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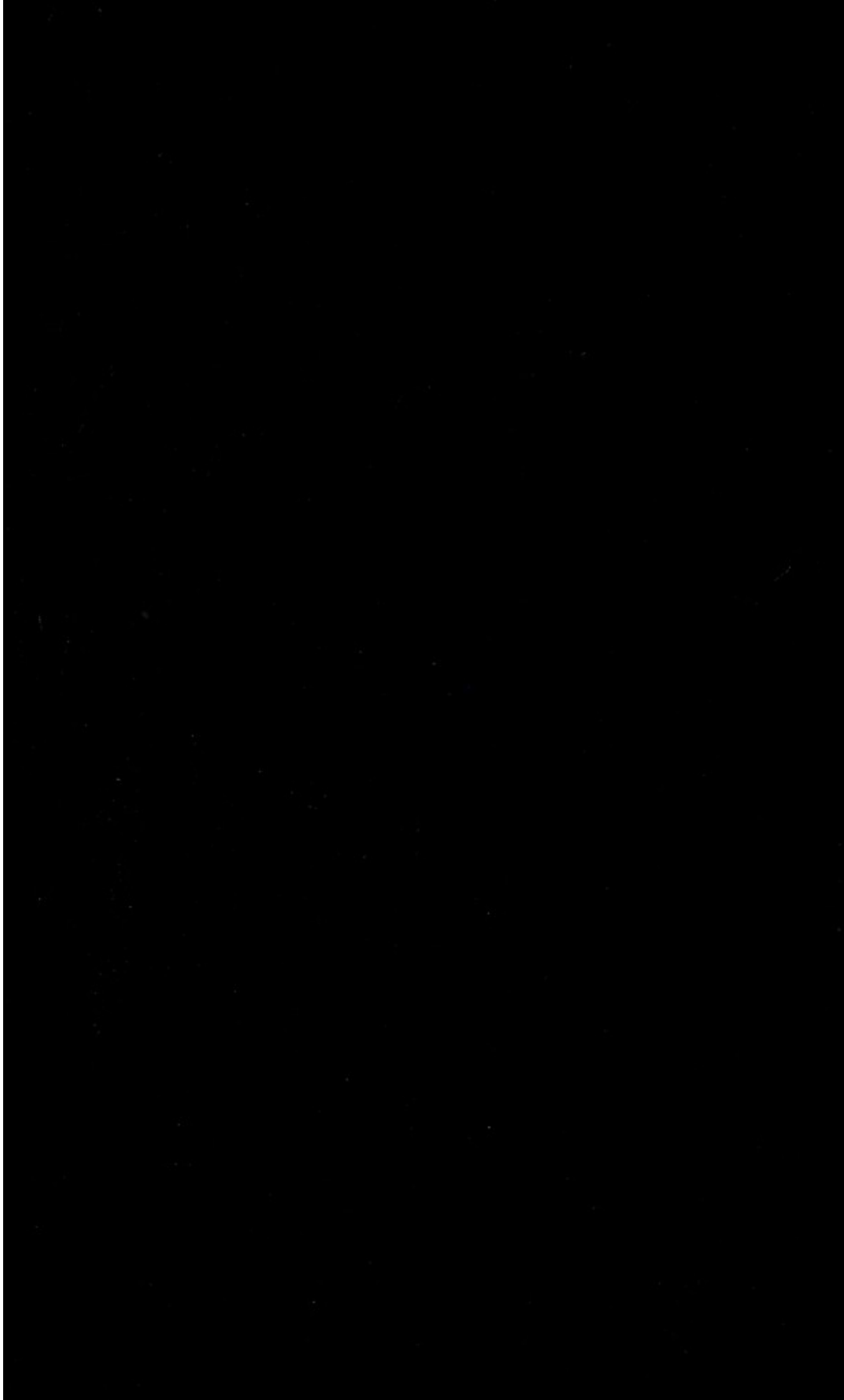
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DISEASES

AND

INJURIES OF THE EAR:

THEIR PREVENTION AND CURE.

BY

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PREFACE.

IN the following pages the author has endeavored to present the important subject of "Diseases and Injuries of the Ear," in a form free from technical terms, so that it may be understood by any one. This plain description of ear-diseases, it is hoped, will enable many to avoid them by care, or, if contracted, will aid in recognizing their nature and thus prevent experimental and erroneous forms of treatment so much in vogue, and which usually do more harm than good. The aim also has been to show the inexperienced what to avoid in the treatment of ear-diseases, rather than what they may try to do for their relief. In this way it is believed the general reader can be best warned against error in treatment, and the hearing saved.

If this little book can show how to take care of the ears and avoid disease in them, or, if they are diseased, how to escape the evils of improper treatment, the author's object will be fully attained.

127 SOUTH EIGHTEENTH STREET, PHILADELPHIA.



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DISEASES AND INJURIES OF THE EAR: THEIR PREVENTION AND CURE.

PART I. STRUCTURE AND FUNCTION OF THE EAR.

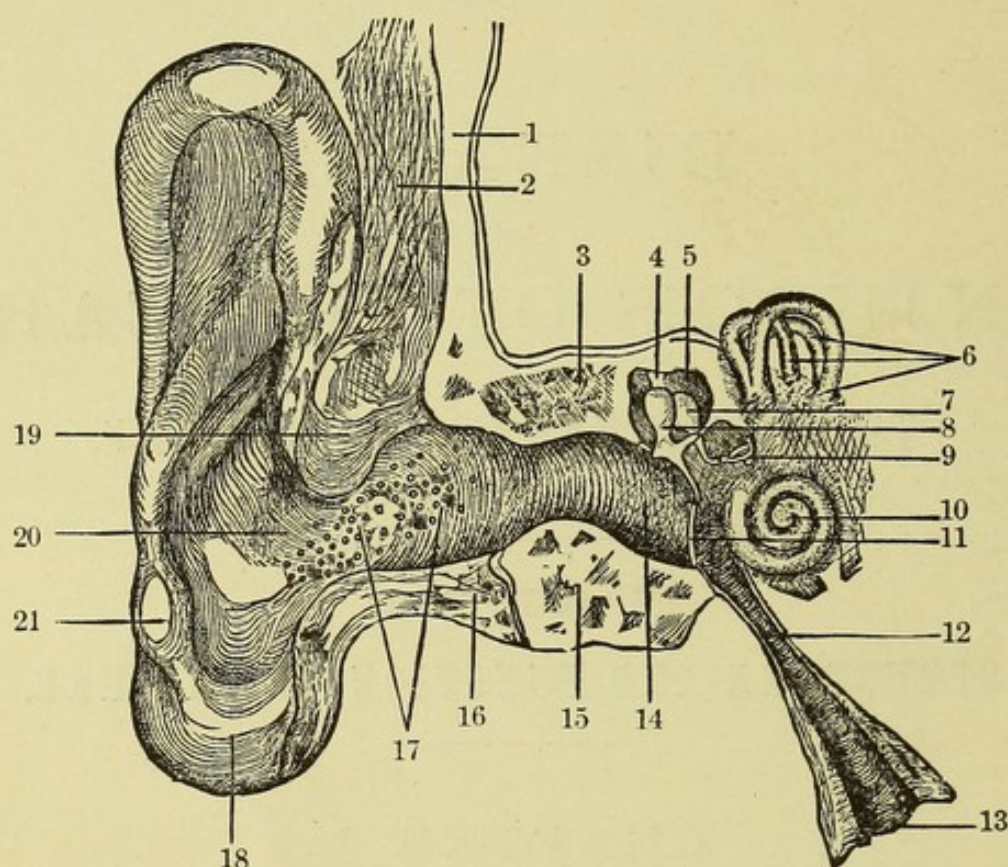
CHAPTER I.

THE DIVISIONS OF THE EAR.

THE organ of hearing, or the ear, is the most complex of all the organs of special sense. For the sake of convenience in speaking and writing of the ear, it is divided into three parts,—viz., the external, the middle, and the internal ear.

The external ear is composed of the auricle, commonly termed the ear, and the canal leading from it to the drum (Fig. I., 14). This canal is termed the external auditory canal. It is about one inch and a quarter long. The auricle, the auditory canal, and the drum-membrane are the only parts of the ear visible from without. The other parts of the ear are situated beyond the drum-membrane, and are, of course, invisible.

FIG. I.



*Diagram of the entire Auditory Apparatus of Man; right side; nearly natural dimensions. (From "Hearing, and How to keep it," by C. H. Burnett, M.D.) The front part of the auditory canal, the front half of the drum-membrane, and part of the Eustachian tube are supposed to be removed. 1, the side of the temple-bone cut through; 2, outer surface of the temple-bone; 3, upper wall of bony portion of hearing canal; 4, ligament holding the hammer-bone to the roof of the drum-cavity; 5, roof and upper part of the drum-cavity; 6, semicircular canals; 7, anvil-bone (*incus*); 8, hammer-bone (*malleus*); 9, stirrup-bone (*stapes*); 10, cochlea (snail-shell); 11, drum-membrane cut across and looked at sideways; 12, isthmus of the Eustachian tube, in the naso-pharynx; 13, mouth of the Eustachian tube behind the nose; 14, the auditory or hearing canal; 15, lower wall of bony portion of the auditory canal; 16, lower wall of the cartilaginous part of the auditory canal at its junction with the bony portion; 17, wax-glands; 18, the lobule; 19, upper cartilaginous wall of the auditory canal; 20, the mouth of the auditory canal; 21, the antitragus.*

The middle ear is that part lying between the drum-head, or drum-membrane, and the internal ear (Fig. I., 5). In this cavity of the middle ear lie the three ossicles of hearing, or auditory bonelets (Fig. I., 7, 8, 9). In the internal ear is the nerve of hearing. This

part lies entirely in bone, and is a small space. It is near the brain, in the petrous or stony bone, so called from its great hardness (Fig. I., 6, 10). The anatomical knowledge of the ear is difficult, but it seems best to give these few guiding facts as to the divisions of the ear, in order to understand what is said of its diseases and injuries. The chief object of this little work is to guide the reader in the prevention and cure of diseases and injuries of the ear. What is here set forth will certainly therefore be better understood if the reader has some idea of the general structure and function of the different parts of the organ of hearing.

THE EXTERNAL EAR.—The outer part of the external ear is the auricle. This is a cartilaginous shell covered with delicate skin. The latter fits into every groove, elevation, and depression of this cup, except at its lowest part. Here there is found simply a cushion of fat covered with skin. To this so-called lobule (Fig. I., 18) ear-rings are often hooked. Numerous blood-vessels, nerves, and lymphatics run through the auricle. It is held fast to the side of the head by ligaments and delicate muscles in man. In the lower animals these muscles are strong and endowed with the ability to move the auricle. The skin of the auricle is abundantly supplied with sebaceous and perspiratory glands, like the rest of the skin of the body. The sebaceous glands are most numerous in the cup of the auricle, where it passes into the mouth of the auditory canal (Fig. I., 17). There is downy hair on the auricle. The long hair on the bulbous projection at the mouth of the ear-canal is a protection against cold air, insects, etc. The sweat-

glands of the auricle are most numerous on the back of it,—an important fact to remember in the nursing of infants; for if their auricles are pushed against their heads and firmly held there, maceration and inflammation of the skin may ensue.

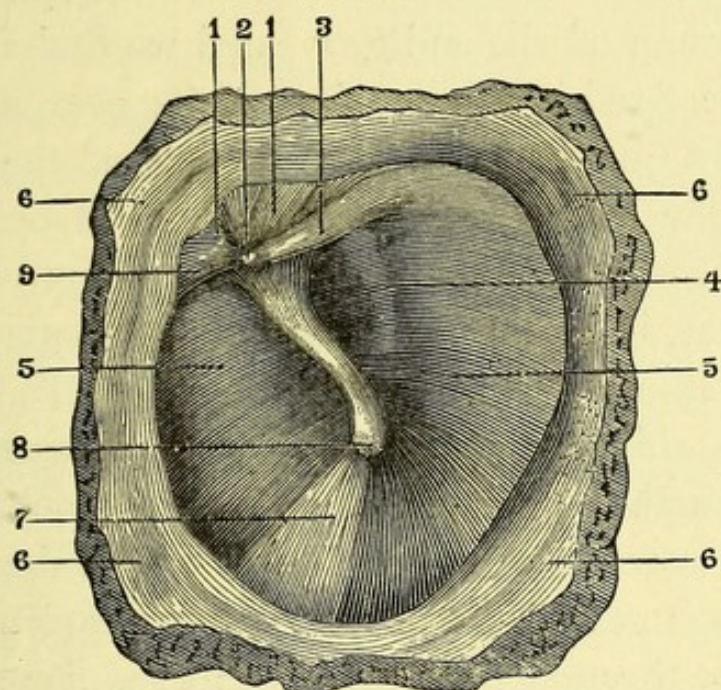
The Auditory Canal.—The auditory canal may be considered the inward continuation of the auricle. It is a canal one and a quarter inches in length by about a quarter of an inch in width, and ends at the drum-membrane (Fig. I., 11). The canal is a little narrower half-way down than it is at either end. Its outer third is composed of cartilage, while its inner two-thirds is of bone. The skin which lines this canal possesses all the elements of true skin. At its outer part, near the junction of the cartilaginous with the osseous part, lie the wax-glands (Fig. I., 17). These are fifteen hundred in number, and secrete the very useful matter called ear-wax. It will be further shown that this substance is most important to the welfare of the ear.

The Drum-membrane.—The drum-head, or *membrana tympani*, is the air-tight partition at the bottom of the auditory canal, between the external and the middle ear (Fig. I., 11). This is the part popularly called the “drum.” This is not an accurate term, as it is really only the outer wall of the drum-cavity or middle ear, and might therefore be called the “drum-head.” The drum-head is nearly circular (Fig. II.), about a quarter of an inch in diameter, and about $\frac{1}{250}$ of an inch thick. The drum-membrane is composed of three layers,—the outer one being of skin, a continuation of the delicate skin which lines the auditory canal. The middle layer is of fibrous tissue, and the inner layer is

of mucous membrane, continuous with that which lines the middle ear or drum-cavity.

In the central line of this drum-membrane is an opaque, white ridge, running from above downward and backward (Fig. II., 5). When the drum is in-

FIG. II.



Outer Surface of the Drum-membrane. Magnified $3\frac{1}{2}$ times. (Politzer.) 1, 1, the flaccid part of the drum-membrane; 2, the short process of the hammer-bone; 3, back fold of the drum-membrane; 4, the long limb of the anvil-bone, shining through the membrane; 5, 5, the true membrana tympani, or membrana vibrans; 6, 6, 6, 6, inner end of bony canal, forming frame for drum-membrane; 7, the pyramid of light; 8, lower part of the hammer; 9, the front fold of the drum-membrane.

spected, this white ridge is the first glimpse the examiner gets of the chain of auditory bonelets already alluded to. This chain of little bones connects the drum-membrane with the portion of the inner ear where the nerve of hearing lies (Fig. I., 7, 8, 9). The white ridge just mentioned is the so-called handle of the hammer, or malleus, the largest of the three auditory bonelets.

This bone is all the more likely to move with every motion of the drum-membrane, because its handle is firmly embedded in the dense middle, fibrous layer of the membrana tympani. When the mechanism of the auditory bones, as a whole, is considered, the further advantage of this intimate connection between the hammer-handle and the drum-head will be shown. At the bottom of the auditory canal we find the drum-membrane fixed in a bony ring of its own, about one inch and a quarter from the opening of the external canal in the auricle. Several features at once attract the eye of the observer when a normal drum-membrane is looked at, in its proper position. Its shape is nearly circular; its color is a delicate bluish pearl, except at the white ridge of the handle of the hammer-bone. There is further noticed the peculiar tint obtained by stretching a transparent membrane over a dark cavity. This is due to the fact that the light in the drum-cavity passes first through the drum-membrane from the outside. It will also be observed that the surface of the drum is smooth and lustrous. This lustre is so great at the lower and front part of the drum that at this point, between the circumference of the membrane and the lower end of the hammer-handle, there is a shining triangular reflection of light. This is called the "pyramid," or "cone of light," and can be seen in any normal ear (Fig. II., 7). There is a prominent point at the upper end of the handle of the hammer, called its short process (Fig. II., 2). This point plays an important part in plotting out the drum-membrane and in getting one's bearings when examining the ear. The short process looks not unlike a small, whitish pimple.

It is situated in the upper periphery of the drum-membrane, at the upper end of the aforesaid white ridge. Two prominent ridges pass from it, one backward, the other forward, to the periphery of the drum-membrane, and are called the folds of the membrane (Fig. II., 3, 9). They serve as the upper boundary of the membrane proper, the so-called vibrating membrane (*membrana vibrans*). Above these folds is a part of the drum-membrane in a triangular spot, without any fibrous tissue. This is called the flaccid membrane, or *membrana flaccida* (Fig. II., 1, 1). The neck and head of the hammer-bone lie directly behind this last-named part of the membrane.

These parts of the hammer bonelet are never visible, however, from without when the ear is in a healthy state. The leverage-line of the hammer lies in the line of these folds. The lower arm of the lever is represented by the handle of the hammer, below the folds, and the short arm, by the neck and head of the same, above the folds. In every vibration of the membrane and bonelets, the malleus, or hammer, swings with a minute excursion about this axis-line, marked by the line of the folds of the membrane.

THE MIDDLE EAR.—The middle ear is the seat of most of the diseases of the ear. Its structure, therefore, demands a brief consideration. It is composed of the drum-cavity, and two important adjuncts,—viz., the mastoid cells behind, and the Eustachian tube, connecting the ear with the nose, in front. The drum-cavity is the most complicated and delicate of the three portions just named, and is most liable to disease (Fig. I., 4, 5).

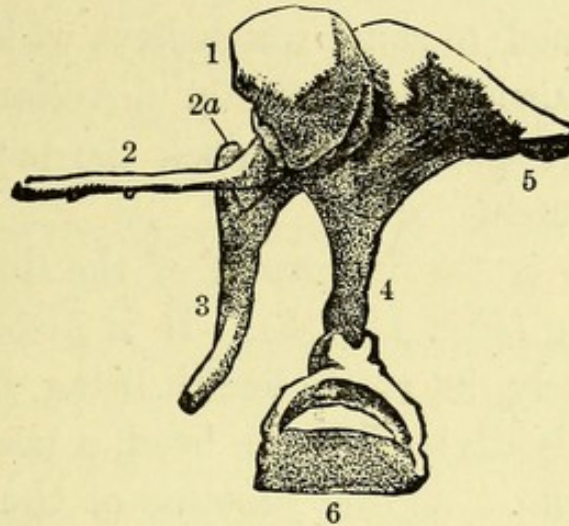
Drum-cavity.—This cavity may be described as bounded by four walls, a roof, and a floor. The walls are named the front, the back, the inner, and the outer. The three auditory bonelets are the most important contents of this chamber. It is, however, lined with a most sensitive mucous membrane, which when inflamed gives rise to excruciating pain. This important cavity is about half an inch in height and width, and from a twelfth to a sixth of an inch deep, measured from without inward, and lies just beyond the drum-membrane. The mucous membrane which lines it is a continuation of that of the nose and upper part of the throat. This cavity is the true drum, and to it alone the name of *drum* should be applied. When the name of drum is given to the drum-membrane or drum-head, great confusion arises.

Auditory Bonelets.—The ossicles of hearing, or auditory bonelets, are three in number,—the hammer, or *malleus*, the anvil, or *incus*, and the stirrup, or *stapes*, named from the fancied resemblance in shape to these implements (Fig. III.). They form the so-called “chain of bones” of the ear. Starting from without, the first bonelet is the malleus (Fig. III., 1, 2, 3), the second is the anvil (Fig. III., 4, 5), and the third, the innermost one, is the stirrup (Fig. III., 6). The first-named is the largest; the last-named is the smallest; in fact, it is the smallest bone in the body.

The hammer is divided into a head, a neck, and a handle. Its length is about a quarter of an inch, one half of which is formed by the handle. The head is about one-eighth of an inch thick. The handle of this bonelet is set into the *membrana tympani*, and holds it

taut. Besides this support, the hammer is held firmly in position by ligaments which fasten it to the roof and outer wall of the drum-cavity (Fig. I., 4).

FIG. III.



The three little bones of the ear, from the right side, in natural connection, seen from within. Magnified about four times. (Henle.)
 1, head of the hammer; 2, long process of hammer, not found in adults; 2 a, the short process of the hammer; 3, the handle (*manubrium*) of the hammer-bone; 4, the long limb of the anvil-bone; 5, its short limb; 6, the stirrup-bone.

As we pass inward, next in order comes the anvil. It is divided into a body and two limbs, the horizontal or short one, and the descending or long one. This bonelet, like the hammer, is held to the upper and posterior wall of the drum-cavity by ligaments, and is jointed to the hammer on the outside of its body, and to the stirrup by the tip of its long limb (Fig. III., 4). The joint between the hammer and the anvil has the peculiarity of unlocking or loosening if the hammer is pulled outward, but if the handle is pushed inward, about the axis-line already described (p. 13), this joint between the hammer and the anvil is only the more firmly locked, and the anvil is carried inward towards

the inner ear. In fact, this form of motion occurs with every impression of sound upon the drum and the nerve of hearing. This function in this joint will be found very important when the mechanism of sound and hearing is considered. The action in this joint has been likened to some watch-keys which wind the watch when turned in a certain direction, but when turned in the opposite way unlock the barrel and fail to wind the watch.

The stirrup is the innermost of the three bones we are considering (Fig. III., 6). It is also the smallest bone in the body, its entire length being one-eighth of an inch. It is divided into a head, a neck, two legs, and a foot-plate. At the junction of the two legs is found the head, in the form of a cup-shaped button. It is designed to receive a knob-like projection on the end of the anvil's long limb. The two legs of the stirrup are made lighter, without being weakened, by a furrowing on their inner surfaces. The foot-plate is ovoid or slightly kidney-shaped, and fits accurately into the oval window of the labyrinth, in the inner wall of the drum-cavity (Fig. I., 9). In this window it is hermetically held by a fibrous packing, as will be further shown. The connection is thus made between the outer ear and the drum-head, on one side, and the labyrinth and the nerve of hearing, on the other. This entire chain of auditory bones moves in and out as a whole, performing a pendulum-like motion about the axis-line in the folds, already described (p. 13). This kind of oscillation, to and fro, on the part of the drum-head and the chain of auditory bones, causes the foot-plate of the stirrup to play backward and forward

in the most minute excursions. This movement of the stirrup, in turn, sets the water in the labyrinth in motion, and impresses the auditory nerve, producing thereby *hearing*.

Boundaries of the Drum-cavity.—The dividing partition between the drum and the brain is the so-called roof of the drum (Fig. I., 5). This boundary is very thin, and in some individuals has chinks in it. On this account an inflammation in the drum may pass into the brain and prove fatal.

The front wall of the drum is nearest the throat or nose, and has in it the opening for the reception of the Eustachian tube (Fig. I., 11, 12). On its upper and inner part there is a canal, through which a little muscle passes called the “stretcher of the drum” (*tensor tympani*), on its way across the drum-cavity, to be inserted into the handle of the hammer on its inner and upper part. This muscle is an offshoot from the muscles of the throat and Eustachian tube, and hence sympathizes with their diseases.

The back wall, like the front, is narrow. It too contains an opening, which communicates with the mastoid cavity and its cells. The topography of the inner and outer walls of the drum or tympanum are more intricate. The outer wall of the drum-cavity is composed mainly of the drum-head. The limit of this wall is the bony ring in which the drum-membrane is stretched (Fig. I., 11). We have already stated that the hammer-bonelet is closely connected with this wall by its handle (p. 14). An important nerve passes across the inner surface of this wall, near the upper boundary of the drum-membrane. Around this nerve a fold of

mucous membrane passes, and, standing off a little from the surface of the drum-membrane, forms with it a crease, or groove, opening downward. There are two of these so-called pouches of the drum-membrane, one in front of, and the other behind, the hammer.

