others mentioned) was heard from vertex and teeth. The tuning-fork C[4] was not heard at all. The shrill whistle of a distant factory was heard. Their own voices the patients could scarcely hear. In other cases of total or nearly total deafness of both ears, in which also only the large tuning-fork C was heard, the writer found sometimes a preponderance of bone conduction over aërial in one ear, while the other ear gave an opposite result. Gradenigo (*op. cit.*), who used tuning-forks of the same size and make as the writer, obtained similar results from his experiments. The examination of children with tuning-forks is, however, in most cases, very unsatisfactory in its results, as many of them are apathetic and indifferent, and can rarely be induced to produce, by singing, the tone of the fork, and one is, therefore, never certain whether they hear the fork or simply feel its vibrations.

The objective examination of the ear may reveal a perfectly normal condition of the drum membrane, the tympanic cavity, and the Eustachian tube, or evidence of present or past disease of these structures. Acute catarrh of the middle ear will be found present in an inconsiderable number of cases, and changes in the drum membrane, evidently the remains of bygone disease, in many others. Symmetrically placed areas of redness (localized periostetitis) on the posterior and upper wall, in close proximity to the drum membrane, in both external canals, were observed in a well-marked case of this disease by Buck (Transactions of American Otological Society, 1889, p. 62). Disease of the naso-pharynx is as often present as it is not. Perforating ulcers of the hard and soft palate, caries and necrosis of the naso-cranial bones, and ulceration of the larynx will be found in a small percentage of the cases.

The diagnosis of the peculiar ear affection under notice presents no difficulty if, in addition to the aural symptoms previously described, other symptoms of syphilis hereditaria tarda are present or have preceded the ear trouble. In addition to the eye diseases already mentioned, these patients often suffer from chronic inflammation of the knees or other large joints. The knees are often very much enlarged and locomotion may be painful, but there is rarely spontaneous pain. The disease usually passes off in the course of a few weeks, leaving the joints apparently in as good a condition as they were before the attack. Nodes on the long bones are also not infrequently present. With regard to the peculiarities of the teeth, Hutchinson says: "If the upper central incisors are dwarfed, too short, and too narrow, and if they display a central cleft in their free edge, then the diagnosis of syphilis is almost certain. If the cleft is present and the dwarfing absent, or if the peculiar form of dwarfing is present without any conspicuous cleft, the diagnosis may still be made with much confidence." Perforating ulcers of the hard and soft palates, deep ulcers of the pharynx, caries and necrosis of the naso-cranial bones, and laryngitis are less often seen than the other affections above mentioned. The patients, moreover, often have withered and old-man-like features, a peculiar square form of the forehead, prominent frontal eminences, a sunken nose, and scars about the angles of the mouth.

With regard to this disease Hinton[34] remarks that he knows of no other affection, except fever, which in a person under twenty years of age brings on a deafness so rapid and complete, and Hutchinson says that it may be broadly stated that if a child or young person, without either earache or otorrhœa, becomes quickly and completely deaf, the patient is almost certainly syphilitic. The writer has, however, recently met with two cases, both in vigorous boys, without the slightest sign of syphilis, in whom nearly total deafness was very rapidly developed while they were in excellent health. No disease of the middle ear could be discovered, and no febrile disturbance preceded or accompanied the onset of the deafness. Examination failed to reveal intracranial disease at the time, and none has developed since. The parents of these boys absolutely denied having had syphilis. Other otologists have doubtless met with similar cases, and have, like the writer, come to the conclusion that hereditary syphilis of the ear cannot be diagnosed from the symptoms presented by the ear affection alone.

From the ordinary catarrhal inflammation of the middle ear (from which syphilitic children are no more exempt than others) the disease here described can be readily distinguished by the clinical history and the results of the local treatment.

