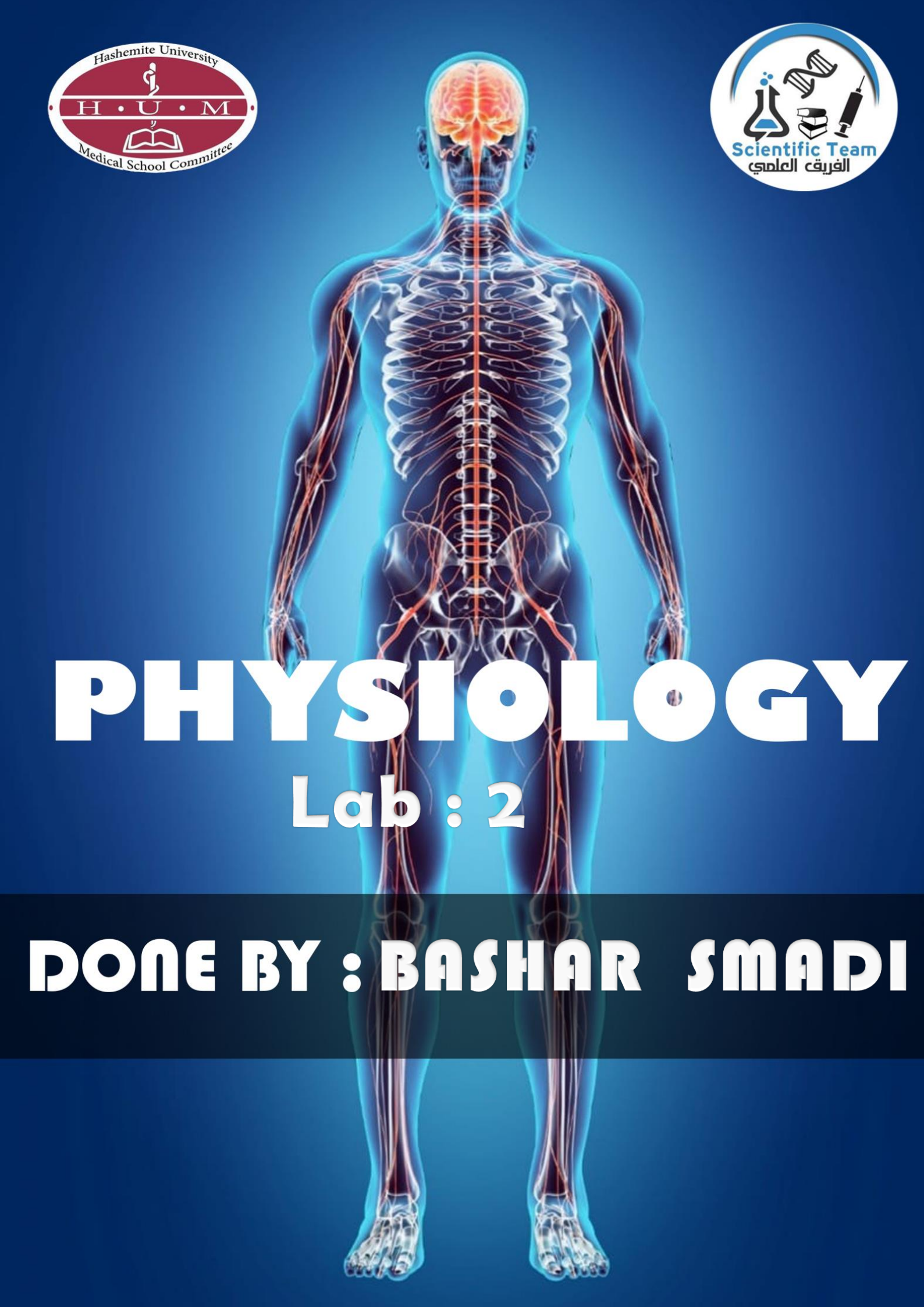


PHYSIOLOGY

Lab : 2

DONE BY : BASHAR SMADI

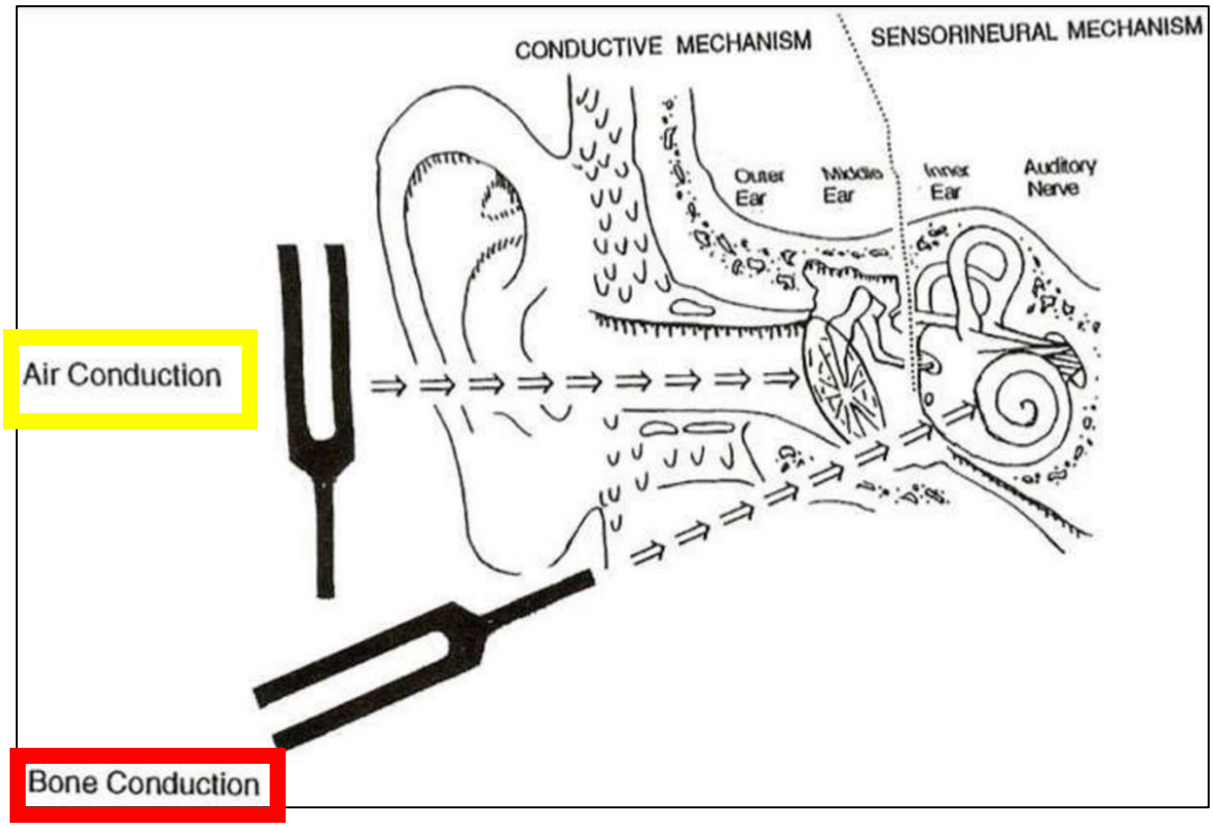
Physiology Lab 2

Tuning Fork

- It is a simple metal
- It consists of Stem, two prongs &foot piece
- It Produces constant pitch when either prong struck against a firm but resilient surface.
- It is used to assess hearing.
- And to differentiate between conductive and sensorineural hearing loss.

Tuning Fork Test

- Test is performed with different types of frequency.
- Commonly used 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** (External Auditory Canal) for Air conduction OR on **mastoid** for Bone conduction.