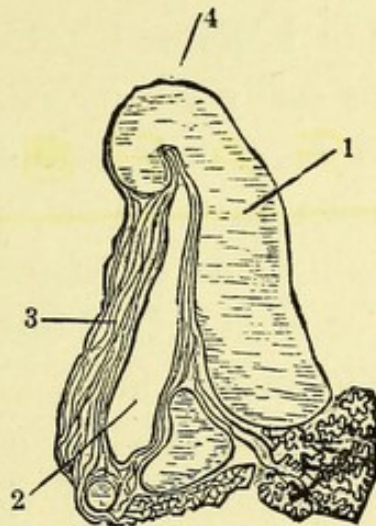
The inner wall of the drum demands close examination. Here we find on the posterior portion the *promontory*, caused by the outward projection, towards the drum, of the lower turn of the cochlea, yet to be described. This can often be seen through the drum-membrane, as a pale-yellowish spot. Sometimes the membrane touches the promontory, and in some cases adheres to the inner wall at this point. Above the promontory is the *oval window*, into which fits the foot-plate of the stirrup-bone (Fig. I., 9). Behind and below the promontory is the *round window*. A little muscle runs from the head of the stirrup backward to its origin in a hollow pyramid of bone in this inner wall.

The little oval window is about $\frac{1}{8}$ of an inch in its longest diameter and about $\frac{1}{16}$ of an inch in its shortest. The diameter of the round window is about $\frac{1}{16}$ of an inch.

Behind the oval window a ridge begins, which marks the course of a bony canal, conveying the facial nerve through the drum to the face. This will account for the fact that inflammation in the ear sometimes produces paralysis of the corresponding side of the face. The *floor* of the drum-cavity is only a narrow groove; beneath it runs the jugular vein on its way to the lower part of the neck. This accounts for the fact that the movements of the blood in this vein sometimes cause abnormal sounds in the ears.

Eustachian Tube.—This tube, or canal, forms the only aërial communication between the nose and the ear (Fig. IV.). It opens near the posterior nostril in the upper part of the throat, behind and above the palate. Its course is upward, outward, and backward towards the drum. In the pharynx or upper throat the opening of this tube is wide (Fig. I., 13). It then

FIG. IV.



Transverse section through the Eustachian tube. Magnified about four times. (Henle.) 1, cartilaginous upper and back wall; 2, the cavity of the tube proper; 3, the front wall composed chiefly of muscle; 4, the hook-shaped part of the upper wall, curving forward to join the muscular wall. This hook-shaped part moves with the muscles in every act of swallowing, and aids in widening the cavity, 2, through which air passes to the inside of the drum.

narrows to what is called the isthmus (Fig. I., 12), from which it widens again to the tympanic cavity. The entire length of this tube is a little more than an inch. Two-thirds of the tube is cartilage; the other third is bone. It is lined with mucous membrane, continuous with that of the throat, nose, and drum-cavity. Hence diseases pass readily from the nose and throat to the ear.

This tube is provided with muscles which arise from the palate and are attached to its cartilaginous part. When these are moved in swallowing they draw the cartilaginous walls of the Eustachian tube apart and allow air to enter the drum-cavity. This is necessary for the healthy action of the ear. If it is deprived of air for any length of time, deafness and earache set in.

Mastoid Cells.—The last division of the middle ear which claims attention is the mastoid portion, with its peculiar cells. This is located behind the ear, in a rounded prominence easily felt by all. It is filled with a number of small bony cells, hollow, containing air, and lined by mucous membrane. One large one is situated at the opening into the drum-cavity. This is called the *antrum*, or cave. It is often the seat of disease, which we shall consider later.

THE INTERNAL EAR.—The internal ear is also called the labyrinth. It is composed of the *vestibule* in the middle, the *cochlea* in front, and the semicircular canals behind (Fig. I., 6, 10). It is a hollow bony cavity, containing soft tissues of a similar shape, also hollow, and receives the expansion of the auditory nerve. The *oval* window, already alluded to (p. 18), is in the *vestibule*. Through this window by means of the foot-plate of the stirrup-bone (Fig. I., 9) pass the waves of sound in normal hearing, on the way to the auditory nerve. The vestibule-cavity is pear-shape. It is about $\frac{1}{8}$ of an inch wide from within outward, and a little more than $\frac{3}{16}$ of an inch measured from front to back. Its four walls run together where the *cochlea* begins. This latter cavity, as its name implies, is shaped like a snail-shell. It is, in fact, a bony canal wound two

and a half times about a bony pillow (Fig. I., 10). This canal of the cochlea is partly divided longitudinally by a bony shelf, which partition is completed by a membrane. Thus we find the cochlear canal divided into two smaller canals, or stairways as they are termed. They are joined together at the top of the shell, at the cupola.

The canal of the cochlea being divided into two passage-ways, one can imagine one's self entering the upper passage from the vestibule, and emerging at last by the lower one at the round window. This latter window is closed by a membrane, which shuts it off from the drum-cavity.

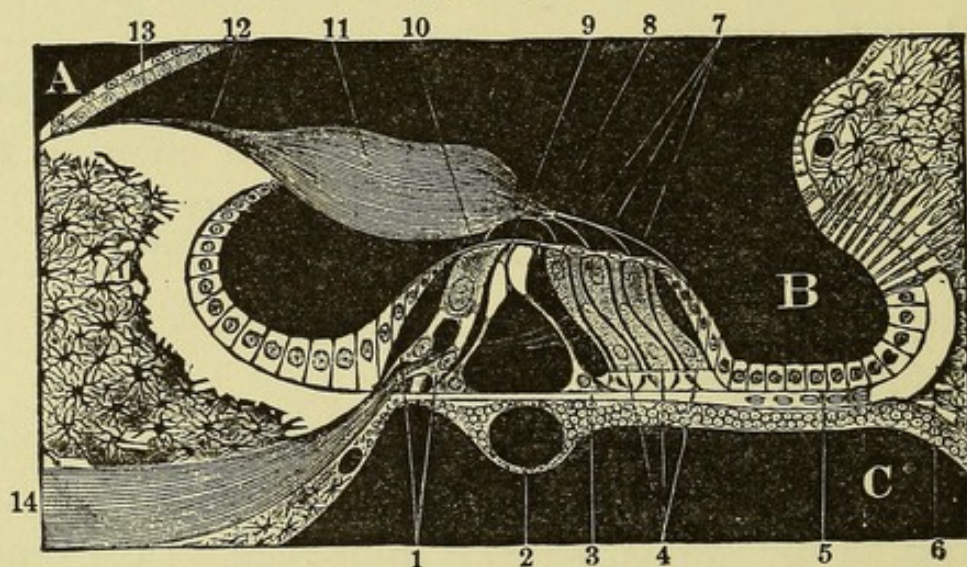
When the fluid which fills the vestibule and entire labyrinth is pressed upon by the foot-plate of the stirrup; in the oval window, it finds relief at the round window by the yielding of the aforesaid membrane.

The semicircular canals, three in number, communicate with the back part of the vestibule (see Fig. I., 6). Thus we complete the sketch of the bony labyrinth. This is a hollow cavity, and, in its normal condition, filled with water. In this are supported delicate soft structures similar in outline and shape to the bony case containing them, and hence called the membranous labyrinth. They may be considered hollow casts of the bony labyrinth. They contain in their soft and delicate cavities the terminal nerve-branches of the acoustic nerve.

Membranous Labyrinth.—Within the vestibule, already described, are found two little sacs, the round and the elliptic, which may be regarded as the central part of the membranous labyrinth. The elliptic is the

larger, and with it unite the membranous semicircular canals. It is joined to the round sac by means of a V-shaped canal. The round sac unites with the cochlea. Hence the membranous labyrinth, like the

FIG. V.



A diagrammatic representation of Corti's organ, the ultimate distribution of the auditory nerve in the internal ear. Magnified between 300-400 times. 1, the base of the inner hairy cells: auditory nerve passing between them; 2, section of a blood-vessel; 3 and 5, the basilar membrane, uniting the edge of the bony shelf at 1 with the outer wall of the cochlea at 6, thus dividing the cochlear canal into A, the vestibular scala, and C, the tympanic scala; 8, the outer pillar of Corti leaning against 9, the inner pillar forming Corti's arch; 4, outer hairy cells, receiving nerve-filaments from 14, the nerve of hearing; 7, upper ends of haired cells where the acoustic hairs are found; 10, upper ends of inner haired cells; 11, Corti's membrane; 12, upper lip of bony shelf: the nerve of hearing, 14, runs through lower part of this shelf, emerging at 1, in the lower lip of bone. Corti's organ may be said to lie between the lines 5 and 12.

bony case containing it, is in reality one cavity. It lies in water, and is also filled with it. This labyrinth-water is part of the natural water of the brain and skull-cavity. The vestibular branch of the auditory nerve supplies branches to all soft parts in the vestibule and membranous semicircular canals, and the cochlear nerve supplies the soft tissues in the cochlea.

It may be of interest to the reader to trace the course of the nerve of hearing in its distribution to the cochlea.

Cochlear Nerve and Corti's Organ.—The cochlear nerve, after entering the base of the bony pillar around which the cochlear canal is twined, emerges on the bony shelf of the canal, and is spread out over the latter, like a fringe. Let us trace one filament of this nerve on its way over this shelf and to its terminus, the so-called organ of Corti. The latter is simply a support, and not a percipient organ. It consists of two pillars placed on the membranous partition between the two cochlear stairways (see Fig. V., B, C). These pillars lean towards each other and are united above, forming a so-called arch of Corti. A delicate net-work, running parallel to the membranous partition above named, is supported by this arch. In this net-work are held a series of cells or disks, with fine hairs on their upper ends. To these cells, named hair-cells, the nerve passes and is attached, as its ultimate destination (see Fig. V., 7, 14).

There are three thousand of these organs, or arches of Corti, in the human ear

CHAPTER II.

PHYSIOLOGY OF THE EAR.

Sound.

SOUND is motion imparted to the auditory nerve. The motion productive of sound is usually conveyed by undulations in the air. A sounding body communicates shocks to the surrounding atmosphere, which pass by waves of undulation, as they are called, on all sides which are free, as the waves ripple the surface of water after it is disturbed by a pebble thrown into it. Sound moves at the rate of 1090 feet per second in air at the freezing-point. The velocity increases two feet per second for each increment of 2° Centigrade, in temperature. Let us assume that water represents the atmosphere, the pebble the source of sound in the vibrating body, the ripples on the surface of the pond the waves of sound in the air, and then the shore of the pool will represent the ear, or the point where sound is received. The perception by the ear of these motions or vibrations in the atmosphere is *hearing*.

Intensity of sound depends on the breadth of these waves; *pitch* depends upon their number in a second; and *quality* (clang-tint, or timbre) depends upon the peculiarity and manner of the occurrence of the sound. Partial tones, so called, compose a sound, just as ordinary light is composed of several colors. The difference in sounds depends upon the number and strength

of these partial tones. Thus it is that one voice differs from another. The first partial tone is called the fundamental note; the others are called the harmonics or "*over-tones*."

Ordinary musical tones, like notes of the piano or organ, vary from 33 to 3960 vibrations in a second. Some pianos give out notes of as many as 4224 vibrations in a second. A shrill note, like that of the piccolo, a kind of flute, contains 4752 vibrations in a second. This is the ordinary range in the musical scale; but the human ear recognizes as musical notes those as low as 20 vibrations or as high as 38,000 vibrations in a second. The high notes are painful to the ear, because they set up a powerful sympathetic resonance in the air of the auditory canal. When waves of sound are thrown back to their source, we have *echo*. If we observe the surface of a pool thrown into waves by a pebble, we will see some of the waves apparently going back to the point of starting, thus representing echo.

When waves of sound occur with regular intervals between them, they produce *music*. When these occur with irregularity, they produce discord, or noise.

Hearing.—When a wave of sound reaches the side of the head, part of it is received by the auricle and directed down the auditory canal to the drum. The latter is thrown into pendulum-like, or to-and-fro, vibrations by the wave of sound. This motion is imparted by the drum-membrane to the hammer-bonelet and the other ossicles, and these are made to swing in and out. Thus the little foot-plate of the stirrup-bone, in the oval window of the vestibule (Fig. I., 9), is

made to play in and out and to impress the water of the labyrinth. This in turn conveys the impression of the movement of the ossicles to the nerve-filaments in the labyrinth, and the brain interprets these motions as sound.

Function of the Auricle.—The auricle acts as a collector of sound in the lower mammals. Here in them are found well-developed muscles, and the auricle is consequently very movable in animals like the horse, the cow, or the rabbit. In these animals the auricle is very movable in all directions, which enables them to catch sounds from all quarters, especially from before and from behind. This is especially valuable to grass-eating animals when in a wild state, as it enables them to hear the approach of flesh-eating beasts in pursuit of them. In the flesh-eaters, like cats, tigers, etc., the auricle is pointed rather forward than backward, and is more easily kept in that position than in any other. As their prey is generally ahead of them, this position of the auricle enables the pursuer to hear where the pursued is.

In aquatic mammals the auricle is very small, but is very useful, as it can be tightly drawn inward into the mouth of the auditory canal and keep the water from entering the ears during their submergence in water. We are taught by this fact in natural history that mammals or warm-blooded animals, including man, should not get cold water in their ears when bathing at any time.

In man the auricle is immovable, so that he is not supplied with any natural means of keeping water out of his ears when he is under water. This I take to

be an indication that man is not intended to expose his drum to the contact of cold water.

Although the auricle in man cannot be regarded as a movable collector of sound, it cannot be regarded as entirely useless as an aid to hearing, since by its shallow, trumpet-mouth shape it acts as a collector or strengthener of some of the weaker sounds falling on it. The auricle has no part in the quantitative conveyance of sound, but it may be regarded as having a decided effect in the qualitative sensation of sound as perceived by the human ear. Any one may convince himself of this when in the presence of a multitude of sounds, such as occur by the sea, near escaping steam, or in a grove of trees with rustling leaves. If when in these sounds the auricle is gently pressed forward or firmly backward against the side of the head, in the first instance all the sounds are fuller and deeper. Hence a deaf man instinctively puts his hand behind and around his auricle, to enable him to hear all sounds better. In the second condition the deeper sounds will seem to vanish or be quieter, while the fainter ones, those of higher pitch, will become more prominent. This is due to the composite nature of all sounds and the power the auricle has by nature to strengthen by resonance the component or "partial" tones of any sound.

Auditory Canal.—The tube of the trumpet of which the auricle is the mouth is represented by the auditory canal. The length of the latter, plus the depth of the auricle, is just the proper length to resound to the tones of the human voice most important for us to hear.

In addition to these resonant functions, the human

auditory canal has the ability to expel the surplus ear-wax which forms in it. As already stated, the wax-glands of the ear lie near the mouth of the passage. From that point inward the walls of the canal are slightly convergent to the middle part of the canal. Here the canal widens again towards the drum, as the shape of the auditory canal is that of two detruncated cones placed together at the point where their apices are cut off. This makes the narrowest part of the canal in the middle, and the wide ends at the opening, and where the drum-membrane is stretched. From the central narrow point the outer part of the canal inclines outward and down-hill on its floor, while the inner part inclines similarly towards the drum. A ball of wax, therefore, in the outer end of the canal would roll outward if let alone. As wax is formed in this outer part of the canal, it will not get beyond the isthmus of the canal unless forced there by artificial means. Again, ear-wax will tend to come from the ear, rather than go farther into it, because the skin over the drum-head and the walls of the auditory canal grows outward towards the external mouth of the canal, and carries with it, just as a finger-nail carries a spot with it, as it grows, until the ear-wax, etc., appears at the external opening of the ear. It is to be regretted that this beneficent process of nature is constantly interfered with by the useless endeavors to swab or pick the ear in order to free it from wax.

Membrana Tympani, or Drum-head.—The function of the drum-membrane is to collect sound-waves, to convey their force to the chain of little bones in the middle ear, and to support and help keep the hammer-

bone in proper position, and by that means the other two bonelets, so that they will all swing easily with every wave of sound. Another function is to protect the mucous membrane in the middle ear from the direct contact of the external air.

If the *membrana tympani* is pressed too far either way, the chain of little bones cannot swing properly, and hence sound is no longer transmitted normally. Thus, if the bones are pressed inward upon one another, they become so locked as not to oscillate freely. If, on the other hand, the drum-membrane is forced outward, the malleus (hammer) is carried outward, and a partial dislocation occurs between it and the incus, or anvil. Hence sounds cannot be transmitted over the imperfect chain. In either case the conductors of sound are said to be out of equilibrium. When a large perforation occurs in the drum, there is a consequent loss of outward traction on the part of this membrane. Hence the balance of power between the *membrana tympani* and the stretcher muscle of the drum is destroyed, and the latter drags the chain of bonelets too far inward. Hearing is then impaired, because the bonelets are then locked upon one another and are unable to vibrate and conduct sound properly.

When the drum-membrane is perforated, the mucous membrane of the drum-cavity is exposed to the action of the external air. Hence when a sudden perforation occurs from violence or accident to the *membrana*, great care should be taken not to pour or drop anything into the external ear. The best protection in such a case is a little cotton laid in the external opening of the auditory canal.

The intact drum-membrane prevents the entrance of an insect or the like into the head. Hence no alarm need be felt that any foreign substance which has got into the external canal may advance farther and reach the brain. This is impossible, as the drum-head is stretched across the inner end of the auditory canal to prevent such an accident. Furthermore, if the membrana tympani should be perforated, a foreign substance might get into the middle ear, but not into the brain, as the latter lies beyond the drum-cavity and separated from it by a wall of bone. We shall show farther on that when disease in the middle ear destroys this bony wall between it and the brain, then the latter may become diseased from the encroachment of the aural disease.

Tympanic Cavity.—The tympanic or drum cavity acts as an air-chamber, over one side of which is stretched the drum-membrane. The arrangement is analogous to that in the musician's drum: in both it and the tympanic cavity, or ear-drum, there is found a membrane stretched over a hollow box, to which air has free access by means of an opening on one side. In the musical instrument air enters by a little hole on one side; in the ear air enters the drum-cavity by the Eustachian tube. If in either case the air-passage is closed, the external atmosphere forces the drum-membrane inward, and a quasi-vacuum is formed in the human ear by the absorption of the atmosphere previously in it. As the drum-head sinks in, the ossicles follow inward, the chain of bonelets is locked, and deafness ensues.

Eustachian Tube.—The front wall of the Eustachian

tube is drawn away from the back wall, and the air enters the thus opened tube with every act of swallowing. By this means an equilibrium of air is maintained on both sides of the drum-membrane. Did such renewal of air in the drum-cavity not take place frequently, deafness would soon occur, from the absorption of the air in the drum, and the membrane and bonelets would be locked, and cease to vibrate. Sudden closure of the Eustachian tube, and a consequent defective ventilation in the middle ear, occur not unfrequently in children, from cold in the head, causing earache from the inward pressure of the drum-membrane. The Eustachian tube acts like a safety-tube when the drum-membrane is forced suddenly inward by concussion from a blow on the ear, or from an explosion. The air of the drum-cavity is then forced into the Eustachian tube, and thence into the throat, thus allowing the drum-head to recoil enough to save it from rupture. Did it not thus yield, it would be torn by the concussion and compression of the air in the auditory canal.

Mastoid Cells.—The acoustic advantages of the communication of the mastoid cells with the middle ear can be appreciated by considering some of the physiological features of the middle ear. Sound-waves will produce the best effect when in the middle ear the following three conditions are maintained :

1. The Eustachian tube must remain closed most of the time.
2. This tube, however, must be opened sometimes for ventilating the middle ear ; and this occurs at each act of swallowing.

3. The cavity of the drum—the tympanum—must be in communication with large irregular air-cavities, for resonant purposes. This is obtained by its connection with the irregular, honey-comb cells of the mastoid bone. Were the drum-cavity larger and of a regular outline or shape, it would be useless acoustically, from its consequently great resonance.

INTERNAL EAR.

The internal ear is an organ in a bony case, filled with water. In this fluid the membranous parts and nerve of hearing float, with but slight attachment. The internal ear is comprised within the so-called labyrinth (see p. 20). We may liken the labyrinth in its practical construction—not in outline—to a water-tight keg lying on its side. On the side of this supposed keg, towards us, we shall find an oval hole hermetically closed by a leather patch, and, in the left ear, to the right of this oval window, there will be found a round hole, also hermetically closed by a membranous patch. At these two points in this cavity containing water, two spots will be found which will slightly yield to pressure, either from within or without. Hence, if one of these points is pressed inward, the water beyond it will force the other one outward correspondingly. Just this condition of compensatory yielding is found in the oval and round windows of the labyrinth.

The stirrup-bonelet fits into the oval window, corresponding to the oval hole just described as in the water-tight keg.

Inward pressure of the stirrup, as occurs with every

sound falling on the ear, is communicated to the labyrinth-water, which is thrown into motion because of the yielding point at the membrane of the round window. Did this yielding at the round window not occur, the inward pressure of the stirrup would so compress the fluid in the labyrinth as to injure the delicate nerve of hearing contained therein.

Vestibule and Semicircular Canals.—It has often been supposed by leading physiologists that we hear noises with the vestibule-nerves, and music with nerve-structures in the cochlea. It would seem that all hearing is brought about by means of the vibration of minute cells supplied with short hairs, in communication with the branches of the nerve in the internal ear. Hensen and Ranke, two German observers, examined certain marine animals with transparent bodies. The microscope revealed in these animals not only curious cells tufted with stiff, vibratile hairs, in connection with the nervous structures of the ear, resembling those in man, but it was also observed that these stiff hairs vibrate when certain musical notes are sounded near them.

Therefore, in all probability, the most sensitive parts of the internal ear are these stiff-haired cells, each one of which would seem to be specially endowed with the ability to respond to, or vibrate in consonance with, the various sounds and notes which fall on the ear. Such cells are specially numerous in the cochlea, the entire arrangement of which seems to favor the mechanical support of these delicate and important bodies.

The physiology of the semicircular canals is not positively known. It is, however, pretty well established now that these canals are endowed with a peculiar

sensibility as to the position of the head and body. Hence it may be said that the sense of equilibrium, or proper carriage of the body, lies in them. It is well known that when these canals are wounded or destroyed in birds or other animals, they no longer are able to control the movements of their bodies in their attempts at flying or walking. Then there occur peculiar reeling and falling symptoms, without loss of consciousness. Since, with certain symptoms of ear-disease in man, there ensue at times just such peculiar reelings and falls, without unconsciousness, it is supposed that in such cases the semicircular canals are the seat of disease. Therefore some locate a sense of equilibrium in these canals in the back part of the labyrinth.

PART II.

COMMON DISEASES AND INJURIES OF THE EAR: THEIR PREVENTION AND CURE.

CHAPTER I.

DISEASES AND INJURIES OF THE EXTERNAL EAR.

Diseases of the Auricle.

IN very cold weather the auricle is liable to be frost-bitten when exposed to a low temperature, as in sleighing, driving, skating, or working in the open air. This is not dangerous either to health or hearing, but it may be painful, when the blood once more circulates in the skin, and, if improperly managed, some distortion and disfigurement may ensue in the auricle. The auricle when frost-bitten becomes white, stiff, and brittle. Great care must be taken not to break it, nor to heat it too quickly. It should be gently rubbed or chafed with cold water, snow, or ice, in a *cool* room, and thus the circulation of the blood slowly restored in the frozen ear. If heat is suddenly applied, inflammation may set in, and the ear will be as though it were burnt. The best plan, therefore, is to apply cold to the frozen skin until it begins to have feeling in it once more, and then the ear is safe.

Prevention of Frost-bites.—To prevent frost-bites in

the future, after the auricle has been thus once attacked, requires a course of treatment which will harden the skin previously affected by freezing. After the skin has healed, it may be made harder, and more resistant to freezing again, by bathing the once-inflamed part with alum-water, ten to twenty grains to the ounce of water. Oil of cubebs may be used in the same way, but the odor of this will often preclude its employment. The oil of sassafras, cloves, or mint, in the strength of ten to fifteen drops to the ounce of vaseline, or albolene ointment, will also act well as a stimulating application. If care is taken not to expose the once-frozen auricle to great cold, after recovery, and some means resorted to to make the skin of the affected part harder, in the following winter, with ordinary care, no freezing will occur. But it will always be safe to make some strengthening application to the skin at night before retiring, as cold weather comes on, the winter following the original frost-bite.

The cartilage of the auricle may be broken by a blow on the ear, or such violence may so loosen the covering of the cartilage beneath the skin as to permit blood to get under it. This may be absorbed again if let alone, or properly treated, but in any case the wound may heal with great puckering of the skin of the ear, and the auricle will become greatly disfigured. This is sometimes seen in pugilists and in the insane, as the result of violent blows or falls in which the ear is injured. In the insane it has been considered by some authorities to be a symptom of their brain-disease, which being attended with debility, weakening of the tissues of the body, and defective circulation of the

blood, the latter escapes from its vessels not only in the brain, but also upon the surface of the body. It is held by some that this blood-tumor or sac of blood in the auricle sometimes forms spontaneously in the insane, and is then a diversion of blood from the brain, and as such saves the life of the lunatic for the time being.

