

Hearing (Practical)

By

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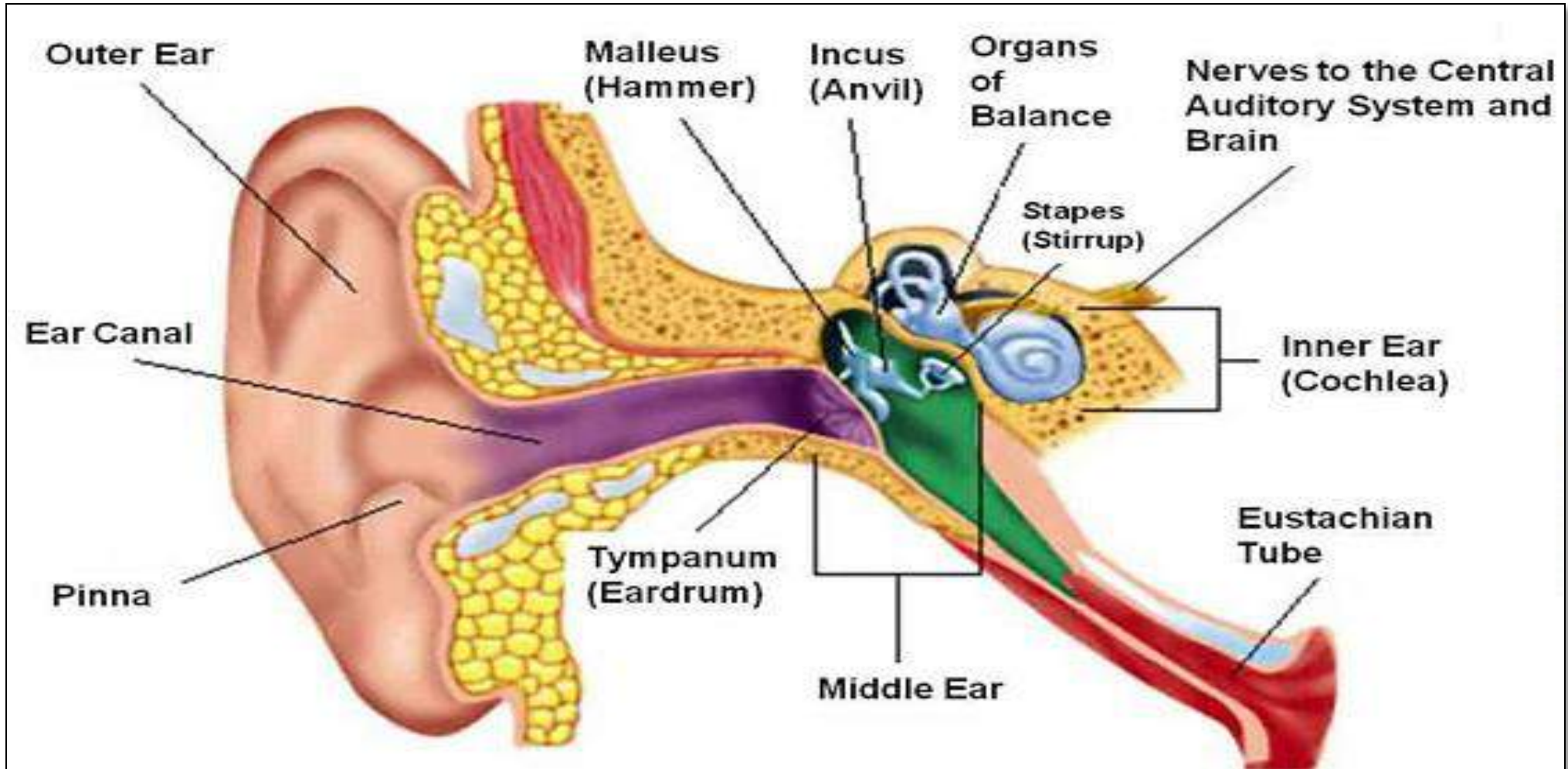
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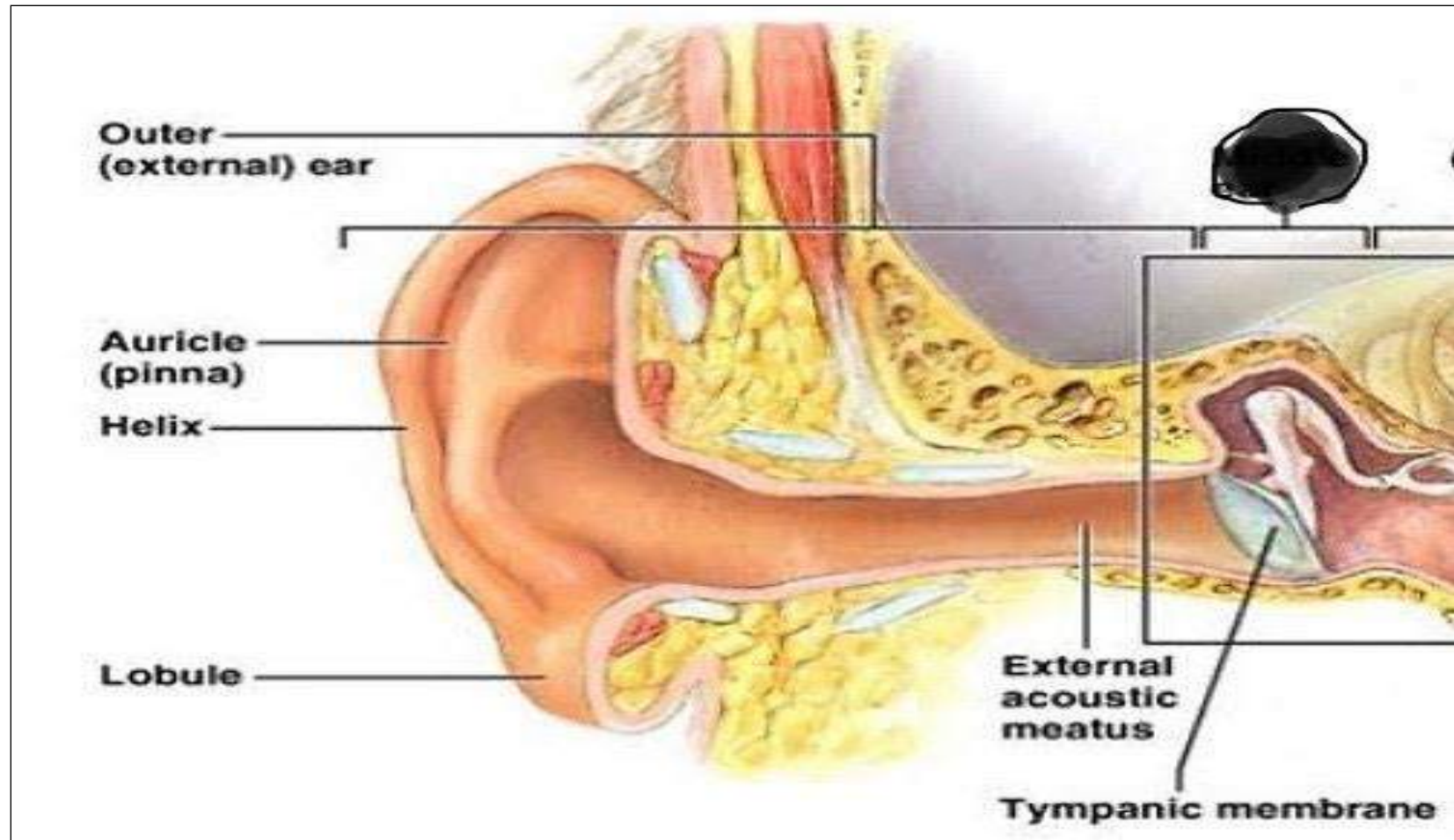
❖ The human ear is divided into 3 parts

