HUMAN ANATOMY AND PHYSIOLOGY-I, BP-101(T)

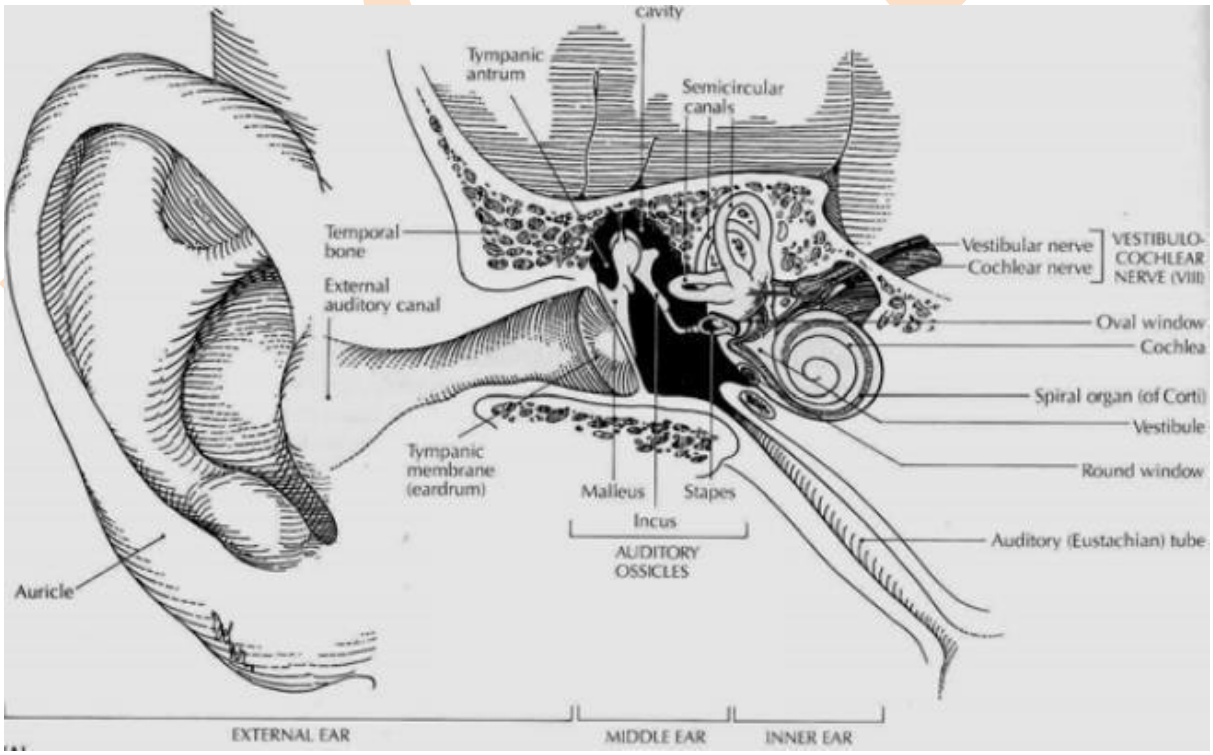
UNIT-IV (Special Senses)

CLASS:2

TOPIC –Structure, functions and disorders of Ear

- The Ear in addition to its role in hearing, the ear also functions as the sense organ of equilibrium and balance.
- As we shall later see, the stimulation or "trigger" that activates receptors involved with hearing and equilibrium is mechanical, and the receptors themselves are called mechanoreceptors.
- Physical forces that involve sound vibrations and fluid movements are responsible for initiating nervous impulses eventually perceived as sound and balance.
- The ear is much more than a mere appendage on the side of the head.
  A large part of the ear, and by far its most important part, lies hidden from view deep inside the temporal bone. It is divided into the following anatomical areas:

1. External ear
2. Middle ear
3. Inner (internal) ear



External ear

- The external ear has two parts: the auricle or pinna and the external auditory canal.
- The auricle is the appendage on the side of the head surrounding the opening of the external auditory canal.
- The canal itself is a curve about 2.5 cm (1 inch) in length. It extends into the temporal bone and ends at the tympanic membrane or eardrum, which is a partition between the

external and middle ear.

- The skin of the auditory canal, especially in its outer one third, contains many short hairs and ceruminous glands that produce a waxy substance called cerumen that may

collect in the canal and impair hearing by absorbing or blocking the passage of soundwaves.

- Sound waves travelling through the external auditory canal strike the tympanic membrane and cause it to vibrate.