Hæmatoma auris, as this blood-tumor of the auricle is called, may originate not only from wounds or injuries inflicted by one person upon another, but carelessness regarding the protection and posture of the ear in winter-time, may lead to the formation of an othæmatoma on the auricle from being frozen and then roughly handled.

Rau, a German writer on diseases of the ear, gives an account of a man who fell asleep with his auricle against the window-pane of a railway-car, while traveling during a very cold night, in an unheated car. In the morning when he awoke his ear was frozen fast to the window-pane; but before he was fully aware of the accident he pulled his head away from the window, and in so doing tore the adherent ear very badly. This led to a traumatic blood-tumor, and subsequent deformity of the auricle. A very good suggestion has been made by Dr. C. J. Blake, of Boston, to apply massage in the treatment of these blood-sacs forming in the auricle. The gentle kneading and rubbing thus applied leads to an absorption of the extravasated blood, and all risks, arising from an opening of the sac with a knife, are avoided. Deformity, too, of the ear is much less likely to occur if massage is used and the sac is unopened.

Ear-rings.—In piercing the lobule of the ear for

wearing ear-rings, the cartilage, which sometimes dips into this fatty appendage, is wounded. Great care, therefore, should be exercised, when the lobe is to be pierced, not to make the perforation high enough to strike the cartilage. This can be avoided by feeling for the cartilage in the lobule. If present, it will reveal itself by its hardness. It would be better not to pierce the ears at all for ear-rings; but if it is done it should be with these precautions.

Cleft Lobule.—Ear-rings are sometimes dragged open, either accidentally in play or intentionally in quarrels. By this means they are torn through the soft lobule, which is left with an unsightly slit. This, however, can be removed by an operation and subsequent proper treatment.

Imperfect Development.—Children are sometimes born without auricles, or they may be born with several auricles. Some of these may be placed low down on the neck, or in front of the usual place. They are generally small, or, as it is termed, rudimentary. Sometimes the auricle is only partially developed. Yet with all of these defects or peculiarities the hearing may be good.

If these defects, however, extend into the auditory canal or middle ear, then the hearing is found defective. There is one peculiar defect sometimes found in children in front of the ear, at the union with the cheek. This is a small hole communicating with a canal leading into the middle ear, or the throat. This is called a *congenital fistula* of the ear. It has no effect on hearing, and generally closes in adult life.

Skin-Diseases.—There are numerous diseases of the

skin which may affect the auricle,—viz., chafing, sunburn, poison from plants or insects, erysipelas, eczema, boils, syphilitic eruptions, shingles (herpes zoster), and cancer. Many of these do not demand much treatment, and are easily cured, but none should be neglected. The graver ones should instantly receive treatment. It should always be borne in mind that whatever drug is put on the auricle should not be allowed to run farther into the ear, for fear of injuring the drum.

Sunburn of the auricle may be treated with applications of cosmoline, vaseline, or albolene. Erysipelas may receive a similar local treatment, but, in addition, internal treatment will be needed. Boils in the auricle at the mouth of the auditory canal are extremely painful. They may be relieved by applications of small pledgets of cotton soaked with glycerin and water, in equal parts, or with a solution of ichthyol (10 per cent.) on cotton. Eczema of the ear demands very careful treatment. The burning can be relieved in the early stages by the application of oxide of zinc ointment, or by dusting powdered starch over the weeping surface of the sore skin. Syphilitic eruptions, shingles, and cancer must receive attention from a medical attendant.

Hygiene, and Avoidance of Disease.—It will be found that generally there is either too much toilet of the ears, or improper care and protection are bestowed on them. Again, there is found great neglect even in health, so that the organs are unduly exposed to stormy weather and cold water. Disease is thus often produced in organs which might otherwise have remained good ears. Thus, the auricle, or outside ear, should get moderate and gentle washing with a wash-cloth in

preference to a sponge, and then receive a gentle and thorough drying. The auricle should never be rubbed hard, or dragged or pulled upon in any way.

When it is desirable to protect the ears from cold air, it should be done by placing over them a covering sitting lightly on them, and not one which would bind them close to the head. A light loose cap will protect the auricle and the bald heads of infants. But a tight cap may do harm to their ears, by binding them too firmly and closely to the side of the head. This causes increased perspiration behind their ears, with maceration of the skin at that point, and a disease like "milk crust" may be started.

The simplest soaps are the best to use about the ears, not only of infants, but of adults. A good soap is hard to find. A little Castile soap (the French make) is safe. It is desirable to obtain a bland soap, not too alkaline, and one free from high perfume, as highly-scented soaps are most apt to sour on the skin after using them. As a rule, children's ears are not only washed too much, but they are rudely and painfully washed, especially by dragging on the auricle and boring or swabbing in the mouth of the auditory canal. Washing in this part of the body must be done gently.

If it is desirable to protect the ears from cold, a light ear-muff or a veil can be placed about the face and ears, or the ear-pieces from a cap, or a woollen scarf will afford ample protection, in children. Adults can employ ear-muffs or coverings similar to the above for protection of their auricles. If pain is felt deeper in the ears on going into the open air, a piece of cotton may be laid lightly in the mouth of the auditory canal,

if there is no discharge from the ear, at the same time. In no case should cotton be worn in the ears in the house.

The ears must sometimes be protected from the sun. This can be done by wearing a hat with a broad brim, or by a light cape falling from the cap, as in the so-called "havelock." This will also protect the ears from the sting of insects. If this cape should be too warm,—as it may be in lands where most needed,—a light veil or net suspended in the same way will answer a better purpose.

I must here speak a word of condemnation against a most reprehensible method of pulling children's ears, in punishment. Although this is not as dangerous to hearing as "boxing the ears," as will be shown hereafter, yet it may injure the drum, because some of the tissues of the auricle and canal are connected anatomically as deep as the drum, as shown by recent investigations of Sexton and Pinkerton, of New York. Nevertheless, the practice must be condemned as cruel and likely to drag so strongly on the ligaments holding the auricle in place as to cause inflammation at the root of the ear. If this inflammation should not be promptly checked, it could lead to permanent hardness of hearing by spreading down to the drum. Aside from the danger to hearing which might accrue, the bone underlying these inflamed fibrous ligaments of the auricle may become affected, and the inflammation from this spread to the brain, which lies just beyond the bone thus diseased.

In performing ordinary toilet, the auricle is often subjected to considerable roughness in washing it. As

inflammation and boils can be thus excited in the auricle, such rough manipulation should be avoided, especially as it is not necessary for cleaning the ear. The auricle should be carefully dried after it is washed, and also the hair and the parts of the scalp behind and around it. This is especially necessary, since if any dampness is allowed to remain in or near the auricle, evaporation goes on, and, the temperature of the ear being thus reduced, cold is taken and the ear may become the seat of catarrh. Hence the popular notion that dashing cold water against the side of the head and into the auricle is strengthening or hardening to the ear, rendering it resistant to cold, is erroneous. There is also a silly form of play consisting in lifting a little child by the head, placing the hands against or over the auricles. In this act the auricles are unduly dragged upon, and may be injured. In any case, a sudden jerk or turn of the child might break its neck. Hence, for all reasons, such forms of play should be most strenuously discountenanced.

DISEASES OF THE AUDITORY CANAL.

Foreign Bodies in the Ear.—Children are more likely to get inanimate foreign substances in their ears than adults, because the former put them in the ear in play, or one child puts something into the ear of another in rude playfulness. Adults are more likely to get living insects in their ears, from sleeping on floors of shops and bakeries, and in dirty beds, etc.

Let it be said at the outset of this subject that anything that can get into the ear can be removed if proper attempts are made. It may not be easy, however, for

any one but a specialist to make these endeavors. The friends of a child who has got something in its ear may be consoled by the fact that no bead, button, or grain of corn, etc., which the child has put in the ear, will do harm, *if let alone* by every one but a skilled surgeon, supplied with proper means of illuminating the affected ear for examination, and suitable instruments for treatment. When a child, therefore, gets something in its ear, rest assured that it has not gone beyond the reach of surgical skill. It cannot work its way into the brain, as many think. The harm which has often followed the simple insertion of a foreign substance into the ear has been entirely due to the utterly ignorant and unskilful efforts at getting it out. These have often pushed the foreign object farther into the ear, ruptured the drum, set up inflammation of the ear, and, in some cases, even of the brain, followed by death. A rough and careless probing, or awkward hooking and scraping, to get hold of the object generally fails to extract the object, but most surely wounds and injures the delicate parts in the ear. Sometimes the pain thus caused by rude efforts to extract the foreign body from the ear is supposed to be due to the presence of the offending substance, and therefore leads to renewed efforts at its extraction. This only aggravates matters, until the drum is often entirely destroyed, while the foreign substance eludes these rude endeavors to extract it.

Not long ago the writer was consulted by a man who stated that some mud had been splashed in his ear, and that his companions in a machine-shop had tried to remove the mud with bits of wire and small tools.

These rude endeavors in rough and unskilful hands caused great pain, which was erroneously supposed to be due to the presence of the mud in the ear, and therefore to demand further efforts for removal of the offending substance. Hence they persevered with rude forms of treatment until they succeeded in picking out the drum and all the little bones of the ear, thus destroying the hearing forever. A syringe of warm water thrown into this man's ear would have removed the mud and restored him to comfort. In fact, had the ear been let alone, it would have been far better in every way, for the mud would have fallen from the ear, in time, when dried.

In children who have placed beans and beads in their ears, and have said nothing about it, for fear of punishment, the foreign substance is often found years afterwards in the ear, where it has lain without causing any discomfort or doing any harm, beyond forming the nucleus of a plug of wax. When the latter is syringed out, the bead or the bean comes out with it.

Not long ago a child about ten years old was brought to one of our hospitals, with the statement that she had put a small ball of silver-paper, such as is wrapped around tobacco, into her ear. It caused her no pain nor any inconvenience, but the mother was alarmed at the presence of the foreign substance in her child's ear; though she had only the child's voluntary statement that the paper ball was in the ear. No one ever saw this ball of paper in the patient's ear, and my belief is that it never was there. The child had played with it about her ear, had mislaid it, and then, going to her mother, had informed her that she had put it into her

ear. But the inexperienced resident who first saw the patient was impressed with the statement of the mother, thought he saw the silver-paper at the bottom of the auditory canal (he probably saw the shining, silvery drum), and proceeded to extract it. But deplorable failure attended his efforts, as well as injury to the child's ear. He succeeded in badly tearing the skin of the ear-canal and in punching a hole in the drum. If the silver-paper was there, he pushed it into the depths of the ear, out of sight, and set up great inflammation and suffering in the little patient's ear. He should have been sure first that a foreign body was in the ear, and, secondly, he should have let it alone for a more skilful surgeon to remove.

Of course foreign bodies in the ear should be removed promptly, if it can be done properly, in order to avoid possible irritation, or the accumulation of ear-wax around them. But if their removal cannot be done properly by a skilful hand, they had better lie in the ear forever, than that the attempt at removal should lead to such consequences as destruction of the drum, with chances of deeper inflammation from such rude surgery. The writer once removed a plug of wax from the ear of an intelligent woman, fifty-eight years old. Much to his and the patient's surprise, a solid blue glass bead, of a strange pattern, rolled from the ear into the basin during the syringing. The patient stated that *fifty years* previous she had played with beads like this one, and supposed she had placed one in her ear and forgotten all about it. Gradually the wax accumulated around the bead and led to deafness. This is narrated here to show the comparative harm-

lessness of the presence of a bead or similar substance in the ear, when let alone. At worst such a substance will form the nucleus of a wax plug, easily removable by syringing.

In fact, the simplest, safest, and most agreeable way to remove any foreign substance from the ear is by syringing it out with warm water. This plan can be pursued with both inanimate and living objects.

Insects in the Ear.—Great annoyance is felt both by adults and by children from the entrance of insects into the ears. A child, indeed, may be thrown speedily into convulsions from such an accident. It happens that flies, or ants, bed-bugs, fleas, small roaches, rose-flies, and the like, get into the ear. Such an accident always causes great discomfort and fright to any one, and a child may be affected by it seriously, as stated above.

There is a branch of the pneumogastric nerve—the nerve supplying the stomach, lungs, and heart—going to the ear. It is, therefore, very easy to excite coughing, nausea, vomiting, and faintness from irritation of this nerve-branch in the external auditory canal. Those who sleep upon the floor in summer-time are liable to experience this intensely-disagreeable annoyance by the incursion of some of the beetle tribe so frequently found at that season, running on the floors of our dwellings. When the ear is thus entered by a small insect, the first thing to be done is to pour into the ear a little oil, say half a teaspoonful, and thus smother the insect intruder. After it is killed it may be syringed from the ear or lifted from it with delicate forceps.

Fly encapsuled in the Ear.—A boy, five years old, was once brought to me for relief from deafness in one ear.

Examination of the affected ear revealed the fact that something black was lying in the auditory canal over the drum. Upon syringing a little while, a small egg-shaped capsule was removed from the ear. This small object, about an eighth of an inch in diameter, proved to be a house-fly wrapped up in dead skin (epithelium) from the sides of the canal. His mother then recalled the fact that when he was about a year and a half old, while lying in his perambulator on the lawn, one warm summer's day, he had suddenly begun to scream, and, after giving further signs of suffering, had fallen into a convulsion. In due time he passed from this state, the cause of which had never been even surmised. It seems probable, however, that in the discovery of the dead fly in his ear we have an explanation of the cause of the convulsion. The fly had been in the ear some time, as shown by its envelope of dead skin, which could only gradually form about it.

Syringing the Ear.—In syringing the ear, *never use cold water*, as this is painful and productive of dizziness, and may induce inflammation of the drum and the middle ear. The proper kind of syringe to use is one made of hard rubber and known as a male syringe No. 2. Before it is accepted from the druggist by the purchaser, its piston should be known to move without jerks. Unless the syringe works smoothly it will throw water with such jerks as to alarm the patient, and perhaps hurt him. The water can be held beneath the ear, in an ordinary old-fashioned finger-bowl, which will also serve to catch the return current from the ear.

The syringer should take hold of the auricle, at its

upper back edge, between two fingers, and by drawing it gently upward and backward the auditory canal can be straightened and the entrance of the water thus facilitated. The nozzle of the syringe should then be directed downward and forward, the stream of water being passed inward upon the roof of the canal rather than upon its floor. This manipulation, if properly executed, will generally remove anything from the ear, if it has not been wedged in by improper treatment.

There are many diseases of the auditory canal which the professional reader may find explained in the larger treatises on the ear. Here it is proposed to consider only some of the simpler diseases affecting both the auricle and the auditory canal, starting in the latter and spreading to the former. Thus, erysipelas after breaking out on the face and auricle may attack the auditory canal, and reach even as far as the drum. Of course every case of erysipelas of the face and ear is a sign of constitutional disease and demands internal treatment, prescribed by a physician; but a word as to the local treatment is demanded here. It will be found that the best protection to the skin will be obtained by covering it with a mucilage of slippery-elm bark, quince-seed, or starch. If these cannot be procured, protection from the air can be obtained by anointing the auricle and the auditory canal, if it be involved, with vaseline or albolene. It must also be remembered that what is applied to the auricle and external auditory canal may run down to the drum-membrane itself. Hence, if iodine or nitrate of silver should be used about the face they must not be allowed to get upon the drum-membrane, as they would blister it. The

same caution must be observed with any other blistering drug.

Eczema of the Auditory Canal.—Sometimes acute eczema attacks the ear, or even both external ears, at the same time. In such a case some general constitutional disturbance will be found to be the cause of the local disease in the ear. Very often digestive, genito-urinary, or uterine disease may be the underlying cause of this eczema. Such must be inquired for and treated whenever the physician is confronted with eczema of the ear. The local irritation (burning and itching) may be intense in these cases, and the first and greatest endeavor must be made to relieve these symptoms. I have found that in acute eczema of the ear-canal "black wash" will usually give most relief to the intense burning of the inflamed skin.

In chronic eczema, when the skin is thickened and also inflamed, the suffering is not nearly so great, though there is even in such cases much discomfort.

The thickening can be combated with citrine ointment; the crusts which form from the exudations from the skin may be softened by vaseline or cosmoline, or by sweet oil. A little plain water would also do, applied on a soft rag, but under no circumstances must any *kind of soap* be applied to the skin, in either acute or chronic eczema of the auricle, or of any other part of the body.

Boils.—Eczematous diseases in the ears are apt to be followed by boils in the canal. These are generally just within the mouth of the canal, and can usually be seen as elevations in the skin, like boils anywhere else. They usually come in a series of two or three,

one succeeding another quite rapidly. They are intensely painful, owing to the denseness of the skin and the confined region in which they occur. The skin lying within a bony boundary at this point of the auditory canal, there is no room for swelling, and hence the great suffering which ensues when a boil occurs at this point. As the boil generally comes where the auditory canal is attached to the skull, any movement of the auricle, as with the hand or finger, becomes very painful.

The pain and soreness can be relieved at the beginning of the inflammation by applying to the boil a piece of cotton soaked with a mixture of glycerin and "black wash," one part of the former to seven of the latter. This will ripen the boil, *i.e.*, bring it to a head, and then it may be lanced if the pain continues. The latter treatment can be done only by the hand of the surgeon.

There are many domestic remedies frequently advised for the treatment of boils in the ear, such as a roasted onion, fat pork, and various "pain-killers." These must be most unequivocally condemned, as they make the ear worse, by further inflaming the skin and laying the foundation for other boils. Whenever they are used, the pain is always most intense. They also are forgotten and left in the ear after the pain subsides. They then furnish an excellent soil for the growth of a peculiar form of fungus, or mould, which has a special tendency to grow in the ear if there is any decaying matter there for it to rest upon. The germs of this parasitic plant are always floating in the air. It will not grow in a normal ear, especially if the natural

wax is at the opening of the canal to protect it, as this fungus will not flourish in the presence of ear-wax. But if the ear-wax is removed, as it is usually in the treatment which must be applied to a diseased ear, the chances are then in favor of the entrance of this fungus-germ into the ear and its settling on the decomposing fats, oils, or pieces of onion which have been put into the ear to cure it. More will be said of this fungus, when the disease it produces in the ear is considered.

Fungus in the Ear.—As has already been stated, the fungus *aspergillus* may grow in an ear which has been the seat of boils, and in which pieces of matter, or some oils and fats used in treatment, have been allowed to remain and decompose. Therefore after an attack of boils in the ear the auditory canal should be syringed and left in a clean state.

When the ear is attacked by the aforesaid fungus, which always seeks the depths of the canal and grows over the membrana tympani and the inner end of the auditory canal near the drum, the first sensation is one of fulness, and dulness of hearing. In a few hours some burning, itching, and a little pain may be added to the symptoms of fulness. In the course of twelve hours, a watery discharge flows from the mouth of the canal, and the ear feels still more stopped up. Sometimes the pain continues, especially if the fungus has obtained a deep hold on the membrana tympani. The only possible cure for this disease is the entire destruction of all the germs of the plant. If this is not accomplished, the parasite may continue to flourish indefinitely in the ear, producing fresh attacks of inflammation and pain.

Much can be done to relieve the patient from this aural affection, by gentle and persistent syringing with tepid water. This acts mechanically in ridding the ear of the germs or seeds of the parasite. If to this water some alcohol is added, we have a means of destroying the plant. But this application must be made not too strong, or it will sting the broken skin in the ear and cause the patient great suffering for a few moments, at least. The alcohol should be only about one-eighth of the fluid syringed into the diseased ear. The mycelial mass—that is, the roots, branches, and fruit-stalks of the fungus—may also be removed from the ear and the membrana tympani by gentle swabbing, if done by a skilled hand. The most efficient and, in my opinion, the infallible remedy is powdered salicylate of chinoline, in combination with boric acid,¹ blown into the ear, after the latter is syringed. When an ear affected with the growth of aspergillus in the canal is examined with the funnel and ear-mirror, the bottom of the canal looks as though filled with a roll of wet newspaper. When this false membrane, as it is called, is removed, the membrana tympani and the walls of the canal near it appear red, rough, and swollen.

Syphilitic Eruptions.—The same papular eruption which may invade the face and neck in secondary syphilis may show itself on the auricle, in the auditory canal, and on the membrana tympani. This can be easily observed with the aid of the ear-funnel and mirror if it makes its appearance in the parts of the

¹ One part of chinoline to sixteen parts of boric acid.

ear just named. Usually such eruptions are best treated by the constitutional remedies.

Shingles.—Shingles, or *herpes zoster*, sometimes attacks the inner cup of the auricle and the entrance and deeper parts of the auditory canal. This is a very painful disease. The patient, without any apparent reason, begins to suffer from sharp and intense pain about the auricle and the mouth of the auditory canal. The pain is of the neuralgic type, and in the course of twelve hours, at most, there will be observed, in the line of the pain, a series of small pimples or blisters. When these appear the pain ceases. These blisters generally form a little matter, or pus, then dry on the top, and scale off. If the scab gets knocked off, or is picked off by the patient, some stinging and pain will ensue in the thus denuded spots. These painful points should then be anointed with cold cream, simple cerate, or albolene ointment. The true cause of this disease in the ear is impoverished blood, and is an indication, therefore, for building up the sufferer by internal treatment. The symptoms about the ear generally fade away in two or three days, unless the eruption is irritated in some way by improper treatment or by picking at it. Then boils or eczema may set in, and the ear becomes very uncomfortable.

Neuralgia in the Ear-Canal.—This is often a very painful disease of the ear. It is usually due to a diseased tooth or gum on the same side as the affected ear. Sometimes neuralgia in the ear is an attendant of neuralgia of the face and scalp, brought on by exposure to cold wind. When due to diseased teeth, the pain in the ear is often mistaken for that due to in-

flammation in the ear, and is consequently improperly treated by the sufferer or his friends. If there is pain in the ear, without any attendant deafness, it will be fair to conclude that the pain is neuralgic and not inflammatory. Very often the tooth which causes the pain does not ache, nor is it even sensitive to the touch. When toothache darts from a painful tooth to the ear, the origin of the pain in the ear is plain enough; but often a toothache is really in the ear and nowhere else. We do not find any discharge in these cases, nor does the patient complain of deafness nor of noises in the ear.

Sometimes only a most careful dental examination, even to the removal of a filling, is necessary before the true cause of the earache is discovered. If this form of dental irritation is reflected from the mouth to the ear for any length of time, true secondary inflammation and ulceration may be set up in the auditory canal near the membrana tympani, and in children even the latter important structure may become affected.

Unfortunately, very often this neuralgia in the ear is mistaken for a sign of inflammation in the canal or the drum itself, and improper remedies are pushed or dropped into the organ. Among these are found all kinds of oils, fats, spices, vegetables, etc., in reality forms of poultices, which invariably further irritate the ear, inflame it, and make matters much worse. No local treatment of the ear will relieve neuralgia in it, unless it be the application of dry heat to it. If the pain is due to a diseased tooth, this must be cured or extracted. Dry heat may be applied by means of a salt bag, or by means of a flat four-ounce bottle filled with hot water.

Dental Plates and Fillings.—Not only do diseased teeth often exert a bad effect on the external ear, but also dental plates and fillings are often the cause of similar irritation.¹ This is brought about in many ways. In general it may be said that many fillings are put in on top of necrosed matter, or living but diseased pulp. This induces great irritation from confining the products of inflammation and retaining decomposing matter. Dental plates act in a similar but a more extensive way, from their larger size. They are often put in over a number of rotten fangs, inflamed gums, and collections of tartar, thus holding in the mouth decomposing matter and inducing reflex irritation in the ear. Vulcanite, so often used for making dental plates, is a non-conductor of heat, and, as Dr. Sexton points out, "the effect of its contact with the highly-sensitive tissue of the mouth is often to produce hyperæmia and inflammation." This, again, has a detrimental reflex effect on the ear. The author just quoted gives 507 cases of disease of the external ear, connected with or caused by irritation of diseased mouths and teeth. Further effects of dental irritation in the ear will be considered under Diseases of the Middle Ear.

