



# Aural Habilitation

**BHPI**

hearing for all 2024

- In learning to understand the spoken language of others and to speak it, an intact auditory system is necessary
- Because so much of the language-learning process occurs within the first few years of life, there has been considerable emphasis on early identification and intervention for hearing impaired children

- It is generally believed that the critical period for language development occurred within the first two years of life and that auditory deprivation in that first years result in deprivation of language learning.

# Components of an Intervention Program

- Parent – Infant Management
- Adequate Amplification
- Speech and Language Training
- Development of Perceptual and Cognitive Skills

# Amplification

- An integral part of the receptive communication chain
  - signal source and the listener
- The amplification device will not restore normal hearing, but optimum communication will be achieved only by the provision of best available device

# Amplification Process

- Selection of Hearing Device
- Evaluation of Hearing Device Fitting

# Why people have hearing difficulties

Treatment of hearing loss depends on which part of the ear is not working properly

Where is the problem?	Type of hearing loss?	What can be done to help?
outer or middle ear	'conductive'	<ul style="list-style-type: none"> <li>☐ medication</li> <li>☐ surgery</li> <li>☐ hearing aids</li> </ul>
inner ear	'sensorineural'	<ul style="list-style-type: none"> <li>☐ hearing aids</li> <li>☐ cochlear implants</li> </ul> <ul style="list-style-type: none"> <li>☐ medication</li> <li>☐ other surgery</li> </ul>
hearing nerve	'neural'	<ul style="list-style-type: none"> <li>? hearing aids</li> <li>? cochlear implants</li> <li>? auditory brainstem implant</li> </ul>

for many profound or total losses, plus some severe losses  
sometimes  
sometimes

sometimes  
if some nerve fibers are working  
for profound or total losses

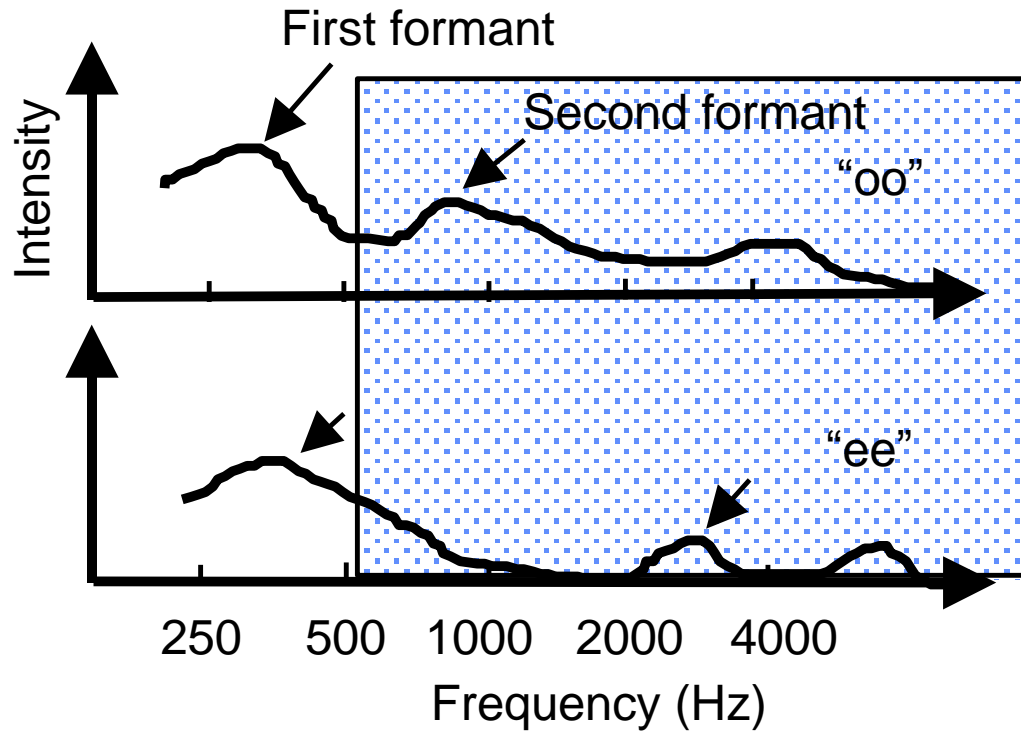
# Nature of Hearing Loss

- Decreased Audibility
- Decreased Dynamic Range
- Decreased Frequency Resolution
- Decreased Temporal Resolution
- Deficits in Combination

