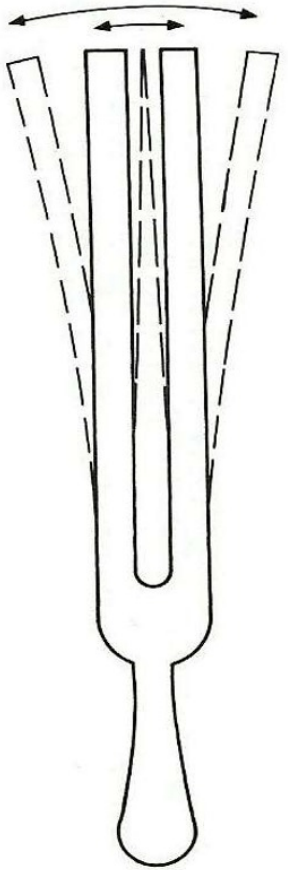
Physiology Lab 2

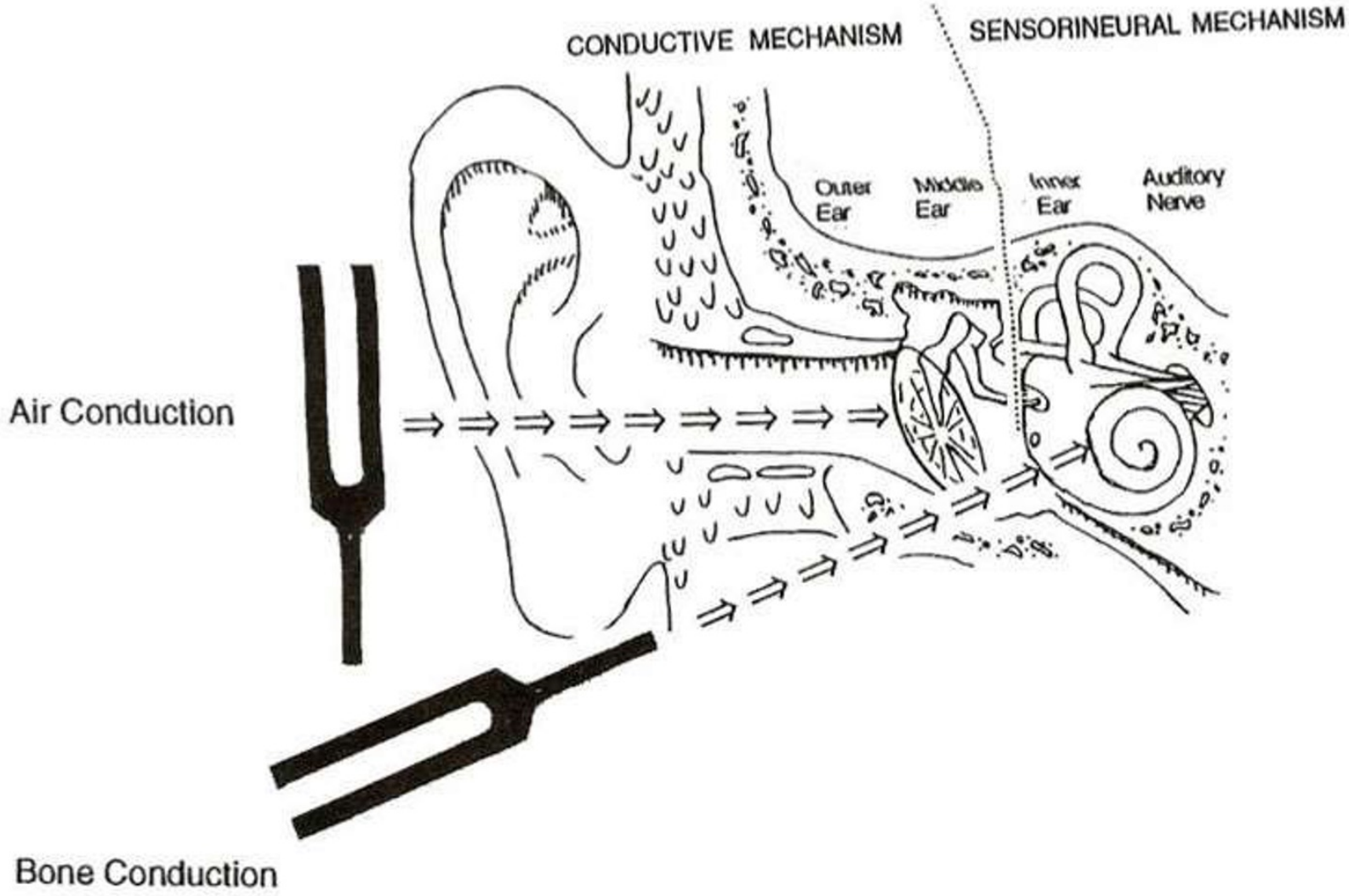
Tuning Fork

- Metal
- Stem, two prongs &foot piece
- Produces constant pitch when either prong is struck against a firm but resilient surface.
- To assess hearing.
- To differentiate between conductive and sensorineural hearing loss.