1- External ear. 2- Middle ear 3- Inner ear

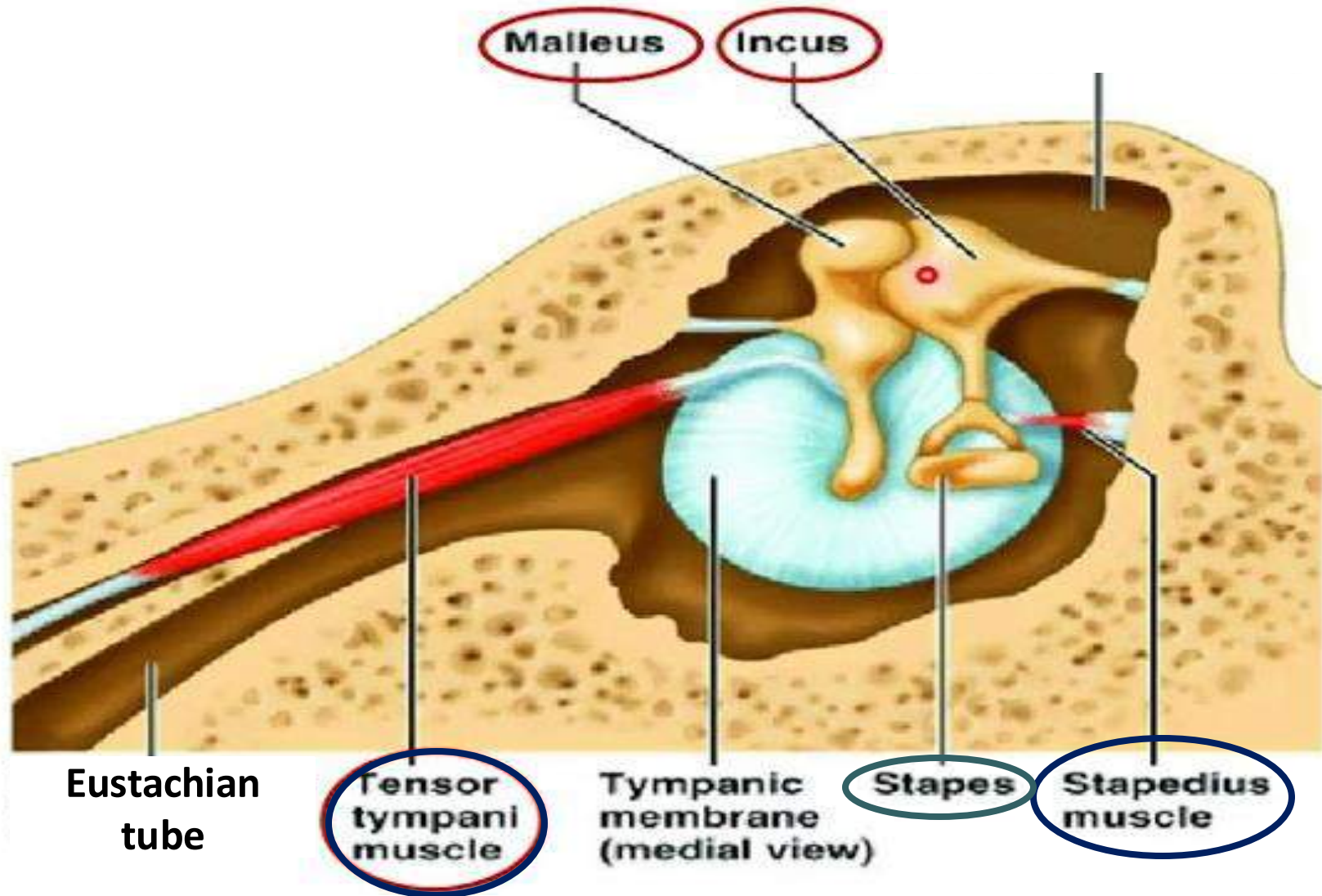


External Ear:

- 1- Ear pinna (auricle)
- 2- External auditory meatus / canal
- 3- Tympanic membrane



Middle ear



Routes of sound transmission

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graph TD; A[Routes of sound transmission] --- B[Ossicular conduction]; A --- C[Bone conduction]; A --- D[Air conduction];
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**Ossicular
conduction**

