Screening and Assessment of Hearing in children

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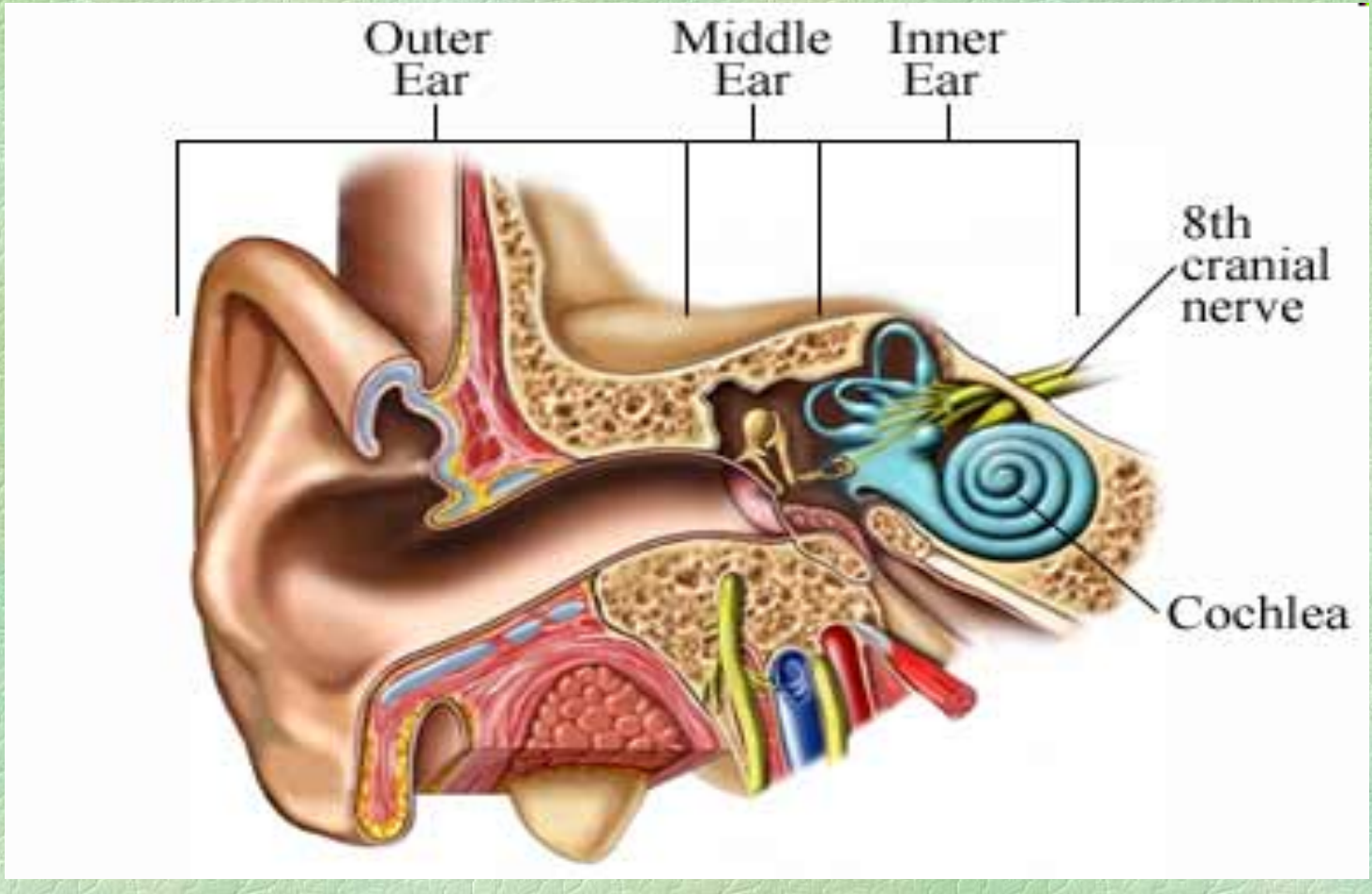
Objectives

- Review the anatomy of hearing organ
- Review the physiology of hearing
- Types and common causes of hearing loss
- Screening children with hearing loss
- Tools of hearing assessment
- Prevention, treatment and rehabilitation of patients with hearing loss
- Take home message