Bleeding from the Ear.—Bleeding from the ear often occurs in fracture of the base of the skull, and is to be considered in these cases a very grave symptom. But it occurs sometimes after injuries to the head, like falls or blows, when there is no fracture of the base of the

¹ See "The Ear and its Diseases," by Samuel Sexton, M.D., pp. 95-99, 1888, New York.

cranium. Bleeding from the ear in these cases is due to a laceration of the skin near the drum, and sometimes from a rupture of the drum-membrane. The concussion of the air in the ear-canal, produced by the fall or blow on the head, is so great as to bring about a tearing of these delicate parts and a consequent hemorrhage. Sometimes blood runs from a wound in the scalp or face, near the ear, into the ear-canal, and when found there, or if it runs from the ear, a hemorrhage from the ear is diagnosed and an alarming mistake is thus made. Careful examination will reveal whether the blood has come from the ear, by discovering the ruptured spot from which it has flowed. In some low fevers, hemorrhage from the ear may occur. It is a symptom of great prostration.

Bone Tumors in the Canal of the Ear.—Hardness of hearing, and even entire deafness, are caused by tumors of bone which grow from the walls of the auditory canal. Sometimes these can be seen by the unskilled eye as greater or less elevations, covered with pinkish skin, and projecting into the auditory passage at or near its mouth. They cause no pain, and are often not known to be in the ear, until some wax and dead skin are caught behind the tumor and cause more or less disturbance in the hearing. They are found in persons affected with gout and rheumatism. They are also more likely to grow in an ear which is the seat of a chronic discharge, or in the ear of a man who has been a great swimmer and often under water. In the former instance the constant discharge from the ear irritates the tissues to such an extent that extraordinary out-growth of bone is excited,—a so-called exostosis,—and

in time the bone tumor is developed. In the case of the swimmer, the frequent entrance of water into the ear acts as an irritant, and nature throws up this bulwark against its further entrance into the ear. This I take to be another indication that the entrance of cold water into the ear should be guarded against. These tumors may enlarge slowly and entirely close the auditory canal. Deafness, of course, will be the result, curable, however, by the removal of the tumor. This can be done, and has been safely and successfully accomplished in several ways, either by drilling, chiselling, or cutting away the bony growth.

If any one discovers such a bony growth in his ear, he should be very careful not to wound the tender skin over it; because any slight swelling of this skin, which ordinarily would not be noted, would quickly add to the closure of the canal in which a bony growth had already partially filled the cavity.

Sometimes cancer affects the ear, the result of either picking the ear or getting severe blows upon it. This is usually attended by severe pain and offensive discharge, and would naturally lead the sufferer to a physician, who would give proper directions for treatment. The fact that cancer does occur in the ear as the result of violence to it should lead all carefully to avoid picking it with anything. In fact, the general reader may learn from all of the foregoing pages, as well as those to come, that the ear is composed of many highly-organized and delicate structures liable to various serious diseases, and that great care must be taken of them. He must also learn that in many instances

he had better do nothing than to resort to his own efforts or those of unskilful hands.

There is, however, a rational protection and care of the ear—or a prevention of ear-disease—largely or entirely within every one's control.

Hygiene and Avoidance of Disease.—The bad results of improper management of the toilet of the ear, such as too much washing, picking, scratching, and swabbing, are constantly seen. If the reader will refer to the anatomy of the auditory canal, he will find that it is lined with delicate skin, entirely dry and unobstructed. At its mouth there will be found a thin film of wax smeared around—not over—the opening. This wax must be essential to the health and well-being of the ear, or it would not be found there. It must not, therefore, be regarded as dirt. We see, then, that this auditory canal must be entirely unobstructed in order to permit sound to enter it and reach the drum. It needs, therefore, a custodian at the entrance to keep out small intruders, like insects, or the fungus *aspergillus* (p. 50). This watchman is supplied in the ear-wax, because insects are smothered in it, and *aspergillus* will not grow on or near it. It may appear paradoxical that nature should demand a free, open auditory canal and yet be constantly forming a sticky substance in the mouth of it. But this apparent paradox is overcome by the fact that the skin of the auditory canal grows outward, beginning at the drum-membrane, and carries with it small quantities of superfluous ear-wax, dust, etc. In fact, a spot of any kind, like a minute fleck of blood, may be watched as it starts on the surface of the drum-membrane, and in the course of a week be seen

far away from its starting-point, on the wall of the canal, gradually nearing the mouth of the passage. But the ear is not able thus to extrude large masses of wax or anything else which has been packed or pushed into the ear. Since we must regard ear-wax as a protector, and not as dirt, we should not try every day, nor at all, to pick or scrape it out of the ear. Unfortunately, this is done all the time, with injurious effects to the ear. The necessary amount of wax is invisible from without, and therefore need not give uneasiness to those sensitive about their toilet. All superfluous wax will in time roll from the ear-canal into the cup of the auricle, and can be easily removed by a gentle wipe of the finger-end.

It must, therefore, be very apparent that all the undue efforts at a fancied toilet of the ear, in which so many indulge, tend to interfere with the successful operations of the natural processes of health in the ear.

Hardened Ear-Wax.—The formation of a hard plug of ear-wax in the ear, and the attendant discomfort and deafness, are entirely the result of misconceived efforts at cleaning the canal. It is impossible for a wax plug to form in the ear unless its escape is in some way prevented by the efforts of the patient to get it out. The use of any form of ear-pick, ear-spoon, ear-swabs, like the rolled corner of a wash-cloth or a so-called "aurilave," a piece of sponge fastened to a handle, invariably packs in more wax than it gets out, and always ends by forming a plug of wax, which will cause great annoyance.

These plugs of hard wax are usually found in the cleanest people, who are led by an erroneous idea of

cleanliness to resort to various ways of getting wax from their ears. Hence they drop into the auditory canal sweet oil, glycerin, etc., and then go on swabbing their ears, with the bad results already named. It is hoped that those who read what has just been written against such a false method of hygiene of the ear will perceive the wisdom in letting their ears alone.

Not only may inconvenient deafness be induced by this unwise meddling with the natural processes in the ear, but positive inflammation and permanent injury to the ear may be thus induced. Scraping away the ear-wax from the opening of the auditory canal causes the ear to itch. This leads to scratching the ear, and abrasion of the skin. The latter may pass into ulcerative swelling and hardness of hearing. Or the juices of the skin, which escape from the abraded spot, easily undergo putrefaction, emit a disagreeable odor, and supply a fitting soil for the growth of the fungus *aspergillus* (p. 50). When the ear is once invaded by this parasite, much discomfort and injury may accrue to the ear. The various greasy substances, both animal and vegetable, so frequently put into the ear, in ignorance, will in time undergo decomposition, irritate the ear, and lead to the growth of the aforesaid fungus.

Masses of Hard Skin in the Ear.—In some cases masses of hardened skin, caused by the accumulation of layers of the thin skin lining the canal, block the passage and occasion great deafness. Very often in these cases an ulceration of the skin beneath these hard masses is found. The canal is also very sensitive, and the ulcers demand most careful treatment. After the plug of hard skin is removed, the hearing is generally

entirely restored. The softening of these plugs can be best accomplished by soaking them in a solution of the following form :

R Sodæ bicarb., gr. xx ;
Glycerinæ, fʒi ;
Aquæ, fʒvii. M.

Warm fifteen drops of this and drop it into the ear three times daily, holding it in the ear with a little cotton. In the course of two or three days, syringe the ear with warm water, and try to remove some of the mass. In any case syringing alone is hardly enough to remove the plug. It will be found necessary to supplement syringing by piecemeal removal of the plug of skin, by means of delicate forceps, introduced into the ear, under perfect illumination, by a skilled hand.

Ear-wax forms most rapidly and in largest quantities in those having the most active perspiratory glands. This can be observed in the laboring-man most frequently ; but it is also seen in private practice in women and men who lead comparatively easy lives, but who have dark skins and dark hair and active perspiratory glands. With the greatest care to avoid packing the wax into the ear, in washing, plugs of wax may form every six months in the ears of such subjects, causing deafness and discomfort and requiring syringing in order to bring about relief.

Collections of wax will also form more readily in the adult ear with a small opening. This holds the wax in the ear, and, as fresh wax forms behind the first small accumulation, an obstructive mass is at last found in the ear-canal. Deafness, buzzing in the ear, and even dizziness, may now quickly ensue, and will

require treatment, either by syringe or forceps, at the hands of a skilful person. The more the patient now works over his ear, the worse he will feel.

Sweet oil, so frequently advised for the ear, is not only useless, but, if it becomes rancid, is positively injurious, like any other putrescent matter in the ear. It has no solvent power over ear-wax, being of greasy nature like the wax of the ear. If this has to be softened, some form of alkali must be employed.

Glycerin has many advocates, in the treatment of ear-diseases, among those who are ignorant of its true qualities. It is by no means as bland as it looks, being more like a mild caustic than a soothing substance. It possesses great affinity for water, we are told by the chemists, and therefore if put undiluted into the ear it abstracts so much water from the skin of the organ as to put it into a state of incipient inflammation and cause stinging and burning. It undoubtedly has solvent power on ear-wax and hardened skin in the ear, but when used for this purpose it must be diluted at least one-quarter. But pure water alone, if allowed to remain in an ear filled with ear-wax, will soften the latter and render it easy to be removed by syringing.

There is a popular but dangerous practice of treating toothache by putting various remedies into the ear-canal. It must be stated here most emphatically that nothing must be inserted in the ear for this purpose. This may immediately cause inflammation of the canal and of the drum-membrane, and cause great suffering. Sometimes the substance put in the ear to ease the pain in a diseased tooth, causes no immediate injury to the ear, and after the toothache ceases the substance put in

the ear is forgotten and left there. Pepper-corns which have been steeped in alcohol are thus used to cure toothache, and are subsequently forgotten. In the course of time, if inflammation, or swelling only, occur in the ear, with a cold, these pepper-corns are grasped by the swollen skin and pushed into the inflamed surface. This, of course, intensifies the inflammation and causes great pain, from the entrance of the stimulating juice of the pepper into the sensitive flesh. Then, again, there is a mania on the part of many to drop various fluids into the ear, for the imagined cure of deafness. In fact, there is a laughable list of such fanciful remedies, in which are found such things as eagle's gall, rabbit's fat, human urine, human milk, and neat's-foot oil. It need hardly be said, after what has been set forth in these pages, that all such substances are unable to cure deafness. They may, however, injure the ear, by inflaming it and making the deafness worse. Sometimes positively injurious substances are recommended by one inexperienced person to another. The writer knew of an instance where a servant was advised by her mistress to pour boiling oil into her ear, with the hope of curing her deafness. It would seem that common sense should have prevented both the advice and the following it, in this case; but it did not. The boiling oil was thus used, the ear was severely scalded, the girl suffered intense pain, and destroyed what little hearing she had in the misused ear.

Itching in the Ear.—At times itching in the auditory canal is intense, and, of course, induces the sufferer to scratch his ear. This is generally due to the fact that the ear has been deprived of its wax by some of the

improper practices already alluded to. At other times it is a symptom of catarrh of the ear, which brings with it a deficient secretion of ear-wax. Generally a little cold cream, vaseline, or cosmoline, smeared in the ear by means of a camel's-hair paint-brush at the itching spot, will relieve the discomfort. The finger should be used very cautiously in scratching the ear, as the fingernail, never entirely free from poisonous matters, will wound the skin and induce soreness and a discharge. The ear should never be scratched with pins, hair-pins, nor pencil-points and ends of pen-holders, as these wound the skin and lead to ear-disease. There is also danger of these implements being pushed suddenly inward against or even through the drum-membrane. This accident is brought about by the awkwardness of the patient or by some one's running against his arm while scratching his ear.

Itching of the ear may be caused by scales of dried wax which have become adherent to the walls of the auditory canal. In such cases syringing the ear with warm water will remove the scales of wax and relieve the itching caused by them.

Protection of the Ear in the Open Air.—The protection advised for the auricle, by means of ear-muffs, scarfs, veils, etc., will also avail for the protection of the auditory canal. When this part of the ear is affected with neuralgia, when exposed to cold air or wind, relief is often obtainable by wearing a little cotton-wool in the mouth of the canal when in the open air, but never in the house nor when the ear is discharging profusely. Cotton should never be continuously worn in the ear in the house, as it is too heating, keeps the

superfluous wax from falling out (see p. 41), becomes unclean, and is often forgotten. In the latter instance it seems to work its way inward, and, getting packed in with the ear-wax, leads to deafness. Greased cotton may be worn in the ear to keep out water, when swimming. It is not easy, however, to maintain it in this position, unless a cap is worn to hold it in the ear. There is no doubt of the risk of injury to the ear which arises in swimming in cold water. A prolonged swim, or numerous repetitions of such sport, are likely to produce inflammation of the drum and consequent pain and deafness. Hence the ear should be protected, if possible, against the free incursion of cold water, both in swimming and in cold-bathing. Cotton is certainly the readiest means of securing some protection in such exposures. Furthermore, a cold bath or a swim in cold water should not be indulged in too long, if one cares for his ears. Boys and girls, who can command it, should swim in a natatorium, where the water is always kept at a safe temperature for bathing, without risk of inflaming the ears or getting chilled in other parts of the body. Bathing every day in cold water or brook-water, as some boys and girls do, especially in the country, is dangerous to health and hearing, as fevers, catarrhs, and colds are thus easily brought about. Surf-bathing has some dangers for the ears, from the force of the breakers which may unexpectedly come against the side of the head and ears. It is not uncommon for the drum of the ear to be thus broken, and a painful and tedious ear-disease to be thus set up. When such an accident does occur, the sufferer should leave the surf at once, as it is the further en-

trance of cold water which does so much additional harm to the ear. In fact, when the drum is thus accidentally burst, *nothing should be put into the ear*. The mouth of the canal should be protected with cotton, in order to keep out even the air.

Sea-water, from its coldness and its stimulating saline properties, is an irritant to the nose and the ear. Hence there occur at every sea-side resort numerous cases of ear-disease, from an earache of a few hours' duration to long-continued inflammation of the ear and deafness. This quality of sea-water and the consequent risks of a too free use of it in the bath should lead to a more cautious employment of what may be a means of health if used judiciously. Unfortunately, there is a popular idea that no one can take cold, either in or out of the salt water, at the sea-shore. This has led to much discomfort and disease in those who have acted upon such a belief. A short bath or dip, once or twice a week, if it is enjoyed, may be a good tonic in some cases, if reaction is perfect,—*i.e.*, if no chilling occurs in the water and if a glow keeps up after coming out of it. But staying in the sea-bath until lips and ears, as well as fingers and toes, are blue or purple, as some people do, is most dangerous to health. Such imprudence will certainly induce a catarrh of the bowels, the lungs, or the head and ears. In fact, such complaints are more numerous at the sea-side than anywhere else among summer resorts.

Again, there is an erroneous idea, which has wrought much injury, that no one can take cold after coming out of a sea-bath; and hence people sit about in draughts and ladies thus take an opportunity of drying

their hair,—which, by the way, should not be allowed to get soaked with sea-water, as it is not easy to get it dry again while at the sea-side, and hence their heads are kept constantly damp, and catarrh is thus caused. Ear-aches, deafness, and cold in the head are constantly induced by their sitting in draughts of cool air after bathing in the sea, and the foundations of deafness are thus laid. In fact, it may be said that the sea-side is the place where one easily takes cold, unless a rational, cautious hygiene is observed. The aurist constantly meets with ear-disease which has begun by imprudence at the sea-shore.

The writer is among the number of those who hope that the daily surf-bath of men, women, and children will soon be obsolete. If the salt-water bath is desired or advised, it should be taken in a private bath-house, either in or near the hotel, where a proper temperature can be assured for the comfort and the health of the bather. Such a custom would prevent much disease of the ear, and promote the general health of those who have to resort to salt-water bathing. It would also prevent much that is grotesque in dress and immodest in behavior, now the almost necessary attendants of the public bath in the surf.

I cannot say too much in praise of sea-air as a tonic in most diseases, and certainly for those who are affected in their ears; but the latter class must refrain from cold-water bathing in all forms.

DISEASES AND INJURIES OF THE MEMBRANA TYMPANI.

The membrana tympani, or drum-membrane, on account of its comparatively exposed position at the

bottom of the auditory canal is very liable to injury and disease from without. As its inner surface is covered with the same mucous membrane as lines the drum-cavity, the membrana easily participates in the inflammations of this space. The most common forms of external violence which affect the membrana tympani are concussions from blows on the ear, explosions, the entrance of cold air and cold water, and the accidental insertion of slender, pointed implements. Some diseases of the external auditory canal may spread to, and inflame, the drum-membrane (see pp. 28-30). When considering affections of the drum-cavity we shall also mention the participation of the drum-membrane in these diseases. At present let us consider some of the results of external violence upon the drum-head. The most common form of concussion applied to the ear is by a "box on the ear." This may be strong enough to rupture the drum and inflict serious concussion upon the deeper structures of the ear, as will be shown farther on. A slap or "box on the ear" compresses the air in the auditory canal so forcibly at times as to split the drum-membrane. Sometimes these blows on the ear are given in rude play. I have known such to rupture the drum and cause great suffering and injury. Usually these blows are given in punishment by the stronger man to the weaker child. It is, therefore, a most senseless form of sport, and a cruel, barbarous method of punishment. Explosions occurring near the ear may cause a rupture of the drum. This has happened from the explosion of gas-bags and retorts in lectures, from the bursting of a large cannon, and from being subjected to heavy cannonading while

shut up in a casemate. A very common cause of a perforation of the drum, and even injury to the middle ear beyond, is the accidental insertion of a slender, pointed implement. This may be done by running a twig in the ear while walking through dense undergrowth in the woods, or by having the end of an umbrella-rib thrust into one's ear in a crowded place. The drum-membrane may also be perforated while the ear is being scratched with a hair-pin or an ear-pick, if the elbow should happen to be knocked accidentally either by the patient or by some one suddenly approaching him.

In many respects a perforation or rupture of the drum-membrane, in the above-named way, is of no great consequence, as it will generally heal in a healthy membrane, if let alone. The great danger in these cases is that the nerve may have been injured by concussion, or that the instrument which has produced the perforation may have broken or displaced the little bones of hearing or injured in some way the middle ear. There is also a danger that an ignorant person may drop some kind of fluid substance, as a medication, into his ear, as soon as he finds out that the drum is ruptured. In fact, such advice is sometimes given by those who ought to know better. After a perforation of a healthy drum occurs in some of the aforesaid ways, anything put into the external ear will flow through the perforation into the drum-cavity and inflame it. Even the external air should be kept out of an ear thus wounded, by placing cotton in the mouth of the auditory canal.

In these cases of rupture of the drum-membrane from concussion, or explosion, the force of the com-

pression of the air in the auditory canal comes suddenly upon the membrana when it is not prepared for it. A rupture of the membrane is also more likely to occur in this delicate structure if weakened by previous disease, or if the Eustachian tube is closed by catarrh, which prevents a recoil of the drum before the impact of the explosive force.

Soldiers, spectators at military reviews, and sportsmen are liable to this accident. The former guard against it by keeping their mouths open during heavy cannonading. This insures an equal tension of air on either side of the drum-membrane, as both the Eustachian tube and the external auditory canal are subjected simultaneously to the impact of the compressed air. Wearing cotton in the ear at such a time is also supposed to protect the membrana tympani from some of the explosive force.

But many sudden explosions, like the explosion of a gas-bag or retort in a lecture-room, or the premature or unexpected discharge of a cannon or of musketry, cannot be guarded against; and such occurrences are likely to rupture the membrana tympani of some of those very near the explosion. If, in addition to the slight pain attending such a rupture of the drum, there is also sudden dulness of hearing, the ear should be at once examined by an expert.

The real damage in these cases is the possible concussion and paralysis of the auditory nerve. If in a case of ruptured drum from a "box on the ear" the sufferer sues the aggressor, the effect on the nerve must be estimated, rather than the mere perforation in the drum. If the nerve has not been injured, the perfora-

tion in the drum will heal without any detriment to hearing, in most cases, if it has not been improperly treated. In a trial of such cases, the previous state of the hearing must be considered ; for it not unfrequently happens that an ear which has received an injury from a "box on the ear" was imperfect before the accidental assault. In estimating damages in such a case, it must also be found out whether anything was dropped into the ear immediately after the blow, in order to heal the ear. This improper treatment may be the real cause of the subsequent inflammation of the ear, and deafness.

Effects of Alcohol and Tobacco.—The effects of drinking alcoholic stimulants, and of using tobacco in various ways, may be very injurious. These act by first stimulating, congesting, and even inflaming the mucous membrane of the throat, nose, and middle ear, and will be more fully considered when diseases of the middle ear claim our attention. It is after the middle ear is diseased that these stimuli affect the drum-membrane. It may be said here that the drum-membrane is sometimes *directly* irritated by blowing tobacco-smoke into the ear for various reasons, mostly as treatment of some form of ear-disease and pain, and also by wearing a piece of tobacco in the ear, as some people—especially the Russians—do, to protect, as they suppose, their ears from cold and deafness.

Snuffing tobacco does most harm to the ears, and "smoking through the nose" comes next in order of harmfulness, as they both congest the nose, Eustachian tube, and middle ear, and then affect the drum-membrane.

CHAPTER II.

DISEASES AND INJURIES OF THE MIDDLE EAR.

THE middle ear comprises the Eustachian tube, the drum-cavity, and the mastoid cells. The consideration of its diseases and injuries becomes of the greatest importance, as they are the most numerous and cause the greatest number of cases of permanent deafness. Most of the diseases of the middle ear are of a catarrhal form, originating in the nose and the part of the head behind the nose, the so-called naso-pharynx, or "nose-throat," where the nose and throat unite.

From this point the Eustachian tubes start and go to the middle ear on each side. The nose, naso-pharynx, Eustachian tube, the drum-cavity, and the mastoid cells are lined with mucous membrane, and practically constitute a continuous cavity lined with the same mucous membrane. It is, therefore, very easy to see how a disease beginning in or behind the nose, in the naso-pharynx, readily affects the Eustachian tube and then the middle ear. In fact, nasal and naso-pharyngeal diseases are the true and frequent source of ear-disease, passing up to the ear by the way of the Eustachian tube.

Diseases of the throat or fauces unattended with nasal disease are very rarely, if ever, causes of ear-disease. A want of appreciation of this fact has led to many errors in diagnosis and treatment of aural disease, as much time and labor has been spent on

treatment of the throat which should have been expended on the nasal disease, in the case. But, strange to say, in many cases of ear-disease the nose has not been even examined, though the originating point of the aural disease and deafness. Though all nose-disease does not bring with it deafness, all catarrhal diseases of the middle ear show signs of previous nose-disease, which latter must receive treatment if the middle-ear disease is to be successfully combated. While throat-disease is rarely the cause of aural disease, nasal affections tend rapidly towards aural maladies in a large proportion of cases.

Nasal diseases act disadvantageously upon the middle ear in two ways : first, by direct extension of the catarrh of the nose to the mucous membrane of the Eustachian tube, and, secondly, by interfering with normal respiration through the nose and thus depriving the Eustachian tube and middle ear of its due ventilation. At every act of swallowing the normal Eustachian tube opens, and air enters the middle ear, or drum-cavity. This entrance of air into the drum is attended with a gentle clicking sound, audible to each of us when we swallow. We are so used to this sound in our ears that we do not notice it until our attention is called to it.

The bad effects of nasal inflammation are seen both in acute and in chronic diseases of the middle ear.

ACUTE INFLAMMATION OF THE DRUM-CAVITY.

The most common cause of an acute inflammation of the drum-cavity, the central and most important part of the middle ear, is a cold in the head. Sore throats come and go, without a cold in the head, and

hence without an inflammation in the drum-cavity. But with a cold in the head nearly everybody experiences at least a buzzing and a stuffy feeling in one or both ears. It is but a sliding scale from this first stage of catarrhal ear-disease to a more severe and continual ear-disease and deafness. This first sensation of fulness and buzzing in the ear may disappear in a few days, or it may gradually pass into a more marked sensation of deafness, with an itching and burning sensation passing up from the nose to the ear. This last sensation may glide into one of decided pain, at first dull and intermittent, then much sharper and darting more frequently into the ear or ears. It is not common, however, for both ears to be acutely inflamed at once. This pain now grows worse, and is continuous. The noises become of a pounding or crashing form, the head grows dizzy, sleep is impossible, and if the patient is a young child it may be thrown into a convulsion unless speedily relieved. This is "earache" in its worst form: it is never a trifling matter in any form. With the increase of pain, fever generally sets in.

