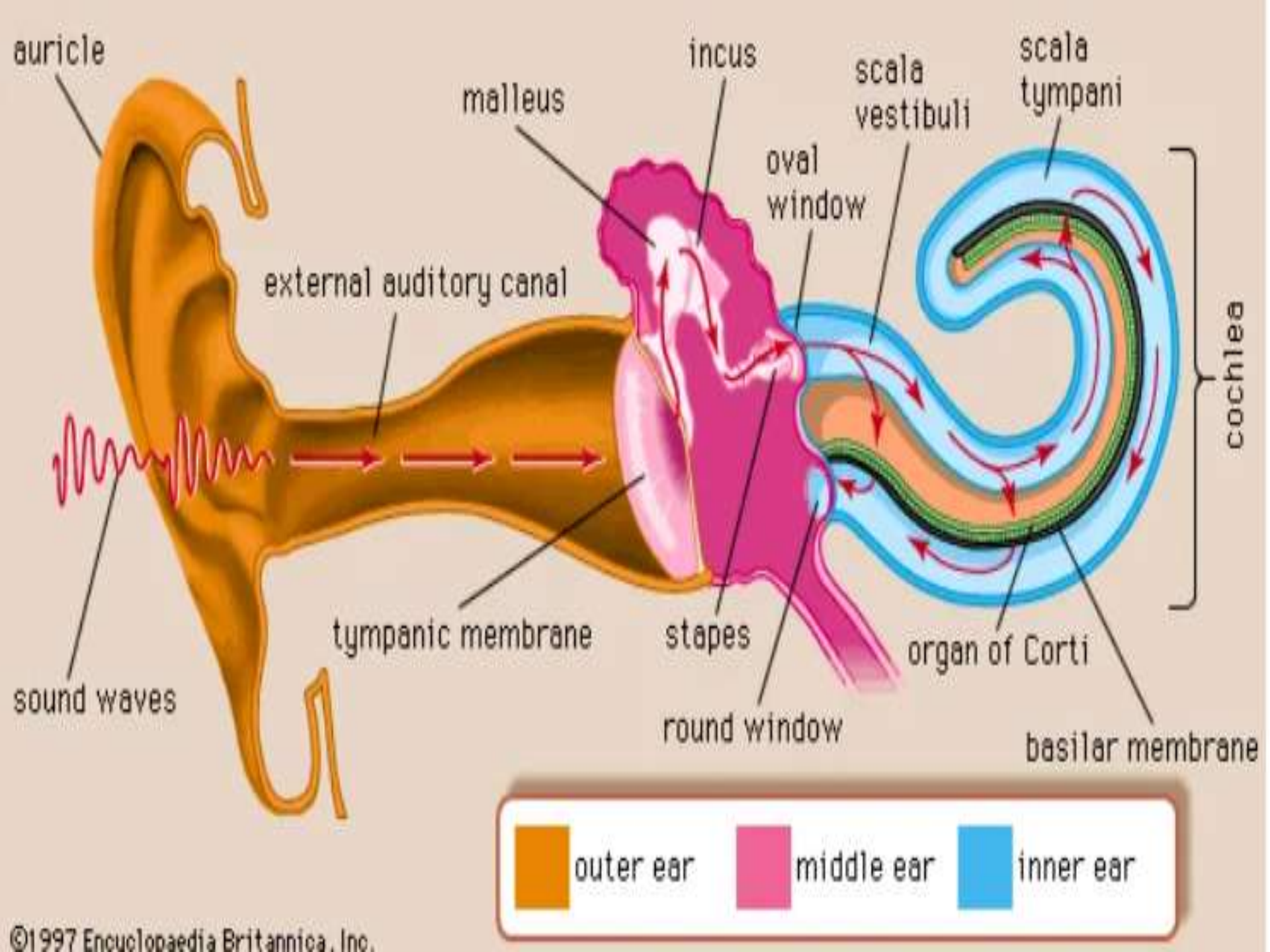
Hearing Tests

Audition and Sound

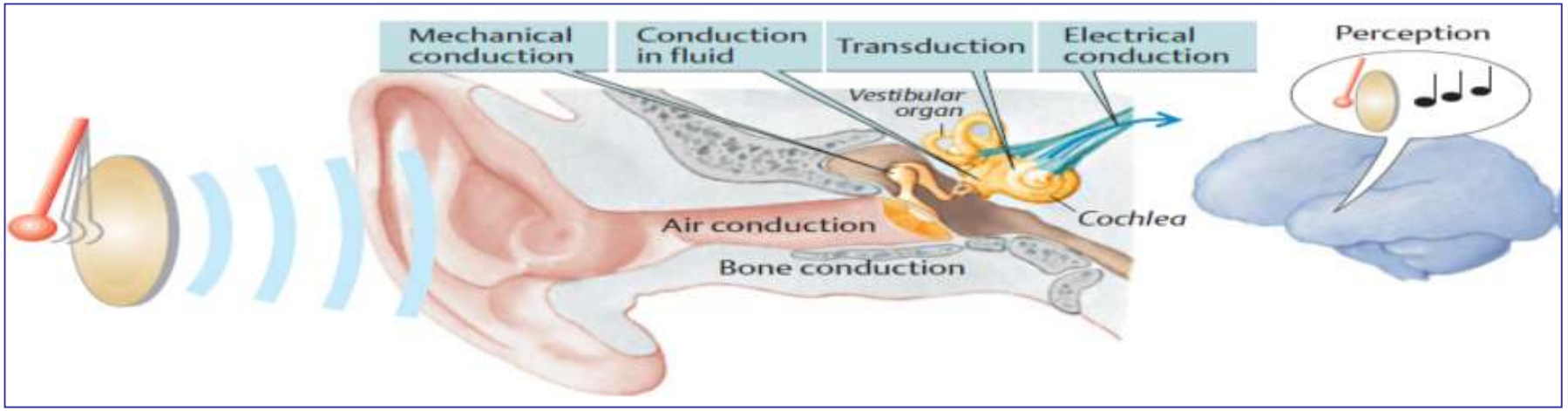
- Audition or hearing is the sense that allows us to communicate and hence interact with other organisms throughout the world.

- **Hearing is the ability to perceive certain pressure vibrations in the air and interpret them as sound.**



Air and Bone Conduction

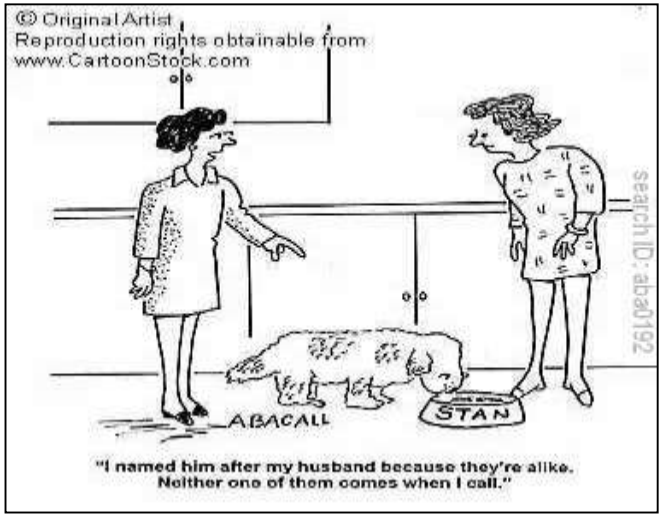
- **Air conduction** is the normal way of conduction of sound waves from air to inner ear through tympanic membrane and bony ossicles
- **Bone conduction** is the conduction of sound to the inner ear through the bones of the skull.
- In bone conduction, a vibrating device is placed on the mastoid process. The vibration over the bone is directly conducted to the cochlea.



Deafness

Def.

- Deafness means **partial** or **complete** hearing loss.
- **Partial loss** of hearing is often called **hearing loss** rather than deafness.
- Deafness can occur in **one or both ears**.
- It is manifested by **decrease** in the **acuity of hearing or increase in the threshold of hearing**.