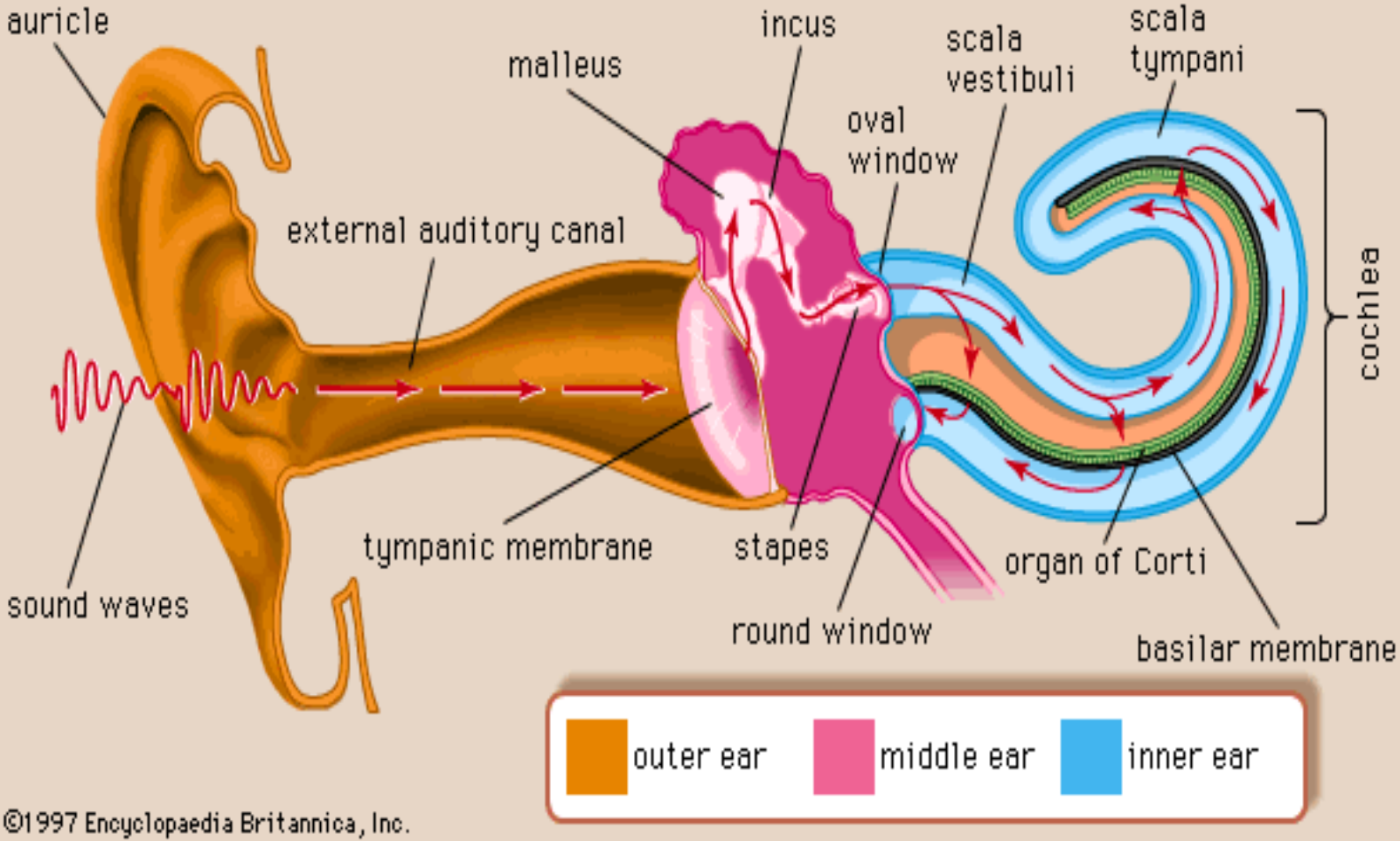
Importance of hearing

- For language acquisition
- To communicate in society
- For social well-being and integration
- For cognition
- For economy
- Hearing is important for ballance