Sometimes a quick relief comes to these cases by a spontaneous rupture of the drum and an escape of mucus or even pus. Again, a small blood-vessel in the drum may burst from over-distention, and thus afford relief to the intense suffering of the patient. Commonly, however, the pain is not thus speedily terminated. It goes on for several days, being worse at night, and it then gradually subsides, either with or without the occurrence of a spontaneous rupture of the membrana tympani. If the latter event take place, the ear will be found discharging a stringy muco-pus, and the hear-

ing will have partially returned. If such spontaneous rupture have not occurred, the deafness will be found to be profound, the patient's voice sounds strange to him, there is a constant hissing in the ear, and often the patient complains of dizziness, because the mucopus confined still in the drum-cavity is pressing on the stapes and forcing it inward on the labyrinth-water, which compresses the auditory nerve and affects the brain. If both ears are thus affected at the same time, the patient's condition is most deplorable.

Treatment.—If relief from pain takes place by the spontaneous rupture of the drum, often the disease is allowed to take its own course, ending sometimes in healing, but more frequently in chronic disease.

A continuance of the pain, however, prompts the patient or his friends to apply some form of domestic treatment, and, this failing to relieve, medical advice is sought. Most forms of domestic treatment in vogue do more harm than good. In fact, they at least increase the pain, if they do not prolong the disease. They often do both.

Quinine.—When any one has taken a "cold in the head," his ears are in danger of inflammation, though the vast majority of patients do not know this. It becomes of the highest importance to the ears, now, to adopt a proper treatment. The patient's mind must be disabused of the very wide-spread popular notion that "a cold can be broken" by taking large doses of quinine. Nothing, in fact, is more likely to bring on a disease in the ear, which may otherwise escape, than taking large doses of quinine, to check the cold, as many say. They give to themselves and their friends

from ten to twenty grains at a time, usually with results of further discomfort in the ears. Quinine tends to congestion of all parts of the ear. The middle ear, therefore, if congested by inflammation, will be further congested and endangered by the above-named doses of quinine. As a cold passes off, the debility which it usually leaves behind it may be relieved by from four to six grains daily, in divided doses of two grains each. When we come to consider the diseases of the internal ear, it will be shown that large doses of quinine may permanently injure the auditory nerve.

High Feeding.—Another popular fallacy is that of “feeding a cold,” as it is called. The patient is told to live well, eat much and highly-seasoned food, and even to drink wines. Such a course is nearly as bad for the cold in the head, and for the ears, as large doses of quinine. The head is further congested, and the ears either inflamed or made worse if already affected.

When any one finds himself attacked by a “cold in the head,” the first act should be to protect himself from further chilling, and, if it be winter-time, to stay in the same room, or the house equally heated throughout, at a temperature of about 70° F. Much below this causes a feeling of chilliness, which is most depressing and tends to further symptoms of cold. If the thermometer rises much above 70° F. the head is further congested, and the cold made worse. If the ears have become inflamed, they generally feel worse in a very warm room. In fact, sitting in a very warm room in winter-time may induce a cold in the head. It becomes evident, therefore, that whatever tends to

congestion of the head, like quinine, alcoholic drinks, very rich food, and overheated apartments, is likely to congest and inflame the ears, and must therefore be avoided, if we value our hearing.

Let us suppose that earache has come on after or with a cold in the head. This indicates to the physician that an inflamed condition of the drum exists. But the uneducated person, not knowing the true state of things, and alarmed at the suffering of the patient, proceeds to do something for the malady, usually choosing something recommended by an entirely incompetent adviser. The remedy most commonly employed by such domestic advisers is laudanum and sweet oil. To say the least, the oil is heavy and loads the already sensitive drum-membrane and increases the pain from this cause. The laudanum often combined with it, as it contains alcohol, being a tincture, is stimulating to an inflamed or raw surface. Just as it or alcohol in any form is to a fresh cut. Every one knows how this smarts. Laudanum if put into a *healthy* ear may penetrate the skin lining the ear-canal and drum-membrane and inflame it. If such an effect can be brought about in a healthy organ, it is easy to understand that such treatment should not be applied to an inflamed drum. But, unfortunately, this or some other equally injurious form of home-treatment is resorted to in every case of acute inflammation of the ear, before the aurist is called in, and consequently he finds, as it were, an artificial disease added to the spontaneous inflammation. The same condemnation may be applied to the use of roasted onion, baume tranquille, pain-killers, etc. The onion macerates the ear

too much, and leads to the growth of granulations or proud flesh. Its juices, too, are stimulating, and in the end painful. The various kinds of drops, as a rule, increase the disease in the ear rather than diminish it and the pain attending it. All forms of poultice, such as bread-and-milk, flaxseed, boiled carrots, and the like, placed over the ear, are decidedly injurious, in the end, to the ear. This is due to their macerating quality rather than to any irritant contained in them. The softening brought about by their moisture overheats the ear-drum, causes the growth of granulations or "proud flesh," and may produce a permanent deformity in the ear, with consequent deafness of an unchanging form. It becomes manifest from what I have said above that all forms of poultice, applied to the ear in acute inflammation, are undesirable.

The only exception may be made in favor of plain warm or hot water poured into the aching ear by the teaspoonful. This may remain as long as its heat seems to give relief. When it cools it must be allowed to escape from the ear, and some more warm water put in. This, however, is not as good as some form of dry heat, or leeching. Let us first consider the application of dry heat to the acutely-inflamed and aching ear.

Dry heat may be applied to the ear in various ways. The simplest and often the quickest way to apply it is by means of very hot water in a four- or six-ounce bottle, a flat one being preferable. This should be held against the cheek in front of the aching ear, or beneath it, or behind it, as seems most relieving to the patient. Many patients prefer to place the bottle of very hot water immediately against the cheek or ear.

Others prefer to place between the bottle and the cheek a piece of flannel, while the water is very hot. If applied at the right time, *before* any improper substance has been put into the ear, I have never known this or some other form of dry heat to fail to relieve. So impressed have I been with this result in cases I have seen at the outset of the inflammation, that I am forced to conclude that most cases of earache which have resulted in continued disease, especially in children, have been made worse by the great variety of improper remedies put into the ear at the outset, and thus launched upon the career of chronic disease in which I have at last found them.

A very similar method of applying dry heat is by means of a hot-water bag. Its size may be an objection, unless it be quite small. Another good way of applying *dry heat* to the inflamed ear is by means of a salt-bag, a hot stone wrapped in flannel, or a heated hop-pillow. The salt-bag may be made six or seven inches in length, by three or four inches in width, and one or two inches thick, and shaped like a bean or a kidney. The notch on one side thus put in the bag will enable it to be applied more easily close about and around the ear. There has been lately made a rubber bag somewhat in this shape, to wear under the chin, over the larynx. Such a bag might also do for the ear.

In some cases these simple remedies may not have been applied at all, nor anything else, before the surgeon is called in. It may then be too late for them to act with good effect, and other measures for relief will be demanded. If the inflammation and the pain have

grown intense, and no rupture of the drum-membrane has occurred nor seems imminent, abstraction of blood from two or three spots near the auricle—*not in it*—may be resorted to, by means of leeching. This can be done either by applying two or three large Swedish leeches, or by using the artificial leech. There are two forms at least of the latter which may be used,—viz., Heurteloup's, a French instrument, and that of Dr. Gorham Bacon, of New York. The latter is simple and efficient, and therefore decidedly preferable to the larger and more expensive French instrument. The object of leeching is to cut short inflammation and prevent suppuration. If, however, the pain has lasted a long time, or if it has lessened and the drum-membrane is bulging outward, any form of abstraction of blood is of no avail. The bulging of the drum indicates that matter is behind it, and that the membrane must be punctured or *lanced*. This of course can be done only by the experienced hand. It gives relief to the pain, permits the escape of matter through a small hole at a well-selected spot, and thus prevents the pent-up matter from bursting its way through the larger opening which it is quite likely to make if left to itself.

After the perforation of the drum is made, either by nature or by art, a discharge of mucus or muco-pus will take place and continue for some days. This matter should not be allowed to remain in the ears, as it undergoes decomposition and irritates and makes the ear worse. The odor of the decomposing matter in the ear is very offensive, especially to the friends of the patient. It is, therefore, a great mistake to put cotton in a discharging ear, as it blocks the ear and prevents

escape of matter. The cotton soon gets soaked with offensive discharge, and, acting like a poultice, macerates and overheats the already diseased ear. In this way "proud flesh" or granulations are formed, the perforation is made larger, polypi spring up, and the hearing grows worse. If this condition of the ear is allowed to continue, the hearing may be very soon irreparably damaged.

As fast as matter forms in the ear, it should be permitted to escape. If it is thin, it escapes much more easily than if it is thick. In either case it may be swabbed out with absorbent cotton twisted on a cotton-holder and very gently inserted into the meatus, and down the canal to the drum. Or, if this does not seem to remove the matter from the ear, syringing with warm water to which a little salt is added will usually suffice to cleanse the ear of the discharge. The reader should refer to the method of syringing the ear given on page 47. After the ear is thus cleansed, a little finely-powdered boric acid may be blown into the ear, if it has ceased to ache. This is best accomplished under illumination of the diseased part by means of the forehead-mirror. It can, however, be done, by means of a little powder-blower inserted into the mouth of the canal, without illumination. But the operator is not sure that the powder reaches the right spot unless the ear is well lighted by the forehead-reflector.

It is not well to treat a running ear by the numerous forms of drops so often resorted to and advised by one patient to another. The only form of drops of much value in these cases is a solution of carbolic acid,—of not greater strength than from ten to fifteen grains to

the fluidounce of water. No mistake could be made in using this until a competent physician can be consulted. But, aside from the few remedies named, nothing else should be used by the patient or his friends on unprofessional authority. But if the ear continues sore or painful, it will be best to do nothing to it but syringe it gently with warm water until medical advice can be obtained.

Causes.—Acute inflammation of the middle ear is likely to occur in scarlet fever, measles, diphtheria, whooping-cough, and typhoid fever. Nurses and physicians must be on the watch for this complication, as the patient may be too ill to draw attention to this very important element in his disease. In typhoid fever, as well as in scarlet fever, measles, and diphtheria, the inflammation of the ear is due to the irritation arising from the decomposition of inspissated mucus and food in the back part of the throat and nose. The fact that the nasal secretions do easily accumulate in these diseases should be borne constantly in mind by nurses, and they should see that the nostrils are kept free. This can be done best by gently spraying the nostrils, from in front, by a solution of carbonate of soda, five grains to the fluidounce of water, or by spraying these parts with some fluid albolene. The latter is one of the latest products from petroleum, being something like fluid cosmoline, but more fluid than it, and entirely unlike it in being free from odor and taste.

There are many other ways in which acute inflammation of the middle ear, characterized mainly at first by earache, can be produced. Some of these may be

called accidental, and others are due to a want of proper care of the ears and nose. I have known an acute inflammation of the ear to be brought on by accidentally allowing cologne-water to flow into the nostrils while smelling it in a reclining posture.

Catarrh-Remedies.—In a similar way a so-called catarrh-remedy has acted in a number of cases coming under my notice. Almost all so-called fluid catarrh-remedies, so loudly advertised everywhere, are ordered to be snuffed into the nose. No matter what the remedy, even if plain water, it should never be *snuffed* up the nose. This act of forcible inspiration is able to draw the fluid into the Eustachian tube and middle ear and inflame the latter. And in fact this accident has often occurred. The dry snuffs (powders) are nearly as bad, though they act more slowly, thickening the mucous membrane lining the nose, naso-pharynx, Eustachian tube, and middle ear, and finally inducing hardness of hearing and deafness. It is seen, therefore, how necessary it is to advise strongly against the use of anything recommended to be snuffed into the nose.

Nasal Douche and Syringe.—The nasal douche comes under this head, as also does the nasal syringe, simply because the pressure of these instruments cannot be accurately regulated. It requires but a little force to send the fluid from the douche or nasal syringe up the Eustachian tube into the middle ear. The writer has known a simultaneous inflammation in both ears to be produced by the unskilful use of a nasal douche. The mistake in the employment of the nasal douche consists in elevating the vessel containing the fluid—gen-

erally water with something dissolved in it—too high. Instead of being above the head, the surface of the fluid in the bottle should be on a level with the eyes of the patient. The nasal syringe must never be used by a patient upon himself or any one else. It must, indeed, be used by a physician with the greatest caution. The writer never uses it in any way in the nose, simply because of the danger of forcing water into the ears. The nares are made to conduct air, and not fluids of any kind. Hence flooding them with any kind of fluid is risky for the integrity of the ears.

Swimming and Diving.—The earache and inflammation of the ear, which often follow a swim or a cold plunge anywhere, are often largely, if not entirely, due to the water which enters the nose at such times. A slight strangling or even coughing may then force enough water into the Eustachian tube to enter the middle ear and induce inflammation of that organ.

Doubtless, in swimming and diving, some water enters the external ear, and may inflame the external canal and outer surface of the membrana tympani. In many cases the writer feels sure that the ear has been attacked both in this way and by cold water forced up the Eustachian tube into the middle ear. Many boys and men swim and dive very frequently, with rarely if ever any ear-disease in consequence. But enough cases of inflammation of the ear do occur from this cause, to render caution necessary in thus exposing so valuable an organ of special sense to danger of great injury.

Washing the Hair.—Even washing the hair, in women, and then exposure to open air or draughts before it is entirely dry, has been the cause of inflam-

mation of the ear. When this part of the toilet is performed, the hair must be most carefully dried *by a towel*, in a warm room in winter-time, and in summer in one free from strong draught.

Hair-cutting.—Men make a mistake in having their hair cut short in winter-time and then exposing themselves to cold air, or even a storm, in driving, riding, or skating. This is often the cause of earache and inflammation of the middle ear, with not unfrequently mastoid pain and congestion. If the hair must be cut in very cold weather, whether it is only trimmed or cut quite short, a comparatively mild day should be chosen, and an hour might be selected when immediate exposure could be avoided by remaining in the house for a little while after leaving the barber's hands. It is also an additional safeguard against cold in the head and ears, not to dampen the hair with anything after it has been cut. There is no exception to be made in favor of bay-rum, alcohol, etc., as these are worse than water, because they evaporate more rapidly and thus reduce the temperature of the scalp. The best course to pursue after the hair is cut in winter-time is to decline a "shampoo" and insist upon a "dry brushing," unless the tonsorial operation is performed in one's own apartments and one is going to remain in for an hour. All these precautions at least indirectly tend to protect the ear, and prevent pain and deafness. They are valuable for those whose ears are good, and they are imperative upon those whose ears are at all affected. But we shall further consider the general hygiene of the ear when alluding to chronic ear-diseases of a catarrhal type.

CHRONIC PURULENT INFLAMMATION OF THE MIDDLE EAR.

If an acute inflammation is followed by a discharge, and the latter is improperly treated or neglected, a chronic discharge will be set up. This is most apt to be the sequel of the ear-discharge which occurs in scarlet fever or measles, and always indicates a perforation of the drum. The quantity of the discharge in such cases varies from a few drops to a teaspoonful or two in twenty-four hours. Sometimes it is hardly copious enough to flow from the ear, while in other cases it flows freely from the ear upon the cheek and requires frequent wiping to prevent disfiguration and irritation of the auricle and the skin near it. Especially is this the case in scrofulous children. There is always a disagreeable odor connected with a chronic discharge from the ear, due, of course, to the decomposition of the matter. This may be a source of blood-poison to the patient, or even to those with whom he comes in close contact. Thus, a nurse or a doctor who may be affected with a chronic discharge of matter from the ear, the nose, or a decaying tooth may become a source of contamination to their patients. There are well-authenticated cases of childbed fever which have been traced to contamination from the hands of the physician, which had been previously soiled by wiping or scratching his running ear. The same thing has occurred from a decaying tooth and a purulent discharge from the nose. These sources of pus render the breath offensive and irritate a patient to further illness. If the pus gets upon the hands of a nurse or a physician,

it may be conveyed to the patient's body and thus poison his blood.

But let us consider the effects of a chronic running from the ear, upon the patient. The hearing grows steadily worse, and may be at last entirely destroyed. The odor from the ear renders the patient a source of discomfort to himself and to those with whom he comes in contact. Granulations spring up and develop into polypi, in a chronic discharge in the ear. A long-continued discharge is apt to lead to disease of the bone of the middle and internal ear. Before this is brought about, there may be many "gatherings" in the ear, with great pain. These are largely due to the decomposition of the matter in the ear and further irritation from this source. After the bone is finally attacked,—eaten through, in fact, at some places, even as far as the brain,—the patient is in danger of losing his life, either from inflammation or from abscess in the brain. If death is not brought about by brain-disease from the inflamed ear, it is induced by pyæmia, or blood-poison, by absorption of the pus from the ear into the blood. This often tends suddenly to inflammation and abscess in the lung or liver, and rapid death.

Treatment of a Chronic Running from the Ear.—The most the patient can do for himself in this disease is to avoid bad self-treatment and to keep his ear clean. The habit of wearing cotton in a running ear is both injurious and unclean. It holds the matter in the ear, favors its decomposition, increases the bad odor from the ear, and causes proud flesh to grow and the inflammation to extend deeper into the bone. One might as well stop a running nose with cotton, as a running ear.

It overheats the ear, and thus induces all the bad symptoms above named. If matter forms in the ear, let it run out, by all means. The ear can be kept clean by mopping it gently with absorbent cotton, or by syringing it with tepid water once or twice a day, according to necessity. More than this the patient cannot do without expert advice. In most cases, if anything is dropped into a running ear without the advice of a physician, it will be a mistake and do harm. The running is the only one of several symptoms of ear-disease which the patient can see. What the others are, what importance should be attached to them, and what should be the treatment demanded by them, only the experienced eye can detect and direct. Polypi and granulations must be removed, or the chronic discharge will not cease. If the drum-membrane and little bones of the ear are necrotic, *i.e.*, half destroyed by disease, their remnants may require surgical removal to insure a cure of the disease, which otherwise may destroy life.

There is a popular idea, emanating from by-gone days, when the nature of ear-disease was not as well understood as now, that it is a bad thing to check a running from the ears, for fear it will go somewhere else and do harm. Nothing could be more erroneous than this view. The truth is that, if a chronic discharge of matter from the ear is permitted to go on unchecked, the disease of which the discharge is a symptom will go deeper, and may at last extend to the brain or some other vital point. But the proper way to check such a discharge is not by damming it up in the ear with cotton, but to clean out the ear and apply efficient medicines to the diseased mucous membrane,

inside of the ear, from which the discharge comes. Then when the discharge grows less under a proper treatment, it is an indication that the causative disease is being overcome, the ear made better, and the general welfare of the patient secured.

There are many ways to accomplish this most desirable end, both by fluid applications and by insufflations of powders into the ears. If the perforation in the drum-membrane is large, I incline to the latter form of treatment; but if it is small, the former may be used with advantage.

Polypi and their Treatment.—After a discharge from the ear has become fully established, even in the course of a few weeks, a polypus may grow in the organ thus affected. Usually it requires a long duration of a purulent discharge from the ear to cause a polypus to form in it. After such a growth has developed in the ear, it will not disappear until removed by surgical art. The discharge by its irritating and moistening effects has brought about the polypus, and the latter acts as a stimulant to further discharge from the ear, so that finally these two causes, reacting upon each other, seem to combine to continue and to increase the aural disease. The matter formed now in the ear cannot so easily escape, on account of the partial obstruction from the polyp. This lessening of the way of escape of the pus favors its decomposition in the ear, the odor is thus increased, and a constant irritation is thus set up in the ear. A discharge from the ear will never stop as long as a polyp is in it.

Treatment.—The first step in the treatment, therefore, is to extract the polyp and prevent its return. Re-

removal of a polyp from the ear may be accomplished either by grasping it with delicate, slender forceps (of course under good illumination from light reflected into it by the forehead-mirror) or by the use of a so-called polypus-snare. The latter consists of a loop of delicate wire, the ends of which run through a slender steel barrel and are then fastened to a sliding holder on the shaft. This holder may be drawn towards the operator, and the loop of wire at the distal end of the steel barrel thus constricted. When the loop has been placed around a polypus, the above-named manipulation will sever it from its stem, and it can then be easily removed from the ear with the instrument.

This, however, is but the first step in the radical cure of a polypus in the ear. The root, or attachment of the polyp, must be touched with some caustic, in order to prevent regrowth. The bleeding from the seat of the attachment of the polypus is slight. Most polypi are attached to their pedicle very much as a cherry is to its stem, and a clean removal can in such a case be made very easily. When the polyp is broad and attached to a pedicle of the same width, it is harder to remove it entirely at one constriction of the snare. In any event the section of the pedicle in such a case will be broad, and will require perhaps further snaring, and certainly more treatment with caustics, to insure its destruction.

When a polypus is finally entirely removed and its root destroyed, the discharge will cease, as a rule, very soon. There may be a concealed polypus which keeps up the discharge after the visible polyp is removed. If after the removal of a polyp the running from the

ear still continues, the presence of a concealed polypus should be suspected. This will generally be found behind the rim of the drum, at its upper part. It will be more likely to come into view after the first polyp is removed, as the latter often seems to push it out of sight. Close examination of the ear, after syringing it, will generally reveal at least the lower edge of a concealed polypus, if present, projecting from behind the plane of the membrane. Such a polypus is usually smaller than the outer one, and can be removed, as a rule, only by a delicate hook on a slender shank. A snare could hardly be made to serve so far in the ear as the attachment of a concealed polyp, as it is behind the plane of the membrana tympani.

No form of local application will cause a polypus to shrink and drop from its stem. It must be removed as above stated.

Mastoid Disease.—Chronic purulent disease of the drum-cavity, either with or without producing polypi in the ear, may extend its ravages inward and backward to the mastoid cells. These cells are in the rounded bone behind the auricle, easily seen or felt in any one. After chronic purulent disease in the middle ear has become fully established, the patient, upon taking cold, or after a bath in cold water in summer-time, may feel an earache, which gradually passes backward and inward towards the mastoid cells in the afore-said region behind the auricle. The bone behind the ear grows tender to the touch, it may also become boggy and swollen, and the pain within the bone may be intense. Headache and fever are usually added to the

other symptoms, and sometimes the patient grows delirious. The discharge from the ear may now suddenly grow much less, or cease entirely, to be re-established as the acute symptoms subside.

Mastoid symptoms of pain, tenderness, and swelling sometimes attend inflammation in the external auditory canal. If there has not been any long-continued running from the ear, these symptoms need occasion no alarm. They will usually yield to poulticing behind the ear.

If, however, other symptoms occur in an ear previously the seat of long-continued discharge of pus, they may indicate serious inflammation of the bone, near the brain. The middle ear should be examined and the auditory canal made free. If polypi or granulations, *i.e.*, proud flesh, are present, they should be removed, so that pus may escape from the ear. Warm fomentations, poultices, and leeching *over the mastoid*, should be tried. Such a case demands careful watching and treatment, as pus may form within the mastoid cavity, and, if not given a way of escape, may force its way through the inner wall of the mastoid cavity into the lateral sinus, an important blood-vessel of the brain. When it reaches this point the condition of the patient is hopeless.

When pus forms within the mastoid cavity and seems not to have free escape through the middle ear, the outer mastoid wall, behind the auricle, must be perforated.

Sometimes the chronic disease in the drum communicates itself to the bone on the inner and upper wall of the drum-cavity. It thence extends itself to the

membranes of the brain lying just beyond, and the result is a fatal one. In such cases the mistake has been made in a too precipitate determination to perforate the mastoid. Such an operation would now be futile as a remedy for a meningitis already established, unless it is proposed to make such an opening in the mastoid the starting-point of an operation to enter the skull-cavity and drain an abscess in the brain which is supposed to be not far from this point of entrance. All of these procedures demand the highest surgical knowledge and skill.

Loose Pieces of Dead Bone.—A mastoid inflammation, especially if it has spent itself on the outer table of the mastoid cavity, often ends in loosening this outer table or a scale of bone near it. These cases are also attended with spontaneous openings in the bone near or in the mastoid wall, which continue to discharge matter for some time. If a probe is put into these openings, dead bone will be felt. Gradually this dead bone will be found to be loose and making its way outward towards the opening. Such pieces of loose bone should be removed as soon as possible, as, if allowed to stay in beneath the skin, they tend to poison the blood, by forming a centre of decay and infection. Slitting open the skin and seizing the edge of the loose bone with forceps, and a removal of it, will generally terminate the discharge which has been going on from both the ear and the spontaneous opening behind it. It will be observed that now the general health of the patient will improve, because a source of infection of his blood has been removed.

