

lungs are composed. This preparation is three-fold: the air must be warmed, moistened, and purified. The first is ensured by the fact that the air, delayed slightly in its transmission by the projection of the turbinates, by which it is thrown into little eddies, has time to obtain warmth from the rich blood supply arranged in the lining membrane. This blood supply can be so regulated as to impart the requisite amount of heat according to the temperature of the air outside the body. The plentiful arrangement of glands that is to be found in the nasal lining membrane ensures sufficient watery secretion to charge the air with the right amount of moisture, whilst the projection of the turbinates and the hairs which guard the outer openings of the nostrils catch impurities and detain them. The amount of gross impurities thus prevented from entering the lungs is evidenced by the condition of one's pocket-handkerchief after a London fog. Moreover, the nasal secretions have a certain bactericidal action—that is to say, power of killing hostile germs.

A very little consideration of the anatomy of the mouth will demonstrate how utterly unfit it is as a portal for breathing air. There is no arrangement to delay the air in its passage; no method by which it can warm, moisten, or purify it. If one goes to sleep with the nose blocked, as by a bad cold, so that breathing has to be carried on through the mouth, one wakes in the morning with that cavity dry from the taking up by the air of the little moisture it contains; the throat husky, and the windpipe clogged from the irritating effect of the cold, dry, impure air. Mouth-breathing leads to catarrh, bronchial troubles, bronchitis. It is by normal, uninterrupted nose-breathing that man is able to endure with comparative ease the heat of the tropics or the cold of the poles. The mouth is meant only to be concerned with the mastication of food and the articulation of speech; it is, as that kindly old physician, Oliver Wendell Holmes, says in one of his poems, "May be a very goodly place to put thy victuals in." Hence the evils of mouth-breathing cannot be too strongly insisted upon in the adult; they are even of greater importance in the infant.

Now let us turn to the structure and functions of the ear. The ear is essentially the organ of hearing; it also plays a part in the sense of space perception, as it contains an arrangement whereby we obtain accurate knowledge of the position of the head in space. Hence one common symptom of ear disease is giddiness, or vertigo. The ear consists essen-

tially of two parts: a delicate nerve ending, enclosed in bone, which is the perceptive portion of the organ; and an arrangement of passages, drum-membrane, and small bones, by which sound is carried to the nerve ending and there converted into nerve currents, which are transmitted to the brain and there interpreted.

This conducting portion of the ear consists of an *auricle* and an *outer passage*, closed at its inner end by a *drum-membrane*. This drum-membrane is so constructed as to be able to vibrate to any sound, differing from the parchment of an ordinary drum, which can be set in movement only by one particular note. On the inner side of the drum-membrane is a cavity—the *tympanum*, or *drum*—across which is a chain of three little bones, the *hammer*, *anvil*, and *stirrup* bones. The outermost bone, the hammer, is attached to the drum-membrane by its handle, and is jointed to the anvil; the latter is also jointed to the stirrup. The stirrup fits by its footplate into an opening on the inner wall of the drum. On the other side of this little hole is a membranous bag, containing fluid, in which are the endings of the nerve of hearing. The waves of sound pass through the outer passage and set the drum-membrane vibrating; the vibrations are passed through the chain of bones to the fluid inside the membranous bag, and so affect the nerve endings therein. The ear is, therefore, to all intents and purposes, a transformer, by means of which sound-waves are collected and transmitted and transformed into nerve stimuli.

In order that the drum-membrane may vibrate properly it is necessary that the air pressure upon both sides of it should be equal. In order that this may be ensured, a tube passes from the tympanum into the nasopharynx. This is the Eustachian tube already mentioned, and it acts not only as a ventilating shaft, but also as a drain to the tympanum. This tube, however, is also the route by which the ear becomes involved and damaged in a large number of cases of deafness.

The membranous sac of fluid in which lie the nerve endings is contained in a bony capsule of peculiar and complicated shape. Part of it is fashioned like a small shell, and is called the *cochlea*; this portion contains those endings of the auditory nerve which have especially to do with hearing. Behind the cochlea are three *semi-circular* canals, arranged in the three planes of the body, which contain the endings of that branch of the auditory nerve which are concerned with the sense of space.

(To be continued.)

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