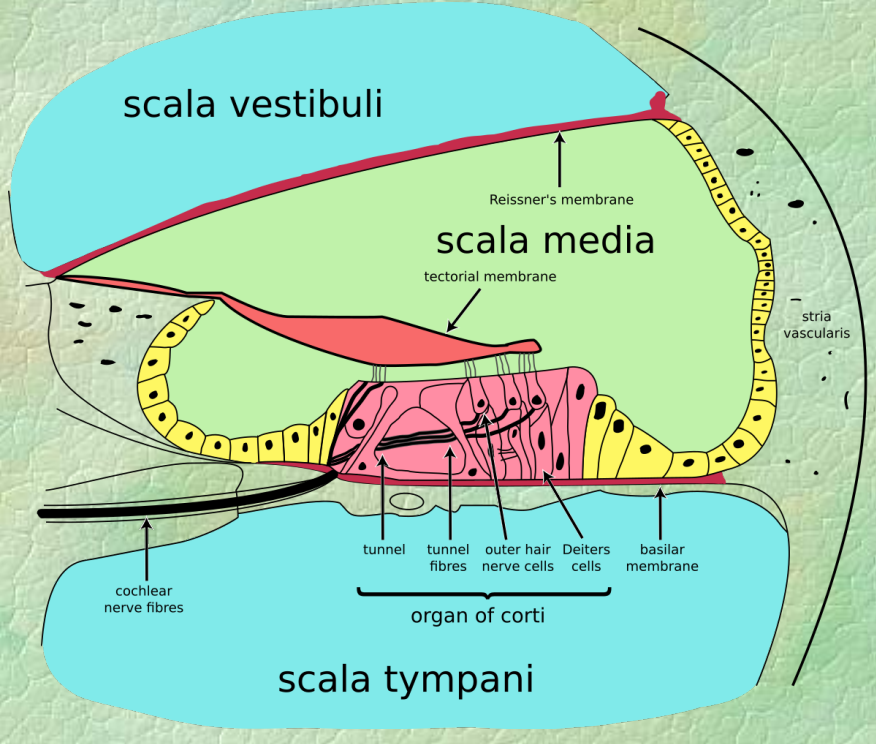
- WHO expect that by the year 2050,
  2.5 billion people will suffer from hearing loss.
- 1 trillion dollar is spent yearly on hearing aids alone
- Language acquisition usually is completed at the age of 6 years if the hearing is normal


Outer Ear
Middle Ear
Inner Ear
8th cranial nerve
Cochlea

HOW DO WE HEAR?



Organ of Hearing (Organ of Corti) in the Cochlea

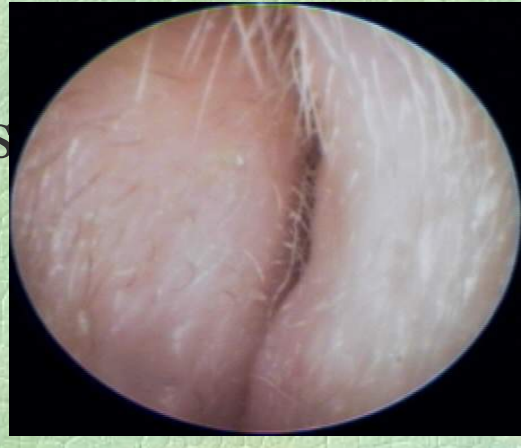


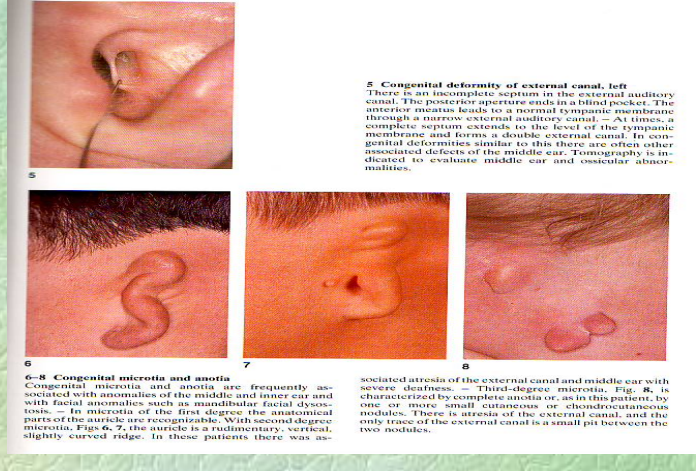
TYPES OF HEARING LOSS:

- CONDUCTIVE
- SENSORI-NEURAL
- MIXED
- NON-ORGANIC

Common Causes of Conductive Hearing Loss

- Middle and outer ear anomalies
- Otitis externa
- Acute and chronic otitis media
- Secretory otitis media





5 Congenital deformity of external canal, left
There is an incomplete septum in the external auditory canal. The posterior aperture ends in a blind pocket. The anterior meatus leads to a normal tympanic membrane through a narrow external auditory canal. – At times, a complete septum extends to the level of the tympanic membrane and forms a double external canal. In congenital deformities similar to this there are often other associated defects of the middle ear. Tomography is indicated to evaluate middle ear and ossicular abnormalities.

6–8 Congenital microtia and anotia
Congenital microtia and anotia are frequently associated with anomalies of the middle and inner ear and with facial anomalies such as mandibular facial dysostosis. – In microtia of the first degree the anatomical parts of the auricle are recognizable. With second-degree microtia, Figs. 6, 7, the auricle is a rudimentary, vertical, slightly curved ridge. In these patients there was associated atresia of the external canal and middle ear with severe deafness. – Third-degree microtia, Fig. 8, is characterized by complete anotia or, as in this patient, by one or more small cutaneous or chondrocutaneous nodules. There is atresia of the external canal, and the only trace of the external canal is a small pit between the two nodules.