Deafness

Types of deafness

1) Conductive deafness:

It results from interference with the proper conduction and amplification of sound waves through the external and middle ears.

2) Sensorineural deafness:

It results from a lesion in the receptive part of the inner ear or the auditory pathway (basilar membrane, organ of Corti, auditory nerve or auditory cortex).

Deafness

	Conductive Deafness	Sensorineural Deafness
Causes	**a) Causes in the external ear:** •Obstruction of the ext. meatus by accumulation of wax, foreign body, inflammation or tumour. **b) Causes in the middle ear:** • Tympanic membrane perforation • Middle ear inflammation (acute and chronic otitis media). • Bony ossicles otosclerosis • Eustachian tube obstruction as in common cold.	**a) Damage of hair cells** due to: ✓Prolonged use of antibiotics e.g. streptomycin. ✓Prolonged exposure to high intensity sounds as in airports and noisy factories. b) Meneier's disease c) Damage of the cochlear nerve or auditory cortex due to severe head injuries or tumors.
Character	-Air conduction is more affected than bone conduction -All frequencies are affected equally.	-Both air conduction and bone conduction are affected equally -Some frequencies are affected more.

Hearing Tests

1- Whispered voice test:→ detect the presence of hearing impairment.

2-Tuning Fork tests → differentiate between types of deafness

3- Pure Tone Audiometery (PTA)→

- Detect the presence of deafness
- Differentiate between types
- Determine the degree of hearing loss and speech discrimination

Speech tests

(Whispered voice test)

- The normal person can hear **whisper voice at 6** meters and sound of **normal conversation up to 12meters**.
- When the person needs **shorter distances** to hear theses sounds→ presence of **hearing loss or deafness**

Tuning Fork tests

- **The frequency of fork may be 128,256, 512, 1024, 2048.**
- **The most common frequency used is 512 Hz**

Weber Test

Principle: It can detect unilateral (one-sided) conductive hearing loss and unilateral sensorineural hearing loss

Procedure:

- A vibrating tuning fork is placed in the middle of the forehead, or on top of the head equi-distant from the patient's ears, in contact with the bone.
- The person is asked to report in which ear the sound is heard louder.

Interpretation:

a. Normal person → hears equally on both sides.

b. Conductive deafness → sound in diseased ear is louder than normal ear

c. Perceptive deafness → sound in normal ear is louder than diseased ear.

Rinne Test

Principle: to compare bone and air conduction hearing in the same ear

Procedure :

- Gently tap the tuning fork (tap it on a book or on your knee or elbow).
- place it on mastoid process (bone conduction; BC) until the subject reports that he no longer hears vibration
- then held it in air next to ear (air conduction; AC) asking the person to report when sound is no longer heard

Rinne Test

Interpretation:

a. Normal hearing persons will note air conduction twice as long as bone conduction (AC >BC; Rinne positive)

b. With conductive hearing loss, bone conduction sound is heard longer than or equally as long as air conduction (BC >AC; Rinne's negative)

c.With sensorineural hearing loss, air conduction is heard longer than bone conduction in affected ear, but less than 2:1 ratio (reduced +ve Rinne)

Schwabach Test

Principle: compare bone conduction of patient with that of physician.

Procedure : Strike a 512 Hz tuning fork softly

and place it on the mastoid of patient and then place it on mastoid process of physician

Results:

a. Normal person → patient = physician.