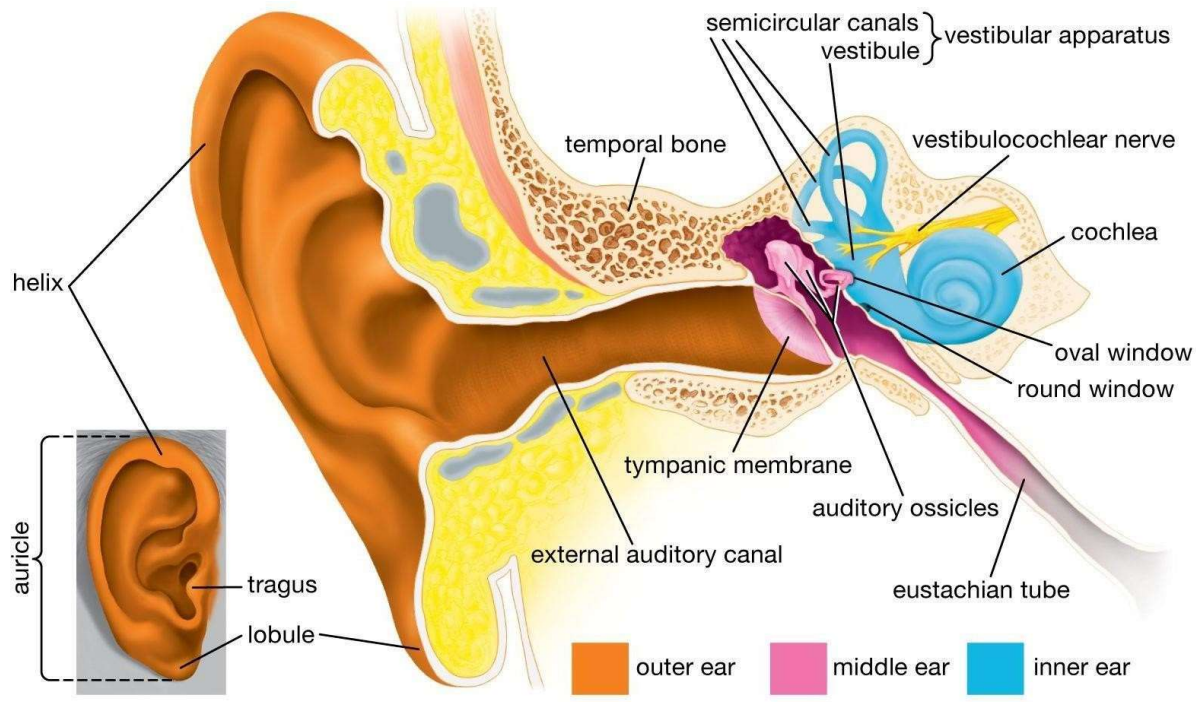
Middle Ear

- The middle ear is a tiny and very thin epithelium lined cavity hollowed out of the temporal bone. It houses three very small bones. The names of these ear bones, called ossicles, describe their shapes − malleus (hammer), incus (anvil), and stapes (stirrup).
- The "handle" of the malleus attaches to the inside of the tympanic membrane, and the "head" attaches to the incus.
- The incus attaches to the stapes, and the stapes presses against a membrane that covers a small opening, the oval window.
- The oval window separates the middle ear from the inner ear. When sound waves cause the eardrum to vibrate, that movement is transmitted and amplified by the ear ossicles as it passes through the middle ear.
- Movement of the stapes against the oval window causes movement of fluid in the inner ear. A point worth mentioning, because it explains the frequent spread of infection from the throat to the ear, is the fact that a tube− the auditory or eustachian tube− connects the throat with the middle ear.
- The epithelial lining of the middle ears, auditory tubes, and throat are extensions of one continuous membrane. Consequently a sore throat may spread to produce a middle ear infection called otitis media.

Inner Ear

- The activation of specialized mechanoreceptors in the inner ear generates nervous impulses that result in hearing and equilibrium.
- Anatomically, the inner ear consists of three spaces in the temporal bone, assembled in a complex maze called the bony labrynth.
- This odd shaped bony space is filled with a watery fluid called perilymph and is divided into the following parts: vestibule, semicircular canals, and cochlea. The vestibule is adjacent to the oval window between the semi circular canals and the cochlea.
- Note in Figure that a balloon like membranous sac is suspended in the perilymph and follows the shape of the bony labyrinth
- much like a "tube within a tube." This is a membranous labyrinth, and it is filled with a thicker fluid called endolymph.
- The specialized membrane receptors for balance and equilibrium are located in the three semicircular canals and the vestibule. The three half-circle semicircular canals are oriented at right angles to one another.
- Within each canal is a specialized receptor called a crista ampullaris, which generates a nerve impulse when you move your head.
- The sensory cells in the cristae ampullares have hair like extensions that are suspended in the endolymph. The sensory cells are stimulated when movement of the head causes the endolymph to move, thus causing the hairs to bend.
- Nerves from other receptors in the vestibule join those from the semicircular canals to form the vestibular nerve, a division of the acoustic nerve or cranial nerve VIII.

- Eventually, nervous impulses passing through this nerve reach the cerebellum and medulla. Other connections from these areas result in impulses reaching the cerebral cortex.
- The organ of hearing, which lies in the snail shaped cochlea, is the organ of Corti.
- It is surrounded by endolymph filling the membranous cochlea or cochlear duct, which is the membranous tube within the bony cochlea.
- Specialized hair cells on the organ of Corti generate nerve impulses when they are bent by the movement or endolymph set in motion by sound waves



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Function of Ear:

Following are the important function of the ear:

Hearing

The mechanism of hearing involves the following steps:

- The sound waves pass through the auditory canal and reach the eardrum.
- The vibrations produced pass through the tympanic membrane to the tympanic cavity.
- The ear ossicles in the tympanic cavity receive the vibrations and the stapes pushes the oval window in and out.
- This action is passed on to the organ of corti, the receptor of hearing, that contains tiny hair cells that translate the vibrations into an electrical impulse that are transmitted to the brain by sensory nerves.