Characteristics of Conductive Hearing Loss

- Low voice
- Hearing better in noisy background
- Hearing aids help better than in SNHL
- Easier for surgeon to correct the problem

Characteristics of SNHL:

- Inappropriately loud voice
- Tinnitus
- High frequency loss common, but any configuration possible
- Speech sounds distorted
- Background noise makes listening more difficult
- Hearing aids may help

1) Compare and contrast Conductive and Sensorineural Hearing loss.

	Sensorineural Loss	Conductive Loss
Anatomical Site	**Inner Ear**, CN 8, or CNS	**Middle Ear**, Tympanic Membrane, External Ear
Weber Test	Localizes to **normal** ear	Localizes to **abnormal** ear
Rinne Test	AC>BC Positive Rinne	BC>AC Negative Rinne

Common Causes of Sensory-neural Hearing Loss in children

- Congenital:
  - Genetic; more than 100 syndromes with hearing loss
  - Non-genetic; maternity diseases like rubella, ototoxic drugs
- Acquired:

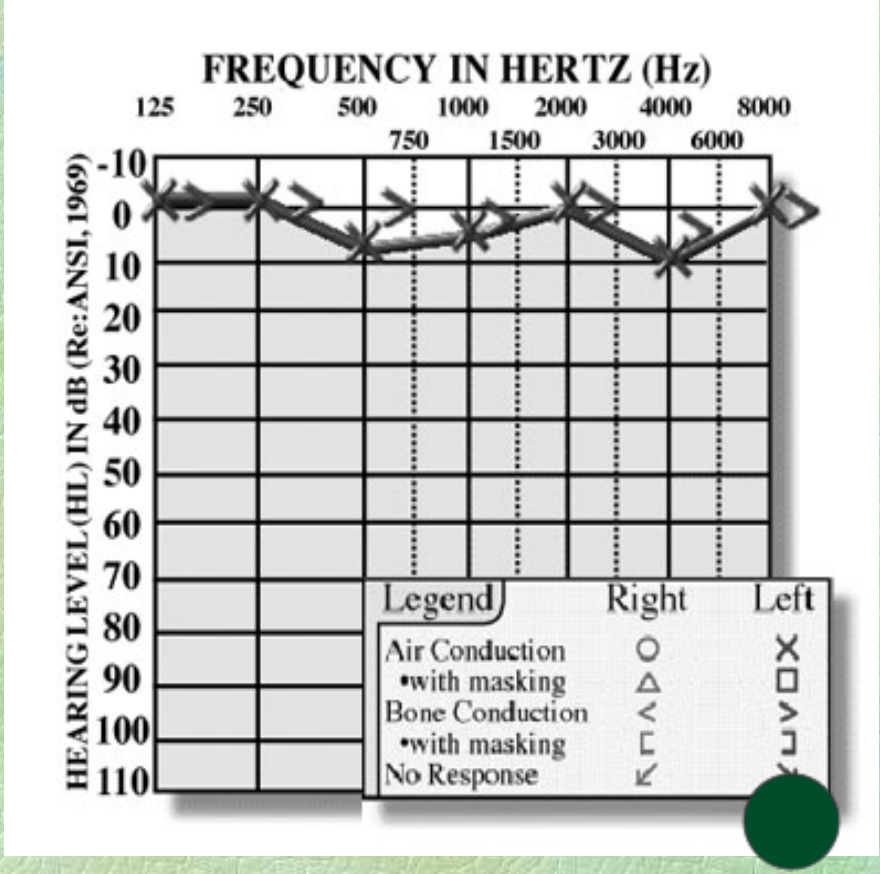
noise exposure,, trauma, ototoxic drugs, tumors, vascular, Meniere's, autoimmune, idiopathic, inflammatory

Hearing evaluation

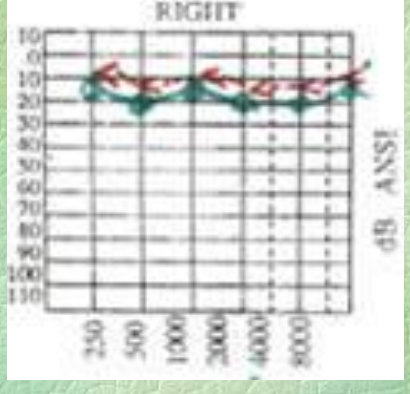
- Behavioral hearing assessment
- Pure tone audiometry
- Speech audiometry
- Tympanometry + acoustic reflexes
- Activated brainstem response (ABR)
- Otoacoustic emissions