Nose and Throat.—It has been stated already that

most acute inflammations and runnings from the ear are due to inflammation in the nose, or a cold in the head. Often the nasal disease passes away with the acute aural inflammation. If a chronic discharge from the ear continues, it may be quite positively assumed that the nose too remains diseased from previous attacks of cold and other irritants. So far as treatment of the nose is concerned, the patient can himself do little towards making a nasal disease better by direct treatment. But he can do much in the way of hygiene to make his condition better and ward off future attacks of cold in the head and permanent deafness. The reader is reminded of what has been said already (pp. 65–67) about swimming and diving in cold water, the use of the nasal douche and nasal syringe, and also concerning taking large doses of quinine and the common but erroneous use of so-called catarrh-remedies. The same statements must be repeated here, as important advice to those afflicted with chronic discharges from the ear. If chronic catarrh of the nose and throat are not relieved, the chronic ear-discharge cannot be checked. Every precaution must be taken against using improper remedies, and also against taking cold. But more will be said about the hygiene of the throat and nose when considering chronic catarrh of the middle ear and the deafness attending it.

CHRONIC CATARRH OF THE MIDDLE EAR.

We now come to that disease of the middle ear which produces the most deafness,—viz., chronic catarrh of the middle ear. This disease has received many names, among which may be mentioned “chronic

thickening and hardening of the drum," "chronic stiffening of the joints of the little bones of the ear," "sclerosis (hardening) of the middle ear," "nervous deafness," and many others, all based on some of the prominent symptoms of the disease. The one most commonly used is at the heading of this paragraph, and is probably the best, because it most nearly expresses the true nature and origin of the disease in the majority of cases. After a very bad cold in the head, which has been attended with inflammation in the nose, Eustachian tube, and drum-cavity, and which has been characterized by deafness and sometimes by pain, as the latter ceases, the hearing may only partially return to its previous condition. This is due to the fact that the swelling in the mucous membrane of the nose, Eustachian tube, and drum-cavity has been so great that they do not regain their previous normal state, and that the ear in consequence is in the first stage of chronic catarrh and deafness. Air which should enter the Eustachian tube and middle ear at each act of swallowing, and which should pass through the nose at each respiration, in order to be near the mouth of the tube, to enter the ear, is kept out of these cavities by the impediment due to the swollen mucous membrane which forms their lining. This condition of the mucous membrane of the nose and middle ear is rarely the result of one cold. It will usually be found that the patient has been long liable to take heavy colds in the head and sometimes has been equally liable to sore throat; though usually it is chiefly the nose in its back part which has been affected. Then the ears have felt stuffed with each cold in the head, and there have been

some hissing or ringing sounds in them. For a long time these ear-symptoms pass off after the severity of the head-cold has vanished. Or a little dulness of hearing may be noticed to remain after a cold. Then, after another cold the hearing is a little duller, the ear not returning again to its once sharp hearing. This may not be considered of much importance at first; but as inconvenience is gradually felt from the slowly-increasing deafness, and as the noises in the ears and head increase, the patient grows anxious or alarmed about his failing hearing, and seeks aid. Sometimes the roaring in the ears, and the stuffed or full feeling in them, are so great as to cause dizziness and even staggering. In such instances the patient has the additional suffering from what is called *aural vertigo* (Ménière's disease). As the nose is often very much stopped by its swollen mucous membrane, the enunciation of the patient becomes indistinct, or nasal as it is called. In some instances, especially when this disease begins, the patient's voice sounds peculiar to him, and as though he were speaking in a closet or a box. In the speech of others the patient loses the consonant-sounds first, but hears the vowel-sounds. Thus, for "pin" he thinks "bin" or "tin" is said. All ages may be afflicted with this form of ear-disease. Chronic catarrh of the middle ear is without doubt the cause of a child's being deaf and dumb. In it the disease may have begun shortly after its birth, with a severe cold, which has been forgotten. As it is too young to even know its own deafness, and as its parents do not require to talk to it in infancy, with the expectation of communication with it, they are unaware

of the beginning of deafness. Thus the profound deafness is founded, because, being unrecognized at its beginning, it receives no treatment.

Colds in the head are the chief cause of chronic catarrh in the ears. But it often is due to scarlet fever, measles, and skin-diseases in childhood, and to typhoid fever and childbed in adult life. In children one of the first symptoms of nose- and ear-disease, with hardness of hearing, is "mouth-breathing:" the child breathes through its mouth instead of through its nose. This causes a dryness and finally disease in the throat. The disease of the nostrils causes them to become further impeded inside, from a want of the necessary stimulus of the respired air. Outside, on its sides, or "wings," the nose falls in and looks pinched. The back part of the nose is deprived of air, and hence the middle ear fails to get its supply of air and its function is impaired.

When this defective aëration of the drum-cavity once sets in, the patient is advancing in his deafness; for if aëration or ventilation of the tympanic cavity stops for a short time only, the ear is put in the first stage of deafness. Such a condition must be overcome as soon as observed. In children we must be on the lookout for stopped nose and relieve it, or have it treated, at once. Adults should be careful not to breathe through the mouth, especially in the open air; and if this seems difficult, they should have the nose put in a condition to permit easy respiration and check mouth-breathing. Mouth-breathing is not only prejudicial to good hearing, but it tends to bring on throat- and lung-disease, because the respired air is taken

directly into the throat and lungs, without being first warmed and sifted of dust in the nose.

Effects of the Use of Tobacco on the Middle Ear.—Men who snuff, chew, or smoke tobacco are liable to chronic catarrh of the throat and nose, and hence to chronic catarrh of the middle ear. Especially is chronic catarrh likely to be produced in one who smokes through his nose. It matters not whether it is cigar, pipe, or cigarette smoke: one kind of smoke is no worse than any other: it is only the method of inhaling it. Cigarettes are not harmful as such. They are convenient, and hence smoked excessively, and their smoke is often chosen to be blown through the nose. But the bad effects would be the same with an equal quantity of any other kind of tobacco-smoke used in the same way.

Snuff is especially bad for the nose and ears, as it is applied directly to the nose, irritating it and, indirectly, the ears.

Chewing tobacco is worse for the throat than it is for the ears. Its bad effects arise from the fact that a chewer of tobacco generally keeps a piece constantly in his mouth, and thus allows the throat to be bathed with tobacco-juice almost all the time.

Effects of Alcoholic Drinks on the Ear.—Those who drink alcoholic drinks to any extent keep up a catarrh in the nose and throat, and hence in their ears. Therefore we find chronic catarrh of the middle ear very often in those given to drinking spirits or high wines. This habit tends to excite a congestion of the head in general, and the nose and ears share quickly in its evil effects. In advanced catarrh of the middle ear the deafness is

always worse after indulging in free drinking. In some cases very little potation is required to make the deafness much worse. It also congests the nerve of hearing in the internal ear.

SYMPTOMS OF CHRONIC CATARRH OF THE MIDDLE EAR.

Chronic catarrh of the middle ear comes on insidiously. As one ear generally fails some time before the other, the ear first affected may become very deaf before the patient is fully aware of his loss. This is often discovered accidentally, as when lying on the good ear, in bed, he suddenly finds that he cannot hear a clock tick or the rain falling. Sometimes deafness in one ear is not discovered until the other ear begins to fail in hearing. If both are affected at the same time, the patient feels very quickly his deficiency.

If among the earliest symptoms, as is very often the case, there are noises in the ear, they constitute valuable warnings of the approach of the disease. Sometimes, however, the hearing fails before the noises begin in the ear. These resemble the ringing of distant bells, the escape of steam, or the roaring of a sea-shell held to the ear. At first such noises are heard only at night, or early in the morning, or when the patient is in a quiet place. Gradually they become louder and continuous and give great discomfort and annoyance. In many cases there is an increased sensitiveness to sound in the early stages of chronic catarrh of the middle ear. Loud noises, like those in the street or in a machine-room, hurt the ear in such a state. It would appear that in some cases the patients get used

to these noises in the ears and head. But they vary in intensity in the same individual, and in different cases of aural catarrh. Their intensity is often dependent upon conditions of the digestive apparatus or of the genito-urinary organs.

Pain, of a dull kind, is felt from time to time in chronic middle-ear catarrh. This is neuralgic and due to the pressure of the swollen mucous membrane on the nerves of the middle ear. At the same time there is generally a dull pain over the eyes or in the root of the nose. Instead of this pain in the ear there may be a sense of fulness in the ear, as though it were stuffed with cotton. These symptoms are always worse in winter-time or whenever the patient has cold in the head. They are also aggravated by stimulating food and wine-drinking, by dyspepsia, and by constipation of the bowel. If there is an active secretion in the posterior part of the nose and in the Eustachian tube, much annoyance is caused by the crackling sounds made by bubbles in this fluid, and the patient's voice sounds very strangely in his own ear or ears, from the swollen condition of the Eustachian tube and middle ears.

Vertigo is often felt in the later stages of this disease, especially in the nervous and those suffering from nervous prostration. Such subjects are easily rendered vertiginous by any cause, but become especially liable to vertigo and dizziness if their ears are affected by catarrh. Attacks of ear-vertigo, as it now becomes, are usually preceded by a fresh attack of tinnitus or by an increase of the buzzing or ringing already in the ear. The deafness, too, usually gets worse just before

or during the attack of vertigo. Sometimes only a dizziness is felt, with a little unsteadiness in the gait. In other instances the vertigo is intense, nausea comes on, and the patient reels and clings for support to any near object. At times the vertigo is so great as to cause the patient to fall down, and sometimes the nausea becomes so oppressive as to induce fainting.

In an ear affected with chronic catarrh, the membrana tympani is both stiffened and drawn inward, and thus held, by the retraction of the tensor tympani muscle. This draws all the ossicles inward and forces the foot-plate of the stirrup-bone in upon the fluid in the labyrinth. Pressure is thus exerted upon the terminal filaments of the auditory nerve, in the labyrinth. As the auditory nerve contains motor as well as sensory fibres, the irritation conveyed by this pressure upon the auditory nerve, to the brain, causes dizziness and vertigo.

Hearing better in a Noise.—In the advanced stages of catarrh of the middle ear the patient usually hears better in a noise. This is not a favorable sign, as it indicates that the chronic catarrh has profoundly affected the drum-membrane and the little bones in the middle ear and led to their stiffening. Ordinary sounds, like those of the voice, cannot overcome this stiffening and make the drum and bonelets vibrate, but powerful noises can temporarily overcome this stiffness and cause vibrations in the sound-conductors. When such take place, the sounds of the voice and many weaker sounds enter the ear, as it were, with the powerful sounds which have opened the way, by making the conductors move to and fro, or vibrate, as it is properly termed.

Heredity.—There is often a marked hereditary tendency to chronic catarrh of the middle ear in some families. This is due to the presence in the middle ear of bands or strings of a fibrous nature which intertwine between the bones and the inner wall of the drum-cavity and prohibit free movements in the conductors of sound. The *odor* in chronic catarrh of the middle ear and of the nose is not usually of the offensive kind.

In chronic catarrh of the middle ear characteristic changes appear in the external auditory canal. These consist chiefly in a diminished or even a suspended secretion of ear-wax. The wax may be very brittle and small in quantity. In many cases there is no wax in the ear affected with catarrh, and the skin of the canal, in these cases, is dry, scaly, and itching. This induces the patient to scratch the ear, which act often abrades the skin of the canal and sets up boils and abscesses and favors the growth of *aspergillus* (p. 51).

The drum-membrane now begins to lose its normal translucent appearance, and as the chronic catarrh of the ear advances it becomes opaque, dull, and looks like ground glass. Sometimes, however, the drum-membrane, instead of growing thicker under the influence of the chronic catarrh, becomes thinner, especially in atrophic forms of naso-pharyngeal catarrh. When the membrane is thinned it transmits the pink or even red color of the congested mucous membrane of the drum-cavity, and consequently looks pinkish. In many cases there are chalky spots on the drum, the result of local points of inflammation, usually in the inner coat of mucous membrane. In this country

chalk-spots on the drum-membrane are rare. They are most likely to occur in the gouty and rheumatic, and in individuals of European birth. I attribute the latter fact to the universal habit of wine- and beer-drinking in Europeans, and the consequent gouty tendency in them.

Changes occur in the position of the membrana tympani as the disease in the drum advances. Instead of the hammer's being nearly vertical, it is drawn inward, upward, and backward. This renders the malleus-bone foreshortened, and the folds of the drum-membrane with the short process of the hammer project sharply outward. The pyramid of light may disappear entirely, or appear broken and thrown upward. In some cases the hammer-bone appears rotated on its long axis, from the twisting force of the tensor tympani muscle, which is constantly drawing it inward and about the long axis of the handle of the hammer.

Local Flushing.—In some cases of chronic aural catarrh the sympathetic nerve is implicated. This is shown by the flushing which may occur on the neck and chest on the side of the affected ear. This reddening or flushing is due to the temporary paralysis of the vaso-motor nerves which control the calibre of the blood-vessels in these regions. When they lose their control over the vessels the latter become distended with blood, and the aforesaid flushing ensues. Very often pressure upon the side of the cervical vertebræ causes pain in the shoulder and ear of the corresponding side, and an increase in the fulness and singing in the ear. In fact, it is very commonly found that women who are neuralgic suffer from chronic aural catarrh, being

deaf when afflicted with a neuralgic attack in the head. This has given rise to naming such forms of chronic aural catarrh nervous deafness. Women are usually the subjects of this form of ear-disease, and are generally worse periodically.

The Condition of the Nose in Chronic Aural Catarrh.—The condition of the nose, both in front and in its posterior parts, is of the greatest importance in chronic catarrh of the middle ear. As the latter disease usually starts in the nose and goes into the Eustachian tubes and drum-cavities, great attention must be paid to their condition in cases of aural catarrh. We usually find a form of hypertrophic catarrh affecting at first the mucous membrane covering the lower turbinated bones. It may, however, from the outset affect all the mucous membrane of the nose. The thickening or enlargement of the mucous membrane may extend to the back part of the lower turbinated bones and form the so-called posterior hypertrophies. These being near the mouth of the Eustachian tube endanger its normal patulence and threaten the hearing. There are often found in these cases enlargements and projections in the cartilage and bone of the septum or partition between the nostrils. All of these growths obstruct the air-passages and diminish the breathing-space. This, of course, deprives the nose of its natural stimulus,—the air; mucus collects, the swelling increases, and the naso-pharynx is also shut off from its important supply of respired air. This, in turn, deprives the Eustachian tube of air, and the middle ear fails, in consequence, to get its ventilation at each act of swallowing. Mouth-breathing then takes the place

of nasal respiration, the air of the drum-cavity not being freely renewed, a kind of vacuum is formed in the middle ear, and the external atmosphere forces the drum-membrane inward. In consequence of the mouth-breathing, the throat gets dry and finally becomes sore. The inward tendency of the drum-head carries with it the chain of ossicles, and, as the air does not enter the drum-cavity freely, the bones are held in an abnormal position, and may stiffen while thus held. In such cases the deafness increases, and may become irretrievably impaired if relief is not soon given to this unnatural position of the drum and the ossicles.

In the early stages of a nasal catarrh which affects also the middle ear, the patient's voice may sound strange to him, and there may be cracking sounds in it, which greatly distress and confuse him. This is largely due to the fact that mucus from the back part of the nose fills the mouth of the Eustachian tubes and causes altered resonance, as it is termed, and the bursting of bubbles or movements in the mucus occasion the cracking sounds. After a cracking report in the ear the nose may seem clearer and the hearing is better temporarily.

Throat and Palate.—Turning our observation downward into the throat, we may find the glands of the back wall of the fauces enlarged. The tonsils may also be enlarged, and at some points in them a gaping mouth of a follicle is seen. In this opening there may be a mass of white secretion, which is often mistaken for an ulcer or a diphtheritic membrane. The appearances in the throat, however, are not so constant an attendant of aural catarrh as are the changes in the nose.

The soft palate, or the velum, is often relaxed, and the uvula generally is drawn to one side, mostly towards the better ear. In some cases the uvula is swollen and elongated, and tickles the throat, especially when the patient lies upon the back. The palate when in this condition is said to be paretic or partly paralyzed. These changes in its appearance and position are due to the effects of the catarrh of the mucous membrane upon the muscle beneath it. The long-continued action of the catarrh interferes with the contractility of the muscle and renders it flaccid. This condition extends upward and backward into the Eustachian tube, and thence into the tensor tympani muscle. Hence a chronic catarrh in the palate, posterior nares, and muscles of the Eustachian tube finally induces a fatty degeneration in the muscles of the parts named, and in the tensor tympani muscle, which originates from one of the muscles forming the soft palate. This muscle of the drum then loses control of the membrana tympani, and the position of the latter becomes abnormal, with the result of a deterioration in hearing. The discharge from the nose, both from in front and backward, into the throat, may be copious at first. As the disease advances, the nose becomes drier than normal, and inspection reveals a hardening and contraction of the mucous membrane in the nose. While the swelling in the nose and discharge from it continue great, the enunciation is nasal. When the changes in the palate are marked, the vocal powers of the patient are impaired. Complaints are often made of the sensation of having a hair in the throat at this period of the disease. Reading aloud soon becomes painful, and

the voice breaks and cracks in singing. Hence public speakers are not able to continue their work as formerly, and singers often cease to sing entirely, when chronic aural and nasal catarrh is fully established. If these symptoms appear in one ear first, as they usually do, the other ear may soon become affected from the same causes. This should be a great inducement to have the catarrh treated as soon as it is known that one ear is diseased, in order that the unaffected ear may escape. Nothing is worse than neglect of the bad ear because the other ear continues good.

Eustachian Tube.—If air is thrown into the Eustachian tube by the surgeon's instrument, or when the patient blows the nose forcibly, a crackling is caused by the air passing through the mucus and the swollen tube.

Near the mouth of the tube there is the so-called pharyngeal tonsil, which is often diseased and enlarged. In this condition it helps to occlude the mouths of the Eustachian tubes and to aggravate the catarrhal disease in the tubes and middle ears. Sometimes instead of this enlarged gland there are found in this post-nasal region several large glands, shaped like cocks' combs, or like cherries. In such cases there will be hawked into the throat from behind the nose flakes of tough, greenish mucus.

Membrana Tympani.—When the secretion in the naso-pharynx is copious, as in the early stages of chronic aural catarrh, after inflation of the drum-cavity, bubbles of air are seen behind the membrana. This indicates the presence of mucus in the drum-cavity. After the inflation productive of the appear-

ance of these bubbles, the drum-membrane seems to have a more normal position. Gradually, as the air is reabsorbed in the drum-cavity, the bubbles disappear and the drum-membrane is retracted. The mucus may be gradually absorbed, but, if it is not, a puncture in the drum-membrane permits it to escape, and the hearing, which is usually impaired by its presence in the ear, improves after the mucus escapes. When mucus thus collects in the drum-cavity it may require more than one lancing of the drum-membrane to effect a cure. The latter is brought about by emptying the drum of mucus and keeping it free. If one incision will not suffice, the operation must be repeated until mucus ceases to accumulate in the cavity behind the membrana tympani.

Causes of Chronic Aural Catarrh.—As has been said, the onset of this disease is often insidious: very few patients can tell accurately when they first perceived a change in their hearing or any premonitory symptom. Generally a severe cold in the head marks the time when the hearing began to be bad and the noises in the head to cause annoyance. Very often, after certain diseases, the ear has begun to show signs of chronic catarrh. Among these promotive diseases may be named phthisis; great sorrow and nervous prostration; progressive locomotor ataxia; sciatica and general neuralgia; neuralgia of the fifth nerve; insanity; intemperance, and all forms of dissipation. Chronic aural catarrh often follows pregnancy, change of life, uterine diseases, continued and eruptive diseases, mumps, shock from injuries, rheumatism, gout, and syphilis.

In some instances the latter disease apparently produces great changes in the middle ear, and deafness. This is due to the sudden and great catarrhal swelling which syphilis induces in the mucous membrane of the middle ear. It has very often been supposed that the nerve of hearing is primarily affected in these cases. But this is not so at first; later on in the disease the nerve may be secondarily affected. The deafness is due to a swelling of the mucous membrane over the little bones in the middle ear, and the consequent stiffening of their joints. It requires but little such swelling about the stirrup-bone to cause impeded vibration in it, and then follows quickly a profound deafness.

Many cases of chronic catarrh of the middle ear are traceable to sleeping on the ground and exposure in camps. I have observed many of this form, attributable to the hardships of our late civil war.

Anglo-Saxons born in tropical countries seem liable to the sclerotic form of chronic aural catarrh. I have seen such forms of ear-disease in children born of Anglo-Saxons in Mexico.

Hunting, if it brings with it a wetting of the legs and body, is a cause of chronic catarrh of the middle ear. Diving in the water, or ducking the head under water habitually, also produces the same effects. Water-dogs and retrievers who enter the water constantly usually grow deaf from chronic catarrh of the middle ear. Mill-hands, boiler-makers, and domestic cooks seem liable to chronic catarrhal deafness. This is due to the fact that mill-hands are exposed to the bad effects of imperfect ventilation, dust, and irregular

meals, which are productive of debility and direct irritation of the nasal mucous membrane and that of the Eustachian tube and middle ear.

Boiler-makers are exposed to confined atmosphere while at work, and also to great noises. These tend to provoke catarrh, and to weaken the nerves of the middle ear, to promote congestion in the drum-cavity, and finally to strain the nerve of hearing.

Domestic cooks are exposed to great heat, and consequently perspire freely. They also do other domestic work, like washing clothes, and go from a heated room into a court to dry the clothes. This tends to produce in them rheumatism and chronic catarrh in the head and ears. These subjects furnish a large number of cases of chronic catarrhal deafness.

Workers in submarine caissons are liable to exposure to dampness and unusual atmospheric pressure when at work. Such workmen constantly develop rheumatism, chronic catarrh of the head and ears; with annoying sounds in their ears, and great deafness.

Carpenters, who are obliged to work in cold and draughty houses, are frequently affected with catarrh in the head, and finally, by neglecting their head-disease, grow deaf from chronic catarrh of the middle ear.

Telegraph and *telephone* operators, if affected with chronic catarrh of the middle ear, grow markedly and rapidly worse if subjected to many hours of continuous work. This is due to the exhaustion of the nerve-power of the drum-cavity, the increase of the catarrhal disease, and finally to a weakening in the auditory nerve itself.

Exposure to the concussion caused by the discharge of heavy cannon in confined quarters, like a fort or a casemate, induces a catarrhal condition of the mucous lining of the middle ear, and deafness. This in time brings on exhaustion of the auditory nerve, like the continuous exposure of the ear to the shocks of a telegraph apparatus or of the telephone.

Hygiene of the Ear in Chronic Catarrh.—Since this disease of the middle ear is usually slow and insidious in its onset, the slightest warning, like fulness or noises in the ear or ears, must not be disregarded. In fact, as this disease is usually dependent upon catarrh of the nose, when this latter affection is known to be present the ears should be carefully watched by the patient, his physician, and his nurse. As it often follows close upon so many diseases, already named (p. 108), a patient affected by any of these maladies should also be carefully watched. Those suffering from catarrhal deafness should be extremely careful not to take cold. While not exposing themselves, they must not house themselves too much, nor dress too warmly, inducing perspiration, in winter-time. Those who suffer from cold feet should change their hose in the middle of the day, putting on dry stockings in the place of those dampened by perspiration. If possible, two pairs of shoes should be in use, being worn on alternate days. This insures a drying of shoes on the off-days. The underclothing should be of a kind to keep one warm in winter-time in all ordinary weather. People vary greatly in their requirements in this way. I always advise some form of *all-wool* undershirt, if it can be worn. It may be very thick, or thin, according to the

needs of the patient. The drawers may be of wool, merino, cotton, or silk, according to the necessity of the case and the means of the wearer. If all-wool undershirts cannot be tolerated, then a mixture of silk and wool, or stout merino, may be tried. It is preferable that the same kind of material worn in winter should be worn also in summer,—of course in much lighter weights. This can easily be accomplished, because all of the above-named kinds of underclothing come in very light weights. If they cannot be purchased ready-made of suitable weights for summer wear, very thin flannel can be bought by the yard and made into undershirts. The drawers in summer-time must usually be of the lightest materials. Patients with chronic catarrh of the middle ear may take cold in summer-time, and get deafer, just as easily as in winter, if not properly clad. Those with a catarrhal tendency should always wear in summer-time an undershirt thick enough to protect them against the sudden changes which come at any time with a shower. Hence a so-called gauze undershirt should never be worn by a patient with chronic nasal and aural catarrh. For him to dress warm enough for safety in summer-time may at times make him too warm for a little while in the middle of the day. But he may lighten outside clothes to make up for this. He had better be a little uncomfortable for a few hours than to take cold from a sudden change in temperature. It is much better to feel too warm for a while than to even feel chilled in summer-time, when the skin is always acting very freely. Checking the perspiration at such time is the cause of nearly all the bowel-catarrhs of summer, and is the cause of

numerous cases of catarrh of the middle ear. If the latter disease is already established, the patient gets much worse by carelessness in dressing in summer.