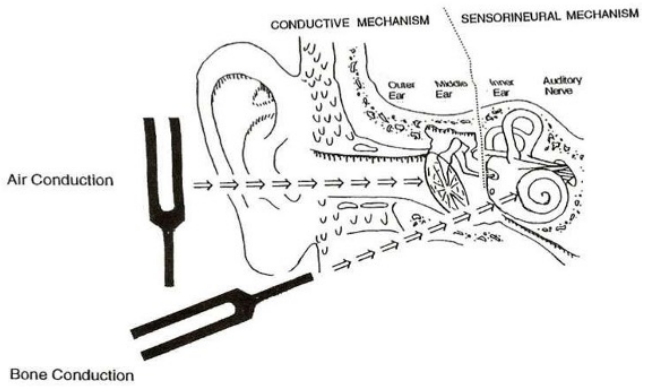
Tuning Fork Test

- Test is performed with different types of frequency.
- Routine practices 256 Hz, 512 Hz, 102 4Hz
- Larger forks vibrate at slower frequency.
- Tuning fork is activated by striking against examiner's elbow, heel of hand and placed 2cm away from **EAC** for Air conduction and on mastoid for Bone conduction.


CONDUCTIVE MECHANISM
SENSORINEURAL MECHANISM
Outer Ear
Middle Ear
Inner Ear
Auditory Nerve
Air Conduction
Bone Conduction

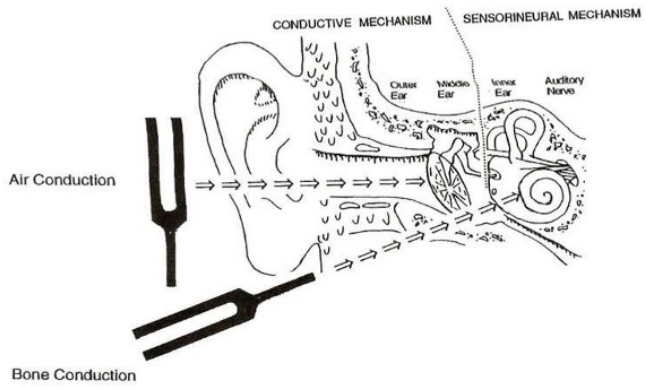
Air Conduction (AC)

- Vibrating tuning fork is placed **vertically** in line with the meatus about 2 cm away from the EAC opening.
- The sound waves transmitted through TM –Middle ear ossicles-Inner ear –Auditory Nerve –Auditory Cortex.
- Both Conductive mechanism and Cochlea are tested



Bone Conduction (BC)

- Foot plate of Vibrating tuning fork is placed on the mastoid bone.
- Cochlea is stimulated directly by the vibrations conducted through the Skull.
- BC measures only the **cochlear functions**.
- Normally AC will be more than BC