**Bone
conduction**

Air conduction

1) Ossicular route: •

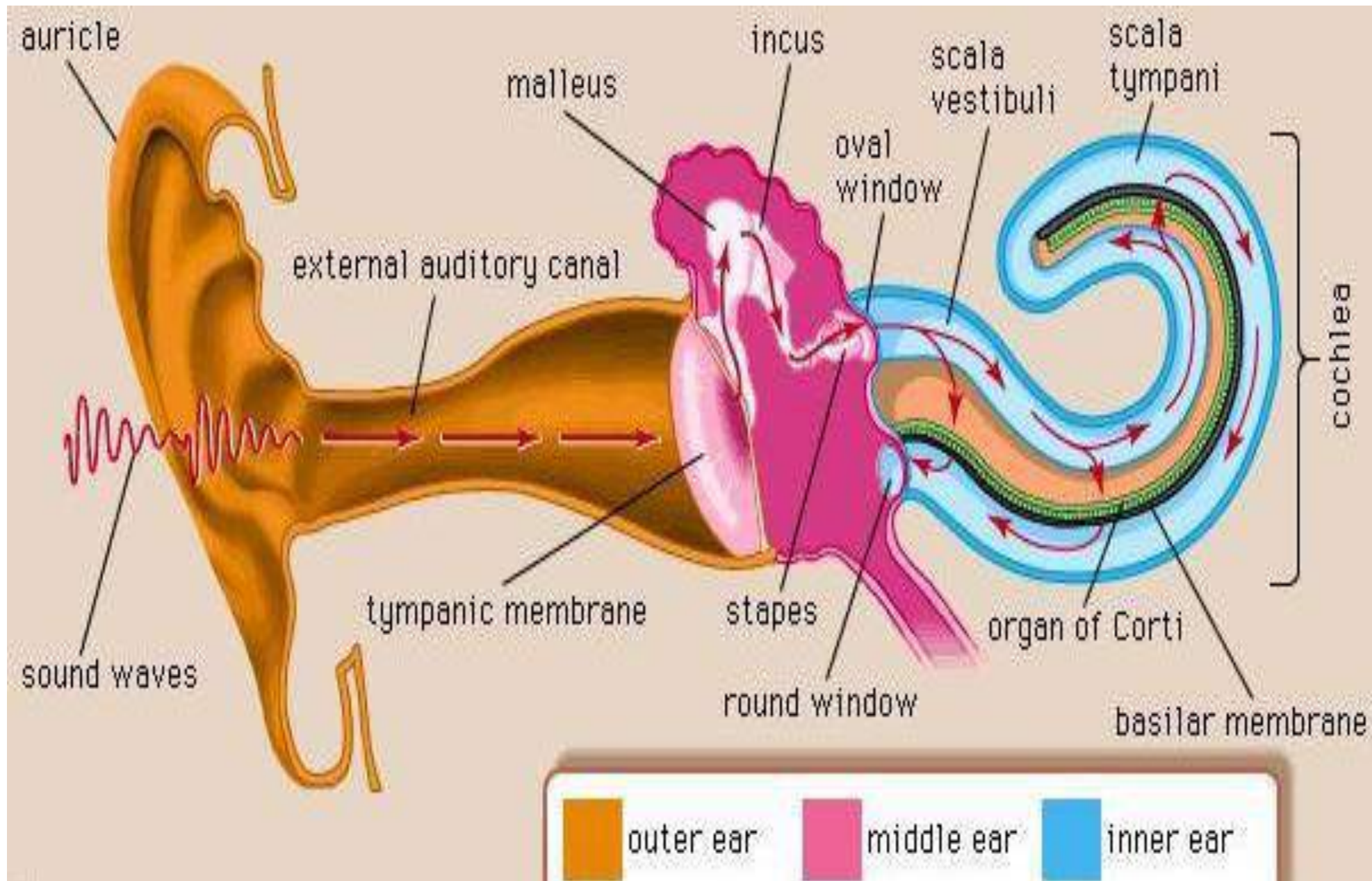
- It is the route that occurs in healthy normal ear. •
- Mediated via tympanic membrane ⇒ **3 ossicles** ⇒ **oval window**. •
- It gives optimum and best hearing sensations. (**22 times magnification**). •

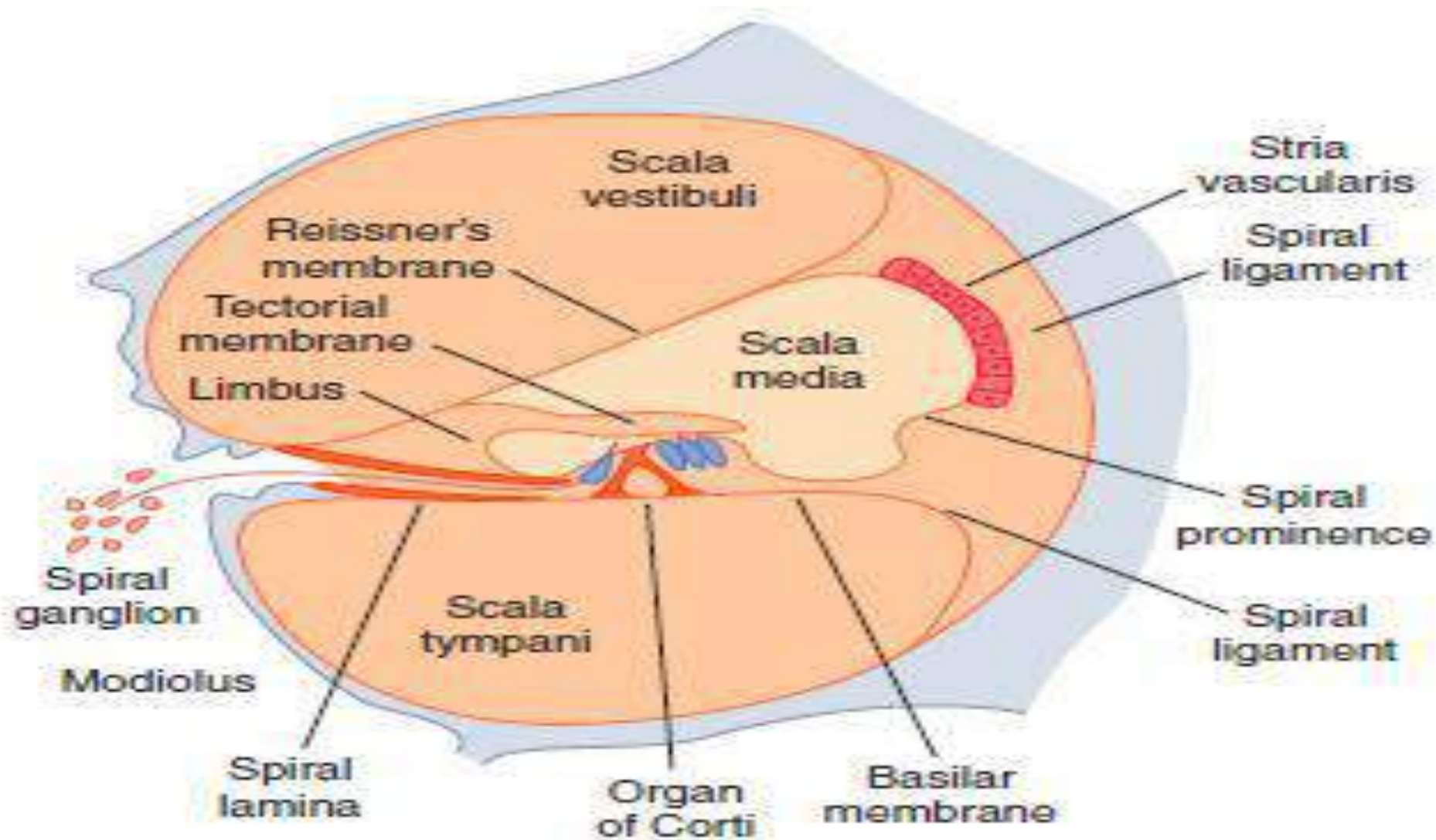
2) Air route: •

- It is inefficient & gives weak sensations. •
- Occurs when tympanic membrane and bony ossicles are destroyed. •
- Sound waves cause vibration of the **secondary tympanic membrane** that •
covers the **round window** ⇒ vibrations are transmitted to the fluid of the •
inner ear ⇒ vibration of the basilar membrane. •