In the absence of post-mortem examinations of the organs of hearing of typical cases of this disease, the writers on this subject are divided in the opinion as to the seat of the lesion. Hutchinson thinks it tolerably certain that the internal ear or the nervous apparatus is the seat of the affection, but as to the exact site and the nature of the morbid process he is still in doubt, and most English writers are of the same opinion. Politzer and Schwartze do not hesitate to speak of the disease as inherited syphilis of the labyrinth, and Gradenigo calls it a syphilitic otitis interna. The view that both the conducting and the nervous apparatus are liable to be involved in this disease is held by Hinton and others, and Roosa has come to the conclusion that the disease is one chiefly of the peripheral and not of the central part of the organ of hearing. The view expressed by the writer in another place,[64] that disease of the nuclei of the auditory nerves might be the cause of the deafness, he has now abandoned, and a larger experience and further study of the disease leave but little doubt in his mind that the labyrinth is involved in all cases, and that in many, both it and the middle ear are the seat of the morbid process. The apparently normal state of the accessible parts of the middle ear found in acute cases, together with the total deafness for the voice with which the disease ends, must be regarded as strong evidence that the auditory nerve is the part affected, and the absence of other signs of cerebral disturbance makes it positively certain that its terminal apparatuses are chiefly affected. The results of tuning-fork tests cannot be utilized, as we have seen, in the settlement of the question as to the seat of the disease. That in many cases evidences of disease of the middle ear are not wanting is generally admitted, but they are rarely sufficiently marked to account for the profound deafness. The usual treatment for the middle-ear affection of children, moreover, is rarely followed by improvement in the hearing, even in the cases in which, under it, the objective signs of the disease disappear.

The purulent inflammation of the middle ear, with perforation of the drum membrane, which developed in several of the writer's cases years after the attack which destroyed the hearing, may have been due as well to a gradual increase in the inflammation of the lining membrane of the middle ear as to an extension of a purulent inflammation from the inner ear to the tympanic cavity.

Treatment is generally regarded as of no avail in any except very recent cases. Hutchinson thinks it more than justifiable, having regard to the terrible results in prospect, *in early* stages of ear disease of this type from inherited taint to confine the child to bed and induce ptyalism quickly. Knapp has reported a case in which a cure occurred under the use of mercury; but the writer, who adopted Hutchinson's advice in a number of cases, has been unable to arrest the progress of the disease in a single one. The iodide of potassium has been given in such cases by the writer for many years, and sometimes with apparent benefit, which, however, was generally transient. Buck saw marked improvement follow the administration of this remedy in gradually increasing doses (gr. v. to gr. xxxviij. three times a day). If middle-ear disease is present, it should be treated by inflation and other means, and even in cases presenting no marked evidence of a middle-ear affection it is best to give the patient the benefit of the doubt and treat him locally as well. Pritchard advises repeated blistering behind the ear for several months in all cases, and as it can do no harm it may be worth while to try it. Hinton has seen striking improvement follow in a severe case from scruple doses of hydrochlorate of ammonia, and has seen good effects produced by the injection of iodine vapor into the

tympanum in less marked cases. Favorable hygienic surroundings and a sufficiency of good food are, of course, to be desired in the treatment of all cases of ear disease, but, if the writer may judge from his personal experience, they have little or no influence on the course of this disease.

Charles J. Kipp.

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EAR DISEASES: TRAUMATIC AFFECTIONS.—For the sake of orderliness and convenience it is proposed to discuss the subject of injuries to the different parts of the organ of hearing under the following heads: Traumatism of the Auricle, Traumatism of the External Auditory Canal, Traumatic Perforations of the Membrana Tympani, Gunshot Wounds of the Ear, and Fractures at the Base of the Skull involving the Petrous Portion of the Temporal Bone.

Traumatism of the Auricle.—The exposed position of the auricle renders it particularly liable to various forms of injury. The importance of these injuries depends entirely upon the extent of the deformity. Superficial bruises and light forms of contusion generally fade away rapidly without leaving any disfigurement. Perichondritis, ulceration, or gangrene rarely follows the lighter injuries, but if the cartilage has been weakened by previous disease the tendency to ulceration is thereby much increased. Ulceration of the cartilage frequently results in auricular deformity. Fracture of the cartilage is not infrequently seen when the violence has been very severe. Incised wounds, even when there has been more or less loss of tissue, usually terminate favorably. Union occurs by first intention if the edges of the wound are brought together by interrupted sutures under strict antiseptic precautions. Piercing the lobe of the ear is a practice liable to cause violent inflammation, gangrene, and possibly tetanus. The dragging of heavy earrings is apt to produce a condition known as cleft ear, which is easily corrected by a plastic operation. Where the lobe is torn or cut, the edges of the wound should be brought together and sutured. The absolute loss of the auricle from any cause does not appear to affect the hearing power to any appreciable degree unless, as a result of replacing the severed member, atresia of the auditory canal develops during the process of healing. Should replacement be impossible, an auricle made of papier-maché will be found a very serviceable substitute.