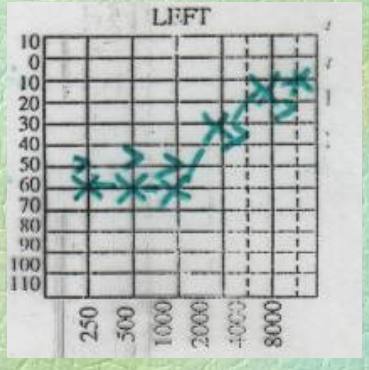
1) Measurement of Hearing

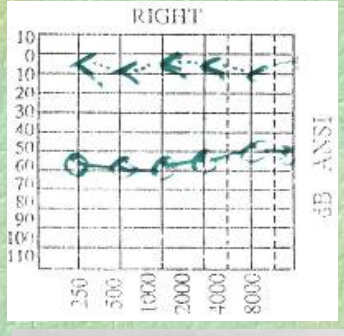
- Hearing is often plotted on an audiogram measuring the lowest dB sound a patient can hear at a given frequency

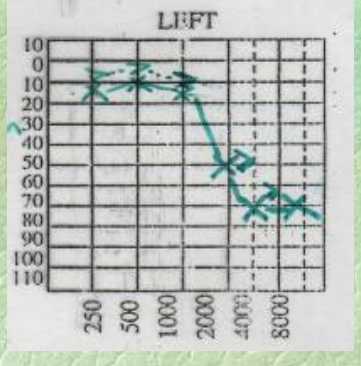


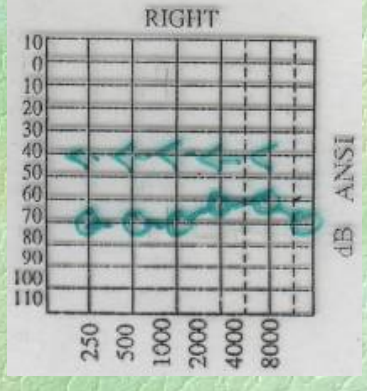
1 Audiograms for Normal Hearing, SNHL, CHL, Mixed HL