3) Bone route or bone conduction: •

- It is inefficient in comparison to ossicular route. •
- Vibrations in bones ⇒ transmitted to the fluid in the inner ear. •
- It occurs either by: •
 - a) Extreme loud sound. •
 - b) Application of **vibrating objects** on skull or mastoid (tuning fork). •
- **Bone conduction is better in case of conductive deafness. (no masking)** •





Deafness

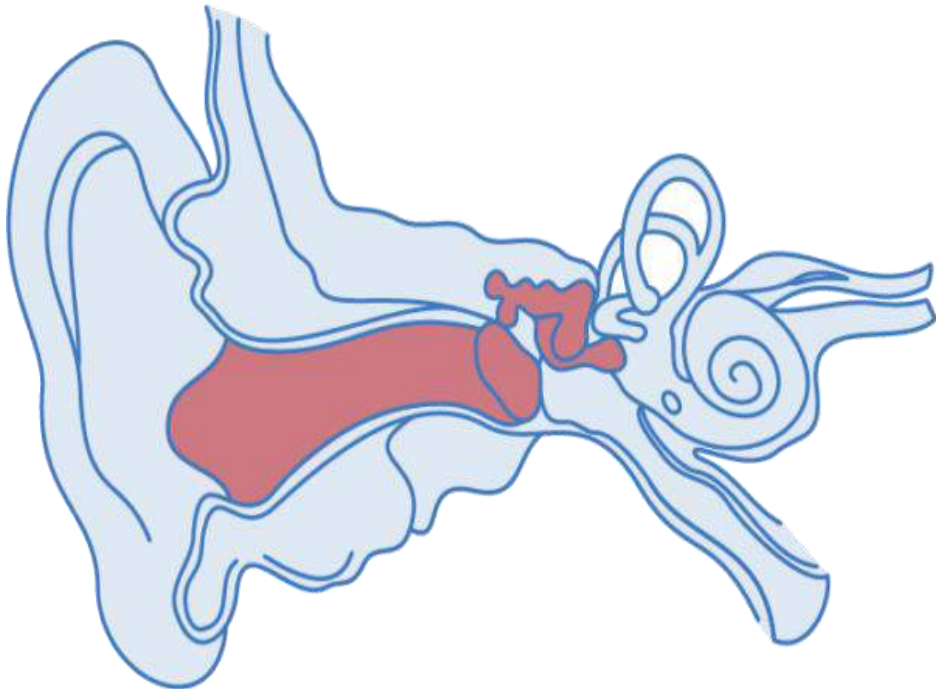
Definition: It is impairment of auditory acuity .

▲ Types of deafness:

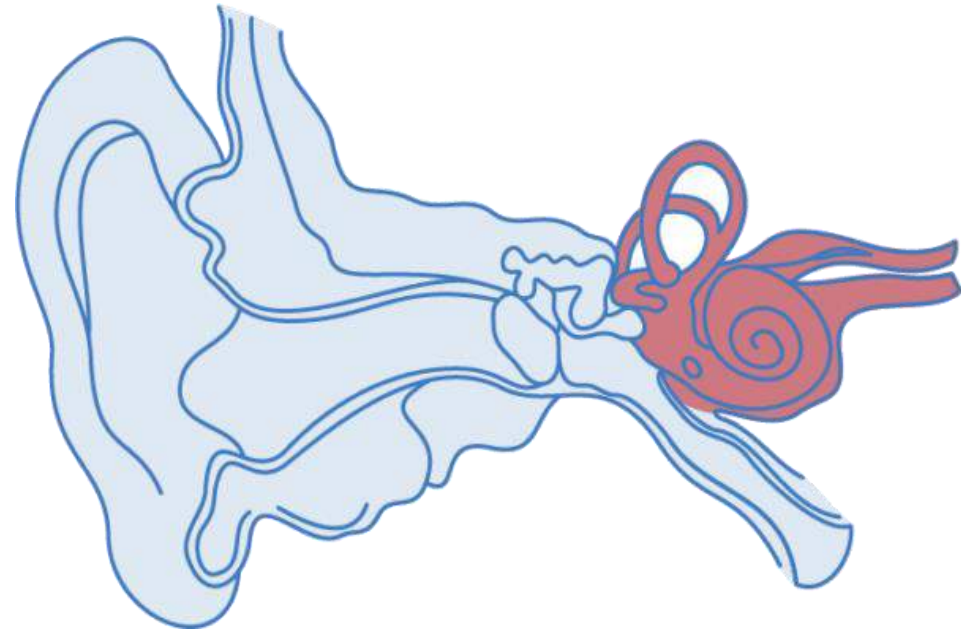
	Conductive deafness	Perceptive deafness
Causes	<p>Block of sound waves conduction from external ear till the oval window</p> <p>by:</p> <ol style="list-style-type: none"> 1) Obstruction in external auditory canal like wax, insects, <u>f</u>ungus or <u>f</u>oreign bodies. 2) Rupture drum. 3) Otitis externa or otitis media 4) Tumor in external or middle ear 5) Eustachian tube obstruction as in common cold, tonsillitis & adenoid. 6) Presbycusis (senile deafness) i.e. loss of mobility of bony ossicles due to aging process. Otosclerosis. 	<p>Defect in auditory impulse transmission from the cochlea till auditory Cortex</p> <p>due to:</p> <ol style="list-style-type: none"> 1) Chronic exposure to high pitched sound (damage of hair cells). 2) Sudden exposure to very high sound like gun shot. 3) Drugs as streptomycin → irreversible damage of hair cells. 4) Meniere's disease (↑ endolymph pressure). 5) Vascular lesion in auditory pathway (thrombosis or hemorrhage). 6) Tumor or Trauma in the brain. 7) Auditory cortex lesion as vascular lesions, meningitis, encephalitis & CO poisoning. 8) Genetic deafness: abnormality in myosin IV & myosin VII (important for Motility of cilia in hair cells).