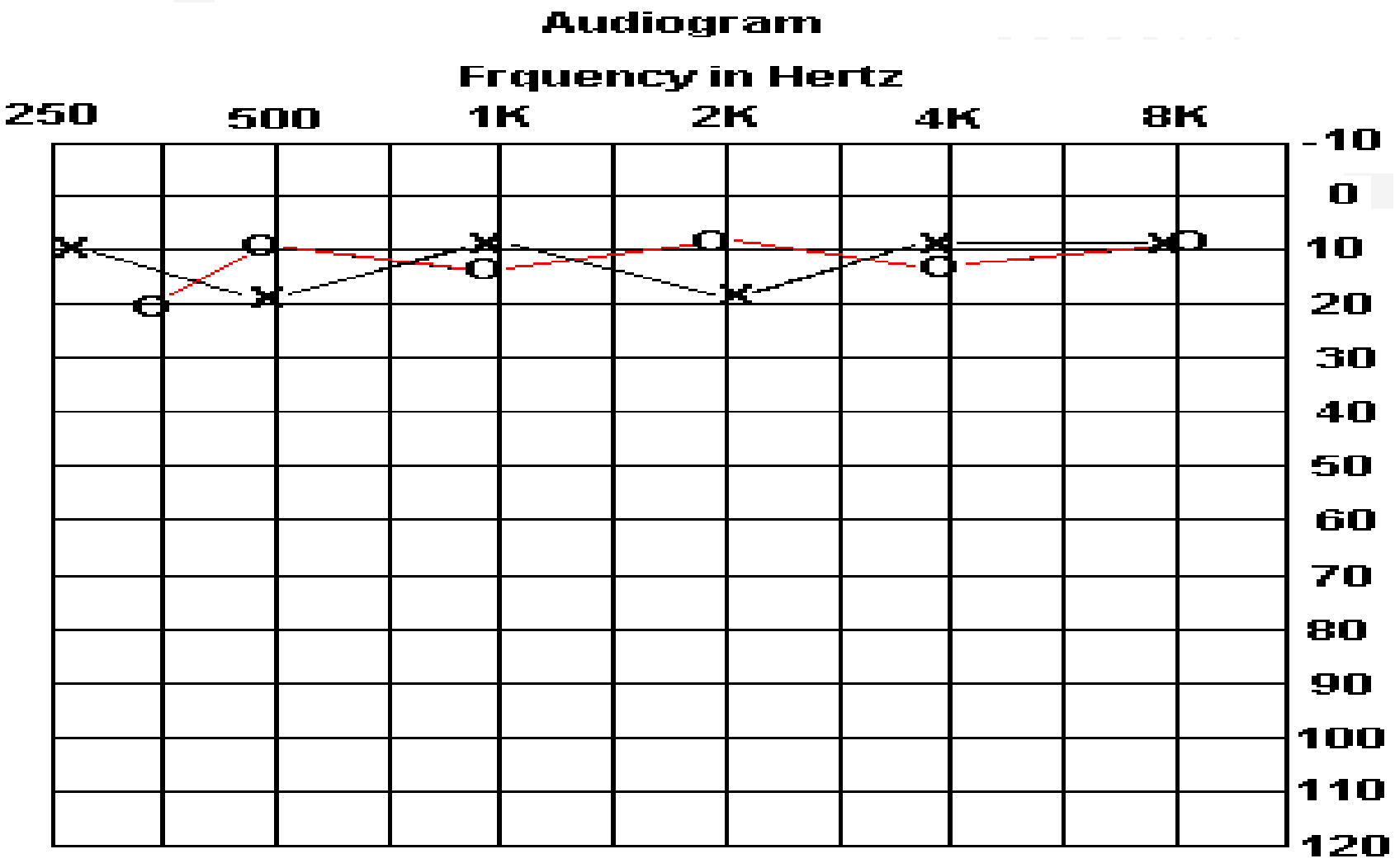
b. Conduction deafness (one ear) → patient > physician.

c. Nerve deafness (one ear) → patient < physician.

Pure Tone Audiogram (PTA)