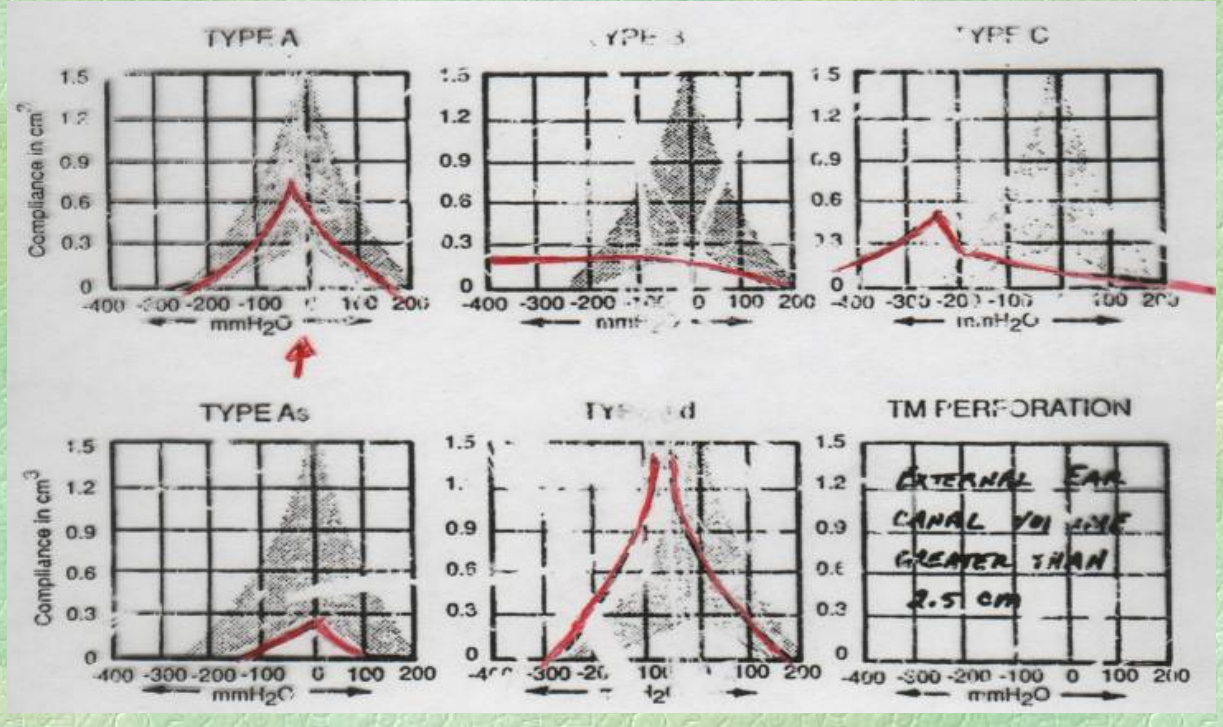








Tympanograms : Normal & Abnormal shapes



Epidemiology

- The incidence of congenital sensory-neural hearing loss (SNHL) is 1-4:1000 live births.
- 50% of children with SNHL is due to genetic factors, and 50% is due to identifiable environmental factors.
- 75% of genetic hearing loss is attributed to autosomal recessive genes, 20% is of autosomal dominant genes and the remainder classified as x-linked or chromosomal disorders.
- >100 genetic syndromes with hearing loss have been identified.

Screening for Hearing loss in children

- The aim of screening is to diagnose hearing loss at the earliest possible age in order to start the treatment.
- Ideally all newborn infants should be screened
- People at high risk should be screened
- 50% of patient with hearing loss do not have any known risk factor
- Areas with high rate of congenital hearing loss
- Screening should be done soon after birth and not more than 1 month of age.
- All children who failed the screening test should rescreened one month later.

Prenatal risk factors

- Who is mothers suffering from ; toxoplasmosis, rubella, cytomegalovirus, herpes simplex, syphilis, septicemia
- Who is mothers receiving ototoxic drugs during pregnancy
- Exposure to radiation

Risk Factors of hearing loss in age 0-28 days

- Family history
- Congenital infections
- Craniofacial anomalies
- Birth weight <1500 g
- Hyperbilirubinemia
- Ototoxic drugs
- Bacterial meningitis
- Severe depression at birth
- Prolonged mechanical ventilation
- Stigma associated with syndromes

Risk Factors of hearing loss in 28 days-2 years

- Parents concern of delayed hearing, language and speech
- Bacterial meningitis
- Neonatal risk factors
- Head trauma
- Stigma associated with syndromes
- Ototoxic drugs
- Children with neurodegenerative disorders
- Childhood infectious disease

Screening tools

- Behavioral
- Otoacoustic emission
- Brainstem evoked response audiometry

Behavioral Evaluation of Hearing

§ **Moro (Startle) Reflex:**

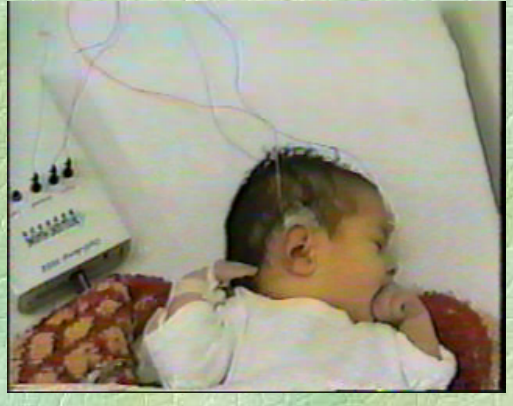
when infant exposed to loud sounds he/she will throw back the head, extends the hands and legs and cries.

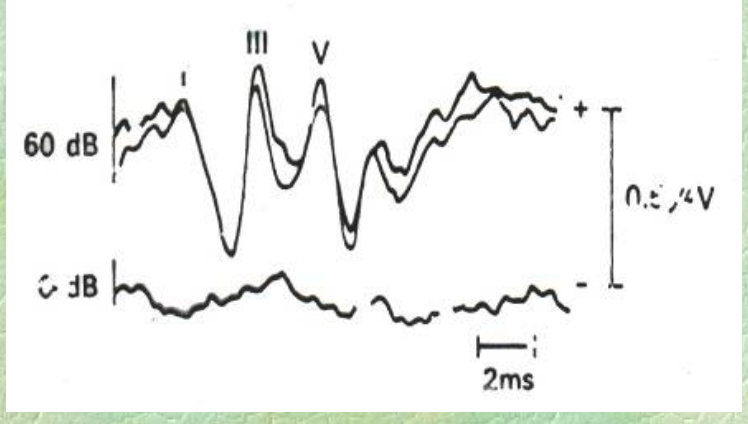
- At the age of 3 months listen quite to mother voice
- At the age of 6 months will turn his head towards the source of sounds
- At the age of 9 months enjoying playing with rattle and bell
- At the age of 12 months baby responds to

Otoacoustic Emissions (OAE)

- Low intensity sounds produced by the cochlea in response to acoustic stimuli
- Outer hair cells motility generates mechanical energy within the cochlea and propagates to external ear canal via middle ear
- Vibration of the tympanic membrane produces the acoustic signals which can be measured by sensitive microphones
- Two types of OAE: Spontaneous and evoked
- Is the cost-effective objective evaluation tool
- 80-90% sensitivity and specificity

Auditory evoked potentials





- Measures hearing more accurate
- Detects neural pathology
- More specific but more expensive
- and needs general anesthesia

Prevention of Hearing Loss??

