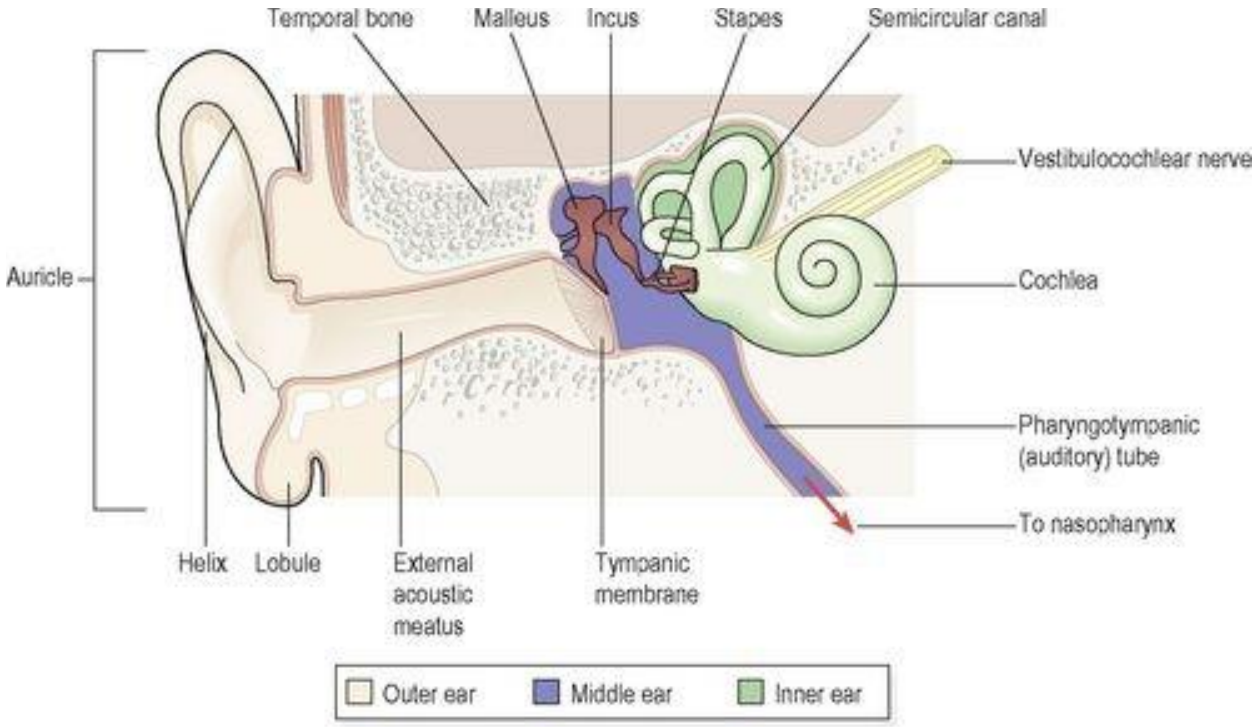
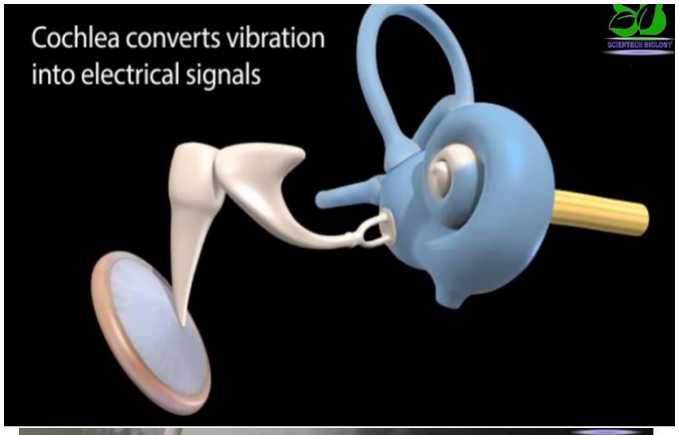