Air Conduction (AC)

- occurs through **air** near the ear, and it involves the ear canal and eardrum.
- Vibrating tuning fork is placed **vertically** in line with the meatus about 2 cm away from the EAC opening.
- The sound waves transmitted through
Tympanic Membrane → Middle ear ossicles→Inner ear → Auditory Nerve→Auditory Cortex.
- Both Conductive mechanism and Cochlea are tested

اول شي لازم نخلي الشوكة ترن ونحطها عموديا بعيدًا عن الEAC ب2cm
ورح تنتقل موجات الصوت في الهواء من EAC الى TM الى ossicles الى Cochlea الى Auditory Nerve الى Auditory Cortex

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.
- Bone Conduction measures only the **cochlear functions**.
- Normally AC will be more than BC

هون تنتقل موجات الصوت في الbone في الجمجمة نفسها
بهاي الحركة نحن بنقيم الcochlea نفسها فقط
بالوضع الطبيعي نحن بنسمع ال AC اوضح من ال BC

Principles of Tuning Fork Tests

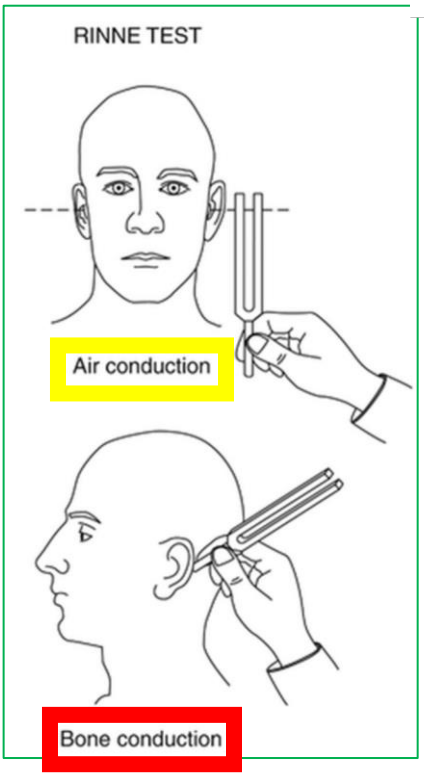
Conductive Hearing loss (CHL)

- ✓ 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.

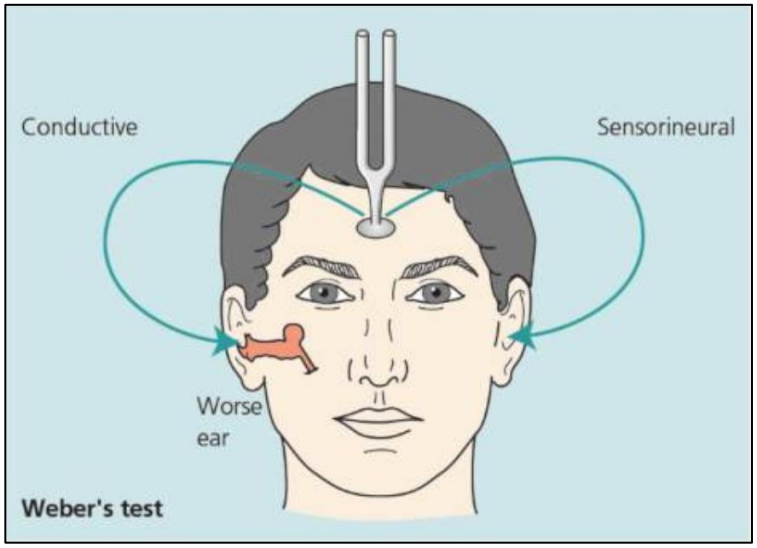
RINNE Test



- It compares perception of sounds transmitted by air conduction to those transmitted by bone conduction through the mastoid.
- 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**