Principles of Tuning Fork Tests

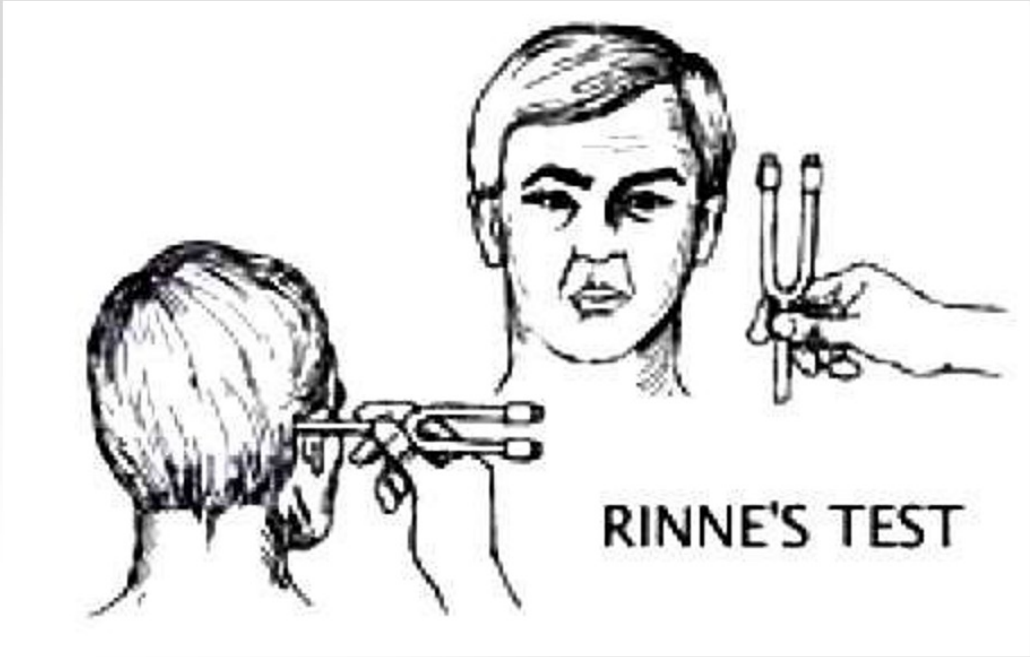
- **Conductive Hearing loss (CHL)**
  - ✓ Sounds delivered to the ear via AC will be decreased
  - ✓ If the sound is delivered to the ear via BC, then the sound will be heard normally.

- **Sensory Hearing Loss (SNHL)**
  - ✓ Sounds delivered to the ear via BC will be decreased.

RINNE Test

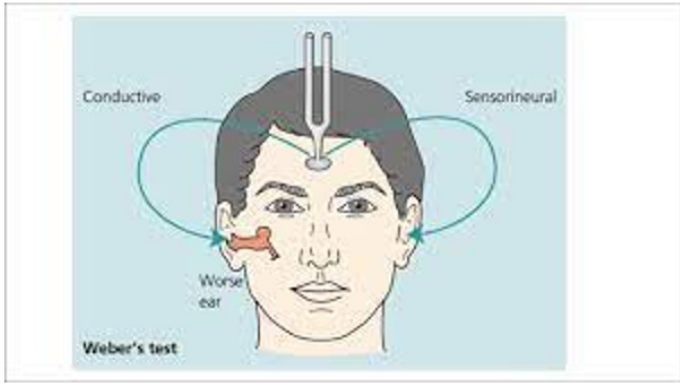
- Air conduction is compared with bone conduction
- The base of Vibrating tuning fork is placed firmly over mastoid process
- Patient is asked to indicate when sound disappears, suddenly the tuning fork is placed vertically 2cm from EAC,

- Normal →If hears still – AC more than BC
- Bone Conduction >Air Conduction =Conductive hearing Loss
- In **nerve deafness**, both air conduction and bone conduction are **diminished or lost**


RINNE'S TEST

WEBER Test

- A test of lateralization
- A vibrating tuning fork is placed in the middle of forehead or the vertex asked in which ear the sound is heard.
- Sound travels directly to the cochlea through bone.



WEBER Test

- **Normal person** hears the sound equally on both sides.

- **In unilateral conduction deafness** (deafness in one ear), the sound is heard **louder** in **diseased** ear→ absence of masking effect of environmental noise.

In **unaffected** ear, there is a masking effect of environmental noise. So, the sound through bone conduction is not heard as clearly as on the affected side.

- **During unilateral nerve deafness**, sound is heard **louder** in the **normal** ear.

Audiometry

- Measuring hearing acuity for variations in sound intensity and frequency.
- To determine the nature and the severity of auditory defect.
- Audiometer connected to an earphone → generating sound waves of different frequencies <u>from lowest to highest</u>.
- Audiometer has an electronic vibrator also. It is used to test the bone conduction from mastoid process into the cochlea.