Traumatic hæmatoma auris, or othæmatoma, is caused by the severer forms of injury and is more frequently seen on the left auricle than on the right, seldom on both. It is characterized in most cases by an effusion of blood between the perichondrium and cartilage, but should the violence be slight the effusion may be limited to the layers of the cartilage, or it may be simply subcutaneous. The tumor is a circumscribed swelling of a bluish-red color and appears most frequently in the fossæ triangularis and scaphoidea. It is rarely fluctuating and is hard or soft to the touch. Considerable pain and a feeling of fulness and heat are usually experienced during its development. The entire auricle is but seldom involved. Perfect absorption of the sanguinolent fluid will insure a normal restitution of the part, but imperfect absorption will, on the other hand, lead to organization of the fluid with cicatricial thickening, contraction, and atrophy, producing a shrivelled mass so well known to pugilists —the shrunken or cauliflower ear. The lighter forms of traumatism of the auricle rarely require any treatment. In hæmatoma the treatment should be expectant, and if the tumor is painless it is better not to interfere at all. Massage and fomentations tend to increase the effusion rather than favor its absorption. Evacuation of the swelling by aspiration is advised only when positive signs of pus are present, or after local treatment fails to relieve the pain. The application of ice, or ice water by means of the Leiter coil, or the use of Goulard's solution tends to reduce the violence of the inflammation and pain. Incision and packing the cavity with gauze are to be resorted to only when other means fail to effect a cure.

As a result of personal encounters, the practice of biting the auricle is not infrequently seen in foreign countries and among our foreign population. Various degrees of mutilation, from incised wounds to total amputation,

have been reported. The danger of such wounds lies principally in ulceration of the cartilage and in the development of general toxæmic symptoms.

Traumatism of the Auditory Canal.—Traumatism of the auditory canal is more frequently seen in the osseous portion and is commonly due to rough and over-zealous efforts made in extracting foreign bodies, or to the use of hairpins, knitting needles, and the like, for the relief of itching. Injuries of the cartilaginous canal almost always represent an extension of traumatism of the auricle. Fractures are generally due to indirect forms of violence, and are further complicated in many cases by fractures of the base of the skull. A blow or fall on the point of the chin may fracture one or both osseous canals, and such a fracture may or may not involve the osseous walls of the tympanum. Rupture of the membrana tympani, while nearly always present, is not a constant factor. The swelling and laceration of the membranous canal make it very difficult to verify the presence of a perforated drum membrane. Bleeding from the canal is always present, and when the soft parts have been badly torn the hemorrhage is considerable; but its profuseness by no means proves the existence of a fractured base. The escape of a watery fluid from the injured ear is commonly considered to be a reliable sign of such a fracture. Facial paralysis usually complicates the severe cases, and occasionally loss of taste is observed, from involvement of the chorda tympani nerve. The subjective symptoms in the light forms of trauma are transient. Deafness and constant tinnitus aurium are liable to become permanent if the labyrinth is in any way involved. Deformities resulting from slight injuries are rarely observed; but an extensive fracture of the osseous walls may result in caries, in the formation of sequestra, and ultimately in stenosis or complete atresia. The complicated forms of trauma often end fatally in meningitis, although a number of seemingly hopeless cases have terminated in recovery.

The treatment of all forms of trauma should depend upon the changes noted in the tissues. Douching with hot boric-acid solution, four per cent., or with 1 to 5,000 bichloride solution, is usually practised, and is particularly indicated when there is evidence of suppuration. For the relief of active inflammation of the soft parts antiphlogistic measures are of benefit. The progress of repair in extensive fractures is most tedious, since in such cases the removal of sequestra, cauterization of granulations, and obliteration of fistulous openings may be necessary. The pronounced inflammatory reaction following severe injuries is not confined to the auditory canal only, but is often located within the middle ear as well, thereby adding other important considerations in the question of treatment.

In considering the lesions of the auricle and auditory canal from a medico-legal standpoint, it is most difficult to formulate any rules upon which a surgeon can base an opinion, as it is most exceptional ever to see two cases alike. In estimating the extent of an injury to the auricle it is essential to exclude any previous disease or weakness of the cartilage, since a deformity out of all proportion to the force of the violence may result in such cases. One should be guided by the form of the violence, the extent of the injury, and the final result. Serious injuries are those which result in disfigurement; an injury may be termed slight when no change in the form of the auricle takes place.

