

Biology - Ear (Sense Organs)

How we produce and hear sounds–

In our larynx:-

- ❖ We use our vocal cords to make sounds in our throat.
- ❖ When we speak, our vocal cords vibrate.
- ❖ Air from the lungs flows through the windpipe and into the voice box (where the vocal cords are present).
- ❖ Then the air pushes the vocal cords apart making them vibrate.
- ❖ The vibrations create a series of sound waves that exit through your mouth.
- ❖ The change of shape of the vocal cords changes the sound and its pitch.

In the air:-

- ❖ The vibrations move as sound waves through the air.
- ❖ It moves by forming compressions and rarefactions

In the ear:-

To hear sound, your ear has to do three basic things:

- ❖ Direct the sound waves into the hearing part of the ear
- ❖ Sense the fluctuations in air pressure
- ❖ Translate these fluctuations into an electrical signal that your brain can understand

The ear consists of three basic parts - **the outer ear, the middle ear, and the inner ear**. Each part of the ear serves a specific purpose in the task of detecting and interpreting sound.

<p>(air filled)</p> <p style="text-align: center;"><u>Outer ear—</u></p> <ul style="list-style-type: none"> □ The outer ear serves to collect and channel sound to the middle ear. ✓ Consists of Pinna, ear canal <p>Pinna- <u>Structure</u>-Outer flap, immovable cartilaginous structure that leads to the auditory canal. <u>Function</u>-</p> <ul style="list-style-type: none"> • protects middle ear to prevent damage to ear drum • catches and channels sound into ear canal • helps detect direction of sound <p>Ear Canal or auditory meatus or auditory canal <u>Structure</u>- 2cm long tube like structure- ends at the eardrum <u>Function</u>—</p>	<p>(air filled)</p> <p style="text-align: center;"><u>Middle Ear—</u></p> <ul style="list-style-type: none"> □ The middle ear serves to transform the energy of a sound wave into the internal vibrations of the bone structure of the middle ear □ It is embedded in the cranial bone ✓ Consists of air filled cavity (tympanic cavity) with three tiny bones called ear ossicles <p><u>Structure</u>—the three bones are the tiniest bones in our body and are -malleus (hammer), incus (anvil) and stapes (stirrup) Malleus – hammer shaped and articulates with incus on the other side Incus or anvil like and articulates with malleus on one side and the stapes on the other Stapes or stirrup like, its footplate is attached to the oval window <u>Function</u>—</p> <ul style="list-style-type: none"> • The movements of the eardrum will set the hammer, anvil, and stirrup into motion at the 	<p>(fluid filled)</p> <p style="text-align: center;"><u>Inner ear--</u></p> <ul style="list-style-type: none"> □ The inner ear serves to transform the energy of a compressional wave within the inner ear fluid into nerve impulses that can be transmitted to the brain. ✓ The inner ear consists of a cochlea (associated with hearing) and the auditory nerve. ✓ It has a complex system of canals and cavities and vestibular apparatus associated with balance. <p><u>Structure--</u> The cochlea is a snail-like structure divided into three fluid-filled compartments that would stretch to approximately 3 cm. It has 2 ½ turns The inner surface of the cochlea is lined with over 20 000 hair-like nerve cells <u>Function</u>—</p> <ul style="list-style-type: none"> • Inside the cochlea, the vibrational signal from the middle air passes through fluid , where it is turned into
---	---	--

<ul style="list-style-type: none"> • carries the mechanical sound wave forward • Amplifies sound <p>Eardrum—or tympanic membrane</p> <ul style="list-style-type: none"> ❖ Interface between outer and middle ear ❖ The eardrum is a very durable and tightly stretched membrane that vibrates as the incoming pressure waves reach it ❖ Carries the vibrations to the middle ear 	<p>same frequency of the sound wave</p> <ul style="list-style-type: none"> • The three tiny bones of the middle ear act as levers to amplify the vibrations of the sound wave. • Due to a mechanical advantage, the displacements of the stirrup are greater than that of the hammer. • Since the pressure wave striking the large area of the eardrum is concentrated into the smaller area of the stirrup, the force of the vibrating stirrup is nearly 20 to 25 times larger than that of the eardrum. • This feature enhances our ability of hear the faintest of sounds. • They transfer vibrations from eardrum to cochlea. <p>The middle ear is connected by the Eustachian tube to the pharynx. It helps in equalizing <u>air</u> pressure on <u>both sides</u> of the eardrum and allows it to vibrate freely.</p>	<p>electrical impulses when coming in contact with “hair cells”</p> <ul style="list-style-type: none"> • These electrical impulses finally exit through the auditory nerve into the brain. <p>The Brain interprets these sounds</p>
---	---	---

Inner ear and hearing:

- ❖ Cochlea is a highly coiled tube about 3 cm long and divided into three canals—the vestibular canal, the middle canal and the tympanic canal.
- ❖ The Reissner's membrane separates the vestibular and middle canal
- ❖ The basilar membrane separates the middle and tympanic membrane.
- ❖ The membranous part of the cochlea is called the scala media.
- ❖ The vestibular and tympanic canal are filled with a fluid called perilymph
- ❖ The median canal is filled with endolymph.
- ❖ Where the stapes touches the inner ear is called the oval window.
- ❖ The cochlea is coiled. When vibration reaches the stirrup it hits the oval window and travels along the cochlea in the fluid filled to the tip.
- ❖ Once the fluid reaches the inner tip it has to start coming back.
- ❖ But it does not come back to oval window but goes to the round window and pushes it out,
- ❖ This is because in the middle of the cochlea is a membrane that runs all the way in the cochlea that is called the Organ of Corti.
- ❖ The organ of Corti is composed of the basilar and tectorial membrane.
- ❖ This back and forth motion of the fluid continues till all energy dissipates.