Ear Phone to test
Air conduction threshold

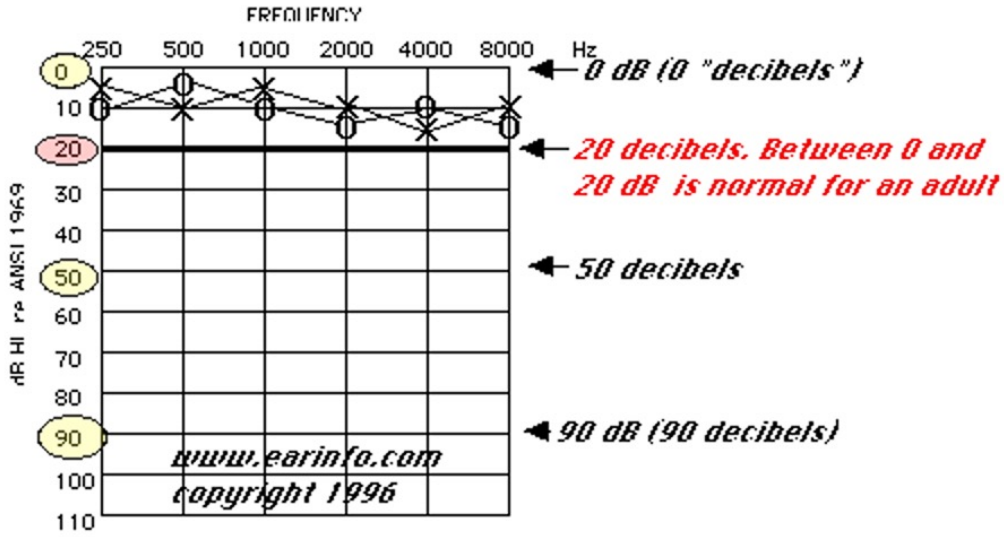
Response switch

Bone oscillator to test Bone conduction threshold

Pure Tone Air Audiometry procedure

- The audiologist present pure tones **of one frequency** to the patient, initially at an **intensity level** that it is assumed they can hear quite well.
- The intensity (loudness) of the tone is decreased in **10 to 15 dB steps**.
- This is continued, until the patient **no longer responds**.
- The **intensity** is then raised in **5 dB** steps until the patient responds, decreased again and increased again in 5 dB steps **until the patient responds.**
- This **lowest audible intensity** is defined as the patient's **threshold** for the particular frequency
- By using these values, the audiogram is plotted.

AUDIOMETRY


FREQUENCY
250 500 1000 2000 4000 8000 Hz
0
10
20
30
40
50
60
70
80
90
100
110
0 dB (0 "decibels")
20 decibels. Between 0 and
20 dB is normal for an adult
50 decibels
90 dB (90 decibels)
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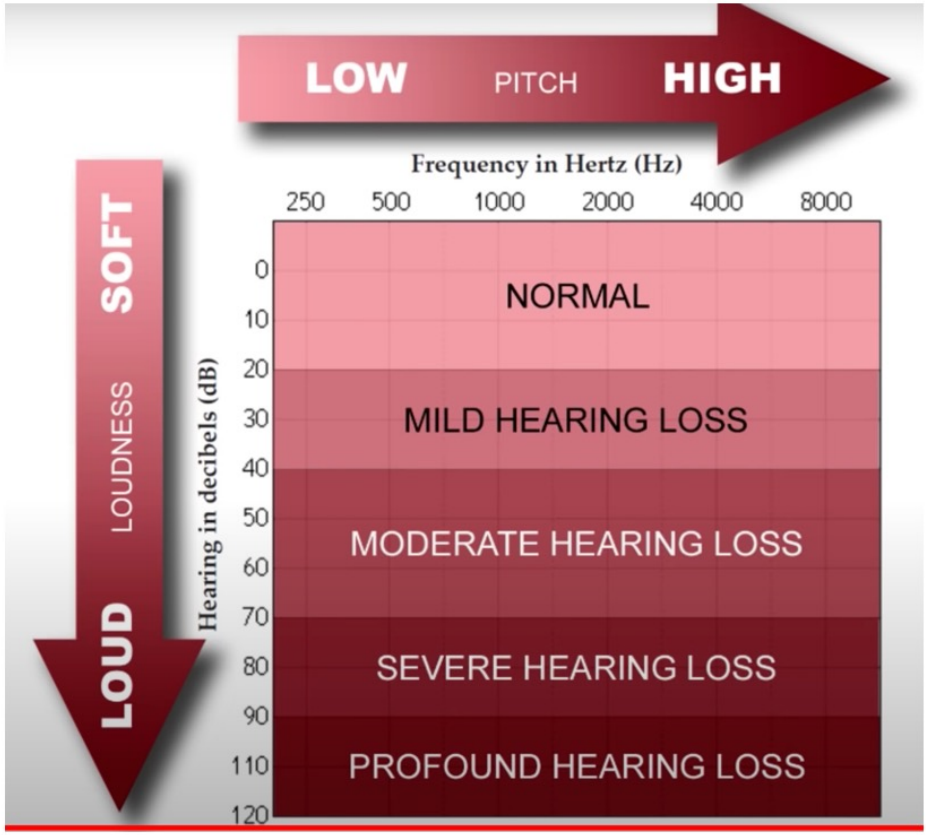
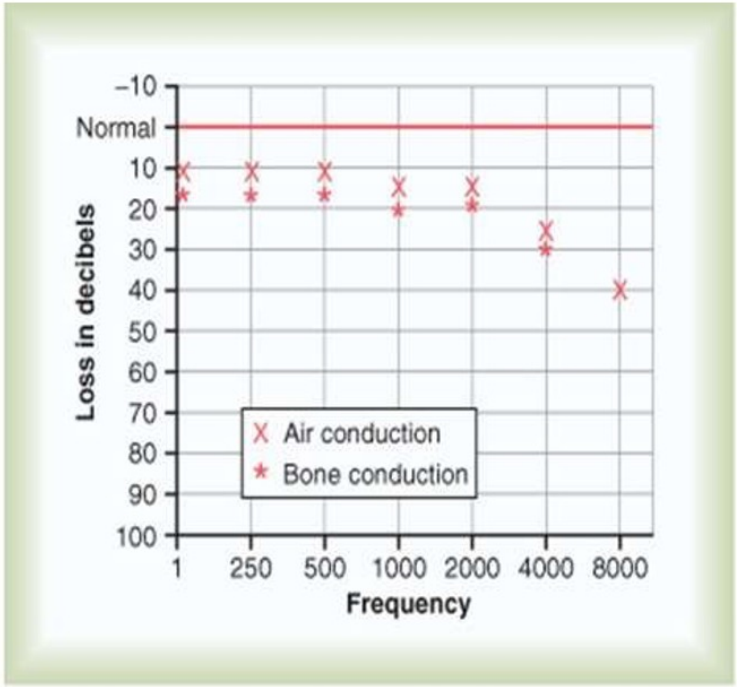

