portion of the facial nerve as well as a lack of development of the auditory apparatus and the zygoma.

Virchow, cited by Gruber, considers that deformities of the auricle are to be regarded as connected with faulty morphological development in the region of the first branchial cleft.

Congenital absence of the entire auricle is very rare, as some portion of the auricular cartilage covered with integument is generally to be found. Defects of particular portions of the auricle are more common and possess, except from a cosmetic point of view, but little pathological importance. In this category belong those cases in which the normal inrolling of the helix may fail to take place, and as a result we then have the ape-like auricle, or Darwinian pointed auricle; those in which the antihelix is larger than, and overrides, the helix—the "Wildermuth auricle"; and, finally, those cases in which the auricle is lapped over on itself ("cat's auricle"), with or without the growing together of the helix and tragus (see article in Vol. I., on *Auricle, Anatomy and Physiology of*).

Microtia is comparatively rare and the ear, though diminutive, may be well developed, or it may be malformed. When this latter condition is present it is often found that the malformation occupies some abnormal position, as in front of or below its usual location—a possibility which should always be remembered if an operation to form an external auditory canal is attempted.

Congenital aural fistulæ are to be found in front of the tragus or in the ascending portion of the helix; they are short blind canals lined with an epithelium which produces a white creamy secretion. They are liable to mild inflammatory attacks from closure of the entrance.

Malformations due to an excessive development include: (*a*) supernumerary appendages; (*b*) abnormal development of a part or of the entire auricle (macrotia partialis vel totalis); and (*c*) supernumerary auricles (polyotia).

Supernumerary appendages are most often seen in front of the tragus and are composed of reticulated cartilage with its coverings of perichondrium, subcutaneous areolar tissue and skin; such a structure must therefore be considered to be a true auricular appendage.

Macrotia partialis is not rare and is often found among the women of those races which wear heavy earrings. In such women the lobes are often to be found to be of an enormous size. *Macrotia totalis* is rare. *Polyotia* is extremely rare. Lauger relates the cases of two double-bodied monsters each of which had four auricles. The most frequent and most readily corrected of the malformations of the auricle are those in which the cephalo-auricular angle measures 55° or over. This latter condition is not always congenital, but is frequently caused by a faulty style of dressing the hair or of using strings in adjusting the headgear; for this reason it is more frequently to be found among women.

Prognosis.—In cases of malformed auricles, when there is an absence of an external auditory canal and the tuning fork is not heard by bone conduction, it is best not to attempt any operative interference unless it be for cosmetic reasons. In cases of unilateral deformity in infants it is almost impossible to state whether they hear or not, and it is therefore best to give an unfavorable prognosis.

Treatment.—In the correction of some of the above-mentioned defects otoplasty is of service, but its range is limited. It is often best, in a case of marked auricular deformity, to remove the entire auricle, with the exception of a stump to which an artificially devised auricle may be fastened. Supernumerary appendages may be removed. Congenital aural fistulæ must be opened and thoroughly exposed to view; the lining membrane must then be carefully exsected; and, finally, the whole cavity must be thoroughly curetted and the wound then allowed to granulate. Excessively large ears may be reduced in size by an operation of which the following are the two fundamental features: the removal of an elliptical-shaped piece of cartilage from the fossa of the helix, and the excision of a triangular section from the posterior border of the helix. The apex of this triangle should be located in the posterior portion of the concha. After the removal of these two portions of the auricle, the edges of the wound are to be united with fine interrupted silk sutures. For the correction of the handle-shaped ears, if the patient be young enough, pressure bandages applied for some time may suffice. If this does not accomplish the end desired, an elliptical piece of the posterior auricular fold should be removed and the edges of the wound united by sutures. In very marked cases it may be necessary to remove a small portion of the cartilaginous framework as well. In operating, care must be taken to have the cephalo-auricular angle the same on both sides.

In the so-called "cat's auricle" the holding of the auricle in a correct position by means of adhesive strips or bandages may remedy the deformity. At the same time, if adhesions are found to exist between the helix and the tragus, they will have to be cut through, and if the cartilage is not sufficiently flexible it may also have to be cut through along the line marking the folding. In some cases it may be necessary, in addition, to hold the auricle upright by denuding a small area on its posterior surface and a similar area on the side of the head, and then causing these two denuded surfaces to adhere together. Every case will call forth a certain amount of ingenuity on the part of the operator.

Robert Lewis, Jr.