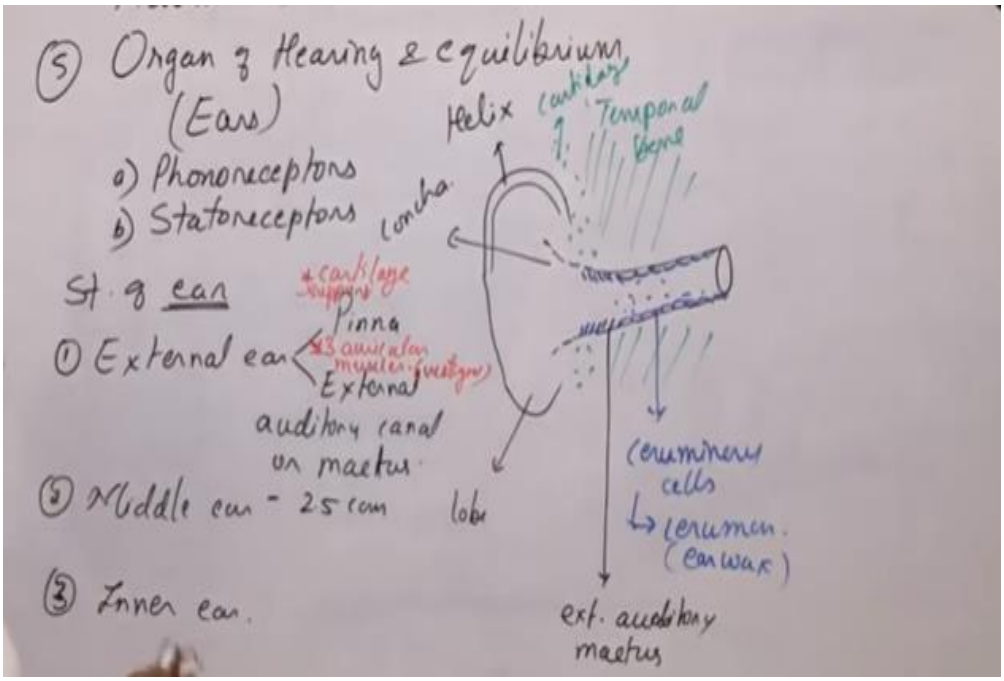
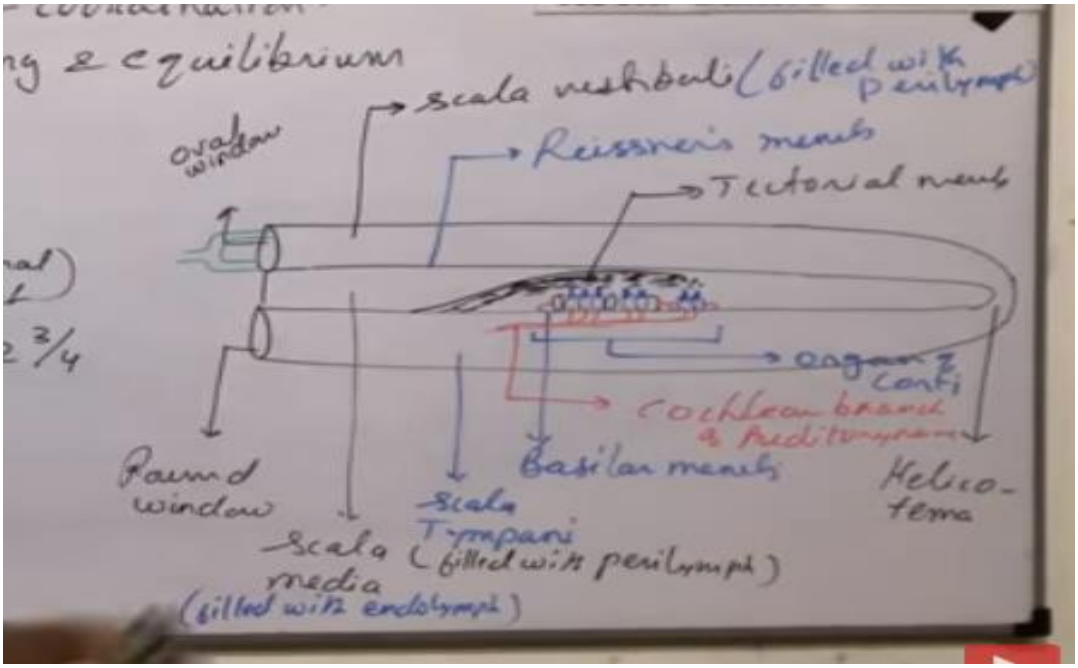
Structure and function of Ear