Deafness

Conductive deafness

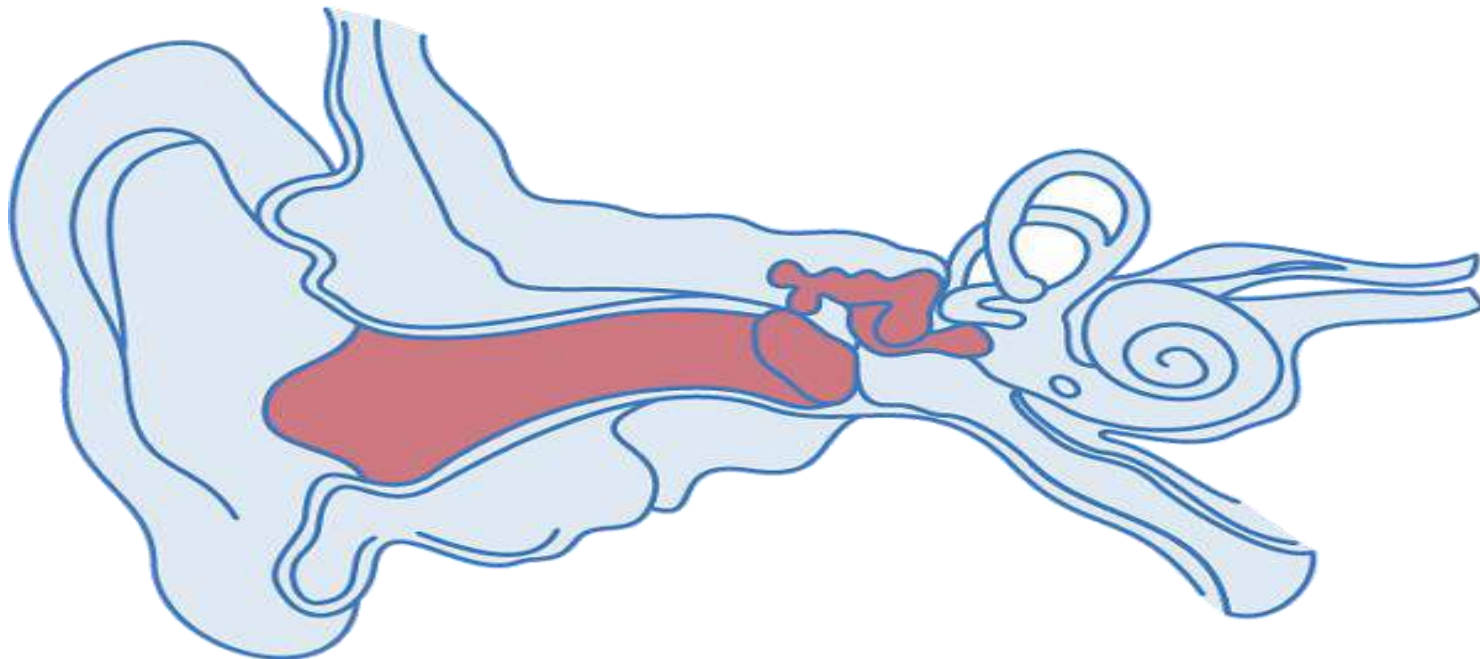


**Nerve / perceptive/
sensineural deafness**



Conductive deafness

- Occurs due to interference with the conduction of sound waves from external ear till the oval window.

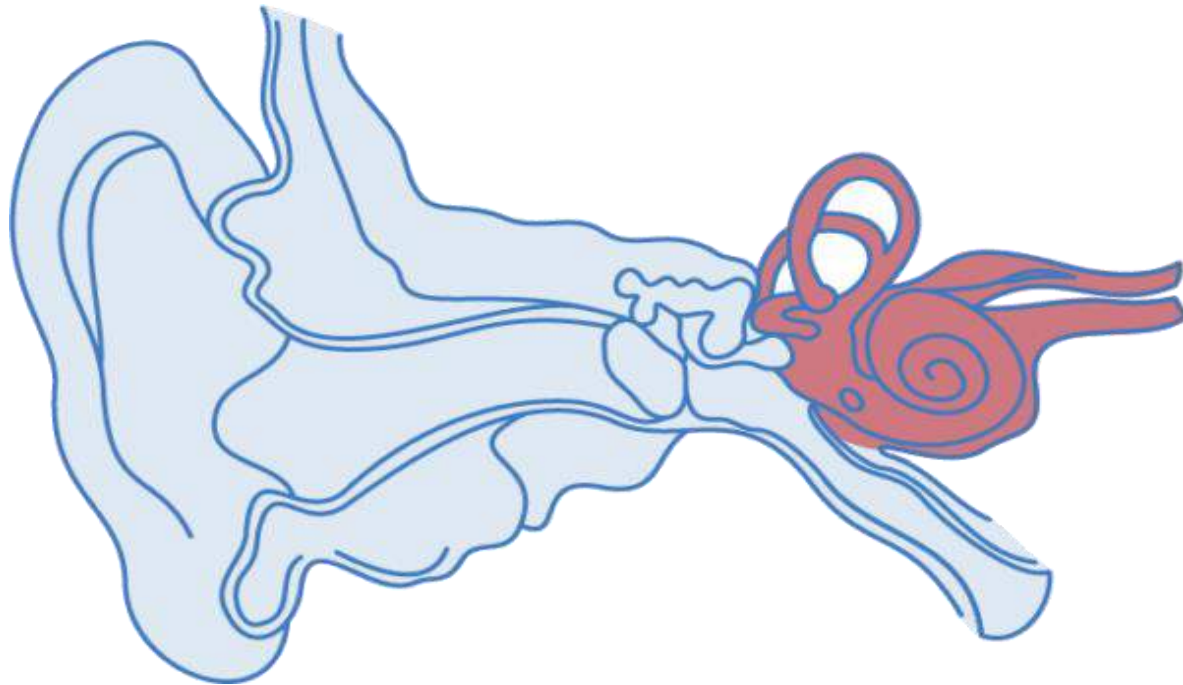


Criteria of conductive deafness

- Bone conduction >> Ossicular conduction.
- Patient speaks at low voice (because he hears his sound magnified).

Nerve (Perceptive) deafness

Occurs due to interference with auditory transmission from oval window till the auditory cortex.



Criteria of nerve deafness

- Ossicular conduction >> Bone conduction But both ossicular & bone conduction are reduced than normal.
- Patient speaks at high voice

Diagnosis of deafness

- Watch test.
- Hearing tests.
- Audiometry.



Hearing tests

Hearing tests

Definition: comparative tests to diagnose type of deafness, either conductive deafness or perceptive deafness .

Types:

- 1) Rinne's test.
- 2) Weber test.
- 3) Schwabach's test.



