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FEATURES OF THE ANATOMY OF THE EAR ITSELF

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Annotation: Human ear, organ of hearing and equilibrium that detects and analyzes sound by transduction (or the conversion of sound waves into electrochemical impulses) and maintains the sense of balance (equilibrium). The human ear, like that of other mammals, contains sense organs that serve two quite different functions: that of hearing and that of postural equilibrium and coordination of head and eye movements.

Key words: Human , ear, equilibrium, tympanic membrane.

Anatomically, the ear has three distinguishable parts: the outer, middle, and inner ear. The outer ear consists of the visible portion called the auricle, or pinna, which projects from the side of the head, and the short external auditory canal, the inner end of which is closed by the tympanic membrane, commonly called the eardrum. The function of the outer ear is to collect sound waves and guide them to the tympanic membrane. The middle ear is a narrow air-filled cavity in the temporal bone. It is spanned by a chain of three tiny bones—the malleus (hammer), incus (anvil), and stapes (stirrup), collectively called the auditory ossicles. This ossicular chain conducts sound from the tympanic membrane to the inner ear, which has been known since the time of Galen (2nd century CE) as the labyrinth. It is a complicated system of fluid-filled passages and cavities located deep within the rock-hard petrous portion of the temporal bone. The inner ear consists of two functional units: the vestibular apparatus, consisting of the vestibule and semicircular canals, which contains the sensory organs of postural equilibrium; and the snail-shell-like cochlea, which contains the sensory organ of hearing. These sensory organs are highly specialized endings of the eighth cranial nerve, also called the vestibulocochlear nerve.

The most-striking differences between the human ear and the ears of other mammals are in the structure of the outermost part, the auricle. In humans the auricle is an almost rudimentary, usually immobile shell that lies close to the side of the head. It consists of a thin plate of yellow elastic cartilage covered by closely adherent skin. The cartilage is molded into clearly defined hollows, ridges, and furrows that form an irregular shallow funnel. The deepest depression, which leads directly to the external auditory canal, or acoustic meatus, is called the concha. It is partly covered by two small projections, the tonguelike tragus in front and the antitragus behind. Above the tragus a prominent ridge, the helix, arises from the floor of the concha and continues as the incurved rim of the upper portion of the auricle. An inner, concentric ridge, the antihelix, surrounds the concha and is separated from the helix by a furrow, the scapha, also called the fossa of the helix. In some ears a little prominence known as Darwin's tubercle is seen along the upper, posterior portion of the helix; it is the vestige of the folded-over point of the ear of a remote human ancestor. The lobule, the fleshy lower part of the auricle, is the only area of the outer ear that contains no cartilage. The auricle also has several small rudimentary muscles, which fasten it to the skull and scalp. In most individuals these muscles do not function, although some persons can voluntarily activate them to produce limited movements. The external auditory canal is a slightly curved tube that extends inward from

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the floor of the concha and ends blindly at the tympanic membrane. In its outer third, the wall of the canal consists of cartilage; in its inner two-thirds, of bone. The entire length of the passage (24 mm, or almost 1 inch) is lined with skin, which also covers the outer surface of the tympanic membrane. Fine hairs directed outward and modified sweat glands that produce earwax, or cerumen, line the canal and discourage insects from entering it.

auricle, in human anatomy, the visible portion of the external ear, and the point of difference between the human ear and that of other mammals. The auricle in humans is almost rudimentary and generally immobile and lies close to the side of the head. It is composed of a thin plate of yellow elastic cartilage covered by a tight-fitting skin. The external ear cartilage is molded into shape and has well-defined hollows, furrows, and ridges that form an irregular shallow funnel. The deepest depression in the auricle, called the concha, leads to the external auditory canal or meatus. The one portion of the auricle that has no cartilage is the lobule—the fleshy lower part of the auricle. The auricle has several small basic muscles that connect it to the skull and scalp. Generally nonfunctional in human beings, they are capable of limited movement in some people.

cartilage, connective tissue forming the skeleton of mammalian embryos before bone formation begins and persisting in parts of the human skeleton into adulthood. Cartilage is the only component of the skeletons of certain primitive vertebrates, including lampreys and sharks. It is composed of a dense network of collagen fibres embedded in a firm, gelatinous ground substance that has the consistency of plastic; this structure gives the tissue tensile strength, enabling it to bear weight while retaining greater flexibility than bone. Cartilage cells, called chondrocytes, occur at scattered sites through the cartilage and receive nutrition by diffusion through the gel; cartilage contains no blood vessels or nerves, unlike bone.