Traumatic Perforations of the Membrana Tympani.—Traumatic perforations of the membrana tympani are the result of direct or indirect forms of violence. The direct forms are most frequently due to efforts made in extracting wax, or to the use of knitting needles, hairpins and the like, to ease itching of the canal. The instrument in such cases is inserted too far, or by an accidental push of the arm it is driven down through the drum membrane. Careless use of the probe without sufficient illumination, lack of skill on the part of the surgeon in removing foreign bodies, reckless use of ear syringes, particularly those with long, pointed tips, too violent syringing, introducing Eustachian-tube bougies too far, are among the occasionally observed causes of direct rupture. Indirect ruptures are due to sudden condensation or rarefaction of air in the external canal, as in detonation of heavy ordnance, in explosions, in violent coughing or sneezing—in which acts the intratympanic pressure is increased,—in abuse of pneumatic massage, and in concussion of the head; they may also be caused by extension of fractures at the base of the cranium. Fracture and dislocation of the ossicles can occur quite as readily through the entrance of a foreign body (direct) as by extension of cranial injury (indirect). The seat of fracture is usually in the lower portion of the manubrium, and is recognized by the obtuse angle formed by the broken portion with the upper end.

The symptoms following the various kinds of traumatic injuries to the drum membrane are often so severe that the patient is incapacitated for any work. The instant the perforation occurs there is a loud report in the affected ear, followed by pain, tinnitus aurium, and more or less deafness. Vertigo, nausea, and vomiting are more frequently present when simple concussion of the labyrinth exists. Bleeding from the ear is generally slight in uncomplicated cases; but profuse and prolonged hemorrhage indicates deeper and more extensive involvement. Suppuration of the middle ear is not so apt to follow the indirect as the direct forms of rupture, but its development will retard the recovery in either form. In mild cases of trauma the deafness rapidly disappears, but should suppuration of the middle ear follow the traumatism and produce permanent changes within that cavity, or should the labyrinth be injured, such conditions are liable seriously to affect the hearing power. Simple, uncomplicated traumatic rupture of the drum membrane heals in a very short time, the site of the perforation being finally indistinguishable from the uninjured portion. Some importance is attached to traumatic perforations on account of the exposure of the middle-ear cavity and the subsequent inflammatory process that is liable to follow such injuries. When the drum membrane has become resistant through the presence of interstitial catarrhal changes, calcification, etc., traumatic perforations rarely occur, so that the full force of the violence is transmitted through the ossicular chain to the labyrinth and terminal filaments of the auditory nerve. The objective changes noted in such cases are injection of the vessels, ecchymoses, and hyperæmia. Extreme and occasionally absolute deafness and distressing tinnitus aurium are almost always the results. Again, when the drum membrane has been weakened by previous disease, as atrophy, cicatrices, etc., traumatic perforations readily follow the lightest forms of injury, causing little or no damage to the hearing power, provided no subsequent complications develop. Traumatic perforations can be single or multiple. The form following any direct violence depends upon the size and shape of the instrument used to produce them. They are usually seen in the anterior or posterior inferior quadrant; still any portion of the membrane is quite as liable to be injured. Indirect ruptures are most frequently seen behind or in front of the manubrium, and are oval or elliptical in shape, seldom round. The long axis of the rupture is parallel with the direction of the radiating fibres, and the edges are partially or totally covered with blood. Ecchymoses in the drum membrane and injection of the vessels along the malleus and over Shrapnell's membrane are often present. In treating cases of traumatic rupture it is best to avoid all forms of medication, and simply to protect the delicate middle ear from sudden atmospheric changes by the introduction of a piece of cotton into the external canal. The development of suppuration in the tympanum should be handled by the recognized rules governing that disease. Marked tinnitus aurium and deafness due to labyrinthine involvement are often relieved by the application of the galvanic current.

An action for damages in a court of law for simple, uncomplicated perforation of the drum membrane is of less frequent occurrence than formerly, when the popular

fallacy of absolute deafness following such injuries received more or less credence. When a medico-legal opinion is required, it is quite essential that the case be examined within two or three days after the injury has been received. Should the characteristic appearances of a traumatic perforation be present, its nature can be further verified by observing the progress of cicatrization from day to day; this plan will enable the examiner to discriminate between it and the presence of a perforation due to prior pathological processes. If too long a time elapses between the date of the injury and the examination, complete cicatrization may obliterate all traces of the perforation, and any existing functional complications could not then be associated with the cause. If, at the time of the examination, suppuration has already developed, it will be impossible to differentiate the condition from the appearances seen in primary forms of purulent inflammation. Audition is only in rare cases permanently involved by uncomplicated traumatic perforation. The hearing power generally returns to its former degree of acuteness on the completion of cicatrization. As the amount of damages depends upon the degree of permanent disability incurred, such injuries are considered transient.