Underclothing should always be worn at night. The night-undershirt should go on with the night-shirt, the day undershirt coming off with the day-clothing. In summer-time this may be of the lightest type. In winter-time the night-undershirt should be lighter than the kind worn in daytime, except in very cold weather, when the same weight may be worn, if desired, both at night and in daytime. If the feet are cold in bed, light stockings or socks should be worn. We have great extremes of temperature in this country, and we must dress accordingly.

Ventilation.—The question of ventilation of the sleeping-apartments of those suffering from chronic catarrh of the middle ear is very important. In summer-time one can hardly get too much air, unless the weather happen to be decidedly cool. Our good sense and our feelings must often be the guide. A strong draught of cool air is never safe for any one: for one with catarrh of the head and ears it is dangerous. In winter-time no one should feel cold in bed. Renewal of the air in a bedroom can easily be had and must be secured without chilling the patient or any one else. If the apartment is large and not in a densely-crowded city street, it is much easier to make it too cool and draughty than too close. If the patient sleeps alone, it will not be easy to make his bedroom too close or too warm in winter-time. In fact, a catarrhal patient should never feel a draught nor a sensation of great cold on his head at any time, especially

at night, when in bed. In daytime he cannot get too much air, if he takes it in the right way. The apartments occupied in daytime, whether offices, boudoirs, school-rooms, or places of manual work, should be well ventilated. They need not be draughty, in order not to be "stuffy." The air breathed, especially in schools, is often permitted to get foul while trying to keep the pupils warm. This can be obviated, not by opening windows at the top or bottom, but by some simple form of adjustable ventilator to be placed in the window. This will effect a purification of the air, without chilling any one or exposing those near the window to a draught. Children with chronic catarrh of the nose and ears are often made worse by breathing the effete air of a school-room for long periods, and then sometimes they are suddenly chilled by having the windows thrown open when the rooms become insupportably close. Both of these extremes are injurious to all,—especially so, however, to the catarrhal patient. The air of artists' studios is sometimes quite impregnated with the fumes of turpentine and paint. This has been known to excite and congest the catarrhal nose and ears and make them worse. All such fumes must be avoided by those affected with catarrh of the nose and middle ear, if it seems to injure them in even a slight degree. The air of all apartments is rendered purer by a fire in an open fireplace, even when not sufficient nor required for warmth.

Exercise.—Walks or rides are far preferable to drives, as an exercise or for taking an airing. Fresh air and exercise, or exercise in the fresh air, should be the guiding motto for all of us, but especially for any one

with catarrhal disease in the head and ears. Exercise, however, must never be carried beyond a healthy fatigue. Exhaustion in this respect, as in any other pursuit or pastime, would inevitably make the ear-disease worse.

In summer-time exposure to the direct rays of the sun to any great extent would be likely to make the ears worse, by inducing congestion in them. In winter-time the ears need not be protected from the cold air unless exposure to the cold brings on earache. Then a little cotton may be placed in the mouth of the canal of the ear, while in the open air,—never in the house.

Mouth breathing must be most carefully avoided, and the nose forced to do its work as a respirator. If exercise in the open air has produced considerable perspiration, the patient must not cool off suddenly by standing or sitting in the open air. The exercise may be lessened, or a slow walk made to substitute the rapid one. Sitting down must be deferred until in the house or in a covered vehicle. It is only safe to have some additional wrap to throw on after the exercise is lessened, whether in winter or in summer.

When quitting warm places of amusement, or any warm apartments, in winter evenings, an extra wrap should be put on unless the wraps worn to such places have been taken off while there. It is also safer to breathe at first through a handkerchief, or the like, upon going into the cold air of a street at night after leaving warm apartments. Many of these suggestions may seem, or be, burdensome; but, as the hearing may depend upon them, they are worthy of our consideration.

As a severe cold in the head in one affected with

chronic aural catarrh may make the hearing permanently much worse, everything which can be done to ward off the cold should be carefully attended to.

Low slippers should never be worn about the house in winter-time, nor even in one's bedroom in very cold weather. The low slipper exposes the top of the foot and the ankle to the cold of the floor, and gives many people cold in the head which they cannot account for. Light shoes or boots should be worn about the house, and high, loose, fleece-lined slippers in the bedroom, when the weather is cold. The knitted bedroom slipper is very good. Neither the bare foot nor the feet encased in stockings should be placed upon the floor in winter-time. There is an intimate sympathy between the feet and the throat, nose, and ears. I have known the exposure of the feet even on carpeted floors, in winter-time, to give a severe cold in the head, and to be followed by a marked increase in deafness. Constant watchfulness and care in this particular is the price the patient with aural catarrh should willingly pay to retain his hearing.

If these little exposures, as some may call them, are followed by bad consequences in the deaf, it would seem unnecessary to caution the patient against greater ones. Yet the young often expose themselves to intense cold, in sleighing-parties, and to cold wetting by wading in snow or in inordinate coasting. I have known walking a few blocks in deep snow, and then sitting in a car or carriage for a half-hour with the wet clothing still on, to produce a severe cold in the head, followed by great and permanent deafness, in those already affected with aural catarrh. But even

in the perfectly healthy such exposure may lay the foundation of chronic catarrh in the ears and deafness, and therefore should be most sedulously avoided.

Bathing, in all its forms, in the performance of the toilet, becomes an important matter for consideration, especially in the case of those affected with chronic catarrh of the middle ear. We should all bathe in winter-time simply for the sake of cleanliness, and not as a matter of pleasure. The latter is not to be thought of in cold climates, in winter-time. The bath should always be taken in a warm bath-room (70° F.), in cold weather, the temperature of the water being regulated by the feelings of the bather. It is always safest to bathe in the evening, in winter-time, and then go to bed in a warm room.

Bathing in cold rooms in cold water in winter-time never does any one any good; and in the case of patients with chronic aural disease it does positive harm. Many such patients who have been indulging in cold sponge-baths, with the idea of hardening themselves, have been improved at once in health and hearing by stopping their cold-water bathing. In any case, once a week is quite often enough for a full warm bath in winter-time. If the bath-night fall on a very cold night, the bath should be postponed to milder weather.

The feet, neck, and face may be washed as desired in all kinds of weather, if they are carefully dried after the bath. Tepid water is preferable in winter-time, especially in the deaf, and the neck must not be exposed too low, and never in a cold room while performing the toilet. The nerves going up on the sides of the neck are intimately connected with the ears, and the latter

are injured if these nerves are unduly chilled by imprudent bathing, at any season.

Equal caution must be observed in washing the hair (p. 84) as in washing and bathing the body. Ladies and children are especially exposed to the dangers of ear-disease and deafness from imprudent washing and deficient drying of their hair. In them the hair is much longer and denser than in men, who nowadays wear their hair very short.

The danger in hair-washing consists in the subsequent imperfect drying, and the consequent evaporation, which may go on for hours, lowering the temperature of the head and often inducing most severe colds in the head, ear-catarrh, and deafness.

Clothing.—In regard to clothing there is little to be said to men: there is much to be said to women, however, on this score. If there is any catarrhal tendency in the head and ears, tight lacing, by impeding the circulation of the blood in the large vessels of the body, interferes with the circulation in the head and induces a passive congestion of the nose and the ears. This of course keeps up a catarrhal inflammation in these parts, and makes the deafness worse. Women also make a mistake in varying the weight of their clothing in winter-time, a heavy outfit of daytime being substituted for a light one in the evening, in accordance with the exigencies of society. This sudden alteration both in the cut and in the weight of the dress often brings with it severe colds and establishes chronic catarrh of the head and ears. If great changes in the weight and style of the clothing are made in winter-time, ample protection should be given to the

neck and shoulders, by extra wraps, while passing from the house to the ball-room, and upon returning home again. The danger, however, of such changes in clothing is very great in one already affected with catarrhal disease in the ears.

There is also a carelessness on the part of many young women regarding the wearing of warm under-clothing in winter. Many will wear none at all, and thus some find themselves suffering from muscular rheumatism. If there is any tendency to catarrhal disease in the ears and hardness of hearing, the chest and shoulders must be well protected by an undershirt which comes high up in the neck. It is needless to say that such an undershirt must not be laid aside in order to wear a low-necked dress, in cold weather. Such an act would endanger not only the hearing, but also the general health.

Those affected with catarrhal deafness must be as careful with their feet as with their necks and chests. If slippers are worn to the evening party or ball, the feet must have additional protection in transit to and from the ball-room.

Our bodies in health contain heat and electricity. If they get chilled or wet, the heat and electricity escape quickly, and vitality is lowered, especially at night. The body then becomes an easy prey to disease. We easily get fevers and catarrhs of all kinds. Prominent among the latter are the catarrhs of the throat, head, and ears. Therefore we must be careful not to expose our bodies to too much cold in winter, nor to much wetting, as in washing and bathing. If we err in this respect, through carelessness, we lose our body-

heat and electricity and pay the penalty, as above, in impaired health and hearing, or in other ways. If there is any tendency to deafness, the above-named cautions must be observed if recovery is desired.

While these cautions are imperative in winter-time, they must not be disregarded in summer. Many cases of severe and irremediable ear-disease have resulted from sleeping with very little clothing, by a window, or on the floor in a draught. In the country, especially in mountainous regions, the radiation of heat from the earth is great, especially between midnight and sunrise. Any one sleeping near an open window, or with his head on the sill of an open window, will at such a time incur the risk of a chilling of the head and neck. This endangers the welfare of the ears, and, as a matter of fact, has produced severe congestions in the head, followed by disease of the ears and deafness. Some forms of tumor in the brain, involving the auditory nerve, have been traced to this kind of careless exposure of the head to the damp coolness of the night-air in mountain-districts.

Food and Drink.—Those who suffer from catarrh of the ear and deafness must not eat highly-seasoned food nor drink alcoholic beverages, since both of these agents excite further congestion in the head and ears. Many such patients are made immediately worse by a drink of wine or spirits, or even by a meal of highly-seasoned food. It is not the province of this little book to consider the moral side of these acts, but the author cannot avoid saying most emphatically that it is usually a *physiological mistake, or sin*, to indulge in highly-seasoned food and strong drink.

If dyspepsia is produced and the bowels become constipated or sluggish, the catarrh in the ears is always rendered worse. As indulgence in food and alcoholic drinks inevitably tends to diseases of the digestion, too great caution in this respect cannot be observed by all, but especially by the patient with catarrhal deafness.

Large doses of *quinine* and *salicylic acid* tend to produce congestion of the head and ears, and hence make catarrhs of these parts of the body worse. These drugs should, therefore, be used with great caution by those affected with aural disease.

Use of Tobacco.—Moderate smoking of tobacco in any form—*i.e.*, the equivalent of three cigars a day—will not injure the patient in chronic catarrh of the ears, if no smoke is blown through the nose or inhaled into the lungs. Pipe-, cigar-, and cigarette-smoke are equally harmless if used in great moderation and not exhaled through the nose. Tobacco-chewing is an unclean practice, and may irritate the throat and hence the ears. It can never be entirely free from danger to those with catarrhal ear-disease.

Snuffing tobacco is very injurious to the ears, because it is a direct irritant to the nose, and thence to the Eustachian tube and the ears. Good ears and hearing are generally found in those with good health. Most cases of ear-disease and deafness are due to carelessness and neglect of the laws of health. They improve or recover if the disease is not too far advanced, when advice is finally sought and followed.

When an individual already affected with chronic catarrh of the middle ears finds that he has taken cold in his head, and consequently feels deafer, he must not

make the very common mistake of prescribing for himself large doses of quinine, to "break the cold," as it is erroneously termed. Such patients should take *no* quinine at the beginning of a fresh cold, for reasons already given (p. 75). If there is marked debility as the cold passes off, perhaps as much as four to six grains daily may be given as a tonic.

The best course for such a patient to follow is to stop all local treatment of the nose, if he has been applying any, and seek the advice of his physician. The author believes that housing in a warm room in the early stages of a cold in the head is the surest step towards prompt recovery.

Colds in the head, especially in those already affected with chronic aural catarrh, should be treated like fevers. The patient should remain in his room, or even in bed, if the fever is high, and his diet should be low.

As highly-seasoned food, meats, game, etc., tend to congest the head even in health, they must be left entirely out of the diet of any one with an acute cold in the head. There is no worse treatment than "feeding a cold." It must be starved out. Very little medicine will be required at first. Bromide of potash in small doses every half-hour or hour will quiet the pulse and lessen the irritation in the nares and fauces. If the throat is sore, lozenges of chlorate of potash will relieve it.

It is a mistake to drink hot toddies or any form of hot drink, in order to promote perspiration, in the early stages of a head-cold. They are more likely to further accelerate the pulse and congest the head and ears. In any event they may excite too much perspiration and

give more cold, especially if the patient goes out soon after drinking them. Rest in a warm room or in bed will produce enough warmth of the skin to insure sufficient perspiration. It is never well to take the body by storm in our remedies. We must gently persuade the system back to health, from which, too often, we have driven it by rough and careless mismanagement.

In the early stages of a cold in the head, *sneezing and blowing the nose* should be avoided as far as possible, as they tend to tear the mucous membrane and further congest it, thus making the cold, which is an inflammation in the nose, much worse. Sneezing may be suppressed by pressing the upper lip and holding the nose, best accomplished by pressing a handkerchief over these parts, as is done in the act of blowing the nose. By keeping back sneezing, a cold may be made much less severe, and in some cases it would seem that by avoiding sneezing at the outset, a cold in the head is aborted at once. Blowing the nose can be avoided very easily, and if not indulged in will hasten the cure. If the nose runs, it should be *wiped, not blown*.

Treatment.—The proper and successful treatment of chronic catarrh of the middle ear cannot be prescribed and carried out by any one but a skilful physician. A careful examination should first be made, and then a diagnosis can be established. After this is done, the treatment may be carried out partly by the physician and partly by the patient or his nurse.

The rules of hygiene already laid down must be carefully followed by the patient, and this is often all the patient can do. The actual local treatment, like

the minute scientific examination, of the ear, can be done only by an expert.

In chronic catarrh of the middle ear, no treatment carried on through the external ear, like drops or other applications to the outside of the drum-membrane, will do any good. This may be set down as an absolute and fixed law. If any benefit is to come from treatment, the latter must be applied to the nose and Eustachian tube where the catarrhal disease began. In this way only can the middle ear be reached and the deafness arrested or cured. The disease is a swelling in the mucous membrane of the parts just named, which induces a want of air in these cavities, and a collapse of the drum and deafness are the results. The first step, therefore, is to reduce this swelling and restore air to the drum-cavity.

Applications to the Nose.—The first endeavor should be to reduce the swelling in the nose and Eustachian tube by sprays thrown into the anterior nostrils from hand atomizers. These sprays must not be very dense, or they will do more harm than good. If the fluid used to make these sprays is denser than the blood, it is too strong, and draws the fluids of the tissue out,—*i.e.*, it practically squeezes them,—causing pain and distress. If it is rarer, or thinner, than the blood, it is absorbed quickly and in large quantities, the already swollen tissues in the nose and Eustachian tube become puffed up, the swelling is thus increased, and the disease is made worse. In such cases as the latter, the nasal breathing may become impeded by the treatment, and then the patient will be forced into the very injurious resource of mouth-breathing, which, as already stated,

is bad for the throat (p. 97). Every case must, therefore, be examined before any treatment is applied to the nose, and a spray selected best adapted to meet the requirements of the affection in the nose and middle ear. In some cases applications to reduce the swelling of the nose and Eustachian tubes have to be made by means of cotton tufts on probes, carried to the diseased tissues.

The sprays must pass back until they are felt coming into the throat or mouth. This need not be felt in large quantities, as it is not well to flood the back part of the nose with any form of fluid.

If offensive catarrh is met in a case of chronic ear-disease, the spray used must be more stimulating than that used in what is the more common form, the so-called *hypertrophic* (increased growth) catarrh of the nose. The offensive form of catarrh is known as the *atrophic* kind. The latter variety is characterized by a loss of tissue, a cessation of proper growth in the structures of the mucous membrane, and hence receives the name of *atrophic*.

It would be impossible and unnecessary to set forth here a minute course of treatment in various forms of catarrh of the nose and ear. It may suffice to say that in the first-named form (the hypertrophic), the most common variety of nasal and aural catarrh, the following solution sprayed into the anterior nostrils will be beneficial:

R Sodii bibor., gr. x;
Sodii bicarb., gr. vi;
Acid. carbol., gr. i;
Glycerinæ, fʒ ii;
Aquæ, q. s. ad fʒ iv. M.

In the *atrophic* form, the so-called *ozæna*, which is attended with a bad odor in the breath, a spray of the following solution may be used :

R Sodii bicarb., gr. xx ;
 Acid. carbol., gr. iv ;
 Glycerinæ, fʒ ii ;
 Listerini, fʒ i ;
 Aquæ, fʒ iii. M.

It may be said of these sprays that they will do no harm, but be beneficial to some extent in the diseases for which they are recommended. They will not be, however, all that is required to produce the best results possible in any given case. In order to accomplish the most good, each case must be watched and conducted properly by changing the treatment from time to time, as the disease demands and as improvement goes on.

Inflation.—After sprays have been applied to the nose, and have reached the back part of the upper throat, some form of inflation of the ear may be used. The simplest way to accomplish this aëration of the middle ear is to hold one's nose and with the lips firmly closed force the breath up into the head and ears. This is easily done by many, and the result of the act is to hear a cracking and feel a fulness in the ears thereafter. Usually a temporary improvement in hearing is experienced after this form of inflation of the ears. It forces blood, however, into the head, and is not to be recommended for frequent use or if any other means of inflation can be commanded. It should not be used more than two or three times a week.

Politzer's method of inflation by means of a rubber

bag held in the hand is much better and safer, as it does not force blood into the head, as the first-mentioned form, the *Valsalva* method, does. In order to carry out Politzer's method of inflation, a swallow of water must be taken at the moment of inflation, or the same effect may be obtained, in many cases, by a simple distention of the cheeks with breath.

Eustachian Catheter.—Inflation by means of the catheter can be performed only by a surgeon. This operation consists in passing a silver or a hard-rubber catheter through the nose, and turning the beak of the instrument into the mouth of the Eustachian tube. While in this position, air is blown through it from a rubber bag held in the surgeon's hand. The ear of the patient is at the same time connected with the ear of the surgeon by an auscultation- or listening-tube made of soft rubber. By this means the surgeon can hear whether the air passes into the catheter, and what kind of sounds it makes on its way, whether moist and bubbling from the presence of mucus in the Eustachian tube or dry and whistling from the drying and narrowing of the Eustachian tube.

A modification of the Eustachian catheter, consisting of stopping the distal end, and perforating the sides of the instrument near the end with numerous small holes, supplies a means of conveying fluid medication directly to the mouth of the Eustachian tube. Fluids should not be forced into the drum-cavity through the Eustachian tube, in cases of chronic catarrh of the middle ear. The result of such medication is usually an acute inflammation in the drum, with pain.

The tonsils, if enlarged in a case of chronic catarrh

of the middle ear, do not require cutting out or excision as a means of cure of the deafness. It may be demanded for other reasons, but not for remedying the ear-disease, because the latter is not dependent upon the tonsillar disease. In any event, wholesale excision of these glands is rarely practised by the leading throat-surgeons of the day. It is always a barbarous and bloody operation, followed by symptoms of grave depression of the health in many instances. As it is never really required, it ought to be banished from the surgery of the present. If some of the component glands of the tonsil are diseased, or if portions of the fibrous bed in which these lie are enlarged and thickened, they may be excised; but reflection should teach the surgeon that all the glands, healthy and diseased parts alike, should never be removed in a rash and wholesale manner. The danger of copious hemorrhage alone should prohibit the ghastly operation so often done upon these glands, usually innocent of any causative part in the deafness.

If the *uvula* is elongated,—“the palate down,” as it is called,—the redundant mucous membrane at its tip may be snipped off with scissors made for the purpose. But care must be taken not to cut away any of the muscular tissue in the uvula. No operation on it should be performed until it is ascertained that local treatment by washes, gargles, etc., are unable to contract it. It is a great mistake, just as much as the entire excision of the tonsils, to cut off the entire uvula. It causes an intense sore throat, with often serious fever and other constitutional symptoms. It is furthermore a valuable valve, and adjuvant to the palate in cutting

off the throat from the nose in the act of swallowing food and drink. In some cases, were this important part of the palate cut off, regurgitation of food would ensue through the nose. Fortunately, this rude surgery of the uvula is not as frequent as formerly. But there are people still living who have undergone unnecessarily an entire amputation of the uvula. The accounts of their subsequent discomforts might well make any one hesitate to perform such an operation, when a gargle or some astringent application to the throat would have cured the patient promptly and painlessly.

Gargles.—The throat can often be greatly benefited by gargling, and the effect of the motion of this form of treatment, upon the muscles of the palate, has a very good effect upon the muscular structure of the Eustachian tube and middle ear. The inflammation in the mucous membrane of the throat is thus allayed, and the atony of the muscles in the Eustachian tube and the middle ear is overcome. By this means the tube opens more frequently and promptly and the drum-cavity gets more air. This permits free vibrations of the drum-membrane and the ossicles, and the hearing improves.

Applications of *nitrate of silver* should not be made to the throat or nose, as the tendency of this drug is at last to produce an atrophy in the mucous membrane and thus lay the foundation for offensive catarrh.

Gargles of solutions of chlorate of potash, sumach-berries, and tannin are among the best for the purposes we are considering.

The following formula makes an elegant gargle :

R Glycerite of sumach berries,
Tincture of pomegranate bark, of each, fʒiv;
Comp. infusion of roses, enough to make a pint.

A mouthful of this once or twice a day may be used in chronic catarrh of the throat and middle ear.

In some cases, applications to the drum-cavity may be required; this, however, is very rarely the case. The more usual demand is for applications to the Eustachian tube (p. 107) and the naso-pharynx. Much more frequently the cure of chronic catarrh of the middle ear demands an operation on the drum-membrane or upon the little bones within the drum-cavity. If fluid matter accumulates behind the membrana tympani, it must be got out. This is to be done either by an incision in the drum-membrane or by forcing or drawing it down the Eustachian tube into the throat. The first method is the quickest, the surest, the easiest, and the least annoying and painful to the patient. This can be done only by an expert hand, under good illumination of the drum by means of light reflected from the mirror held upon the surgeon's forehead. It is not painful, and generally gives immediate relief to the sense of fulness in the ear, and to the deafness. Sometimes fluid can be forced from the drum-cavity by means of some of the forms of inflation already mentioned, without resorting to incision of the drum.

For many years it has been known that when the Eustachian tube is swollen or closed, the drum-membrane out of place, and deafness has ensued in consequence, an incision in the drum-membrane improves the hearing as long as the perforation of the drum can be maintained. But these artificial perforations in the

drum heal very quickly, and then the dulness of hearing returns. The search of the aurist has therefore been for some method of making and retaining a hole in the drum-membrane in cases of chronic catarrh of the middle ear.

Within the last ten or twelve years, through the researches and operations of Schwartze in Germany and of Sexton, of New York, aurists have learned that a hole may be in most instances maintained in the drum by excision of the membrana tympani and the malleus and incus bones. By this means sound can enter the drum-cavity more readily. As the two little bones named above are generally the partial cause of the deafness, by reason of their stiffening and preventing the innermost one (stapes) from vibrating, their removal in this operation has a further tendency to improve the hearing in cases of chronic aural catarrh. After this operation there is usually no inflammatory reaction. The waves of sound being now better able to enter the drum-cavity and fall directly on the stapes bone, in the oval window, and upon the membrane of the round window, the hearing is more or less improved by the operation. If adhesions between the drum-membrane and the inner wall of the drum-cavity have been the cause of deafness, noises in the head, and dizziness, this operation brings great relief. So far as concerns the noises in the ears and the dizziness, it is possible to effect an entire cure by this operation.

Aurists of most experience have concluded that *electricity* applied to the ears is unable to quiet the noises in the ears and head, and impotent to remove the deafness, in chronic aural catarrh.

It is possible in a work like this to present only an outline of what may be done for chronic aural catarrh, and not how to do it. It is also within the scope of this book to indicate that some forms of treatment are useless.

CHAPTER III.

DISEASES AND INJURIES OF THE INTERNAL EAR: THE DEAF AND DUMB.

