Iowa State University, and also by Professor Haines, M.D., Chair of Chemistry and Toxicology, Rush Medical College, Chicago. The results obtained are as follows:

Analysis by Dr. Heinrichs.		Analysis by Dr. Haines.	
Solids.	Grains.	Solids.	Grains.
Sodium chloride.....	3.85	Sodium chloride.....	3.842
Sodium sulphate.....	78.86	Sodium sulphate.....	77.344
Potassium sulphate.....	.41	Potassium sulphate.....	.630
Magnesium sulphate.....	31.87	Calcium sulphate.....	31.750
Calcium sulphate.....	13.07	Magnesium sulphate.....	10.230
Calcium carbonate.....	17.51	Magnesium bicarbonate.....	25.039
Iron carbonate.....	.67	Iron bicarbonate.....	.258
Silica.....	.29	Alumina.....	.058
Lithia.....	Trace.	Silica.....	.710
Carbon dioxide.....	7.18	Organic matter.....	Trace.
Total.....	153.71	Total.....	150.751

As seen by the analyses, the water is quite strongly impregnated with mineral ingredients, but not sufficiently so to mar its pleasant taste. Ample bathing facilities are provided. The elevation of the location is 1,100 feet above the sea-level, the surrounding country being of a hilly character. The waters of the spring have been found efficacious in rheumatism, dyspepsia, general debility, and in diseases of the blood, liver, kidneys, and nervous system.

James K. Crook.

**FULTON WELLS.**—Los Angeles County, California. Hotel and cottages. This resort is located about three miles north of Norwalk station on the Los Angeles Railroad, and thirteen miles from Los Angeles City. The wells were bored by Dr. Fulton, and the resort is conducted by that gentleman. The two principal wells are 350 feet deep and flow copiously. Anderson's analysis shows the following results:

ONE UNITED STATES GALLON CONTAINS:	
Solids.	Grains.
Sodium chloride.....	9.60
Sodium bicarbonate.....	2.90
Sodium sulphate.....	.95
Magnesium bicarbonate.....	17.46
Ferrous carbonate.....	11.75
Calcium carbonate.....	12.62
Calcium sulphate.....	23.41
Silica.....	2.56
Organic matter.....	Trace.
Total.....	81.25
Free carbonic acid gas.....	Excess.
Free sulphureted hydrogen.....	Excess.
Temperature of water, 64° F.	

This water may be described as a heavy alkaline-chalybeate. It enjoys considerable reputation in the treatment of anaemia, malarial troubles, atonic dyspepsia, congestion of the liver, etc. A large hotel, comfortable cottages, and excellent bathing facilities have been provided for guests.

James K. Crook.

**FUMITORY.**—The plant *Fumaria officinalis* (fam. *Fumariaceæ*), an annual herb with branching stem, smooth and glaucous compound leaves, and small, rather irregular flowers in axillary racemes; the pods are one-sided, and the juice of the stems and leaves is not milky; in other respects of structure it accords with the poppy family. Fumitory is indigenous to Europe, and an introduced plant in the United States.

The leaves or the flowering herb are collected for use; they have a bitter, saline taste but no odor. They contain a crystalline, bitter alkaline base, *fumarine*, *fumaric acid*, and a large amount of carbonate of soda.

Fumitory is an old European house remedy for "visceral, obstructive, hepatic, and scorbutic troubles." It is but little employed at present.

**ALLIED PLANTS.**—*Corydalis* and *Diclytra* ("Dicentra") are pretty flowers, some species of which are cultivated for ornament, and yield drugs which are used to a slight extent. There are several other species of *Fumaria* which have been employed also in medicine.

W. P. Bolles.

**FUNGI, EDIBLE AND POISONOUS.**—The fungi include a series of plants of very diverse characters, varying among themselves as widely in size, structure, and other characters as do the higher and better known seed-bearing plants. All, however, possess the common characteristics of absence of chlorophyl and some method of reproduction by spores. The first character will distinguish the fungi from other cellular plants like the algae, while the latter will distinguish them from higher parasitic plants like the dodders, beech-drops, and broom-rapes. All fungi, lacking chlorophyl, must live on some form of organized matter; this they may derive directly from living plant or animal tissues, in which case they are true parasites; others and by far the greater number draw their nourishment from dead or decaying matter and are known as saprophytes.

In structure, some of the simplest consist of minute, naked masses of protoplasm living parasitically within a single vegetable cell which may be a pollen grain, a diatom, the cell of a filamentous alga, or an epidermal cell of one of the higher plants (Fig. 2233); others, like yeast, consist of single cells enclosed in a cellulose covering which does not differ essentially from that of the higher plants; these cells are free floating and derive their nourishment either from saccharine solutions or those containing amylace-

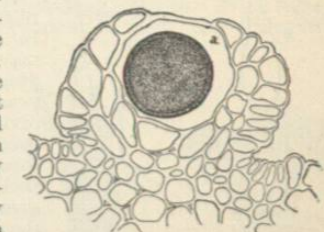


FIG. 2233.—*Synchytrium mercurialis*, producing a Gall on the Epidermis of *Mercurialis perennis*. The fungus is parasitic in a single cell and the resting spore shown at a. (After Woronin.)