EAR DISEASES: AFFECTIONS OF THE EUSTACHIAN TUBE.—The diseases of the Eustachian canal may be classed in two general divisions, viz., one in which there is more or less obstruction, and one in which there is more or less dilatation.

The obstructive class comprises by far the greater number of cases and constitutes practically all in which treatment is of use.

The obstructions are of two kinds: one in which the occluding element lies without the tube, and the other in which it lies within the tube.

The most common of the extra-tubal causes is the naso-pharyngeal tonsil (Luschka's tonsil, post-nasal adenoid, third tonsil, etc.), which is fully described elsewhere in this work. Let it suffice to say here that this tonsil, growing from the roof and sides of the naso-pharynx, may entirely cover the pharyngeal orifices of the tubes and absolutely prevent any aeration of the middle ear. From this extreme condition, found only in young children, there are gradations to so small an amount of adenoid tissue as to be harmless. Whether the occlusion be complete or partial, there is originally no attachment between the tubal prominences and the adenoid, but usually some attachment is soon formed by reason of continued contact or plastic inflammation. With the approach of adult life the glandular tissue of the adenoid, if not removed by operation, gradually gives place to connective tissue; and this, in turn, as it contracts, will, through the attachments just mentioned, draw the lip of the tubal orifice backward. Some degree of flexion is caused in this way and as a further result there is produced a degree of internal occlusion which may be even more serious than that due to the earlier pressure of the hypertrophied gland. In addition to its interfering with the functions of the Eustachian tube the enlarged Luschka's tonsil may retard its development.

There are still other external conditions which indirectly favor obstruction of the lumen of the Eustachian tube. The various pathological conditions located in the nasal cavities belong in this category. The tubal orifices lie in the track of the inlet through which air is supplied to the lungs. Anything tending to retard this supply of air causes a partial vacuum in the naso-pharyngeal vault; in other words, it establishes a condition in which suction is exerted on the mucous membrane lining this canal. Chronic hyperæmia and some measure of hyperplasia of the mucous membrane ultimately follow, and the calibre of the tube undergoes a corresponding degree of reduction.

All the acute febrile diseases of childhood affect the middle ear through the Eustachian canal, and, as a matter of course, involve the canal walls themselves. Of these diseases scarlet fever, diphtheria, and measles are the most troublesome. It is doubtful whether a direct spread of specific infection takes place, particularly in diphtheria; but there is intense congestion affecting the whole tract of the middle ear, as a result of which the Eustachian tube is occluded and all drainage from the tympanum ceases. The previous existence of a certain degree of tubal stenosis, due to hypertrophy of the adenoid tissue in the vault, serves only to aggravate the conditions produced by the febrile disease. The partial paralysis of the throat muscles, that so often follows diphtheria, sometimes also involves the tubal muscles. When deafness develops as a sequel of diphtheria, the possibility of its association with faucial paralysis—*i.e.*, with paralysis of the tubal muscles—should be carefully borne in mind. While it will scarcely be possible to establish a positive diagnosis, the probable dependence of the impaired hearing upon the cause in question may be inferred from the absence of tubal narrowing dependent upon a swollen condition of the lining mucous membrane. For example, gentle catheterization and inflation reveal the absence of any narrowing such as would be produced by a swollen mucous membrane, and yet the inflation improves the hearing to a noticeable degree. In the presence of this evidence we are warranted in drawing the conclusion that the habitual and frequent opening of the tube that results from the normal activity of the muscular fibres attached to it has been absent for a certain length of time, and that consequently the atmospheric pressure upon the outer surface of the drum membrane has during this period been in excess. Then again, the mere fact that the tubal prominences in the pharynx are covered with mucus does not warrant the inference that an exudative inflammation is present, for oftentimes the mucus, which is secreted at some other part of the naso-pharyngeal tract, flows down over the tubal orifices and so gives the appearance as if it were being secreted from parts situated higher up in the tubes themselves.

The other diseases which produce local lesions in the Eustachian tubes are syphilis, tuberculosis, smallpox, carcinoma and other varieties of new growths. Syphilis and smallpox may cause almost any degree of distortion, according to the location of the ulcer. The other diseases, on the other hand, may completely destroy the tubes and the surrounding tissues.