Diseases and Injuries of the Internal Ear.

DISEASES of the internal ear are comparatively rare. They consist in a lesion of the auditory nerve, and are characterized by profound deafness. Their diagnosis and treatment are difficult. They are caused by some diseases, like typhoid fever, cerebro-spinal meningitis (spotted fever), and chronic aural catarrh, and by injuries to the head from blows and falls, and by direct violence to the ear, as by noises near the auricle, concussions, and by the insertion of slender objects down the auditory canal into the drum and the internal ear.

The chief symptom of disease of the internal ear and the auditory nerve is profound deafness. The latter symptom is always sudden if the disease is due to an injury to the head or the ear, as in blows or concussions, or if induced by a fever. It comes on slowly when it is the result of a chronic catarrh in the middle ear, or of a tumor in the brain.

Among the rarer primary causes of disease of the

internal ear may be mentioned anomalies in formation, anæmia and hyperæmia, and inflammation of the soft parts of the labyrinth.

Secondary causes of disease of the internal ear are concussions, convulsions, typhoid and intermittent fevers, apoplexy, and syphilis. Also cerebro-spinal meningitis, mumps, eruptive fevers, skin-diseases, and the puerperal state may induce disease of the internal ear.

The severest injuries, like fracture of the skull, usually result in death. If the patient should survive such an injury, there is every reason to believe he would be deaf, because post-mortem examination in such cases reveals injury of the labyrinth and auditory nerve competent to produce entire and irremediable deafness. Severe blows and falls on the head, not productive of fracture of the skull, are often followed by profound deafness in one or both ears.

The writer was once consulted regarding the case of a boy who, while trying to stand on his head, had allowed his weight to come suddenly on the top of his skull. This accident was followed by symptoms of meningitis, from which the boy finally recovered; but he remained profoundly deaf.

In another case, a gentleman was thrown from his horse, and fell upon his head. He was stunned, and remained unconscious for some time. Upon recovering his consciousness he perceived that he was entirely deaf in his left ear, and he has so remained.

In another case, a boy was struck on the ear by a hard snow-ball. He became entirely and permanently deaf in that ear. A "box on the ear" may have the same bad effect on the auditory nerve. The record of

such accidents is very large, but the recital of these few will suffice to show the result of severe concussion upon the auditory nerve, and to impress upon us the great need of caution in avoiding such violence to our ears.

The accidental but forcible entrance of a slender object, like a wire, a twig, or a pencil, down the auditory canal and into the drum-cavity, where it has inflicted a wound upon the ossicles and the oval window, has been followed by symptoms of injury of the internal ear and auditory nerve. This should warn every one against the bad habit of picking and scratching the ear with any slender instrument which might be forcibly pushed too far down the canal and produce these bad results. Soldiers and sailors, who are exposed to long-continued firing of cannon or to an explosion, often suffer from concussion of the nerve of hearing. The same bad effect may be experienced from exposure to weaker sounds nearer the ear, like a shout or a kiss in the ear. Children thoughtlessly may thus injure their parents' hearing, as has been recorded by some observers.

The ear should never be exposed to intense noises of any kind, if it can be helped. A strain may thus be put upon the auditory nerve which may prove very injurious. There are, in fact, especially in cities, many avoidable noises which should be more stringently suppressed. The writer has great sympathy with that society in London having for its object the suppression of unnecessary and useless noises.

A sound is a form of blow upon the brain. If it assumes the nature of a noise, it becomes a hard blow upon the nerve of hearing and the brain, and may be

followed by serious consequences. That the brain readily feels noises is seen by the natural avoidance of noise we all show when tired or when ill with a headache. A concussion applied through the ear takes the nerve by surprise, and, by displacing and wounding it, causes deafness.

Inflammation of the Brain.—Many diseases destroy the hearing by producing inflammation of the membranes of the brain and a consequent disease of the auditory nerve. Prominent among such causative diseases is spotted fever (cerebro-spinal meningitis). As the patient recovers from the disease he is found to be entirely deaf in one or both ears. The same result is also seen after brain fever, scarlet fever, convulsions, and small-pox, especially in little children.

Spotted fever has caused many cases of absolute deafness in children, who in consequence have become deaf and dumb.

Disease of the internal ear is sometimes found in children suffering from "rickets." This affection alters the bone in which the auditory nerve lies, in the internal ear, and, pressing open the nerve, destroys its functions.

The semicircular canals in some instances are the seat of primary disease. This may be inflammatory or apoplectic. After exposure to great heat, especially of the sun, an inflammation may start up in the internal ear and destroy the auditory nerve. Also after great fatigue and mental strain, great congestion or the rupture of a blood-vessel may occur in the internal ear. As this occurrence takes place in a very confined space within unyielding bony walls, the pressure thus exerted on the nerve is sudden and intense. Immediately the

hearing is greatly impaired, and the pressure of the blood on the auditory nerve induces a destructive inflammation in it, resulting in permanent deafness. There is usually associated with such an event as just described great dizziness and nausea, and the patient has aural vertigo from disease in the semicircular canal of the internal ear.

Aural Vertigo.—Dizziness and vertigo may be caused by irritation and disease in the external or the middle ear (p. 100). Some of the worst cases of ear-vertigo are produced by a disease in the internal ear, probably in that part of it called the semicircular canals. Disease in these canals may have its origin in a chronic disease in the middle ear, which, by weakening the blood-vessels, at last affects the internal ear. Or the disease may have its origin in a tumor in the brain, which, gradually advancing through the auditory nerve, at last invades the internal ear.

Unfortunately, all forms of ear-vertigo are confused and confounded with one another; and in some instances there is a commingling of different forms in the same individual. Aural vertigo, especially when due to disease of the internal ear, is often mistaken for stomachic vertigo, the so-called biliousness, epilepsy, and even apoplexy. However, the great guides in the differential diagnosis between this disease and those just named are the aural symptoms, ringing in the ears and deafness, and the *retained* consciousness, which are found in aural vertigo.

In aural vertigo we observe great pallor and no spasm, while in a fit there are spasms and congestion of the face.

In apoplexy there are loss of consciousness and redness of the face, but no spasm. The form of aural vertigo evoked by disease in the internal ear is best known as Ménière's disease. In fact, this term should not be applied to aural vertigo in general, as it often is, but only to that form which is due to disease in the internal ear and the semicircular canals.

That form of ear-vertigo which is due to the growth of a tumor in the brain near or upon the auditory nerve has the peculiarity of being constant. It is not intense at first, but gradually becomes very great as the tumor enlarges and the pressure in the nerve and internal ear increases. It, like the form just described, is attended with profound deafness.

The apparent motion in ear-vertigo from disease of the semicircular canals of the internal ear is sometimes in a vertical and sometimes in a horizontal plane, according to the semicircular canal most affected, as it is supposed. Two of these canals are in vertical planes, while the third is horizontal.

Treatment.—Aural vertigo is dependent upon the pressure upon the water in the internal ear, communicated thence to the auditory nerve and the brain. This form of giddiness can be cured only by removing the diseased condition of the ear which causes the undue pressure. In the case of vertigo from external or middle ear disease this is easier than in the case of ear-vertigo from disease in the internal ear. Vertigo caused by a tumor in the brain and auditory nerve cannot be cured.

If the vertigo is due to effusions of blood or other matters into the internal ear, absorption of these fluids

will remove the vertigo. This end can be obtained by giving the so-called alterative medicines, which promote absorption, if the pressure on the auditory nerve is caused by effusion or hemorrhages into the bony labyrinth, where the nerve lies.

If the pressure is due to a retraction of the drum-membrane and the chain of little bones, held in this position by adhesions between them and the inner wall of the drum-cavity, this can be taken off by an operation, and the noises in the ear and the vertigo entirely cured. In these cases the hearing is usually very bad, and the operation, if it does not improve it, can make it no worse.

The operation consists in a removal of the diseased drum-membrane and the two largest and outermost ossicles. Their removal permits the stirrup-bonelet to recede from its impacted position in the oval window. The inward pressure on the labyrinth-water and the nerve of hearing is thus taken off, and the dizziness and noises in the head are relieved. The patient who undergoes this operation must first be etherized. The illumination of the ear must then be effected by means of a small electric lamp held on the head of the surgeon. The lamp is run by the current from a small portable storage-battery.

All sports which lead to congestion of the head, like "standing" on the head, and hanging with the head down, should be discouraged. Also, for various reasons, exposure to intense heat from the direct rays of the sun, and from its reflection on hot and open fields, should be avoided, especially near mid-day in summer-time, as all of these influences tend to con-

gestion of the head and of the internal ear, especially if there has been chronic disease in the middle ear. Chronic catarrh of the middle ear has the effect of predisposing the internal ear to congestion and inflammation, with consequent deafness of a profound degree. It has been already stated that many cases of deaf-dumbness are traceable primarily to a catarrhal disease in the middle ear, which finally leads to a disease in the auditory nerve.

It is very apparent, then, that there is a great need of care in the case of children, that they be kept from influences likely to produce catarrhal disease in their ears, as well as from those influences which may induce concussion, congestion, and inflammation in the internal ear. Infants should be carefully guarded against blows and falls on the head, and children of all ages should be instructed not to give nor receive in rude play rough blows on the head and ears, nor to indulge in gymnastics which include hanging with the head downward for any length of time. If their recreations or labors lead them into the intense heat of the direct rays of the sun in summer-time, they should be taught that their heads must be well protected with a light but fairly thick hat. Some hats are so thin that the sun shines quite through them; they are a false security.

Exposure to great heat during the day and then to a chilling at night, induced by sleeping in a cool draught or on the cold and damp ground, will induce profound congestion of the internal ear. This, in turn, may induce the growth of a tumor in the auditory nerve, which, by invading the brain, will prove fatal.

In typhoid fever, a *fatty degeneration* of the auditory nerve, in the labyrinth, may ensue, with profound and incurable deafness.

In the *insane*, the ears may become the seat of distressing noises, due to previous catarrhal disease in the middle ear. These sounds in the ears lead to hallucinations of hearing in the insane mind, and make the patient worse. Wherever hallucinations of hearing are discovered in the insane, the ears should be examined, and if disease of the external or middle ear is found it should be made better or cured, if possible.

Effects of Quinine on the Auditory Nerve.—It is well known that quinine congests the membrana tympani and middle ear. It is also known by recent experiments of Schilling, Bürkner, and others, in Germany, made upon some lower animals, that large doses of quinine, ten to twenty grains at a time, will so intensely congest the nerve in the labyrinth of a cat as to destroy it in a few hours. The same is true of large doses of salicylic acid.

These experiments were performed by first administering the dose of quinine and then killing the animal very soon afterwards. Upon examining the internal ear, the nerve of hearing was found injured as described above.

What happens in the cat can happen, and doubtless has happened, in the human being. Therefore large doses of quinine are likely to destroy the hearing. Smaller doses given at intervals will do more good, and are not attended with the dangers to hearing above mentioned. I would not willingly take ten grains of quinine at a dose, and therefore I would not advise it,

but, on the contrary, I would strongly deprecate its administration to any one. The same caution should be observed in the administration of salicylic acid.

THE DEAF AND DUMB.

When a child is born deaf, or under six years of age becomes profoundly deaf from any form of aural disease, it passes into that unfortunate group of our fellow-creatures called the deaf and dumb. Let me say here that comparatively few children are born deaf, that the deaf and dumb have just as good vocal organs as those who can hear, and that their minds are just as good as the mind of the average child among those who can talk. The dumb cannot talk because they cannot hear, and hence have not learned by hearing others talk. If the deafness occur before the child has learned to talk, it is difficult to instruct it in anything, especially in the idea of what the use of speech is. If the child has learned to talk before the deafness has come upon it, it at least knows what speech is, and what the effort at talking consists in. This knowledge on its part is a great aid in keeping up its power to talk and in perfecting its speech. Even the unfortunate child in the first group can be made to understand what is said to it, by watching the mouth and lips of the speaker; but this is harder in his case than in that of the child who has once talked. This topic will be found further considered in the next chapter.

PART III.

AURAL HYGIENE OF THE DEAF.

CHAPTER I.

AURAL HYGIENE AND EDUCATION OF PARTIALLY DEAF CHILDREN.

THERE is a large number of deaf children who can hear and talk. They may have become profoundly deaf in consequence of ear-disease brought on by scarlet fever, measles, or smallpox. Some have called these semi-mutes, and many of them are found in institutions for the deaf and dumb. If they are placed in such schools they will grow deafer, because their remaining hearing gets no exercise, and by falling into disuse grows worse or is lost entirely. Their speech meets the same fate, for, as they are not called upon to use it in the schools for the deaf and dumb, they forget how to talk, and this valuable acquirement is lost, like the remnant of their hearing, from disuse.

Such children should not be permitted to enter schools for the deaf and dumb. They should be encouraged to go to school with hearing children, their defect being known to the teacher, who must make allowance for it by placing them near the teacher's desk. This will force them to exercise both their hear-

ing and their speech, and they will be kept from falling into the comparatively helpless class, the deaf-mutes.

Parents and teachers must find out whether children are deaf or not. Very often children are suspected of being inattentive, and are punished accordingly, when in reality they are deaf and do not catch half that is said to them. When a child is in this position of semi-disgrace, it is highly probable that it is due to deafness; and parents and teachers ought to know this. It may be that its hearing can still be improved before it is too late and the child becomes deafer. In any case its condition of hearing should be determined by careful examination or by tests. This latter a parent or a teacher could do by placing the child at a short distance away, with one ear stopped and the other turned towards the examiner. Now let isolated words be spoken and the child told to repeat what the teacher or parent says, or what it thinks has been said. If it does not hear single words of ordinary tone at a distance of ten feet, it is decidedly deaf. After one ear is tested, let the other be tried in the same way. When the distance is found out at which the child hears words of ordinary tone, let its desk or seat be placed at that distance from the teacher. It will generally be found that a child thus deaf will begin to talk less or talk indistinctly or like a younger child, and perhaps to make signs. This defect must be overcome by forcing it to speak out, by correcting its mistakes in pronunciation, and by totally ignoring its signs. It must get nothing but what it asks for in words, not by signs. By such natural means the hearing and speech are retained and improved.

If a large number of such children could be brought together, the entire plan of teaching might be adapted to their wants, in the above way. As a rule, they will be found scattered sparsely through the community, and therefore must go to school with hearing children or into schools for the deaf and dumb. If they are found in the latter place and allowed to stay, they ought to be taught in a way to improve their hearing and their speech, and not in one which tends further to impair these valuable functions.

Partially deaf children can be helped in retaining their remnant of hearing and in improving it, and also their power to speak, by the use of some good ear-trumpet and by daily exercise in speaking, reading, and singing. This is best done by their parents or a careful private instructor.

The Otophone.—One of the best means of conveying sound to a deaf ear, and of conducting the education of a deaf child as I have suggested, is the otophone of J. A. Maloney, of Washington, D.C. This consists of a flexible tube about three and one-half feet long and an inch in diameter, with a mouth-piece of convenient arrangement for the speaker. The aural end, for the patient, does not fit into the meatus, like all other ear-trumpets, but has the great advantage in comfort of terminating in a disk, resembling the receiver of a telephone, which is held over the ear. This avoids the great discomfort at the outset so often complained of by those forced to use an ear-trumpet of the old pattern, which fits into the meatus of the auditory canal. By an arrangement of soft-rubber membrane in this ear-piece of the otophone, the disagreeable resonance so

prominent in the entirely open instrument is prevented. In addition to these two advantages, the otophone of Maloney seems to convey sound to the deaf ear more completely than any other instrument as yet offered to the deaf.

With the careful use of this instrument fifteen minutes once, twice, or thrice a day, as the ear is able to tolerate the exercise, the hearing can be improved, and a deaf child instructed in the use of speech. A child who is thus being taught should be made to repeat words and sentences correctly after its teacher, if it has shown any tendency to avoid the use of speech or to speak words incorrectly or imperfectly for its age. It will be found that a deaf child of five or six who has become deaf, say, at the age of four, will continue to talk like a child of four, or even retrograde to the speech of a child of two or three years. This defect can be corrected by speaking into its ear with the mouth close to it; but few will have the patience thus to correct or instruct the child. The systematic use of words spoken through the otophone will overcome and prevent this defective pronunciation of words. All signs must be discouraged, and the use of properly-spoken words encouraged. A deaf child must be corrected in the improper pronunciation of a word at once, and not disregarded in this particular as the child with good hearing. The latter will be corrected in time by hearing the proper pronunciation of words in his teachers and playmates; but not so with the deaf child: he will continue indefinitely to say "otch" for "watch" unless corrected at once. Baby-talk must not be permitted in it.

I have known deaf children prevented from becoming deaf-mutes by the careful attention and instruction of their mothers, carried on by speaking close to the ear. The teachers must assure themselves that the child hears what is said, by requiring a repetition of it from the child. This requires patient *labor*; but who would not do this rather than see their child become a deaf-mute, deprived of the pleasures and advantages of speech and hearing? Such labor is certainly lessened by the use of any form of ear-trumpet, if the latter will convey the sound of the teacher's voice to the deaf ear. In schools such form of teaching becomes almost impracticable, because only one child at a time can be thus instructed. An instrument may be arranged with a number of tubes, connected with one receiver for the teacher's voice. By such means a class of deaf children could be instructed in hearing and in speaking, and at the same time. Such attentions to the deaf child cheer it, and prevent the sad, half-suspicious retirement within itself which is so frequently seen in this unfortunate class, and which is due to the neglect they experience often through the ignorance of their defective hearing on the part of parents and teachers. The deaf and dumb are just as intelligent as the average hearing children of the ordinary schools. The mere fact of deafness is not necessarily a sign of intellectual defect. If the deafness is an attendant of a brain-disease, the latter may have caused the child's mind to be weakened; but the deafness has nothing to do with the intellectual weakness. Brain-fever will injure the mind, even if the child is not made deaf by it.

CHAPTER II.

AURAL HYGIENE AND EDUCATION OF THE DEAF AND DUMB.

EITHER by neglect of the precautionary methods mentioned in the previous chapter, or from profound disease in the ears, children become absolutely deaf and consequently dumb. All such children should receive a careful examination of their ears and a test of their hearing before they are pronounced to be deaf-mutes and consigned to schools for the deaf and dumb. Sometimes it will be found, in the youngest of such cases, that there is an ear-disease, like a chronic running from the ear or ears or a catarrh of the nose and middle ears. By curing these, or relieving them, the hearing may be improved sufficiently to permit the use of an ear-trumpet in its instruction. When an ear is the seat of a chronic discharge, in a deaf child, it is often neglected because it is supposed that the child is hopelessly deaf and a cure of the discharge will not relieve the deafness. This is an erroneous conclusion to come to, because a cure of the discharge may improve the hearing, and it certainly will remove the bad odor, attendant upon this disease, from the child, and render it more agreeable for teachers and companions to approach.

This latter is a most important consideration for parents and teachers to entertain. It is due to the child to render it as agreeable as possible in a cosmetic sense, in order that to its other social disabilities there

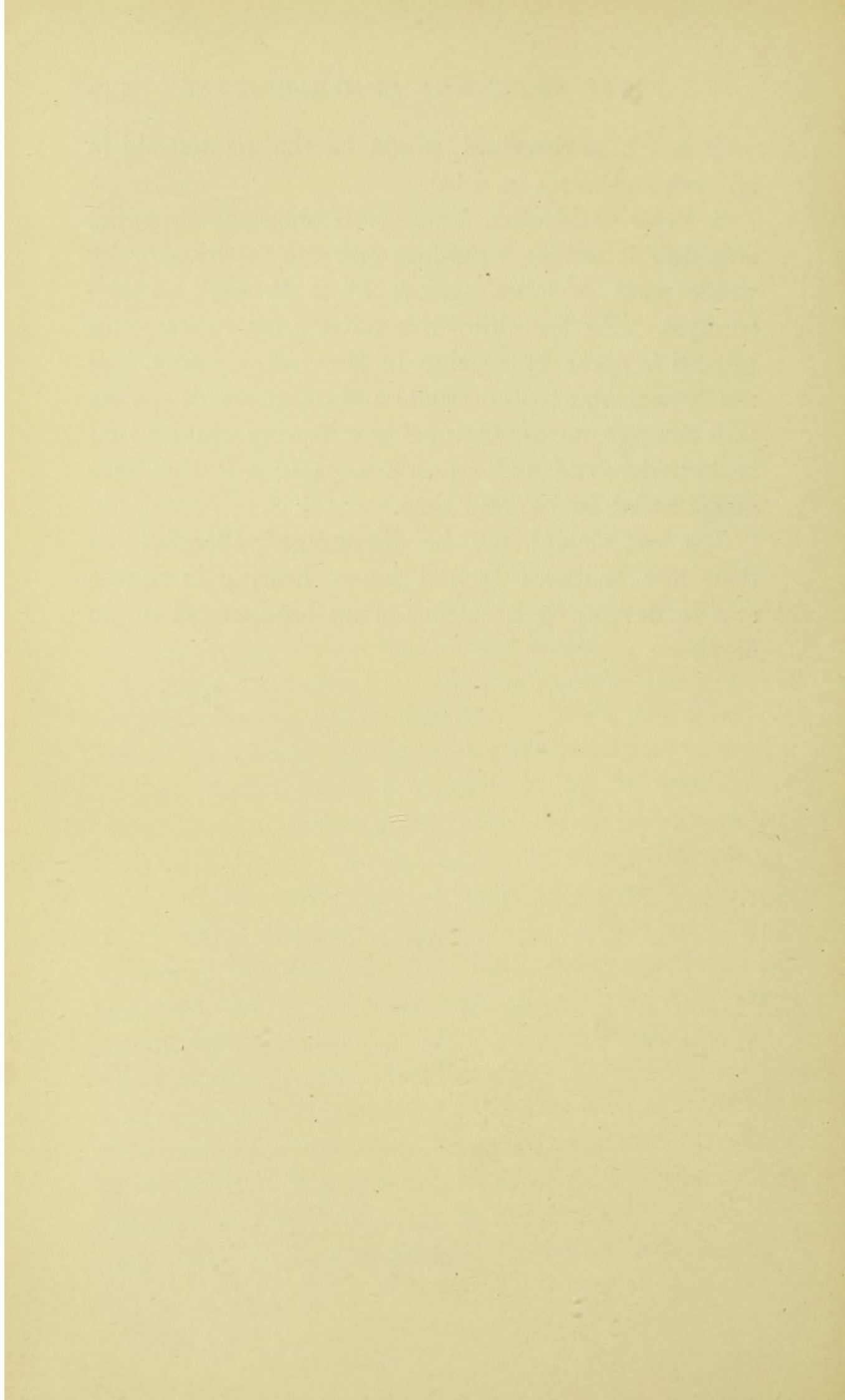
should not be added a constant bad smell from its ears or head.

Lip-reading and Articulation.—The social condition of deaf-mutes is greatly improved by teaching them lip-reading and articulation. This is best accomplished by beginning when the child is six years old. It is not well to begin much before nor after this age. It consists in teaching the child to know what is said to it by the motions and position of the lips of the speaker. These motions and positions the child is taught to imitate, and the vocal sounds, necessary for articulation, are taught it by placing its hand on the larynx of the speaker and perceiving by the vibrations how to use its own larynx with the proper movements. When master of lip-reading and articulation, the deaf-mute may pass, in the world at large, for a hearing person. It requires several years for the deaf-mute to acquire this accomplishment. Children who have once heard and learned to talk some, but have lost their hearing and then their speech, are the easiest to teach lip-reading and articulation, as they have an excellent idea how to use their vocal organs. It is very difficult to convey this idea to the child who has never heard and hence has never spoken. It is astonishing to find how much hearing is still retained by the very deaf-mute. This has been termed *latent* hearing by some. I am convinced that if the young mute were carefully tested, especially one of that class who have become deaf by disease in early childhood, it would often be found possessed of more hearing than was supposed. Here again great effort and patience would be required to develop the hearing if any were found still present. A good ear-trumpet,

such as I have described, would be the greatest aid in all such endeavors (p. 144).

A mute child often hears more than one supposes, although it cannot reproduce either by writing or by words what it hears spoken to it through an ear-trumpet. As the child has never used its ears nor learned to speak by hearing in the ordinary way, it is nearly as unable to understand and repeat words spoken to it through an ear-trumpet as a hearing child would be to understand and repeat a word in a foreign language heard for the first time.

Teachers should not be discouraged, therefore, in their first endeavor to find latent hearing in mutes, and to develop it by means of an ear-trumpet or an otophone.



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