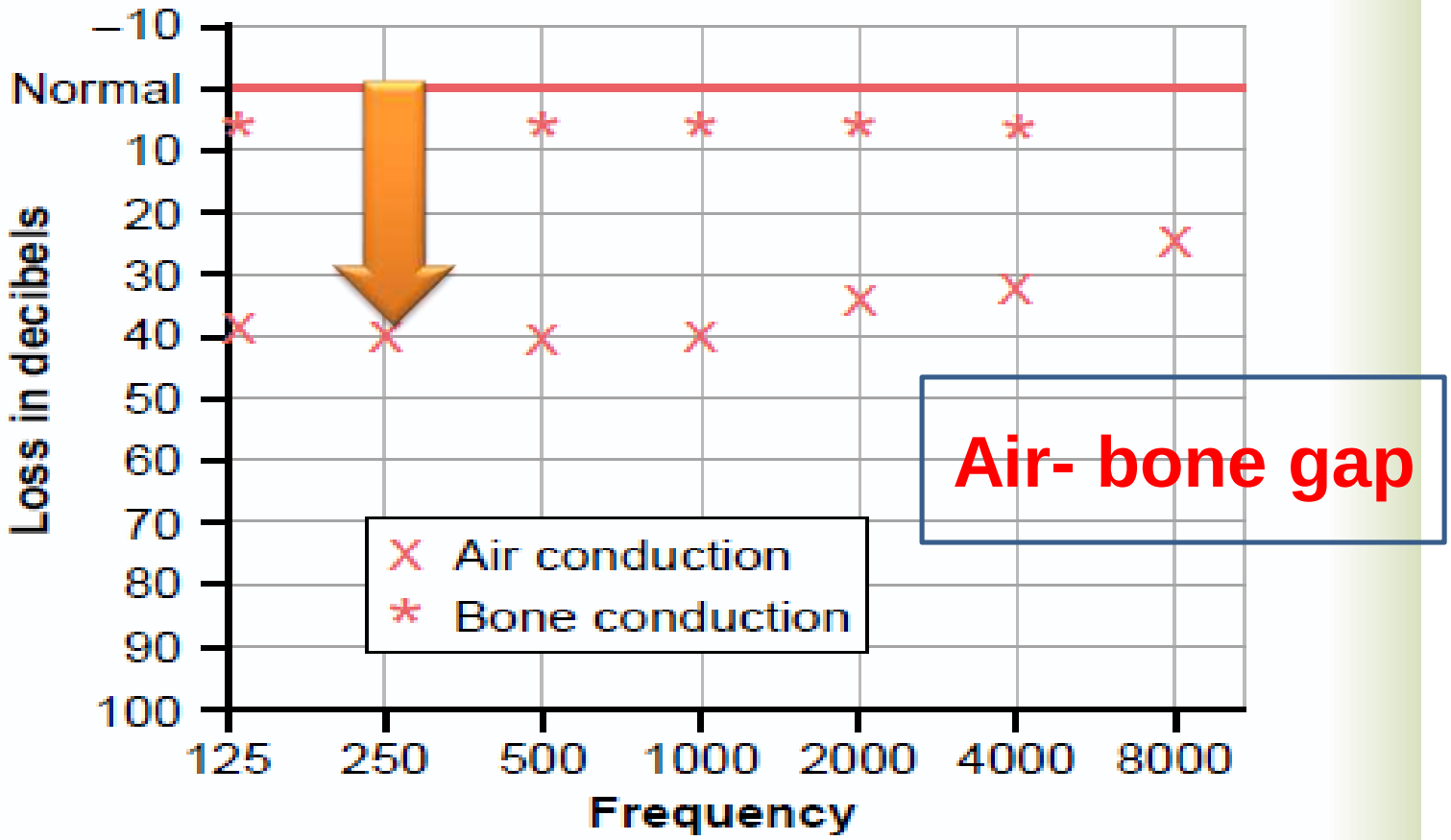
- **Pure tone audiometry (PTA) tests the hearing of both ears**
- **During PTA, a machine called an audiometer is used to produce sounds at various intensity (measured in decibels) and frequency (measured in Hz).**
- **Each ear is tested separately**
- **The person being tested listens to the sounds once through headphones (testing air conduction) and then once through a vibrator on mastoid process (testing bone conduction) and responds when they hear them by pressing a button.**
- **The doctor will reduce the intensity of a tone until the patient can not hear it then increases it gradually until the patient hears it again**
  - **When the intensity of sound is very low, it is not heard, but if it is increased slowly till a certain value at which the sound is heard, this is the threshold of hearing.**
  - **The higher the threshold of hearing, the lower the acuity of hearing and the more the degree of deafness**

Pure Tone Audiogram (PTA)