LOW PITCH HIGH
SOFT
LOUDNESS
LOUD
Frequency in Hertz (Hz)
250 500 1000 2000 4000 8000
Hearing in decibels (dB)
0
10
20
30
40
50
60
70
80
90
110
120
NORMAL
MILD HEARING LOSS
MODERATE HEARING LOSS
SEVERE HEARING LOSS
PROFOUND HEARING LOSS

Audiogram in Nerve Deafness.

- damage to cochlea, auditory nerve, or CNS circuits from the ear.
- person has loss of ability to hear sound as tested by **both air conduction and bone conduction**.

- air conduction and bone conduction are similiar
- the deafness is mainly for **high-frequency** sound.
- This type of deafness occurs to some extent in almost all older people.

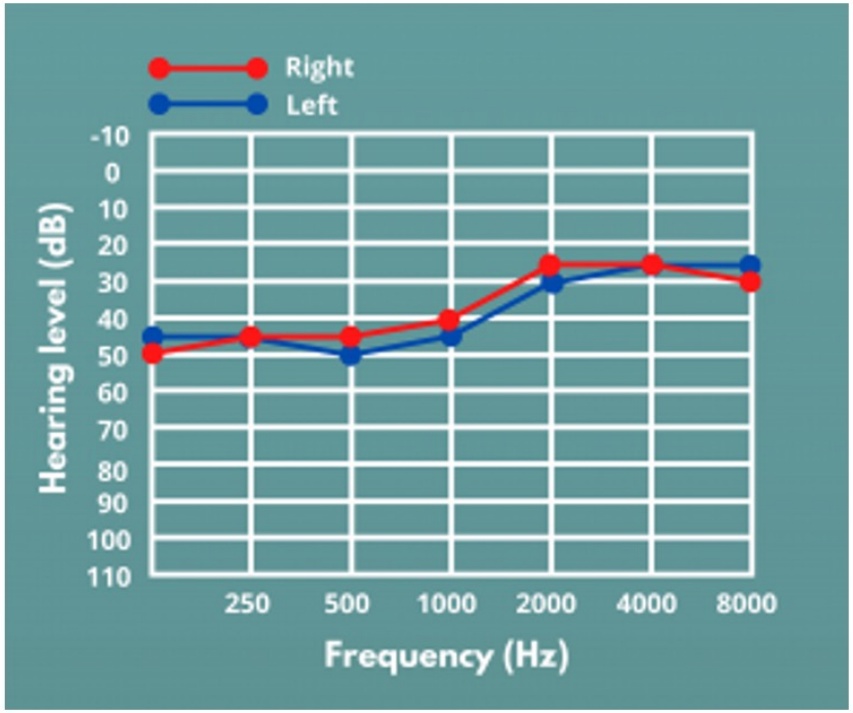


partial nerve deafness

Audiogram in Nerve Deafness.