Serious injuries of the drum membrane are those which are complicated with concussion of the labyrinth, and in which the subsequent development of purulent inflammation of the middle ear produces deafness through the pathological changes following that disease. Yet deafness due to concussion of the labyrinth has been known to disappear in from four to six months' time, and severe purulent inflammation has subsided without leaving any unfavorable results to the hearing power. When deafness and distressing tinnitus aurium follow a blow unaccompanied by the occurrence of a perforation of the membrana tympani, it is very difficult to determine, in the absence of any reliable data, whether the condition present was produced by the trauma, or was caused by the existence of previous chronic pathological changes in the tympanum and labyrinth. In any given case it is wiser to reserve judgment until satisfactory and conclusive evidence is secured through prolonged and careful observation.

Gunshot Wounds of the Ear.—Gunshot wounds of the *auricle*, although rare, may cause considerable loss of tissue and much deformity; but any extensive loss of substance is seldom unassociated with involvement of the adjacent structures. Small bird shot are occasionally found embedded beneath the auricular epidermis as a consequence of accidents attending hunting parties. No deformity is produced thereby and no difficulty attends their successful removal. On account of the complicated structure of the auricle, all attempts to correct deformities following much loss of tissue by plastic surgery have been rather unsatisfactory. Small defects of the upper border and lobule have been successfully replaced by flaps, but new auricles made in a similar manner are without character or formation, and give far less satisfaction from a cosmetic point of view than the artificial ones.

Gunshot wounds of the *external auditory canal* are nearly always associated with cranial injury. The close relationship between the auditory canal and the temporal bone renders it impossible to injure the one without injuring the other. A spent bullet may strike the auricle or auditory canal without causing any laceration, although a deep, painful bruise and absolute deafness result. A bullet striking the head in the immediate neighborhood of the ear usually enters the middle cranial fossa, causing extensive fracture of the pyramid, and injury to the jugular bulb or vein, to the carotid artery, and to the brain and its membranes. Such cases are necessarily fatal. Suicidal attempts made by shooting in the auditory canal are by far the most frequent class of cases seen. Vast damage may be the result therefrom, or, as has been reported, the bullet may reach the pars petrosa and lodge there without causing any injury to the meninges or brain, and upon its removal recovery will take place, but the hearing power will, as a rule, be completely destroyed. In some other cases of a similar nature the reports state that the pistol was placed in the auditory meatus and pointed backward, and the ball, after shattering the osseous wall, became lodged in the substance of the mastoid bone, from which it was subsequently removed without fatal results. From these reports it would appear that shooting into the ear is not necessarily fatal. Gunshot wounds of the ear complicated by injury to the meninges and brain are of secondary importance as compared with that of the cerebral lesion, and it is therefore rare that an otologist ever has an opportunity to see such injuries in their early stages. It is only after recovery from the head injury that the patient seeks the aid of an ear specialist to restore the hearing power or to check the purulent discharge. In such cases, as has been reported, it is not uncommon to find the pistol ball lodged in some portion of the osseous canal, a fact which an early examination would have ascertained; and in consequence of this discovery the ball would have been promptly removed and the serious aspects of the situation would have been diminished. Wounds in and about the ear should suggest the most careful and painstaking investigation.

Treatment.—The utmost care must be exercised in endeavoring to locate the bullet, and if it is found, every effort should be made to extract it, particularly if threatening symptoms are present. The Roentgen rays may prove to be of inestimable value in detecting the location of the bullet, and in determining whether or not it might be successfully extracted. Whatever operation may be determined upon should be guarded by every observance of modern antiseptic surgery. Much destruction of tissue and shattering of bone may render any required operation very difficult through the obliteration of well-known surgical landmarks.

Fractures of the Temporal Bone.—In describing fractures at the base of the skull, it is the intention to limit this article to that portion of the subject which relates more especially to the domain of otology and which usually meets with brief mention at the hands of the general surgeon. Cases of this class involving the temporal bone rarely come under the immediate care of the aural surgeon, and in consequence a careful examination of the auditory canal and membrana tympani with reflected light and aural speculum is seldom thought of or considered necessary. In view of the brilliant advance of modern surgery and its achievements in special or regional work, it is to be regretted that the opportunity offered by such an examination to learn of the condition of the temporal bone in relation to a fractured base, and the invaluable aid such information would give in shaping the course of the treatment, have been so wantonly neglected.