اول شي بنرن الشوكة وبنجطها على الmastoid وبنسأل المريض متى يختفي الصوت ؟ ... بمجرد ما اختفى الصوت بنحط الشوكة بعيدًا 2cm عن الEAC وبنسال المريض اذا سامع او لا ....
اذا المريض قالك انه سامع فهذا طبيعي , لان بالوضع الطبيعي نحن بنسمع ال AC اوضح من الBC
اذا المريض قالك انه الصوت اختفى عند AC , معناها عنده Conductive Hearing loss (CHL)
واذا المريض كان عنده nerve deafness ما رح يسمع لا ال AC ولا الBC

WEBER Test



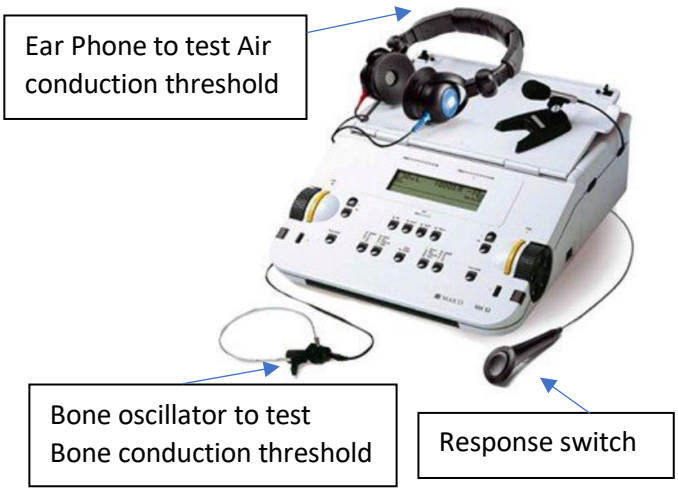
- The Weber test is a screening test for hearing performed with a tuning fork. It can detect unilateral (one-sided) conductive hearing loss (middle ear hearing loss) and unilateral sensorineural hearing loss (inner ear hearing loss).
- A test of lateralization
- A vibrating tuning fork is placed in the middle of forehead or the vertex asked in which ear the sound is heard.
- Sound travels directly to the cochlea through bone.
- **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.

اول شي بنرن الشوكة وبنحطها على رأس المريض وبنسأله اي اذن بتسمع فيها الصوت ؟
الشخص الطبيعي رح يقولك انه سامع بالاذنين اليمين واليسار
اما اذا كان بيسمع بشكل unilateral, رح يكون عنده اما conduction deafness او nerve deafness
فاذا كان بيسمع بالاذن المريضة بشكل اعلى بيكون عنده conduction deafness
(بيسمع اعلى في اذنه اللي فيها مشكلة لانها اخفت ضجة البيئية الخارجية فبتحس باهتزازات الشوكة بشكل اوضح)
اما اذا كان ما بيسمع بالاذن المريضة يعني بيكون عنده nerve deafness فبيسمع بالاذن الطبيعية اعلى من الاذن المريضة

Audiometry

- Test used for measuring hearing acuity for variations in sound intensity and pitch and for tonal purity, involving thresholds and differing frequencies.
- 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.