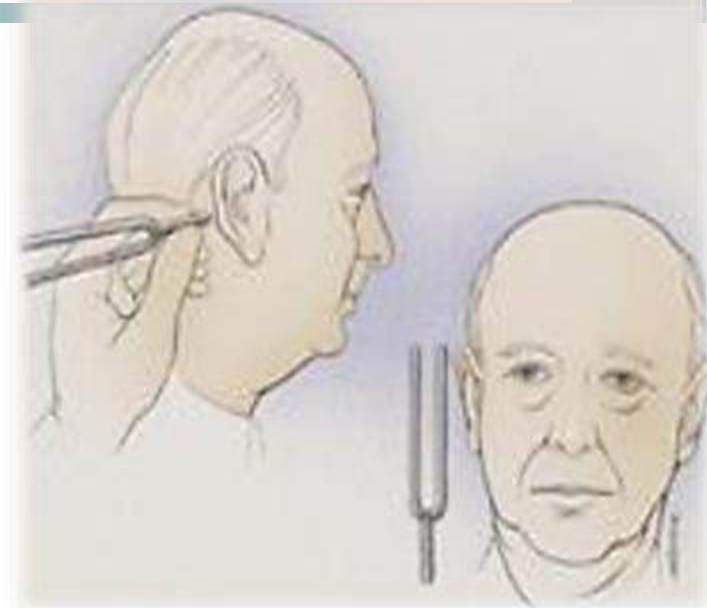
**512 Hz
tuning fork**

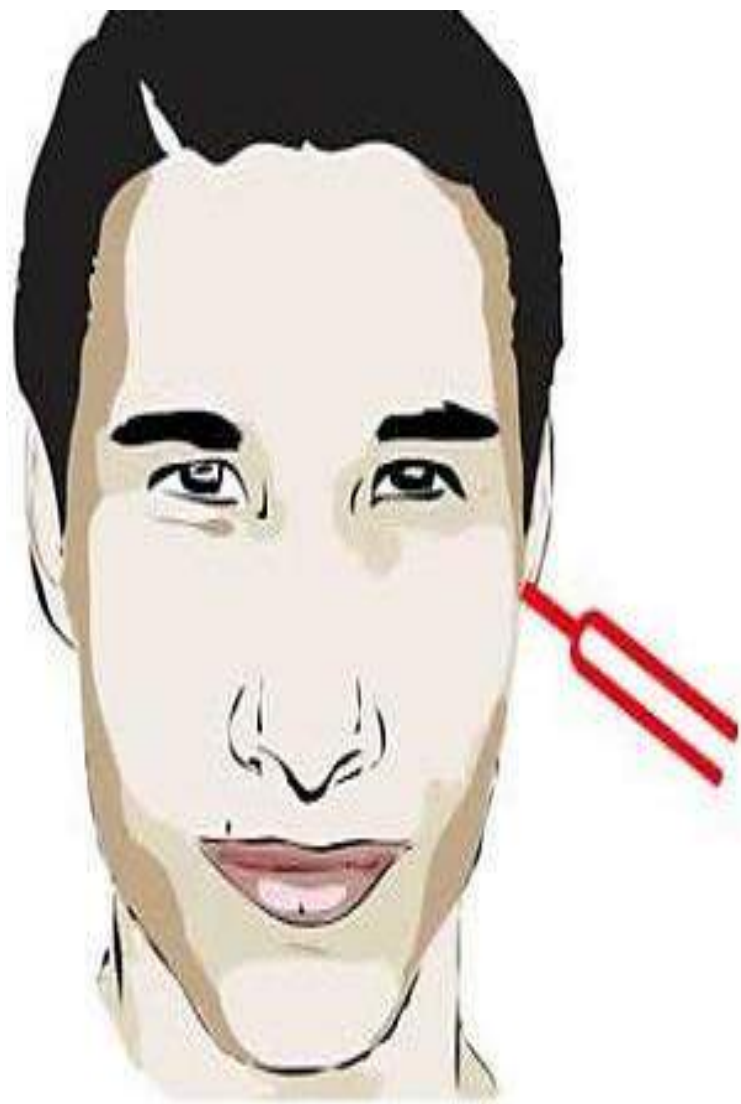
Rinne's test

- Compare between ossicular conduction & bone conduction in same person each ear separately.

-Results

- **Normally:** Ossicular conduction is better than bone conduction for 45 sec (**Rinne +ve**).
- **Conductive deafness:** Bone conduction is better than ossicular conduction (**Rinne -ve**)
- **Perceptive deafness:** Ossicular conduction is better than bone conduction, but both are reduced (**Reduced Rinne**)





Rinne's Test

With a 512 Hz tuning fork press against the mastoid bone and then hold it 1cm away from the ear.

'Which is louder, behind the ear or in front?'

Weber test

- Compare bone conduction between the two ears, in the same person.

- Results:

- **Normally:** The sound is heard equally in both ears.
- **Conductive deafness:** Sound is louder in diseased ear (due to absent masking effect of noise on diseased ear).
- **Perceptive deafness:** Sound is louder in normal ear.



Schwabach's test

- Compare bone conduction between two persons: patient & examiner, Provided that, the examiner is normal.

-Results:

- Normally: Equal time of hearing.
- Conductive deafness: Patient is better (due to absent masking effect of noise on diseased ear).
- Perceptive deafness: Examiner is better i.e.; the patient stops hearing before the examiner.



Weber Test

- Compare bone conduction in both ear.

Rinne Test

- Compare ossicular and bone conduction.

Schwabach's Test

- Compare bone conduction between the subject & the examiner provided that the examiner is normal.

2-Audiometry



- ❖ This instrument can generate sound waves of different frequencies from lowest to highest.
- ❖ Intensity (loudness or volume) of sound at each frequency is adjusted based on previous studies in normal persons.
- ❖ Thus, before calibrating the instrument, minimum (threshold) volume or intensity or loudness, for each frequency of sound heard by normal persons is determined.
- ❖ Minimum intensity is set in the instrument as zero. Now, while testing the patient, the loudness is increased above zero level
- ❖ Intensity of sound is expressed in decibel (dB).

- ❖ The audiometry tests are conducted in a quiet sound-proof room. Earphones will be placed on your head. You will be asked to sit still and not talk.
- ❖ The earphones are connected to audiometer that will deliver the tones and different sounds of speech to your ears.
- ❖ In audiometer, in addition to being equipped with an earphones for testing ossicular conduction by the ear, is equipped with a mechanical vibrator for testing bone conduction from the mastoid process of the skull into the cochlea.

- ❖ At a particular frequency, if the patient hears the sound with loudness of **30 dB** above zero level, the person is said to have **hearing loss of 30 dB** for that frequency.
- ❖ During the tests by audiometer, the subject's ability to hear the sounds with 8 to 10 different frequencies is observed and the hearing loss is determined for each frequency.
- ❖ By using these values, the audiogram is plotted.