It may be asserted in a general way that fractures of the base of the skull always involve the temporal bone to a greater or less degree, but the wisdom of dividing them into the two following classes has often been verified by clinical observation:

1. A fracture or fissure of the tympanic or squamous portions without causing any corresponding damage to the petrous portion.
2. A fracture of the tympanic portion and pars petrosa occurring simultaneously.

The line of fracture or fissure in the first division is found to extend along the line of union of the squamous, the tympanic, and the petrous portions, which represent in the fœtus three centres of ossification. The line of fracture in the second class passes through the body or substance of the petrous portion. Whether a fracture of the petrous portion of the temporal bone may occur without involving the tympanic or squamous divisions is a possibility not yet fully established by clinical data.

Fractures such as we are now considering are always caused by the indirect forms of violence, styled by the French observers "contrecoup" (counter-stroke), and are usually seen as a result of a fall, the patient striking the top or base of the skull. The peculiar construction of the temporal bone renders it liable to such forms of in-

jury, as its resisting power is much reduced by the presence of several cavities within its substance—cavities which are separated only by very thin osseous walls. Force applied to the vertex expends itself on some distant point through elasticity of the cranium, and, owing to its weakness, the temporal bone is almost always damaged. The external auditory canal in the region of the fissura Glaseri is that portion of the temporal bone which is most frequently involved, yet the locality of the fracture depends on the site of the traumatism. If the violence is applied in the region of the occiput, fracture of the posterior osseous wall results, and this may or may not involve the mastoid; a severe blow or fall on the point of the chin may cause a fissure or comminuted fracture of one or both anterior walls. As a rule, however, fractures are rarely seen limited entirely to the auditory canal, for in most cases in which the traumatism has been severe, it is further complicated by a contemporaneous fracture of the superior or inner walls of the tympanum, and at times of the pyramid. Fracture of the walls of the tympanum may involve the facial canal in some portion of its course, producing a paralysis corresponding to the particular locality injured. There is always a laceration of the mucous membrane lining the cavity of the tympanum, corresponding to the line of fracture. Fracture of the ossicles or dislocations of their articulations or detachment of the drum membrane from its groove are seen only as a result of excessively violent traumatism. The membrana tympani, while not always involved, is ruptured most frequently in the neighborhood of Shrapnell's membrane. The perforation appears in the form of a linear or oblong slit traceable along the superior or anterior meatus. Multiple perforations of the drum membrane are most rarely observed. Concussion of the skull occasionally produces a hemorrhagic extravasation in the tympanum, causing a condition known as hemotympanum. The drum membrane appears to bulge and is of a dark-blue color; sudden deafness, tinnitus aurium, pain, vertigo, and a feeling of fulness in the ear result, but upon absorption of the extravasation these subjective symptoms disappear. When the line of fracture passes through the petrous portion of the temporal bone, involving the internal auditory canal and the nerve trunks passing through it and lacerating the delicate membranous labyrinth, deafness is immediate and absolute, and it is observed as soon as the patient recovers consciousness. Damage to the nerves in the internal auditory canal is seldom if ever confined to the acoustic; the facial nerve is injured at the same time. A staggering gait, vertigo, nausea, vomiting, and facial paralysis generally persist for months, and in some cases these symptoms remain unchanged for years. Such functional disturbances are not always due to a fracture, however, but are seen as a result of pressure following an extravasation of blood. Injuries to the osseous portion of the Eustachian tube and the mastoid cells are rare, but the extension of the line of fracture to the nose through the anterior fossa and ethmoidal cells is more frequently observed. Paralyses of special nerves appearing immediately after the injury are due to laceration or compression; those seen to occur some time after the injury may be due to inflammatory action. Among the symptoms connected with fractures or diastases of the temporal bone, associated or not with a contemporaneous fracture of the base, and to which considerable importance has been attached, are: hemorrhage and an escape of a watery fluid from the injured ear. Profuse bleeding from the auditory canal, with a discharge of a watery fluid, can occur only when some portion of the membrana tympani is perforated or when the line of fracture and laceration of the soft parts extends well into the external auditory canal. Bleeding from the ear under these circumstances, even though it persists a comparatively long time, has not that critical significance which has heretofore been attributed to it. It does not necessarily indicate that the tympanum and one or more of the large vascular channels surrounding it have been opened, for the region in which these lacerations most frequently occur—the membrane of Shrapnell and the superior wall of the auditory canal—is sufficiently rich in blood-vessels to account for it. Alarming hemorrhage from the ear has been known to follow injury limited to the osseous canal; it has also been observed in cases in which a rupture of the drum membrane and a laceration of the mucous membrane of the middle ear have occurred without any demonstrable evidence of the existence of a fractured base. As a symptom, therefore, bleeding from the ear means a rupture of the soft parts in the vicinity of the line of fracture, since authentic cases of fracture of the temporal bone have occurred without the slightest hemorrhage or bleeding from the ear. The escape of watery fluid from the ear is a symptom of graver import, and is generally considered to point to a fracture of some part of the petrous portion of the temporal bone, with a tearing of the cerebral membranes. When first seen its color is a reddish-white, but later it becomes clear as water, and is considered to be cerebro-spinal fluid. Every watery or serous discharge from the ear is not necessarily cerebro-spinal fluid, for this symptom occurs in acute inflammation of the middle ear of non-traumatic origin. The presence of this watery discharge from the ear in no way implies a fatal issue, as such patients have recovered, but the symptom aids in forming an estimate of the extent of the injury sustained by the temporal bone.