Deafness for low-frequency sounds

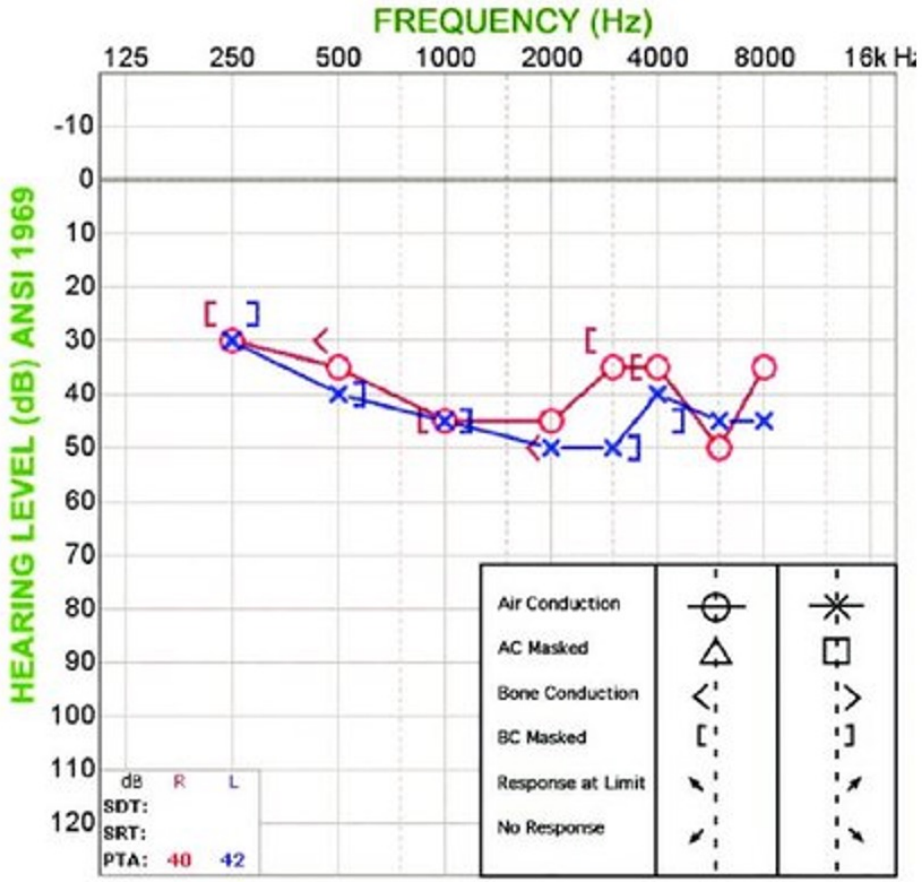
caused by excessive and prolonged exposure to very loud sounds→ because low-frequency sounds are usually louder and more damaging to the organ of Corti



Audiogram in Nerve Deafness.

deafness for all frequencies caused by drug sensitivity of the organ of Corti

streptomycin, gentamicin, kanamycin, and chloramphenicol.



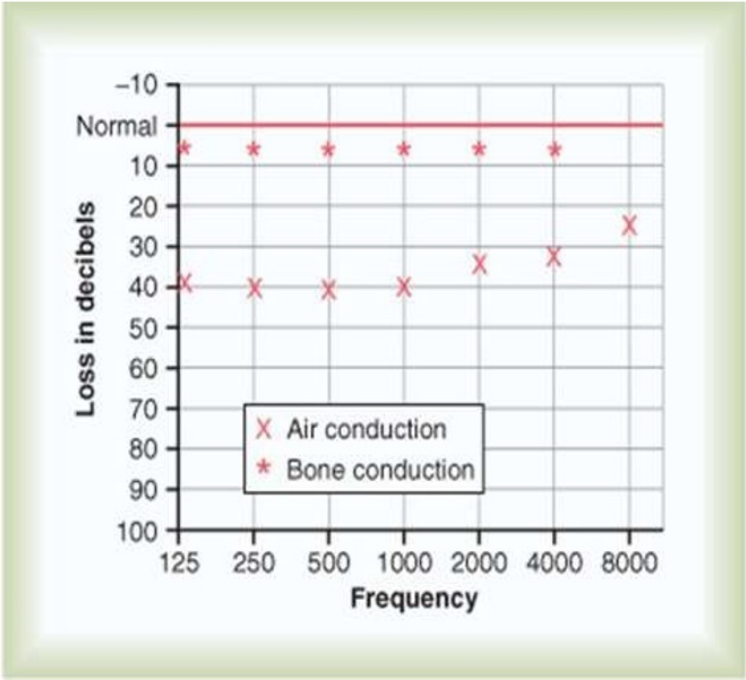
Audiogram for Middle Ear Conduction Deafness

- Causes

fibrosis in the middle ear → repeated infection / otosclerosis.