Anatomy of the Ear

The ear is divided into three main regions: (1) the external ear, which collects sound waves and channels them inward; (2) the middle ear, which conveys sound vibrations to the oval window; and (3) the internal ear, which houses the receptors for hearing and equilibrium.

External (Outer) Ear

The **external** (*outer*) **ear** consists of the auricle, external auditory canal, and eardrum .The **auricle** or *pinna* is a flap of elastic cartilage shaped like the flared end of a trumpet and covered by skin. The rim of the auricle is the **helix**; the inferior portion is the **lobule**. Ligaments and muscles

attach the auricle to the head. The **external auditory canal** (*audit-* = hearing) is a curved tube about 2.5 cm (1 in.) long that lies in the temporal bone and leads to the eardrum.
The **tympanic membrane** or *eardrum* is a thin, semitransparent partition between the external auditory canal and middle ear.
the external auditory canal contains a few hairs and specialized sweat glands called **ceruminous glands** that secrete **earwax** or *cerumen*). The combination of hairs and cerumen helps prevent dust and foreign objects from entering the ear. Cerumen also prevents damage to the delicate skin of the external ear canal by water and insects.

Middle Ear

The **middle ear** is a small, air-filled cavity in the petrous portion of the temporal bone that is lined by epithelium It is separated from the external ear by the tympanic membrane and from the internal ear by a thin bony partition that contains two small openings: the oval window and the round window.
three smallest bones in the body, the **auditory ossicles** which are connected by synovial joints. The bones, named for their shapes, are the malleus, incus, and stapes—commonly called the hammer, anvil, and stirrup, respectively. The "handle" of the **malleus** attaches to the internal surface of the tympanic membrane

Internal (Inner) Ear

The **internal** (*inner*) **ear** is also called the *labyrinth* (LAB-i-rinth) because of its complicated series of canals . Structurally, it consists of two main divisions: an outer bony labyrinth that encloses an inner membranous labyrinth.It is like long balloons put inside a rigid tube. The **bony labyrinth** is a series of cavities divided into three areas: (1) the semicircular canals, (2) the vestibule, and (3) the cochlea.

