



Biology of the ear



[http://www.nal.gov.
au/images/conductive-loss-new.jpg](http://www.nal.gov.au/images/conductive-loss-new.jpg)

Agenda

- **Pre-test**
- **Lecture**
- **Group Gesture**
- **Types of hearing losses**
- **Audiograms**
- **Views**
- **Post-test**

Pretest!!

- **See how much you know**
- **Answer questions and label the parts of the ear**

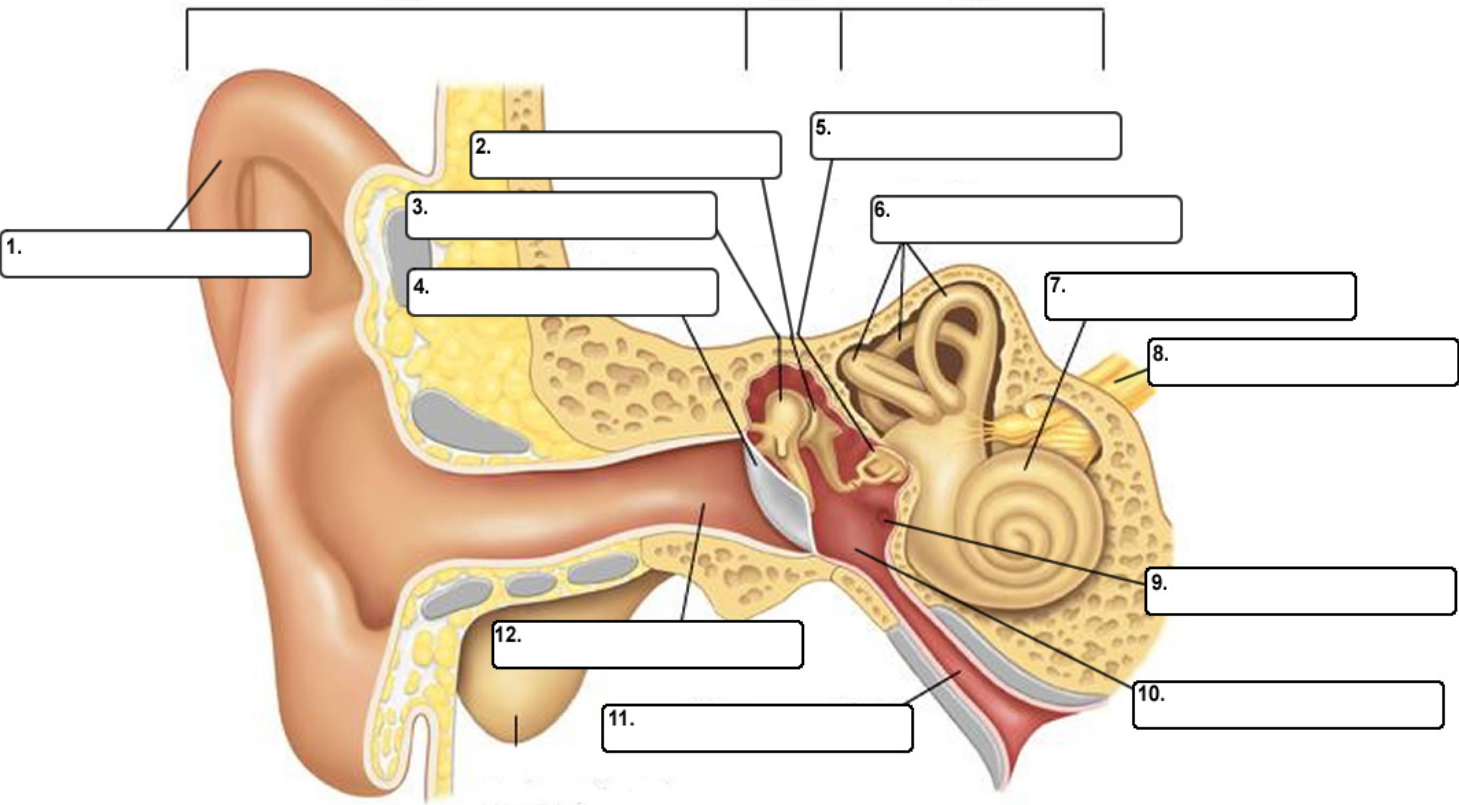
Purposes:

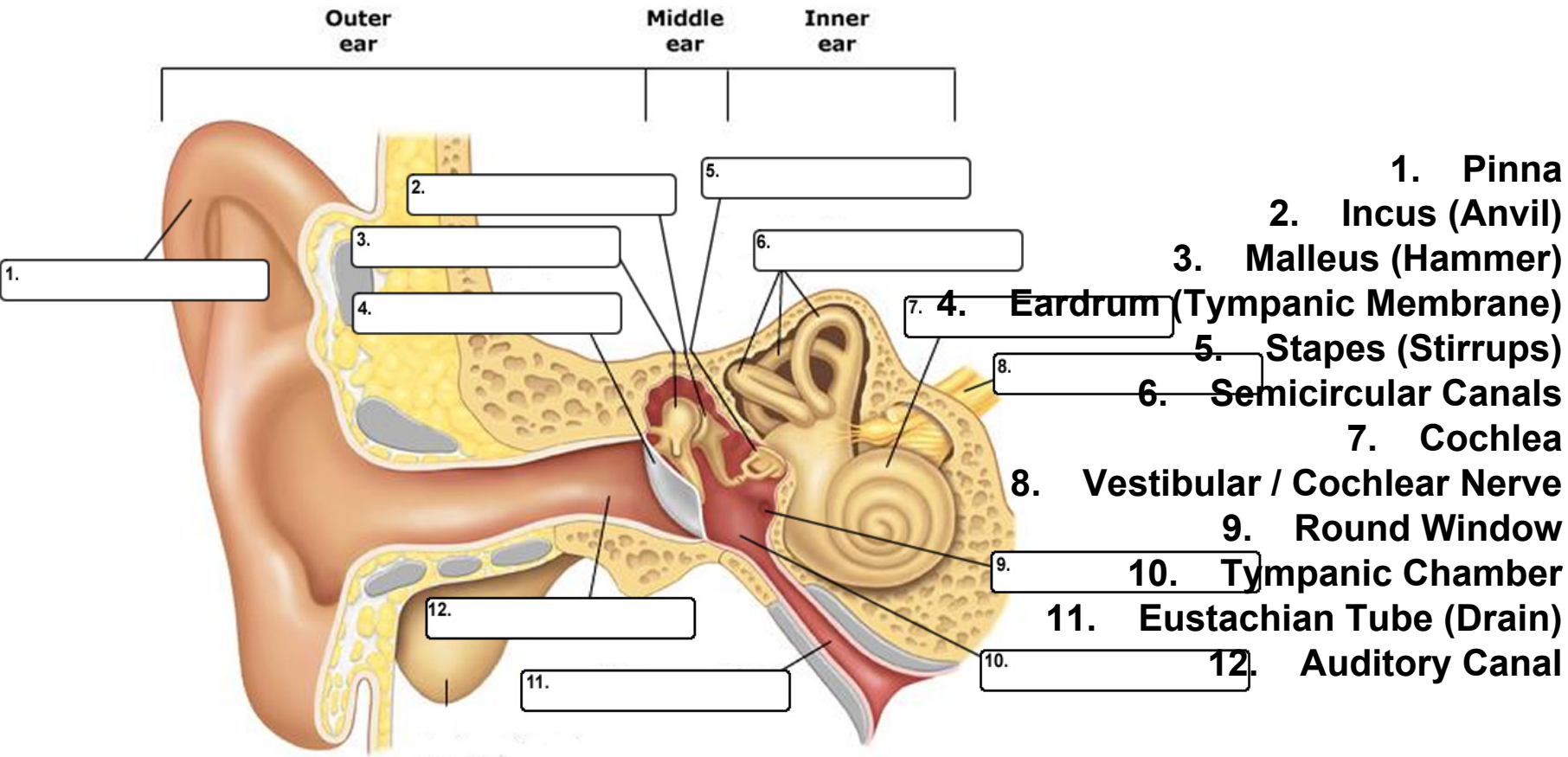
- **To understand the basic function of the ear.**
- **To be able identify parts of the ear.**
- **Learn the types of hearing losses and causes of deafness.**
- **To be able understand audiograms.**
- **To be able understand the difference between medical and cultural of deafness.**