- sound waves cannot be transmitted easily through the ossicles from the tympanic membrane to the oval window.

- <u>middle ear air conduction deafness audiogram</u>
  - ✓Bone conduction is essentially normal
  - ✓conduction through the ossicular system is greatly depressed at <u>all frequencies</u>, but more so at low frequencies.



middle ear air conduction deafness

Caloric testing Basics

generating **thermal** variation

↓

changing temperature of middle ear

↓

changes density of **endolymph** within the **lateral** semicircular canal

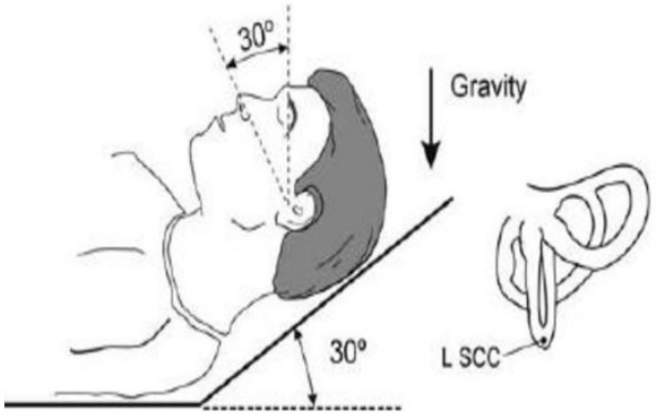
↓

producing convection currents

↓

stimulation/inhibition of ampulla

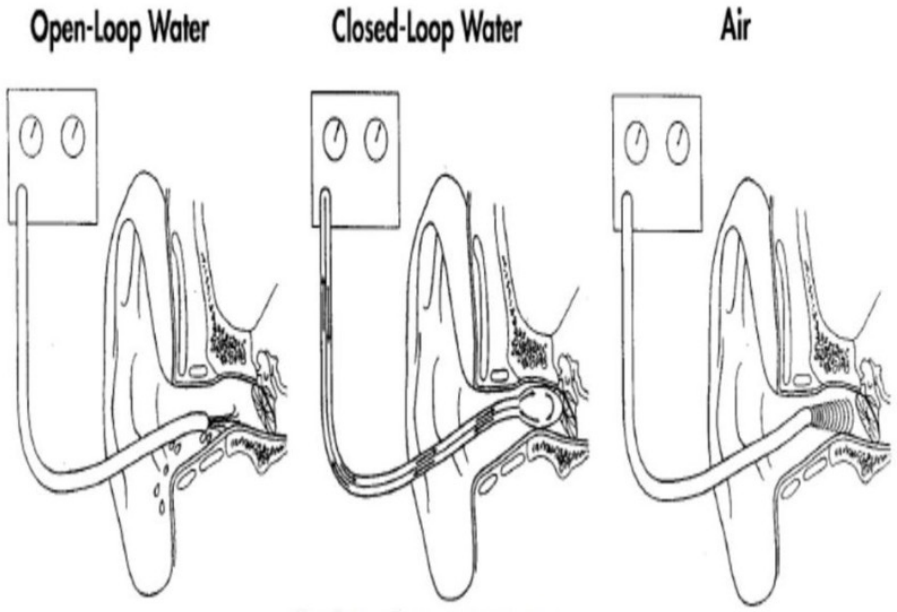
Caloric testing procedure



- Caloric testing does not assess the function of the sacculus or the utricle of the vertical canals.
- patient is placed in dorsal decubitus at 30º relative to the horizontal plane.
- This position places the **lateral** canal **vertically**, as a liquid column, and places the ampullary crest superiorly.