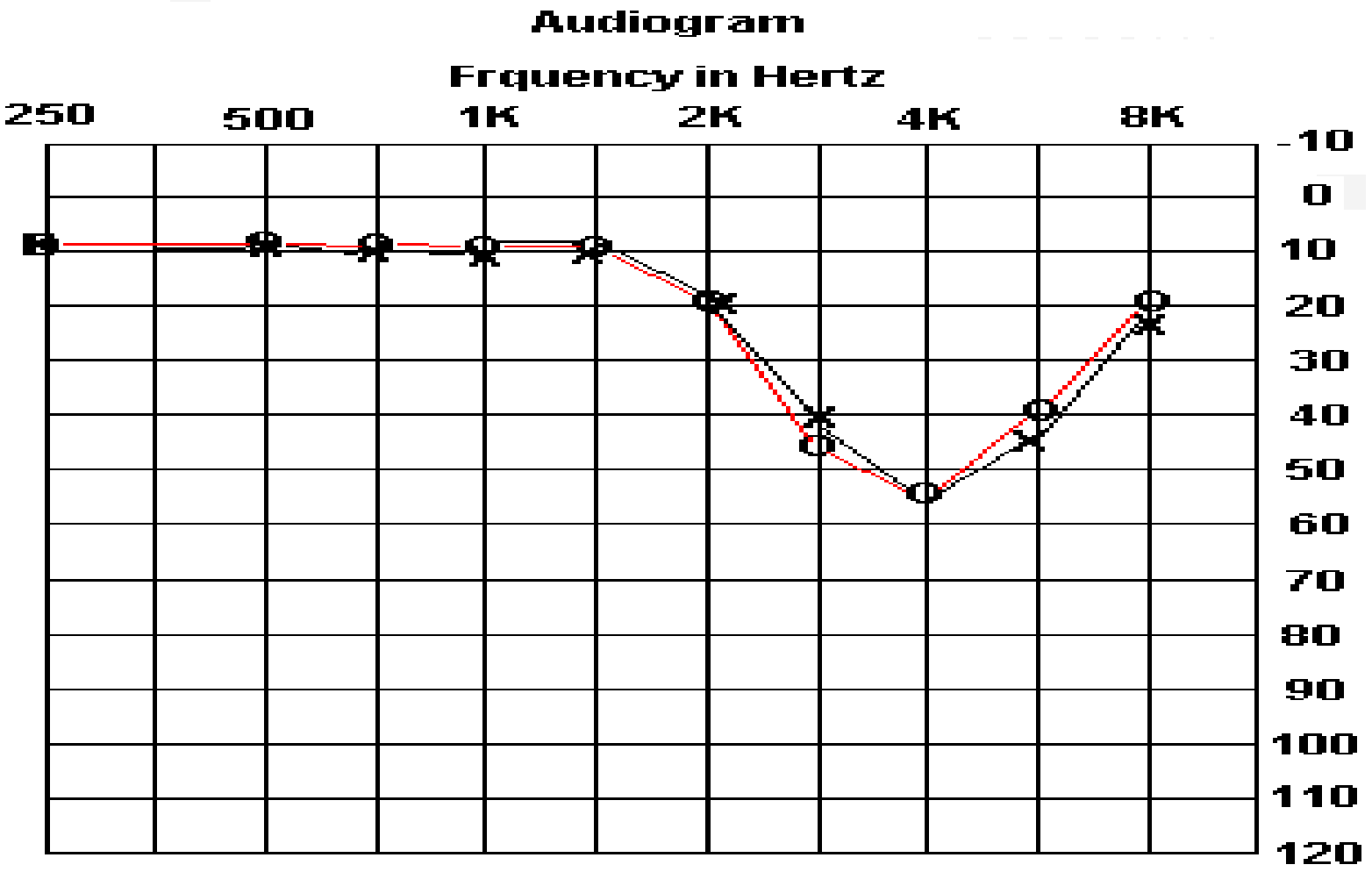
Normal person

Pure Tone Audiogram (PTA)



Conductive deafness

Pure Tone Audiogram (PTA)