Outer ear

Middle ear

Inner ear





1. Pinna

2. Incus (Anvil)

3. Malleus (Hammer)

4. Eardrum (Tympanic Membrane)

5. Stapes (Stirrups)

6. Semicircular Canals

7. Cochlea

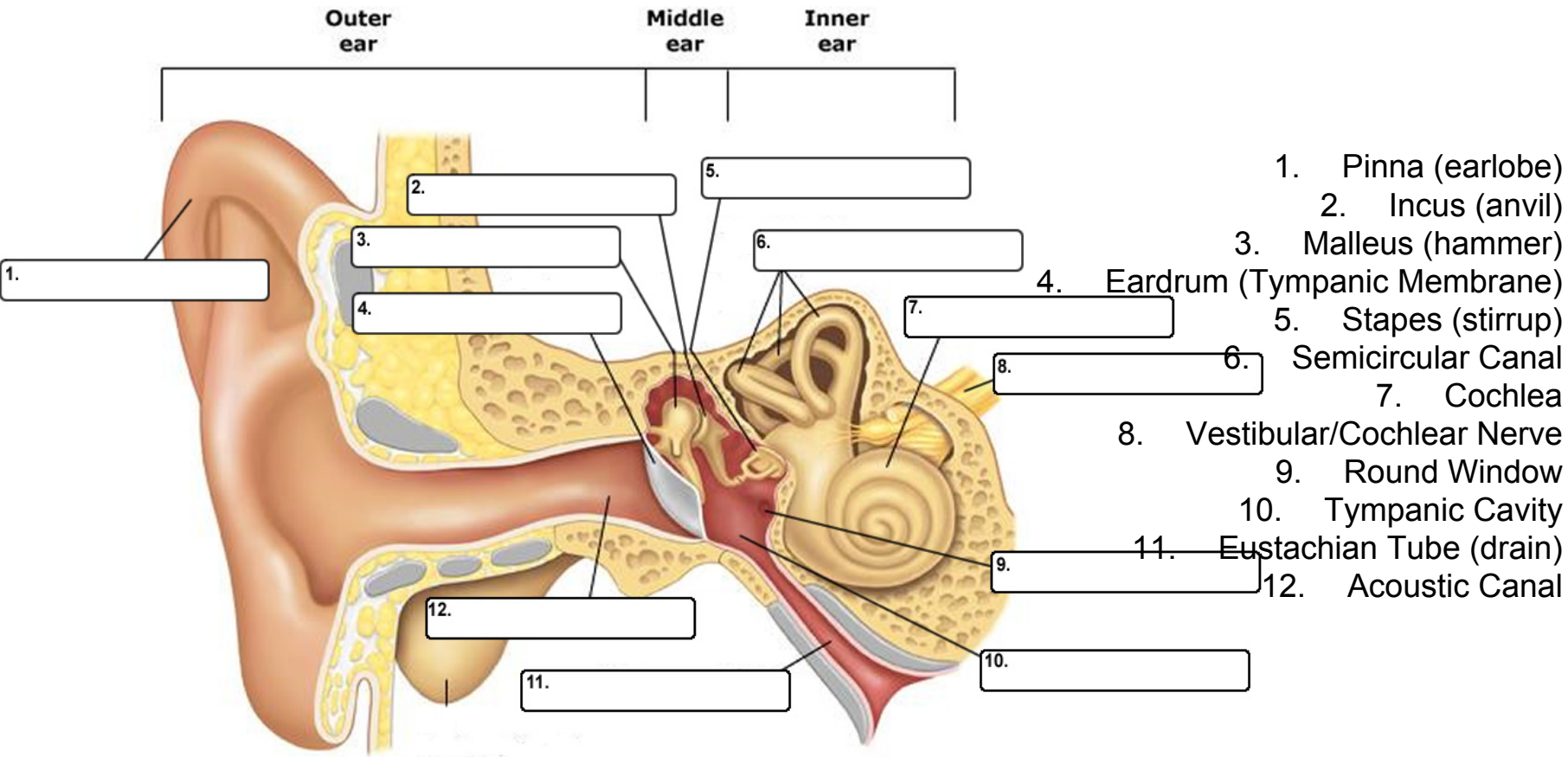
8. Vestibular / Cochlear Nerve

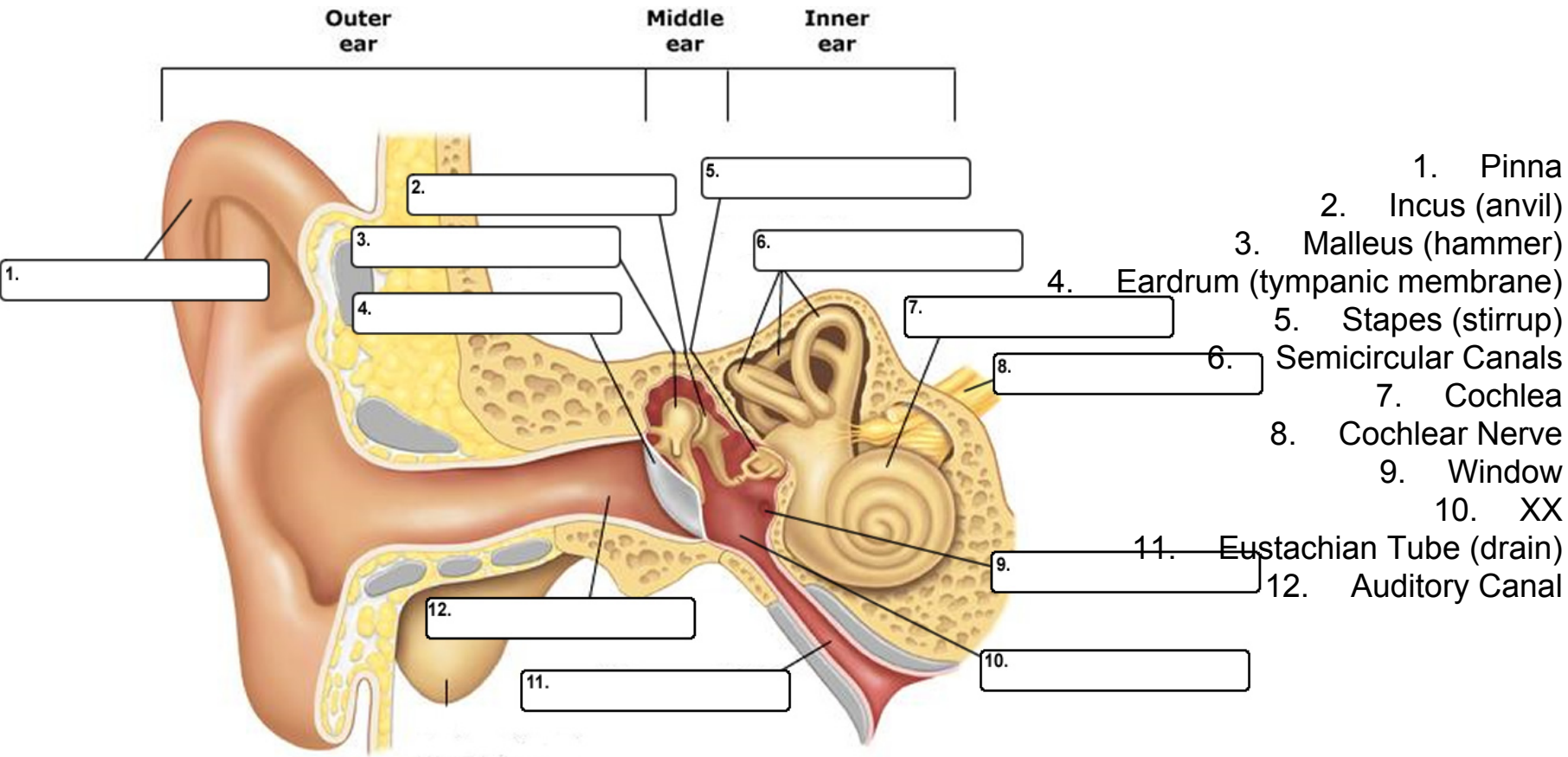
9. Round Window

10. Tympanic Chamber

11. Eustachian Tube (Drain)