Caloric testing procedure

- 44°C and 30°C
- more robust caloric responses
- less variability

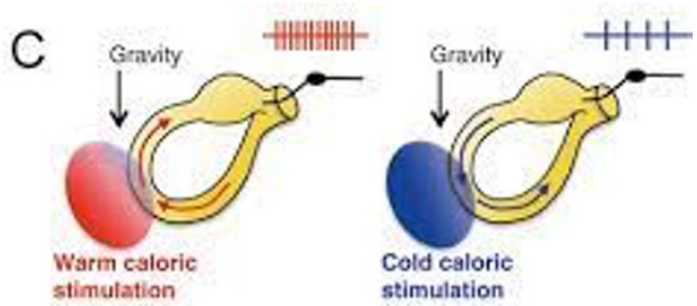


- 50°C and 24°C
- may reduce the slow phase nystagmus by 20% to 40%

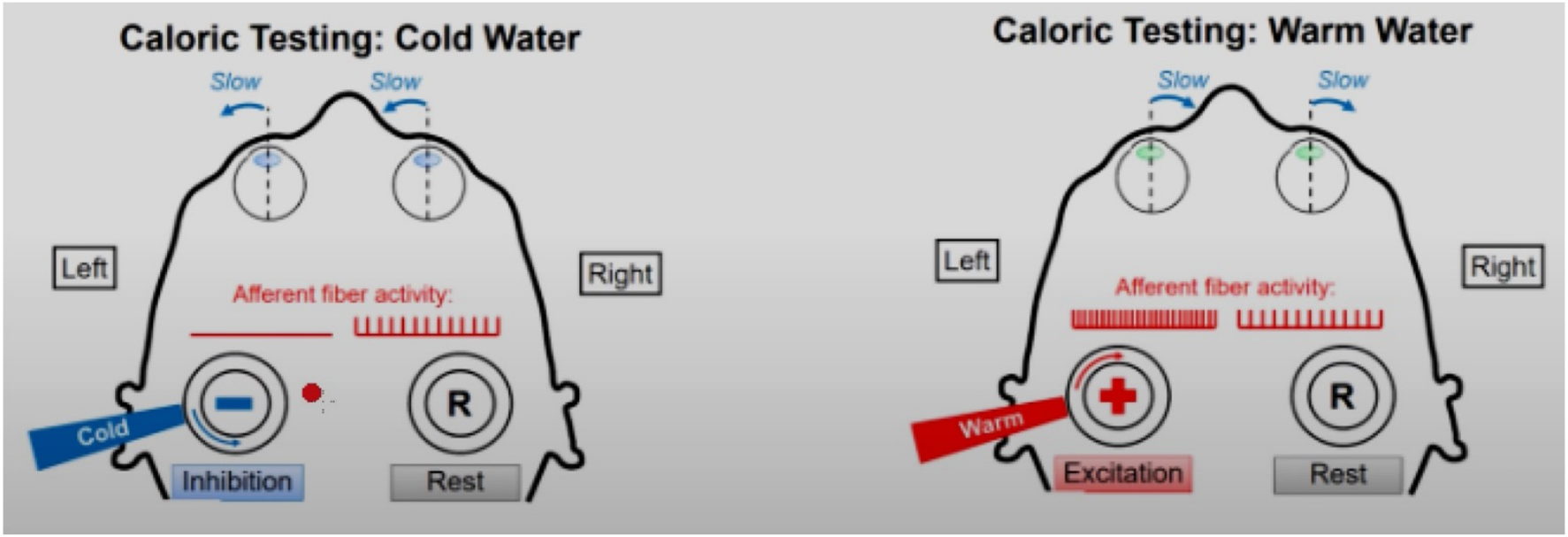
Caloric testing procedure

High temperature → upwards endolymph movement→ towards ampulla.
Low temperature → opposite movement

Stimulation → vestibuloocular reflex (VOR)→ nystagmus.



Direction Nystagmus "COWS"
Cold : Opposite Side
Warm :Same Side



Cold water → activation of SSC in **opposite** ear (**CO)**
e.g
cold in L→ SCC activation in R
initial eye movement → to L
Nystagmus →to R (**CO)**

Warm water→activation of SSC in **same** ear (**WS**)
e.g
warm in L →SCC activation in L
initial eye movement→ to R
Nystagmus→ to L (**WS**)

COWS

Caloric testing interpretation

- **Normal** labyrinths respond symmetrically
- Positive test→ **absent/reduced** (Areflexia/ Hyporeflexia) nystagmus→ damage to labyrinth, nerve or brain stem

- Peripheral vestibular dysfunction
- 8th cranial nerve tumors
- Vestibular neuronitis
- Ménière's disease
- Migraine
- Cerebrovascular diseases.

- Hyperreflexia is defined as nystagmographic responses **higher than expected**
- central or peripheral vestibular diseases

The End