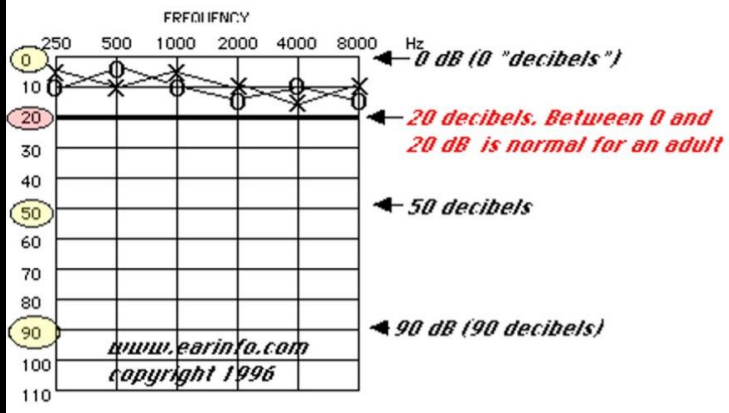


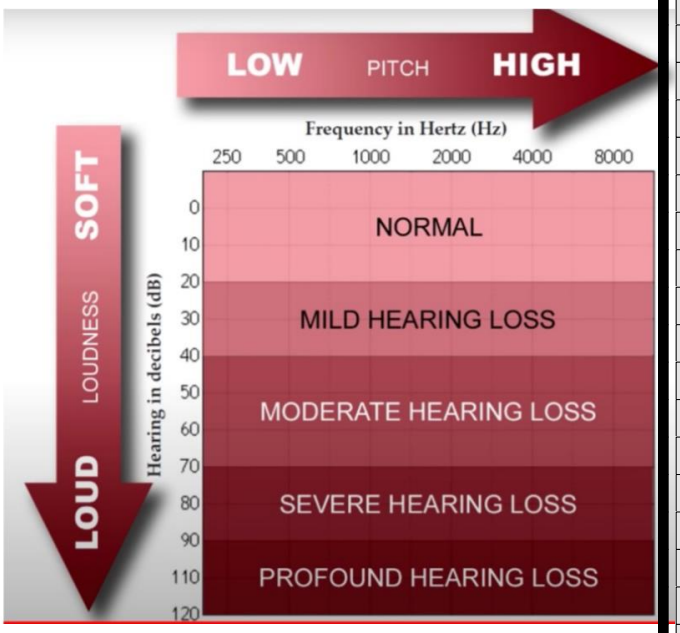
بخلي المريض يحط السماعات على اذانه اذا بدي افحص ال Air conduction
او يحط ال Bone oscillator اذا بدي افحص الBone conduction
وبحكيله يكبس على زرResponse switch اذا سمع صوت

Pure Tone Air Audiometry procedure

- test to measure auditory sensitivity.
- 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.

↓ the audiogram



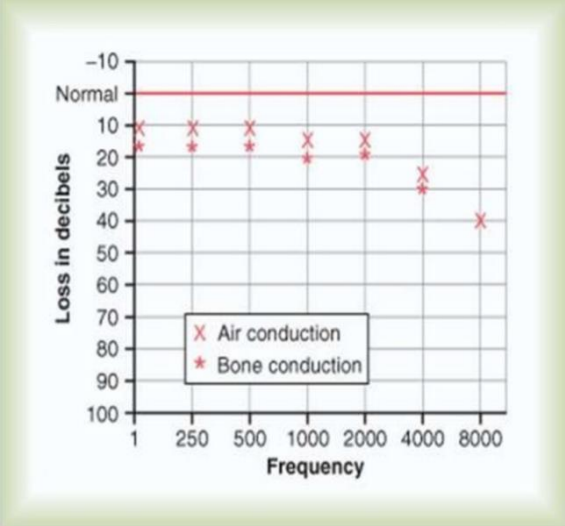


The audiogram shows the type, degree, and configuration of hearing loss.
When you hear a sound during a hearing test, you raise your hand or push a button. The audiologist will make a note of how loud the sound was at each frequency. At the end of testing, the audiogram will show what you heard.
Each line that runs from left to right shows a **frequency**. The lowest pitches are on the left side and the highest pitches are on the right side.
Each line from top to bottom shows how loud the sound is in **decibels**, or dB. Lines at the top of the chart are for soft sounds. Lines at the bottom of the chart are for loud sounds.

The audiogram shows the pattern of your hearing loss. It also shows how severe it is, called the degree of hearing loss. For example, your hearing might be normal for low pitches but not for high pitches.

Audiogram in Nerve Deafness.