Diagnosis.—In trying to discover the extent of a fracture of the temporal bone in a general way, the use of the tuning-forks renders much valuable information. In fractures of the first class, a tuning-fork placed on the vertex will be heard better in the affected ear; in those of the second class, in which the fracture includes the pars petrosa, the tuning-fork will be perceived more distinctly in the unaffected ear. A complete or partial restoration of the hearing power may be looked for in the first class of cases; in the second, permanent deafness follows. Deafness following contusion of the head without symptoms of basal fracture is usually incomplete, and is generally first noticed some days after the injury. It may be caused by inflammatory neuritis, by hemorrhagic inflammation of the labyrinth, or by involvement of the acoustic centre.

Treatment.—In treating fractures of the temporal bone more attention should be devoted to learning the extent of damage sustained by the osseous canal, drum membrane, and middle ear, with the view of preventing any extension of the inflammation resulting therefrom to the adjacent structures. Acute inflammation of the tympanum follows these injuries, and when the cavity of the cranium and the delicate meninges are exposed through the line of fracture, thereby opening up paths of infection for countless numbers of micro-organisms, much might be done to reduce the development of meningitis. Both the external auditory canal and the membrana tympani should be thoroughly inspected to establish the presence of a fracture or a rupture. Copious hemorrhage might make this difficult of accomplishment, but still it can be done. The treatment usually employed in acute inflammation of the middle ear can be used with benefit in the inflammation arising from a traumatism. When the details cannot be carried out, a thorough drainage and cleansing of the middle-ear cavity through the mastoid is a surgical possibility not to be forgotten. To prevent the development of meningitis should be the effort of the surgeon, but the application of the ice cap and rest in bed will not suffice when the channel of infection is left totally neglected to the invasion of what too often proves to be the exciting cause. *James B. Clemens.*

EAR DISEASES: TUBERCULOSIS OF THE MIDDLE EAR.—The occurrence of a purulent discharge from the ear in the latter days of patients afflicted with phthisis pulmonum was observed by the earliest clinical writers, who attributed it to poison within, seeking its way out. Naturally, nothing very precise was written on the subject until the use of the head mirror, which afforded a more exact way of observing the conditions occurring in various diseases, had been discovered. After this discovery had been made, certain peculiarities of the

objective appearances in ear tuberculosis were soon chronicled.

As in most other pioneer otological work, so here also we find evidences of the fact that Politzer contributed his share. In his "Beleuchtungsbilder," published in 1865, he pictures one of the typical appearances of this condition. He was one of the earliest observers to write at all extensively on the subject, and gave one of the first satisfactory descriptions of the microscopic changes taking place in the mucous membrane of the middle ear in this disease. Still later, when tubercle bacilli were discovered, we find him one of the first to work out the presence of these in the discharge and in the ulcerated membranes.

During this interval many other observers worked upon the subject from various standpoints until to-day we find tuberculosis of the middle ear thoroughly well recognized, exhaustively studied, and in general as well understood as tuberculosis of any other organ or portion of the body.

Etiology and Pathology.—Theoretically, there is no reason why a tuberculosis cannot begin primarily in the ear, but, owing to the fact that the middle ear is shut off from the rest of the body, and communicates only indirectly with the lymphatic system—the great disseminator of tuberculosis, and also in view of the fact that the only direct connection which it possesses with the outside world is through a very narrow tube which passes down into the nose, we have a right to assume that it can only rarely serve as the primary source of a general tuberculosis. Cases have been reported in which the discharging ear furnished the first objective symptom, while only later, sometimes after a considerable lapse of time, did the lung and other symptoms manifest themselves. I have myself, however, never seen any cases in which I could satisfy myself that I had before me a genuine instance of primary middle-ear tuberculosis. There is one fact, however, which is indisputable, viz., that in the vast majority of cases the ear tuberculosis manifests itself long after the disease has been more or less active in some other part of the body.