- Avoidance of known causes
- Consultation prior to marriage
- Early treatment of the known causes

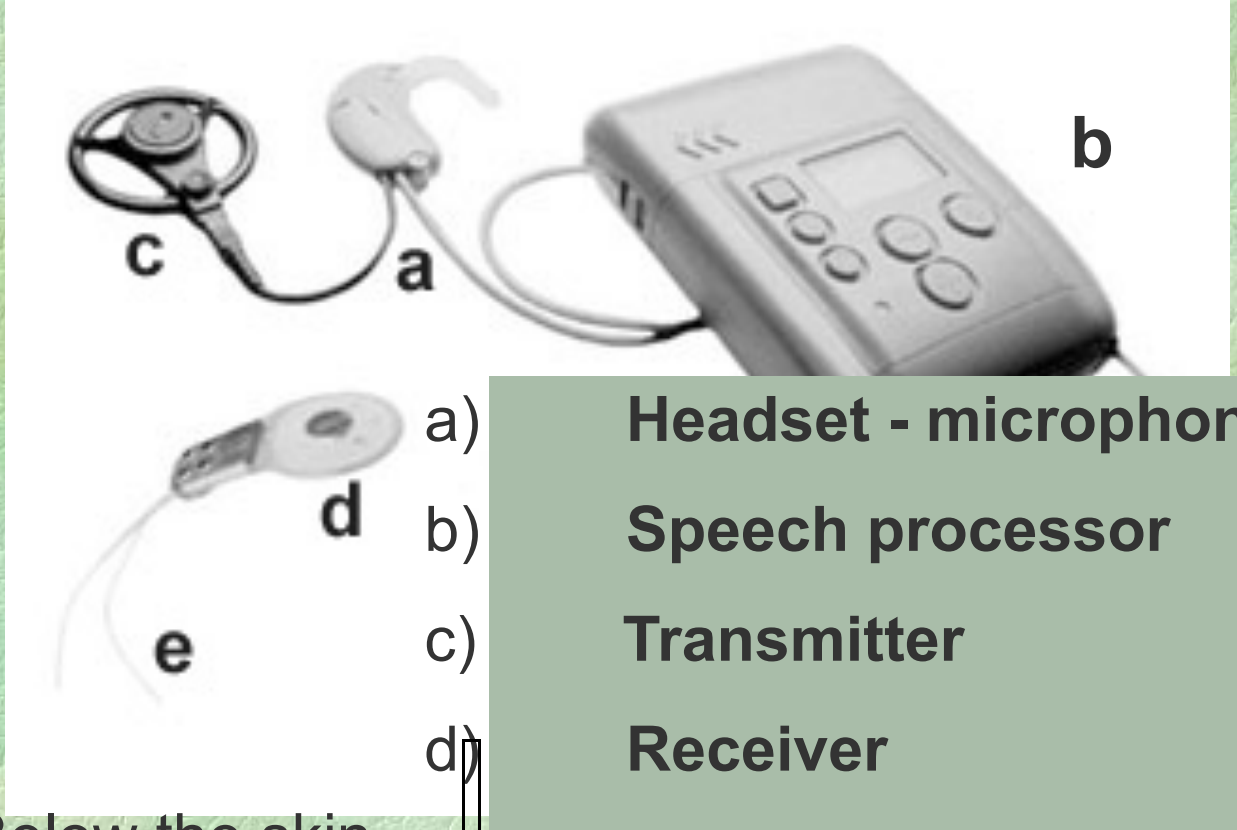
Treatment Options

- Hearing Aids
- Cochlear implants
- Hearing rehabilitation;

  sign language, school for deaf people, lip reading

a) Hearing aid

5) List the components of a cochlear implant and describe how it works.