12. Auditory Canal





1. Pinna

2. Incus (anvil)

3. Malleus (hammer)

4. Eardrum (tympanic membrane)

5. Stapes (stirrup)

6. Semicircular Canals

7. Cochlea

8. Cochlear Nerve

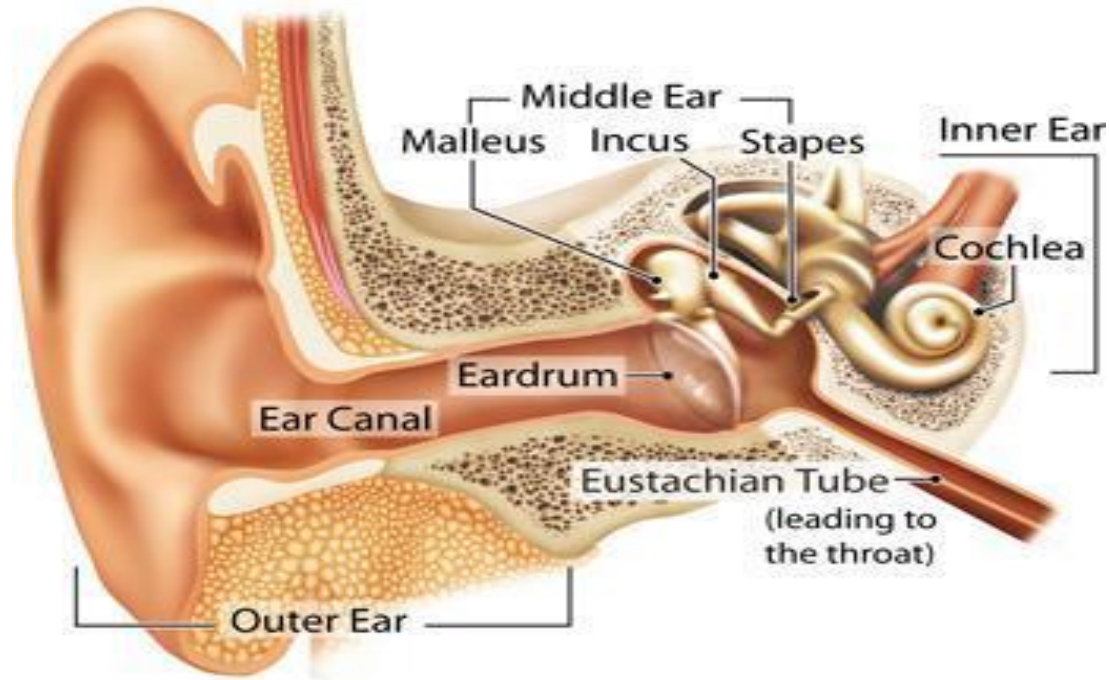
9. Window

10. XX

11. Eustachian Tube (drain)

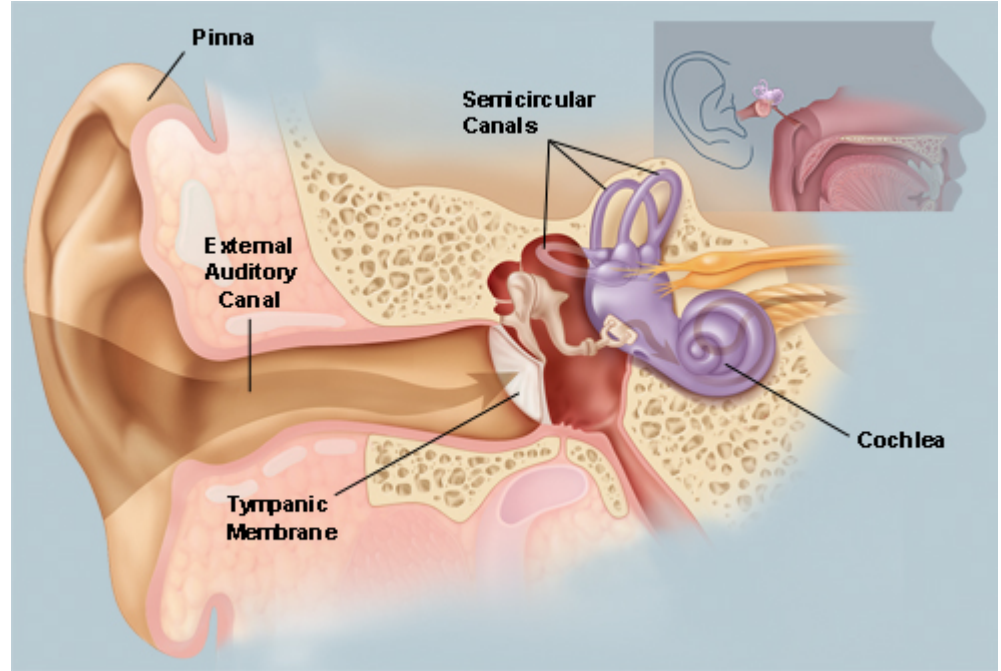
12. Auditory Canal

Anatomy of the ear



Outer ear

- **Pinna**