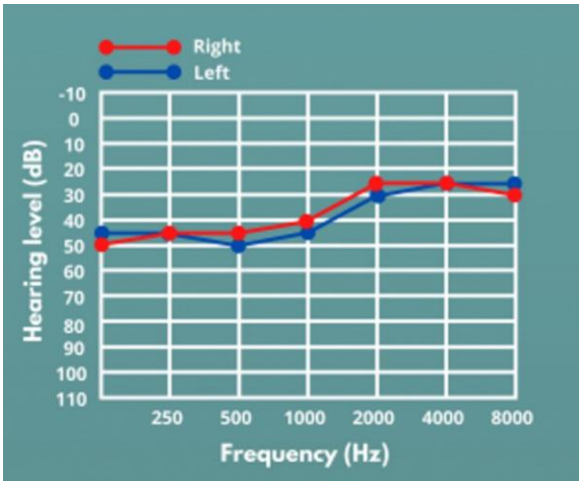
The audiologist marks air conduction and bone conduction.
If the marks are at the top of the graph, your hearing is normal.
if you have a hearing loss the marks are farther down the graph.



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

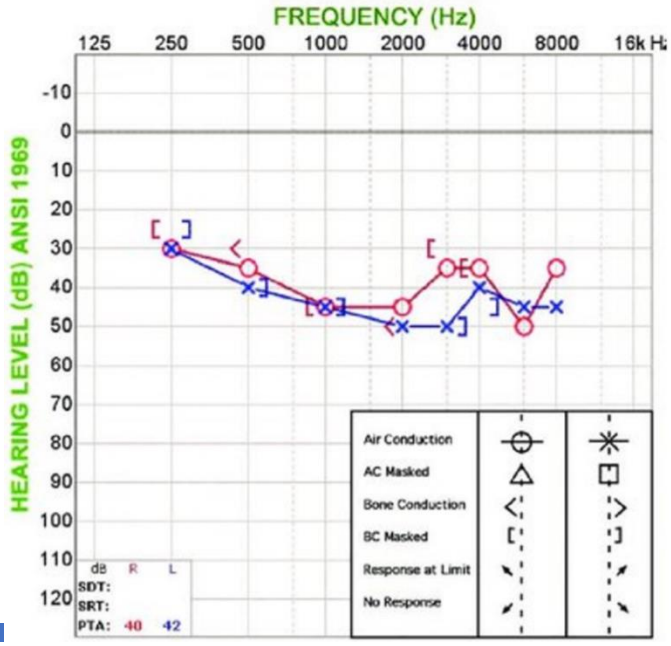
<u>Deafness for low-frequency sounds</u>

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



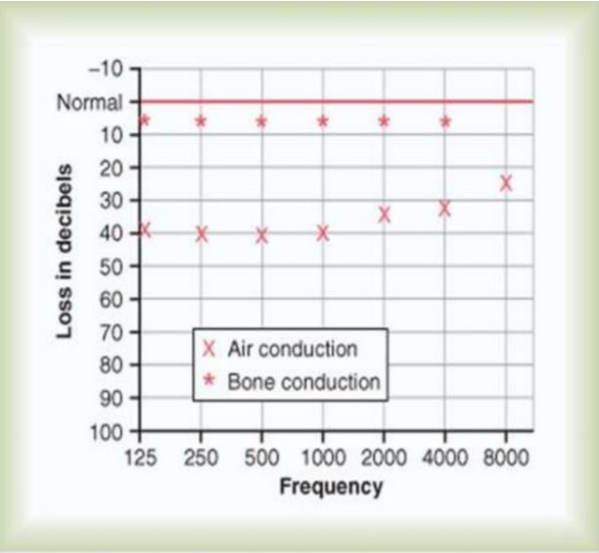
deafness for all frequencies caused by drug sensitivity of the organ of Corti