How often aural complications occur in tuberculous subjects, it is not possible to state in exact statistics, all of the latter being more or less modified by the fact that the ear trouble is often so little noticed by the patient (and even less so by his medical attendant) that a great many patients even in our best-managed institutions die without any mention being made on the record of any discharge from the ear. In private practice a still larger number of cases remain undiscovered, or, if mentioned, are soon forgotten as being, in the presence of disease elsewhere in the body, unimportant. For these reasons I am disposed to believe that tuberculosis affects the middle ear much more often than is generally supposed.

It is probable that tuberculosis in the middle ear develops in one of two ways: either the tubercle bacilli effect a lodgment in the relatively healthy but constitutionally vulnerable tissues of the membrana tympani and middle-ear mucous membrane, or else they are favored, in making a successful invasion of the ear, by the fact that these parts are weakened by disease (infection by streptococci, pneumococci, etc.). The mode of approach of the bacilli, which doubtless are in the air a large part of the time, is clearly by way of the Eustachian tube.

It is interesting to note, in this connection, that oftentimes the most careful and persistent search (microscopical and bacteriological) fails to discover the existence of tubercle bacilli in either the discharge or the affected tissues themselves, and that too in cases which present the strongest possible clinical evidences of the existence of a tuberculous process in the middle ear. This experience has happened to the author in a number of instances.

It seems natural to inquire next as to the nature of the pathological processes which take place in the ear; how they progress step by step. The inflammation is almost always of the sluggish, asthenic type. Without much disturbance a discharge appears, and then, shortly afterward, a large part of the drum membrane will frequently disappear. Thus, sometimes, in the course of only a few hours, a whole quadrant will as it were melt away, or two independent perforations will form, will persist for a short time, and will then merge into one large defect. After this first loss of substance has taken place, frequently nothing further transpires beyond the simple conversion of the mucous membrane on the promontory wall of the middle ear into a granulating mass, and from this and the whole cavity of the middle ear there is secreted a thin acrid pus which, often in no very large amount, runs on for months and months until the demise

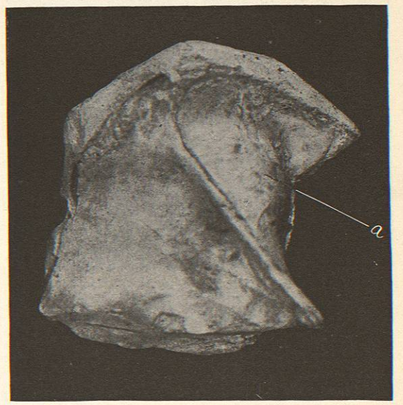

Fig. 1804.—Cast of Petrous Portion of the Temporal Bone, from a case of advanced tuberculosis of this part of the skull. (Original.) *a*, Roof of the tympanum, which is seen to be arched up into the middle fossa of the skull. The overlying brain substance at this point showed a corresponding depression.

of the patient. No very great further destruction of tissue takes place, and the granulating surfaces do not ulcerate, but most obstinately persist in giving forth the discharge.

In another group of cases the tuberculous process shows a most decided destructive tendency. Possibly this may be due in some measure to the fact that the patient lives longer, more time being thus afforded for the destructive processes to work. It is more probable, however, that there are real differences in the types of the disease itself. The drum membrane undergoes complete destruction. The ossicles become loosened and disappear in the discharge, and later we are able to discover that the bone on the promontory wall is bare underneath the granulating tissues which cover it. The process indeed does not even stop here, that is, with the formation of a limited area of bone caries; but, instead, quite large masses of bone tissue die. Especially is this liable to be the case in children in whom there is a well-developed general tuberculosis. The sequestra thus formed are sometimes of extraordinary size, including wellnigh the whole petrous portion of the temporal bone as well as the wall of the external auditory canal. Such pieces are only rarely extruded by natural processes; usually operative measures are needed for their removal. The periosteum or dural surface, in the specimen pictured in the accompanying cuts, presented an entirely healthy appearance except at the spot where the bone has been sawed in two, as is shown in Fig. 1805. At this spot the peri-