 - **Ear Canal**
 - **Ear Drum**
- (Tympanic Membrane)



Middle ear

- Ossicular chains
- Malleus, Incus and Stapes
 - Parts of ear drums
 - Known as hammer, anvil and stirrup
 - Smallest bone in the body!!
- Eustachian Tube
 - Fluids

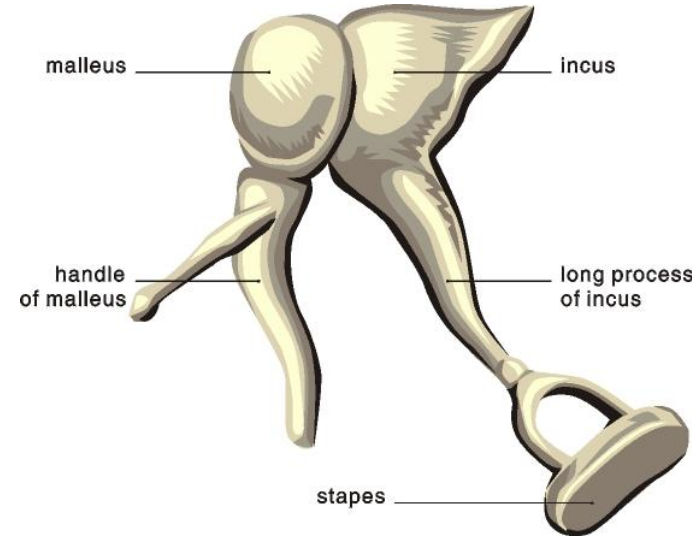
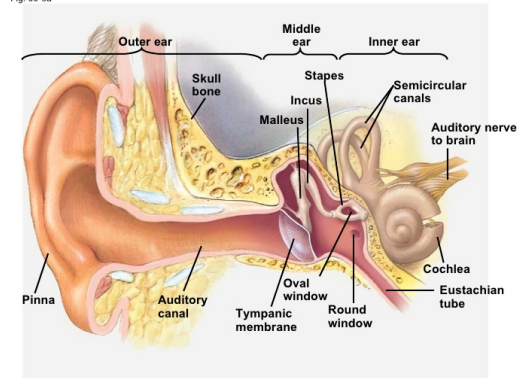
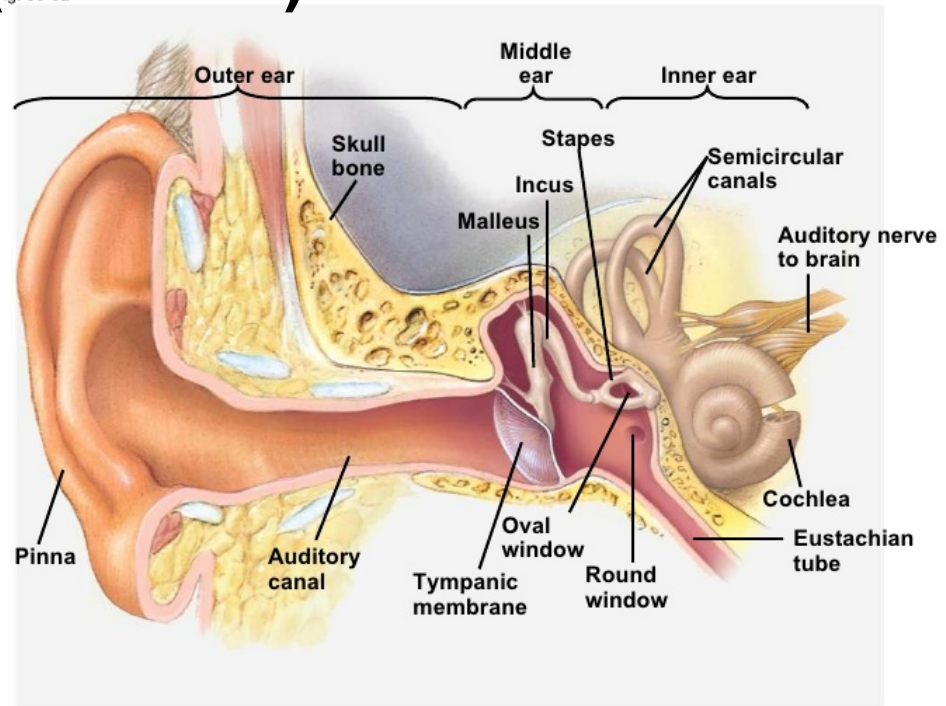