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



middle ear air conduction deafness

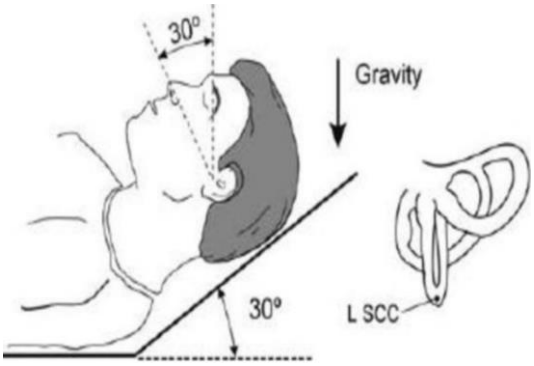
Caloric testing Basics

الفكرة من الاختبار هذا هو أن بنعمل تغيرات للحرارة (الحرارة أو البرودة) عشان يتغير كثافة الendolymph (ضمن **lateral** semicircular canal) وهذا بينتج تيارات الحمل وهذه التيارات هي يلي رح تعمل stimulation/inhibition للampulla

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

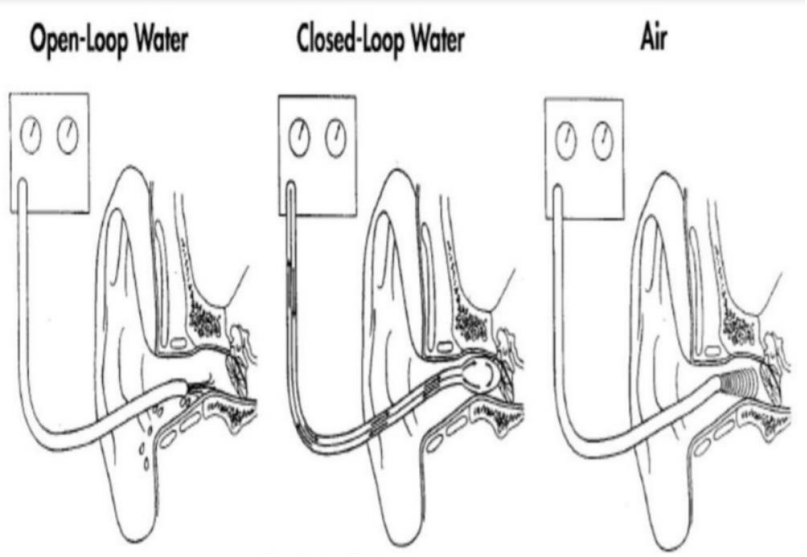
- Caloric testing does not assess the function of the sacculus or the utricle of the vertical canals.
- patient is placed in dorsal decubitus at 30° relative to the horizontal plane.
- This position places the **lateral** canal **vertically,** as a liquid column, and places the ampullary crest superiorly.



بنحط المريض30 درجة فوق سطح افقي (عشان نخلي ال **lateral** canal عنده عامودية) عشان تسهل نزول وصعود الendolymph فبصير عنا حركة الcurrents اما باتجاة الsaccule او SemiCircular Canal

Water Caloric test (closed or open)

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



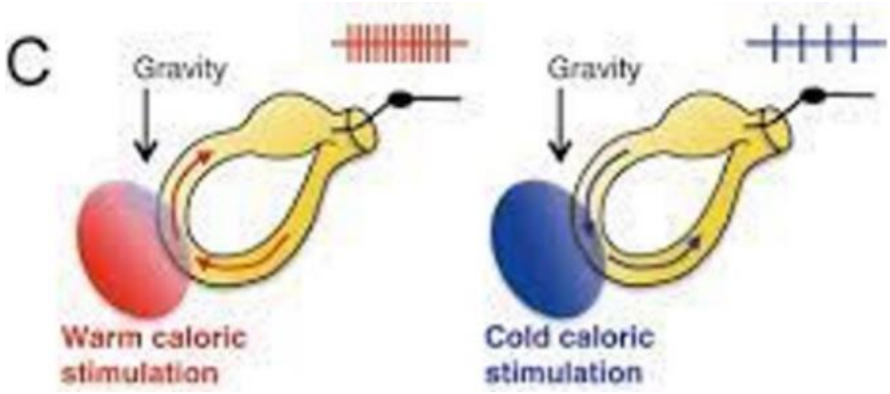
ماء ادخلوه اما بارد او ساخن
44°C: درجة حرارة مرتفعة ب7 درجات عن حرارة الجسم
30°C :درجة حرارة منخفضة ب7 درجات عن حرارة الجسم