❖ Hearing loss is often described as follows:

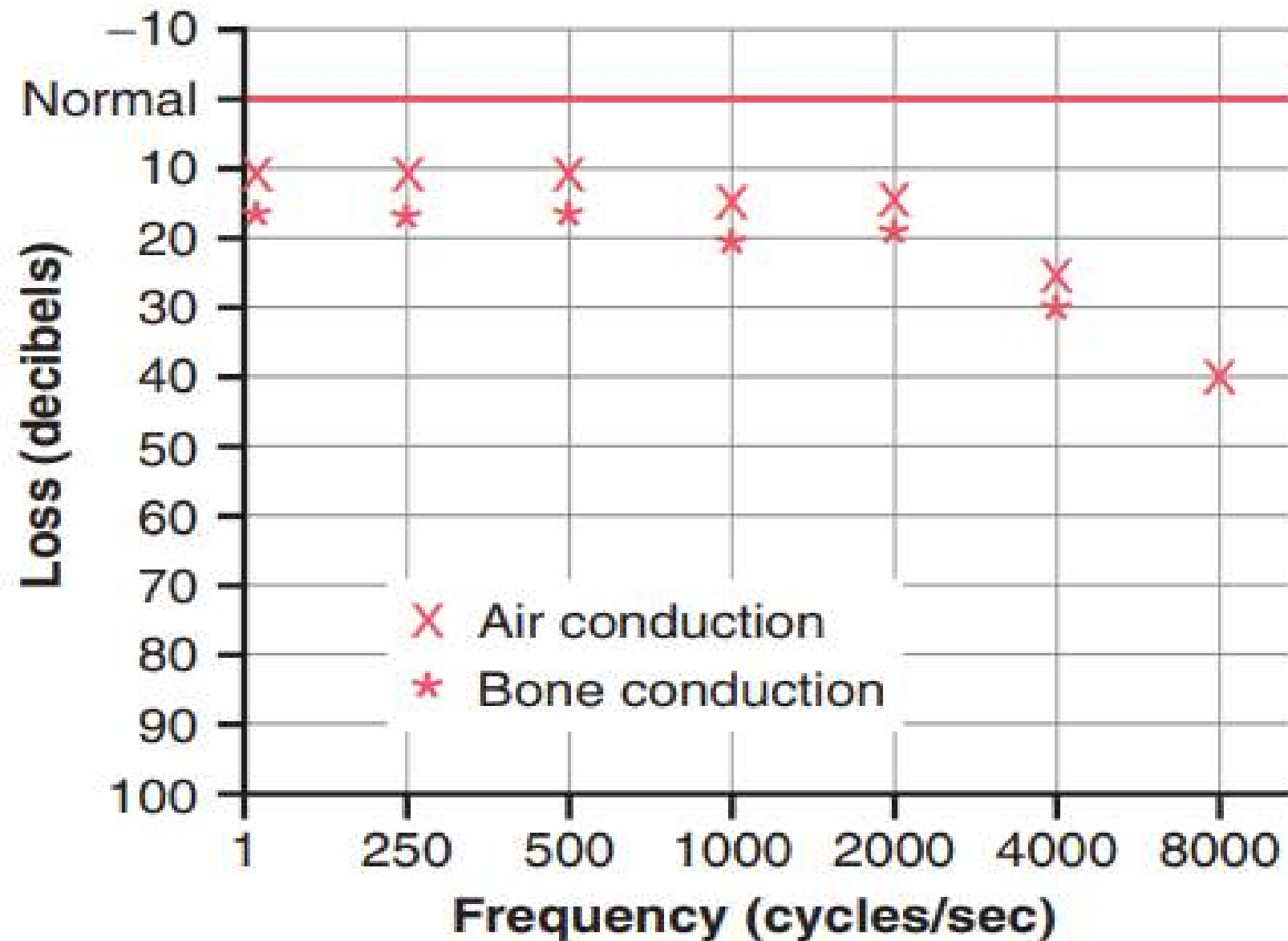
-Normal = less than 25 dB HL.

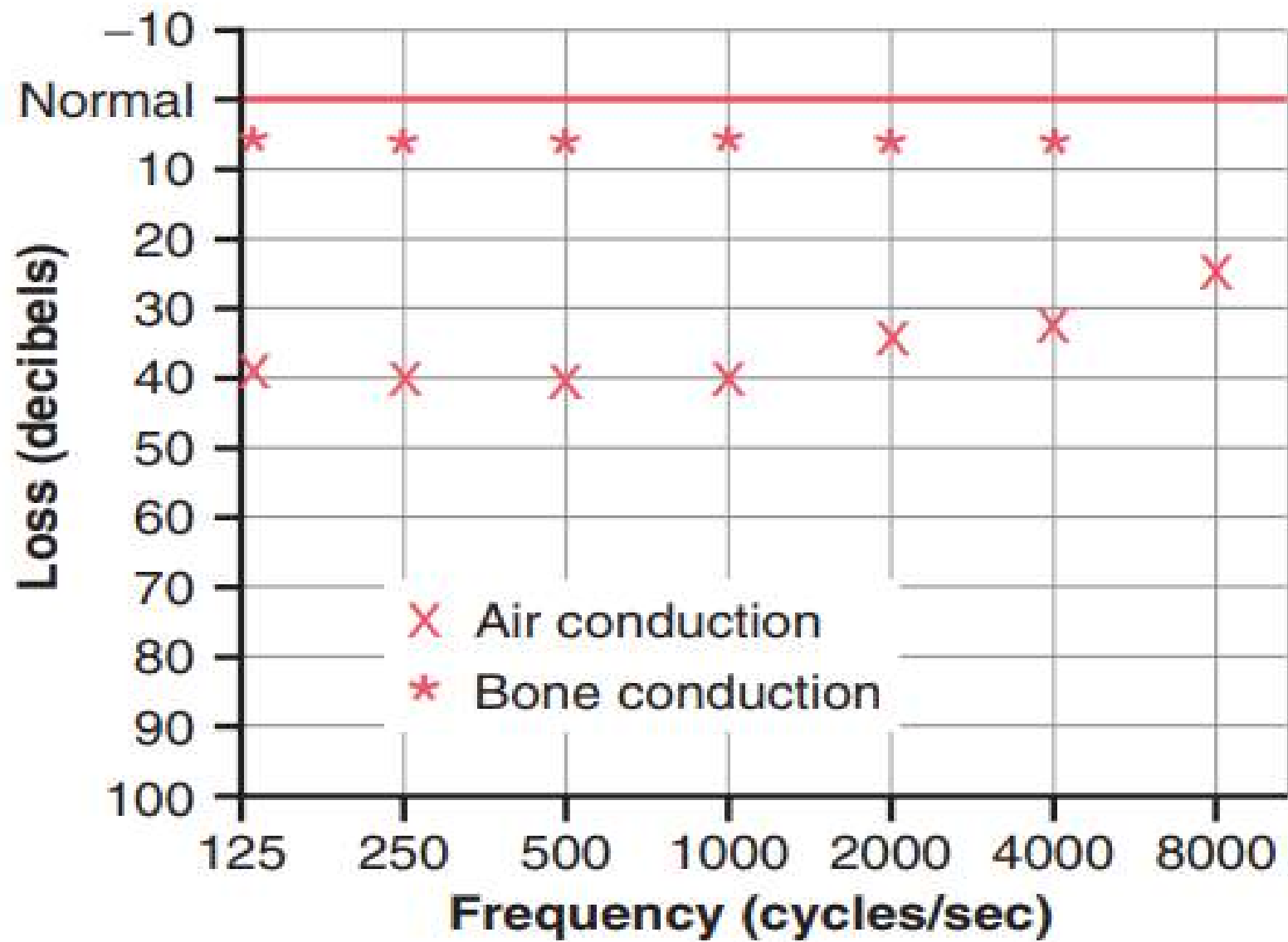
-Mild = 25-40 dB HL.