Fig. 50-8a

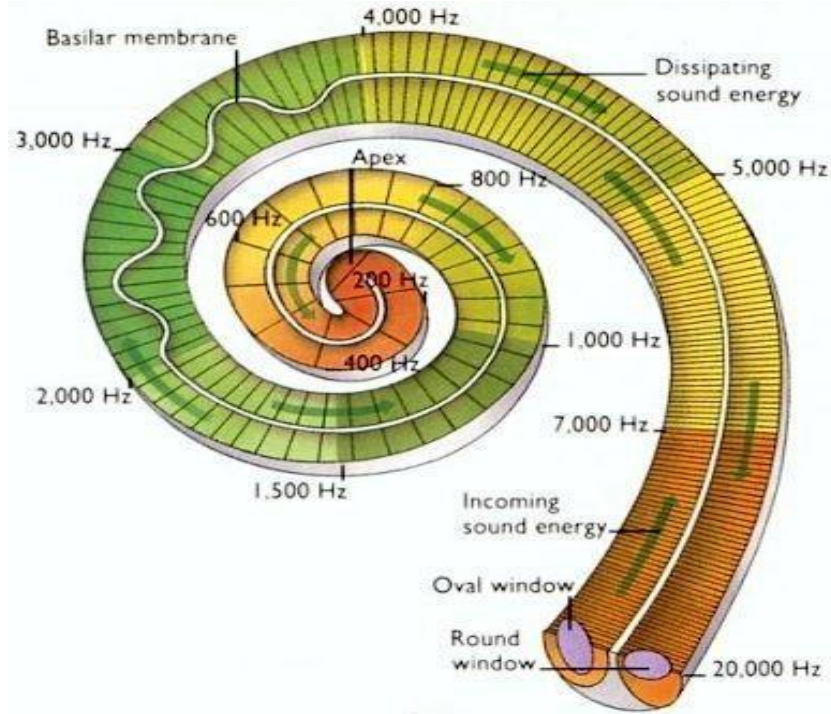


Inner ear

- Semicircular Canals (balance)
- Vestibular nerve
- Cochlea (hearing)
- Cochlear nerve
- Cochlea hair



Cochlea and frequency



- How the ear works

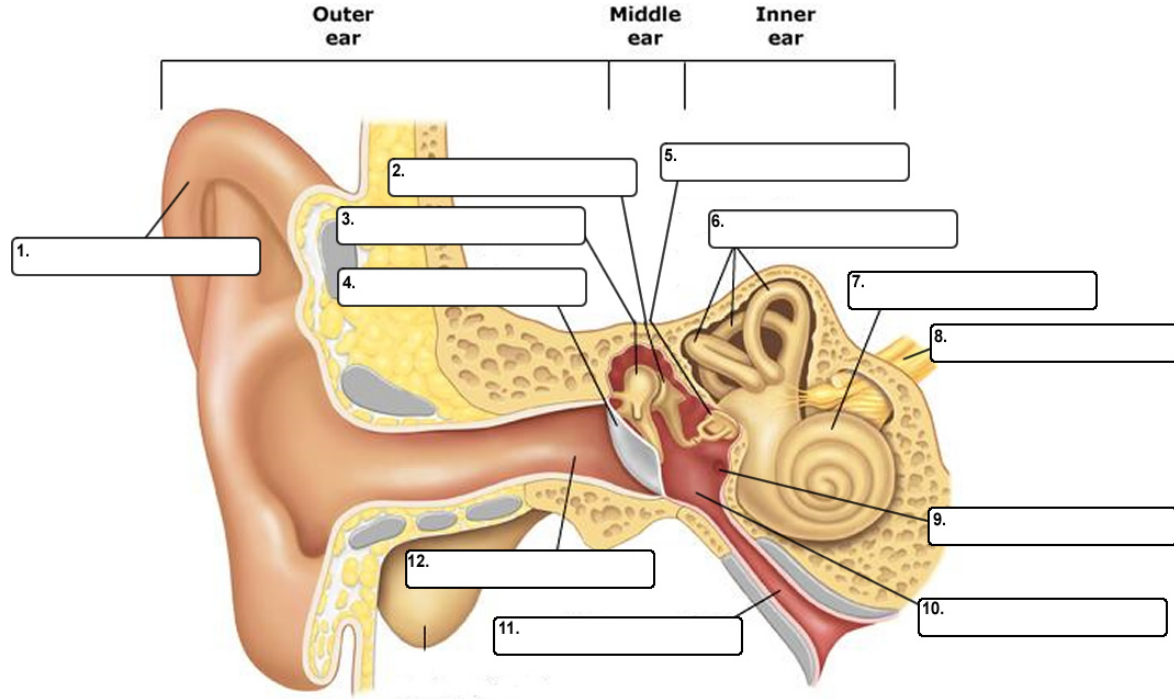
Gesture

- **Three groups; each group are responsible for outer, middle and inner ear parts.**
- **As a group, you have to figure out how to gesture each part of the ear.**
- **When you are all done discussing, ALL groups have to work together to make the ear “work.”**