Foreign bodies are rarely encountered in the Eustachian tube. Bougies have been broken while in use and the distal fragment has been left in the tube. I have twice removed a pin from the tubal prominence of a patient who habitually carried several pins in her mouth in spite of repeated accidents. A man who amused himself by passing curved wires through his nostril and letting them slip past his palate into his mouth, came to my office in great distress because a wire had engaged in one of his Eustachian tubes. Particles of food are sometimes forced a little way into the tubes by vomiting. (See also the case mentioned by Dr. Sprague, on p. 591 of the present volume.)

The obstructions lying within the tubes are usually stenoses that have resulted from inflammations. These consist chiefly in hypertrophies of the mucous membrane and secondarily in hyperplasias of the submucous connective tissue. The lower ends of the tubes are most frequently affected, the upper ends rarely, and the central portions almost never. The stenosis at the lower end of the tube is caused by hyperæmia. This is induced in some of the ways already mentioned, and leads to a chronic thickening of the membrane. This may be said to be the intermediate link in the series of pathological changes which underlie chronic inflammation of the middle ear with its annoying subjective noises and associated deafness. It is often the condition that causes the patient to come for treatment. It must be relieved if deafness and a wide range of nervous disturbances dependent upon defective or perverted hearing are to be prevented. The degree of hypertrophy should be ascertained as accurately as possible by learning as fully as we can from the patient the past history of the trouble, and by making a thorough investigation—by digital exploration, by direct inspection through the anterior nares, and by aid of the rhinoscopic mirror—into the condition of the vault and nasal passages. Indirectly, inspection of the membrana tympani is, of course, valuable.

TREATMENT.—So far as hypertrophy of Luschka's tonsil is concerned, there is only one plan of treatment which is likely to be of much service, viz., the removal of all the redundant tissue by suitable surgical measures. These are described in detail in another part of this work, and it will therefore not be necessary for me to discuss the matter any further in this place. The same remark applies equally well to all the various procedures which are employed for the relief of hypertrophied conditions in different parts of the nasal passages, to the methods adopted for the removal of spurs of bone or cartilage from the septum narium, to the proper manner of introducing the Eustachian catheter, and to the plan of forcing air through the Eustachian tube into the middle ear by means of what is known as Politzer's method. There are a few matters, however, in regard to which I may speak without incurring much risk of repeating what will be stated elsewhere.

Electrolysis for the reduction of long-standing hypertrophies has many advocates. It is accomplished by introducing an insulated metal catheter, thoroughly polished and slightly oiled on the inside, and passing through this a gold probe with a smooth nodular end. The probe is connected with the negative pole of the battery, and the positive pole may be held against the side of the neck. When the stricture is reached, the probe is allowed to rest against it, and then an electric current of from two to five milliamperes is passed for five minutes. No pressure whatsoever is to be used on the probe. It is claimed that, after a varying number of sittings, there will be no stricture for the probe to rest against.

Such diseased conditions of the middle ear as are accompanied by an irritating discharge may cause inflammation of the tube by the drainage which takes place through it. As the drum membrane is perforated in these cases, the tube may be washed with antiseptic and styptic solutions by filling the external canal with the desired fluid and forcing it through by pressing on the tragus as it is bent backward over the meatus. Pure alcohol and weak solutions of nitrate of silver may be thus used. They cause pain at the time, but much relief almost immediately follows. Polypi in the middle ear sometimes close the upper end of the tube. These or any accretions should be removed.

Dilatation of the tube is sometimes observed in connection with atrophic conditions.

Richard R. Daly.

EAR DISEASES: AFFECTIONS OF THE EXTERNAL AUDITORY CANAL.—MALFORMATIONS.—Malformations of the auditory meatus are usually combined with congenital defects of the auricle and middle ear, sometimes with arrest of development of the bones of the head (Mich. Jaeger, Moos, Zuckerkandl, Steinbrügge, and others). Contractions of the canal, complete closure, osseous or membranous (congenital atresia), and entire absence of the auditory meatus, represent the three different degrees of congenital defect.

In place of the external orifice of the ear there may be a shallow depression, or a short blind canal, or a very fine canal extending inward for some distance beyond the narrow, funnel-shaped cartilaginous portion. The canal may be uniformly narrowed throughout its extent, or constricted near its middle like an hour-glass, or the principal contraction may be near the membrana tympani. Congenital bridge-like bands of connective tissue crossing the meatus have been described by Moos ("Klinik der Ohrenkrankheiten," p. 85). Abnormal width of the meatus, amounting to deformity, is sometimes a congenital condition.

Some instances of *double meatus* are known; these are to be referred to an arrest in the closure of the first