The bony labyrinth is lined with periosteum and contains **perilymph**. This fluid, which is chemically similar to cerebrospinal fluid, surrounds the **membranous labyrinth**, a series of epithelial sacs and tubes inside the bony labyrinth that have the same general form as the bony labyrinth and house the receptors for hearing and equilibrium. The epithelial membranous labyrinth contains **endolymph**.
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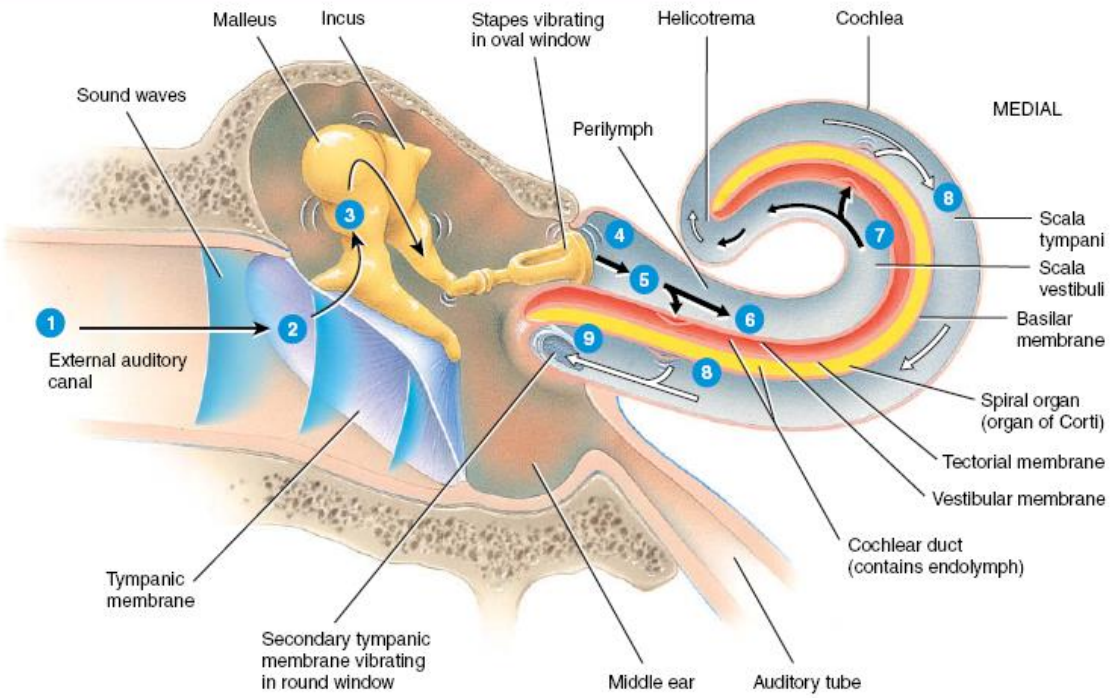
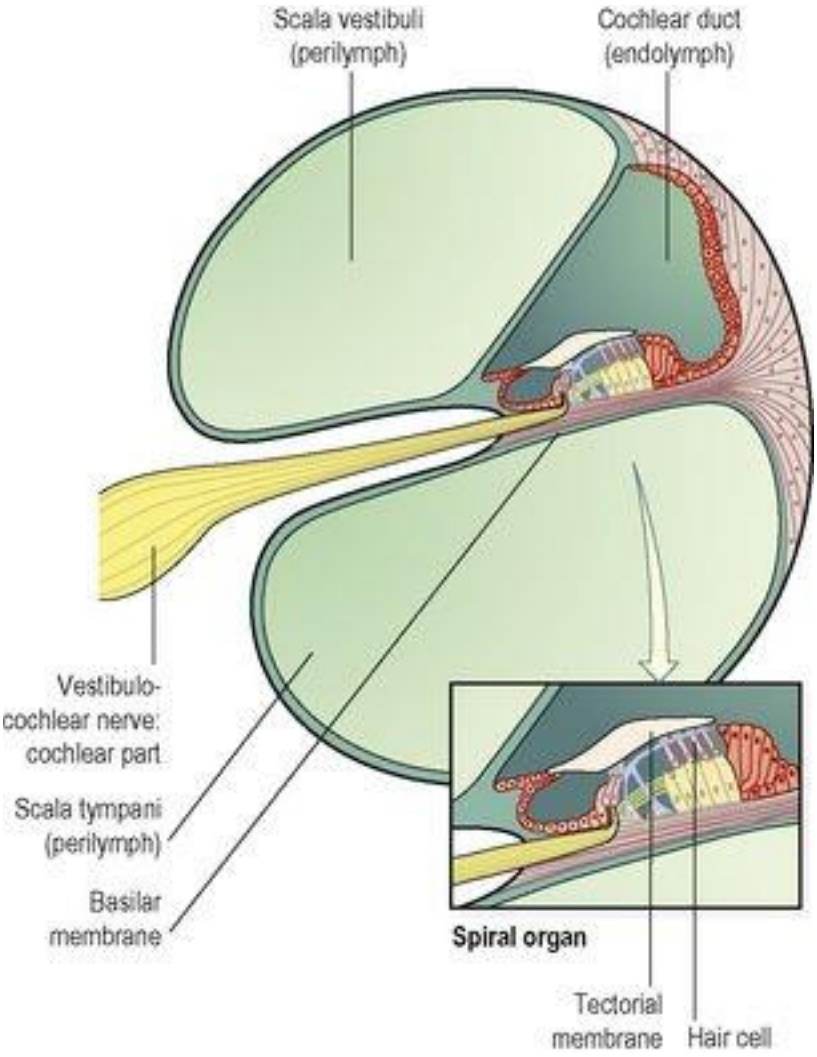
Physiology of Hearing

The following events are involved in hearing

The auricle directs sound waves into the external auditory canal. When sound waves strike the tympanic membrane, the alternating waves of high and low pressure in the air cause the tympanic membrane to vibrate back and forth. The tympanic membrane vibrates slowly in response to low-frequency (low-pitched) sounds and rapidly in response to high-frequency (high-pitched) sounds. The central area of the tympanic membrane connects to the malleus, which vibrates along with the tympanic membrane. This vibration is transmitted from the malleus to the incus and then to the stapes. As the stapes moves back and forth, its oval-shaped footplate, which is attached via a ligament to the circumference of the oval window,vibrates in the oval window. The vibrations at the oval window are about 20 times more vigorous than those of the tympanic membrane because the auditory ossicles efficiently transmit small vibrations spread over a large surface area (the tympanic membrane) into larger vibrations at a smaller surface (the oval window). The movement of the stapes at the oval window sets up fluid pressure waves in the perilymph of the cochlea. As the oval window bulges inward, it pushes on the perilymph of the scala vestibuli. Pressure waves are transmitted from the scala vestibuli to the scala tympani and eventually to the round window,

The pressure waves in the endolymph cause the basilar membrane to vibrate, which moves the hair cells of the spiral organ against the tectorial membrane. This leads to bending of the stereocilia and ultimately to the generation of nerve impulses in first-order neurons in cochlear nerve fibers.




Scala vestibuli
(perilymph)
Cochlear duct
(endolymph)
Vestibulo-
cochlear nerve:
cochlear part
Scala tympani
(perilymph)
Basilar
membrane
Spiral organ
Tectorial
membrane
Hair cell