<https://www.youtube.com/watch?v=qNf9nzvnd1k>

Review

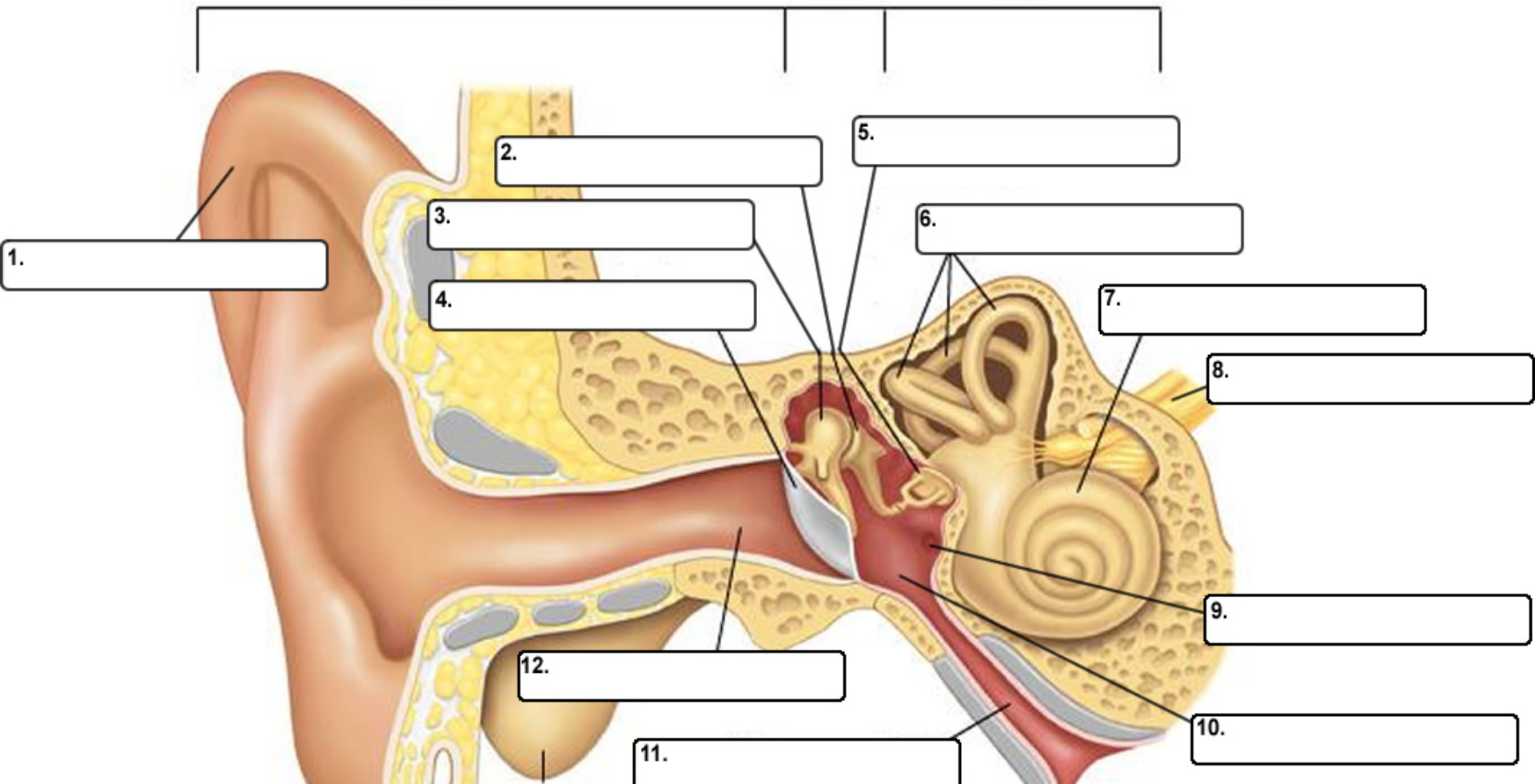
- Semicircular canals
- Vestibular nerve
- Ear Canal
- Cochlear nerve
- Malleus
- Incus
- Stapes
- Ear Drums
- Cochlea
- Cochlear hair
- Pinna
- Outer ear
- Inner ear
- Middle ear
- Eustachian Tube



Outer ear

Middle ear

Inner ear



Situations

- **Normal hearing**
- **Hard-of-hearing**
- **Deaf**

4 common causes of Deafness

4 common causes of Deafness

- **Genetics**
- **Illness**
- **Trauma/Environment**
- **Medicines**

Causes of Deafness

- **Congenital Deafness (Occurring prior to birth)**
 - **Heredity (Deaf family, chromosome 26)**
 - **Rubella (German Measles, responsible for 10% of congenital deafness. During epidemics in 1960's, the percentage rises up to 50%)**
 - **Unknown**

Causes of Deafness

- **Perinatal Deafness (Occurring at the time of birth)**
 - **Premature, and blood type incompatibility.**

Causes of Deafness

- **Adventitious Deafness (Occurs during later stage of life)**
 - **Illness; ear infection, measles & mumps, and spinal meningitis.**
 - **Usher's syndrome**
 - **Aging, environment, concerts, etc.**

3 Types of hearing loss:

-Conductive HL (Outer/middle)

-Sensoneural HL (Inner)

-MixedHL (both)

Conductive Hearing Loss (CHL)

Middle ear



CHL's causes of damage are:

- Born without pinna (ear)**
- Sharp objects**
- Loud noises**
- A hard hit**
- Illness (cold or fluids into ear)**

Hearing Aids

- Assist people with CHL



Image courtesy of The American Academy of Audiology

Sensorineural Hearing Loss (SHL)

“Nerve Loss”

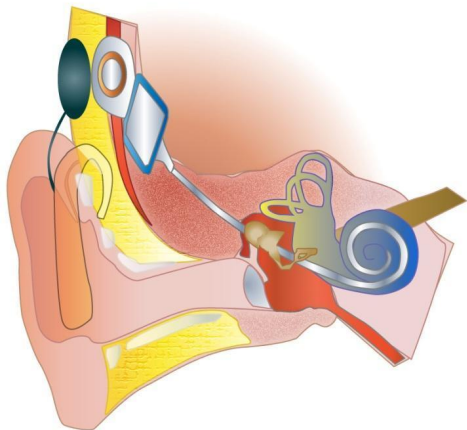


SHL causes of damages are:

- **Premature**
- **High fever**
- **Illness (Mumps, measles, chicken pox, flu)**
- **Heredity**

Cochlear Implant (CI)

- This device replaces a damaged cochlea



Gross picture...ready??

Cochlear Implant surgery

Gross picture...ready??

Cochlear Implant surgery



Brain Stem Implant

- **This device goes deeper into the brain.**

Stem Cell Therapy

- **This process tries to regrow damaged tissue**

Mixed Hearing Loss (MHL)

- There are damages to the inner and the middle/outer ear.
- One ear has a nerve loss and other has a conductive loss.

Hearing test for babies

One of the tests is called Otoacoustic emissions or OAEs.

For this test, a miniature earphone and microphone are placed in the ear, sounds are played and a response is measured. If a baby hears normally, an echo is reflected back into the ear canal and is measured by the microphone. When a baby has a hearing loss, no echo can be measured on the OAE test.