Air Caloric test

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

الهواء على درجة حرارة 50°C (اعلى ب13 درجات عن حرارة الجسم)
او 24°C(اقل ب13 درجات عن حرارة الجسم)

وجدوا ان **Water Caloric test اكثر كفاءة**

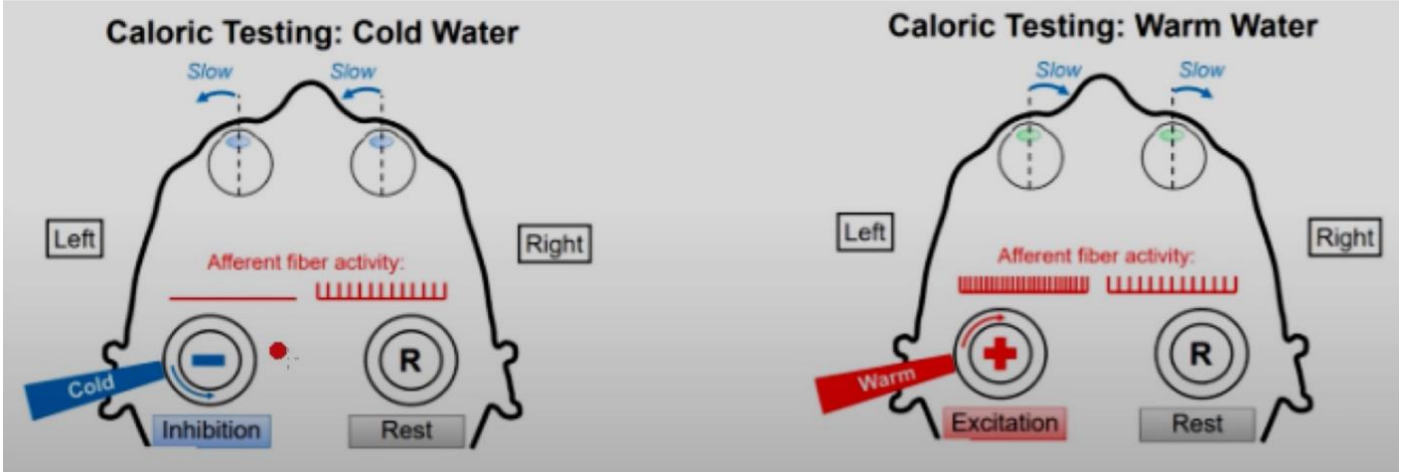


- High temperature → upwards endolymph movements towards ampulla.
- Low temperature → opposite movement

لان الماء البارد اثقل فبتنزل لتحت اما الماء الساخن بتمدد وبيصعد لاعلى

- 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

- اذا دخلنا بالاذن اليسار ماء بارد فبينزل ال endolymph لتحت away from the saccule وتعمل inhibition لليسار
اما اليمين الطبيعيه ما صار عليها شي لكن بتضل تعمل resting impulses فبيفهم الCNS ان اليمين activated فالمريض بيحس حاله بيلف لليمين فحركة العين بتروح على اليسار (عكس اتجاة يلي بحاول يلف فيه)
اما الNystagmus باتجاة اليمين
- اذا دخلنا بالاذن اليسار ماء ساخن فرح يصعد ويدفع الampulla باتجاة الsaccule وتعمل activation لليسار
فاليسار activated اكثر من اليمين .. فبيحس المريض ان بيلف لليسار فحركة العين رح تروح لليمين
اما الNystagmus باتجاة اليسار

Caloric testing interpretation

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

اسباب الpositive result:

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

- Hyperreflexia is defined as nystagmographic responses **higher than expected**

سببه central or peripheral vestibular diseases

THANK YOU AND GOOD LUCK