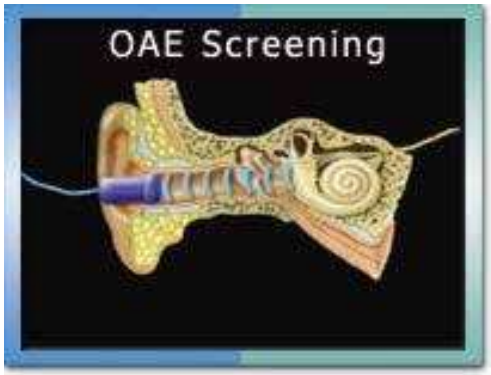


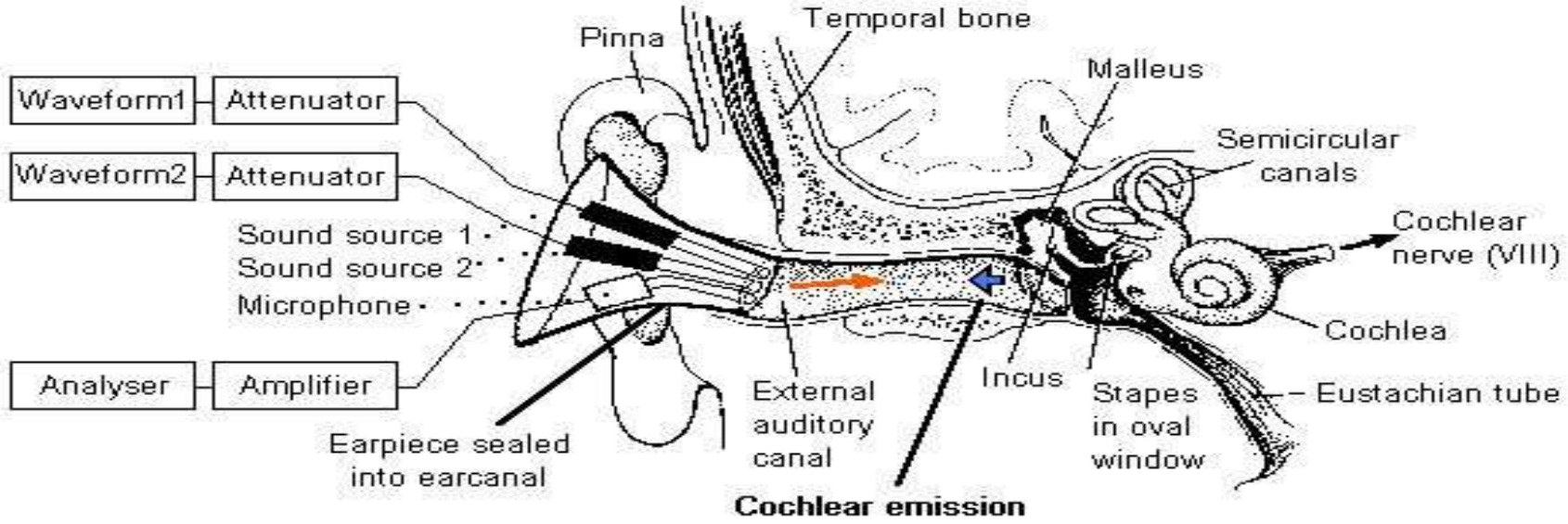
Sensorineural deafness

Oto-Accoustic Emission

- Otoacoustic emissions (OAEs) are vibrations created by contractions of the outer hair cells that are located in the cochlea.
- The identification and recognition of sounds of different frequency is thereby amplified.
- The outer hair cell contraction generates a vibration within the cochlea that is retrogradely transduced to the middle ear. There, it is transduced by the ossicles to the eardrum, that is brought to vibration.
- These vibrations create sounds that can be recorded in the ear canal.
- These sounds are soft, but potentially audible, infrequently amounting to as much as 30 dB SPL.

- **For detection of these OAEs, normal middle ear function is mandatory.**
- **OAEs are generated only when the organ of Corti is in normal or near normal condition and their presence, therefore, is indicative of normal middle ear and cochlear function.**





THANK YOU