-Moderate = 41-65 dB HL.

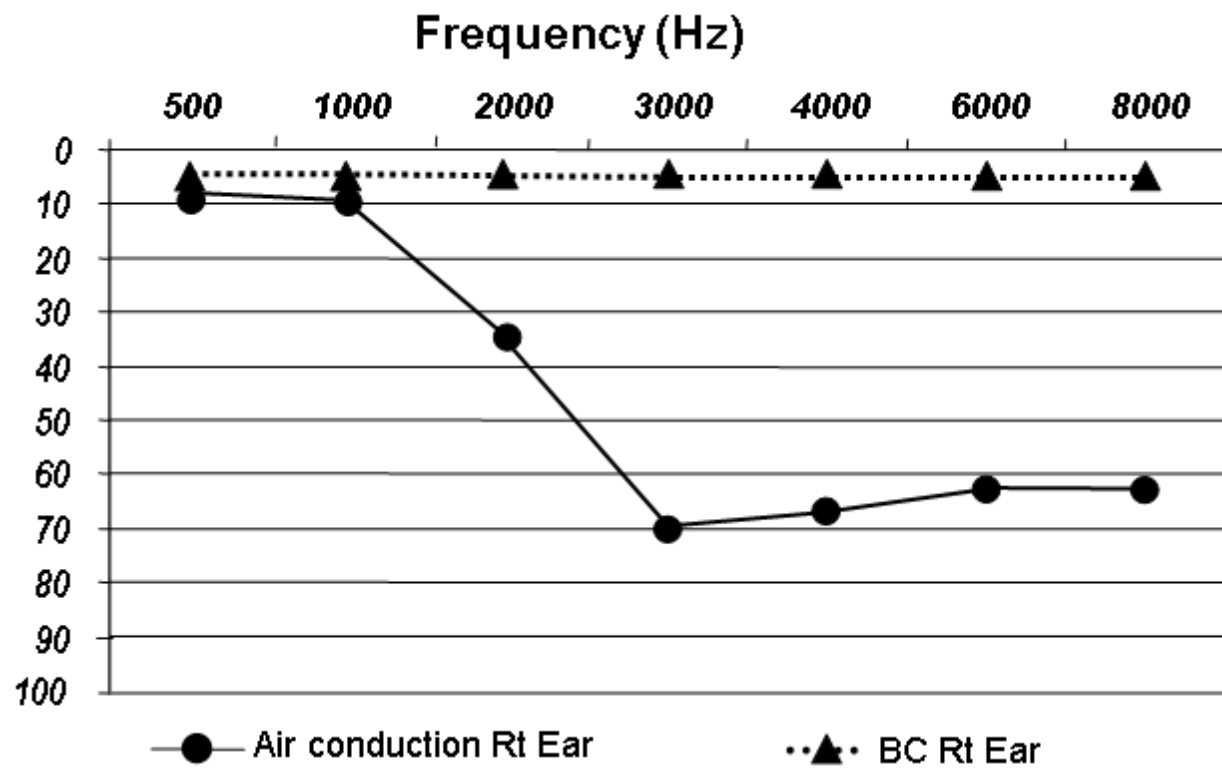
-Severe = 66-90 dB HL.

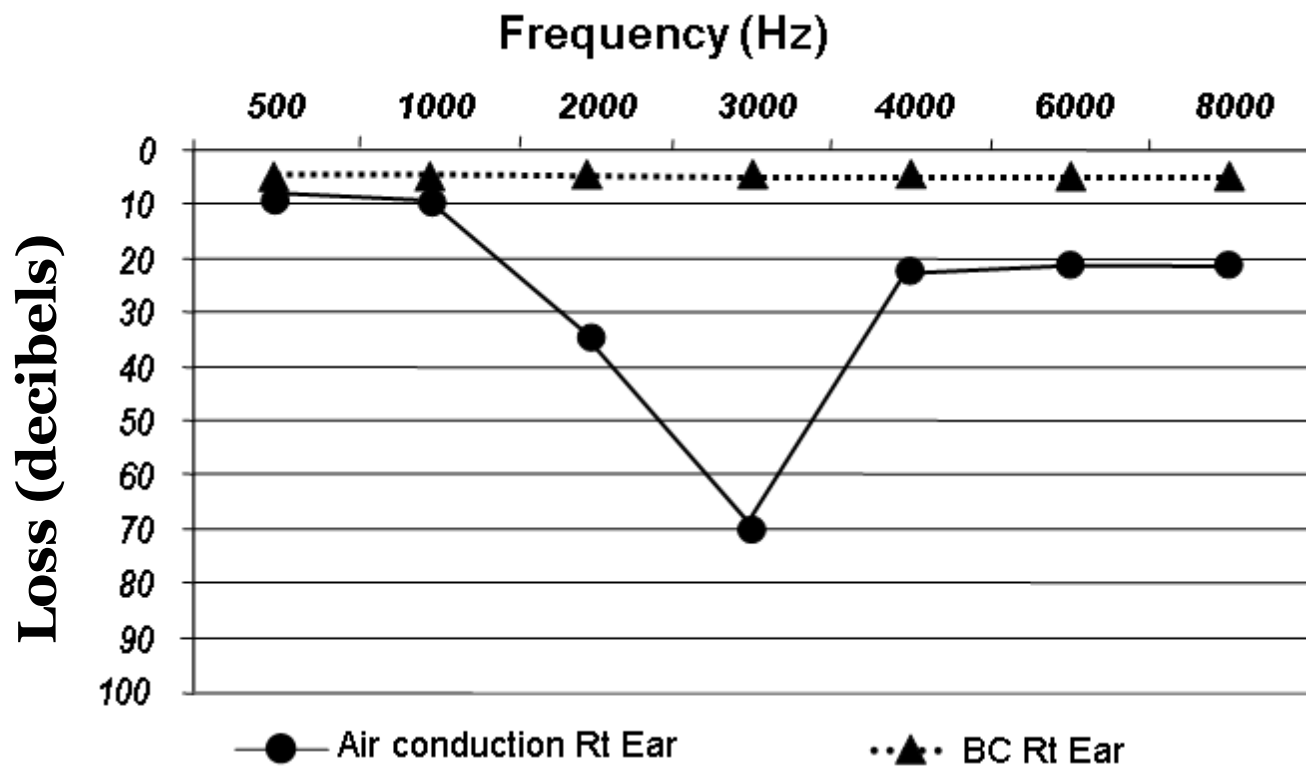
-Profound = more than 90 dB HL.





Loss (decibels)







THANK YOU