a) **Headset - microphone**

b) **Speech processor**

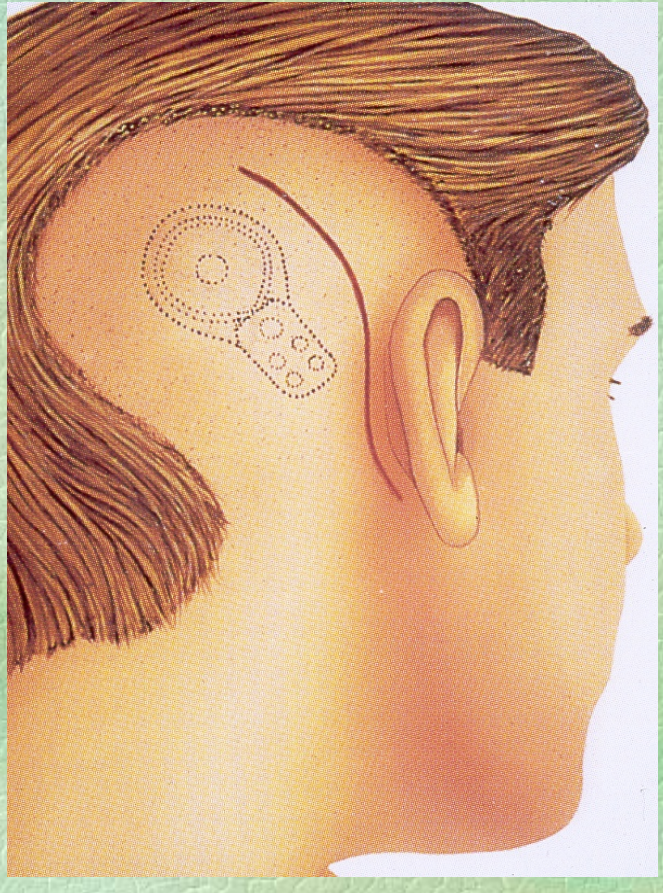
c) **Transmitter**

d) **Receiver**

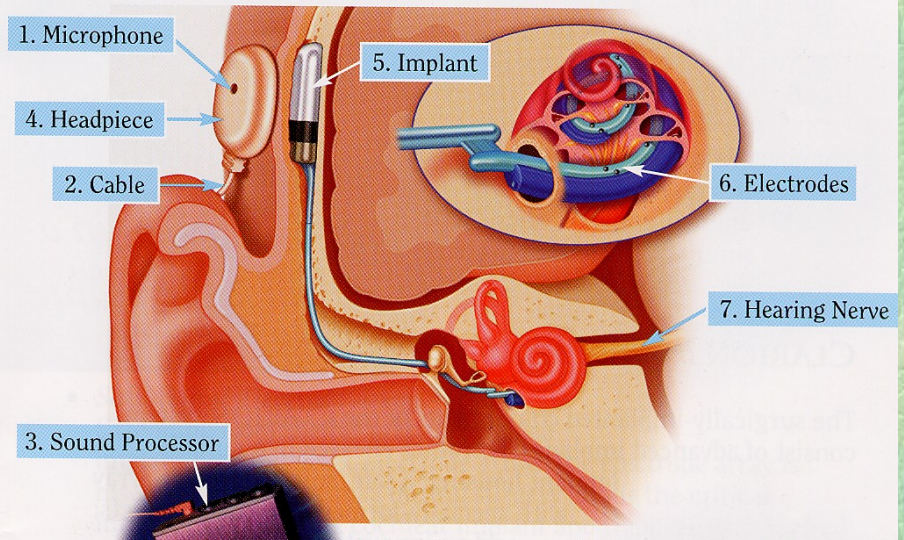
e) **22-Channel electrode**

Below the skin

Location of Receiver and 22-channel electrode

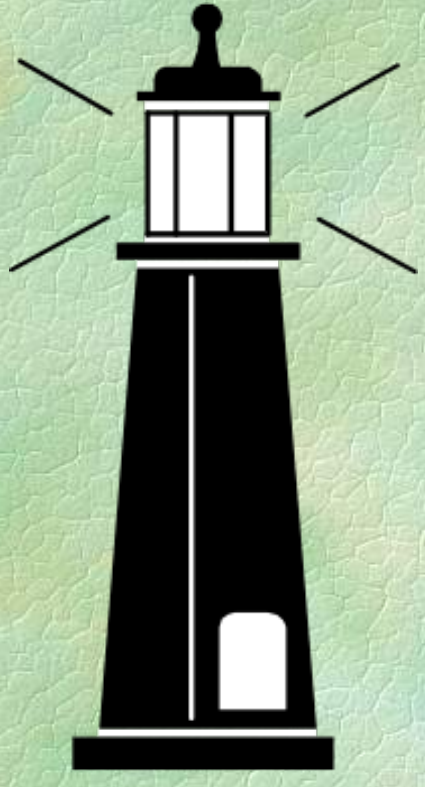


appreciate how advanced CLARION is, follow the step-by-step outline of how the technology works.



1. Sound waves enter the system through the **microphone** located in the headpiece.
2. This sound is sent to the sound processor via a thin **cable**.
3. The **sound processor** converts sound into a

Questions?




Thank
you