Three main types of cartilage can be distinguished. Hyaline cartilage is the most widespread and is the type that makes up the embryonic skeleton. It persists in human adults at the ends of bones in free-moving joints as articular cartilage, at the ends of the ribs, and in the nose, larynx, trachea, and bronchi. It is a glossy blue-white in appearance and very resilient. Fibrocartilage is the tough, very strong tissue found predominantly in the intervertebral disks and at the insertions of ligaments and tendons; it is similar to other fibrous tissues but contains cartilage ground substance and chondrocytes. Elastic cartilage, which is yellow in appearance, is more pliable than the other two forms because it contains elastic fibres in addition to collagen. In humans it makes up the external ear, the auditory tube of the middle ear, and the epiglottis.

tympanic membrane, thin layer of tissue in the human ear that receives sound vibrations from the outer air and transmits them to the auditory ossicles, which are tiny bones in the tympanic (middle-ear) cavity. It also serves as the lateral wall of the tympanic cavity, separating it from the external auditory canal. The membrane lies across the end of the external canal and looks like a flattened cone with its tip (apex) pointed inward. The edges are attached to a ring of bone, the tympanic annulus.

The drum membrane has three layers: the outer layer, continuous with the skin on the external canal; the inner layer, continuous with the mucous membrane lining the middle ear; and, between the two, a layer of radial and circular fibres that give the membrane its tension

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and stiffness. The membrane is well supplied with blood vessels, and its sensory nerve fibres make it extremely sensitive to pain.

Accurate diagnosis of middle-ear diseases depends on the appearance and mobility of the tympanic membrane, which is normally pearl gray but is sometimes tinged with pink or yellow. The condition that most commonly involves the tympanic membrane is otitis media (inflammation of the middle ear), which frequently affects children (particularly those between three months and three years of age) and typically is caused by bacterial infection. In severe otitis media, pressure from the accumulation of fluid in the middle ear can lead to tearing or rupturing of the tympanic membrane. Trauma, such as from a blow to the head or from water pressure, can also cause perforations in the membrane. Although tympanic membrane perforations often are self-healing, a patch or surgery may be needed to close the tear. Failure of the membrane to heal can result in varying degrees of hearing loss and increased susceptibility to otitis media and cholesteatoma (the formation of a cyst in the middle ear). ear bone, any of the three tiny bones in the middle ear of all mammals. These are the malleus, or hammer, the incus, or anvil, and the stapes, or stirrup. Together they form a short chain that crosses the middle ear and transmits vibrations caused by sound waves from the eardrum membrane to the liquid of the inner ear. The malleus resembles a club more than a hammer, whereas the incus looks like a premolar tooth with an extensive root system. The stapes does closely resemble a stirrup. The top or head of the malleus and the body of the incus are held together by a tightly fitting joint and are seated in the attic, or upper portion, of the eardrum cavity. The handle of the malleus adheres to the upper half of the drum membrane. Three small ligaments hold the head of the malleus, and a fourth attaches a projection (called the short process) from the incus to a slight depression in the back wall of the cavity. The long process of the incus is bent near the lower end and carries a small knoblike bone that is jointed loosely to the head of the stapes—the third and smallest of the ossicles. The stapes lies in a horizontal position at right angles with the long process of the incus. There are two openings in the wall of the bony labyrinth and the stapes footplate fits perfectly in one of these openings—an oval-shaped window, where it is held in place by yet another ligament called the annular ligament.

There are two tiny muscles in the middle ear, which serve to alter the tension on the ear bones and thus the intensity (degree of loudness) of sounds. One, the tensor tympani, is attached to the handle of the malleus (itself attached to the eardrum membrane) and by its contraction tends to draw the malleus inward, thus increasing drum membrane tension. The second, called stapedius, tends to pull the footplate of the stapes out of the oval window. This is accomplished by tipping the stirrup, or stapes, backward.

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