Auditory Brainstem Response

The second test is called the auditory brainstem response or ABR. For this test, sounds are played to the baby's ears. Band-aid like electrodes are placed on the baby's head to detect responses. This test measures how the hearing nerve responds to sounds and can identify babies who have a hearing loss.

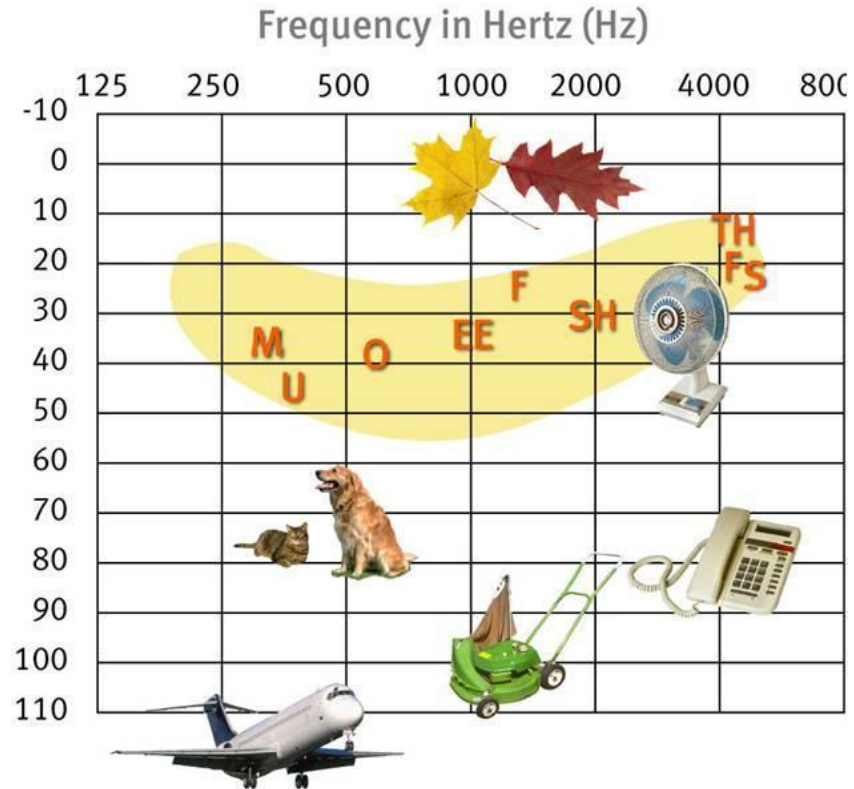
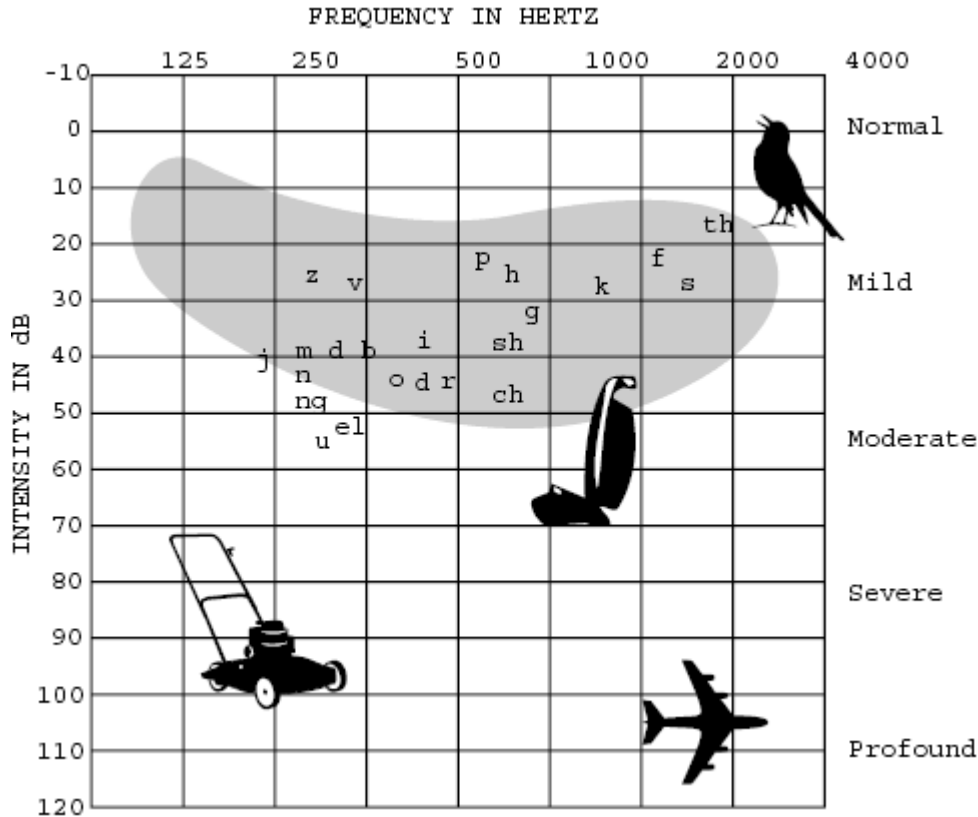
Audiogram

Pitch = Frequency (hz)

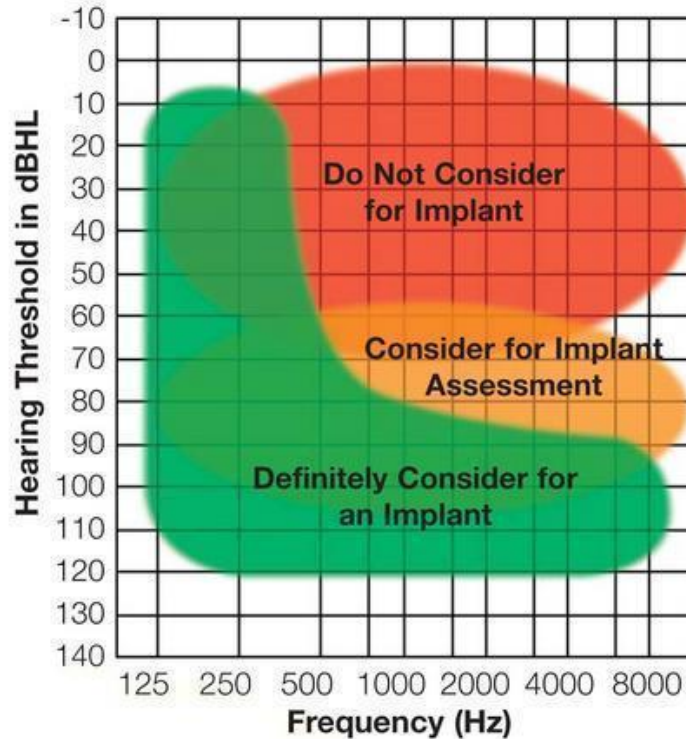
Loud = Decibels (db)



Speech Banana



Cochlear Implant candidates

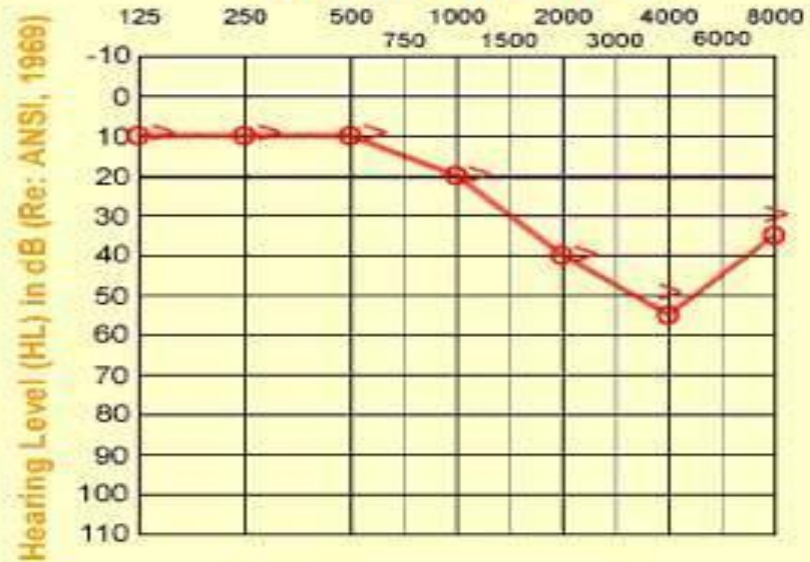


Pure Tone Average (PTA)

- X = left ear 0 = right ear
- To calculate your PTA, add the number at 500, 1,000 and 2,000 (hz) then divide by 3.
- Decibels = db is by numbers, not percent!

Sensorineural Hearing Loss Audiogram

Frequency in Hertz (Hz)



Legend

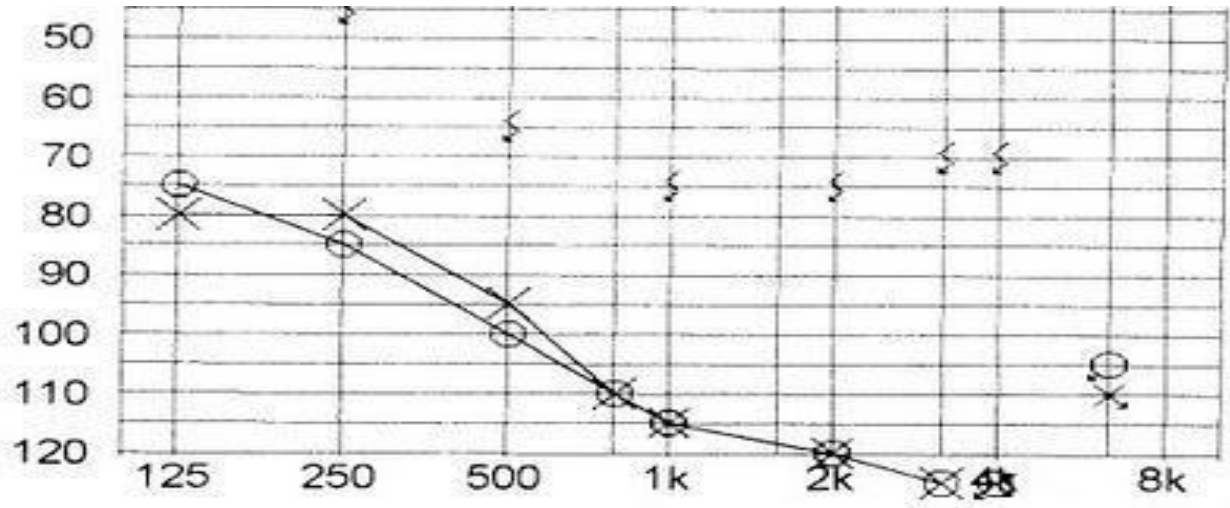
Air Conduction



Bone Conduction



x = left ear, 0 = right ear



Audiograms

- **Buffy = Deaf at birth, unilateral hearing aid**
- **Guthrie = Deaf at birth, bilateral hearing aids**
- **Chad = Deaf at birth, Cochlear Implant**
- **Iza = Hard-of-hearing, unilateral hearing aid**

Medical and Cultural Views

- **Medical:** *Focuses on what deaf people cannot do.*
Focuses on medical terms and attempt to “fix” them. (Handicaps, etc)
- **Cultural:** *Focuses on what Deaf people can do!*
Focuses on the language, experiences and values of a group of people who happen to be deaf. (Different)

Lowercase d or capital D?

- **deaf** = a physical state of not being able to hear most or all speech sounds. (Medical)
- **Deaf** = identifies a person, community, or other group as a member of the Deaf cultural group. (Cultural)

Hard-of-hearing

- **A hard-of-hearing person is someone with a mild hearing loss who is able to hear and understand most speech sounds (w/ or w/o hearing aids)**
- **Usually are not members of the Deaf community.**

Deaf culture ways 😊

- **DEAF: MUST** look right at the person while conversing.
- **HEARING:** Can look around and not be considered rude.

- **DEAF:** Will hug good bye... even if you've just met... or ILY. Tapping or touching to grab attention is okay.
- **HEARING:** Hugging and touching is not acceptable until you really know that person

- **DEAF:** Saying good byes can sometimes take 30 minutes or longer. Because they have to talk to everyone using their eyes before they leave. You will see deaf group in front of a closed restaurant because they have not finished all their good byes.
- **Known as “Deaf Standard Time” (DST)**
- **HEARING:** Saying good bye may be a few seconds to 5 minutes.

Post-test!

Causes??

- **Medical causes of deafness**: Illness, trauma, genetics, heredity, etc.
- **Cultural causes of Deafness**: Deaf family (at birth), join Deaf community, Deaf school, Deaf university, interpreters, and family members.