# Decreased Audibility

- Hearing impaired people do not hear all sounds
- Difficulty in understanding speech because key parts of some phonemes are not audible
- Degree of Impairment usually worsens from 500Hz to 4000Hz

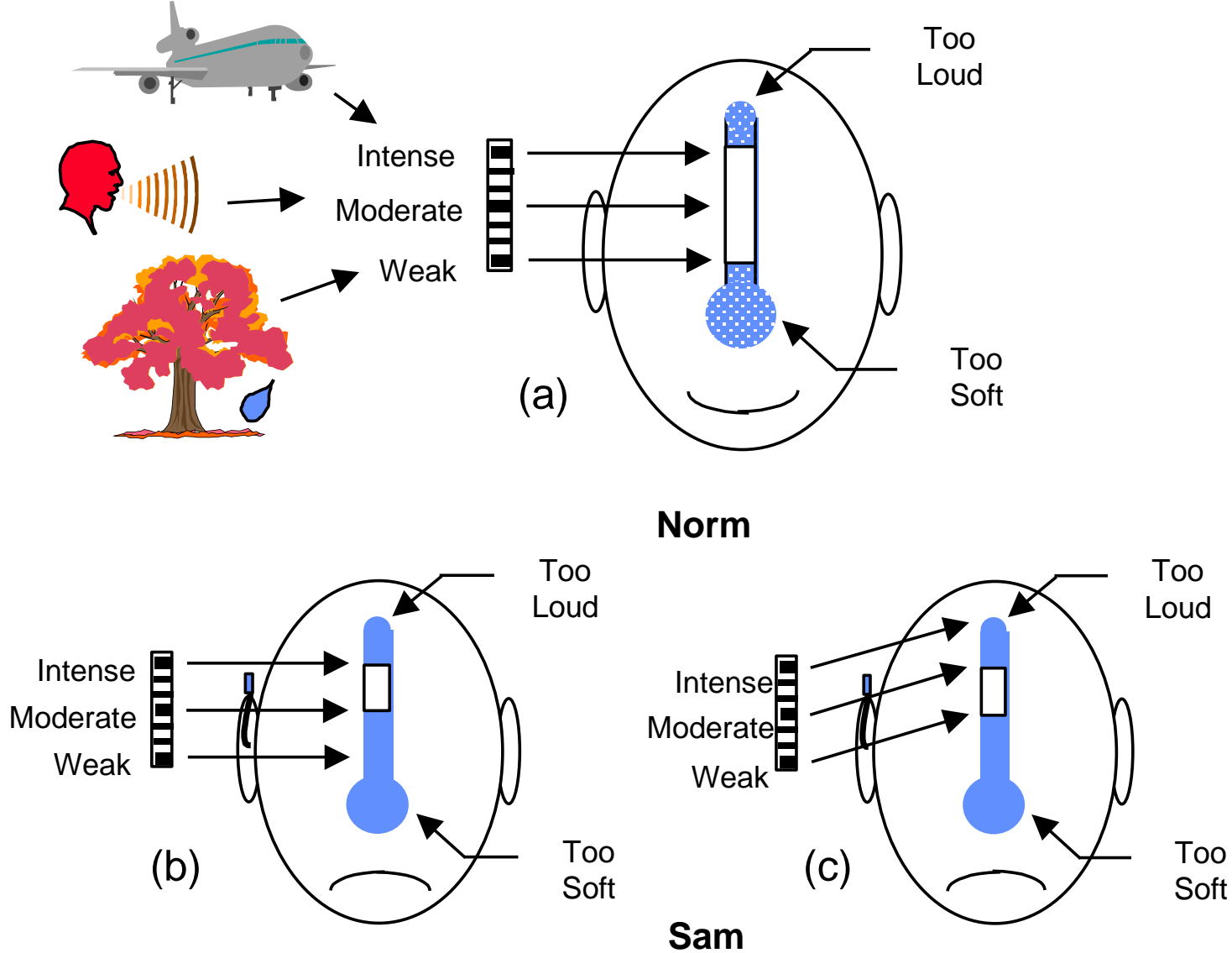
# Decreased Audibility



**Figure 1.1** Similarity of the two vowels "oo" and "ee" when the second formant is inaudible because of hearing loss (grey area).

# Decreased Dynamic Range

- The level difference between discomfort and the threshold of audibility

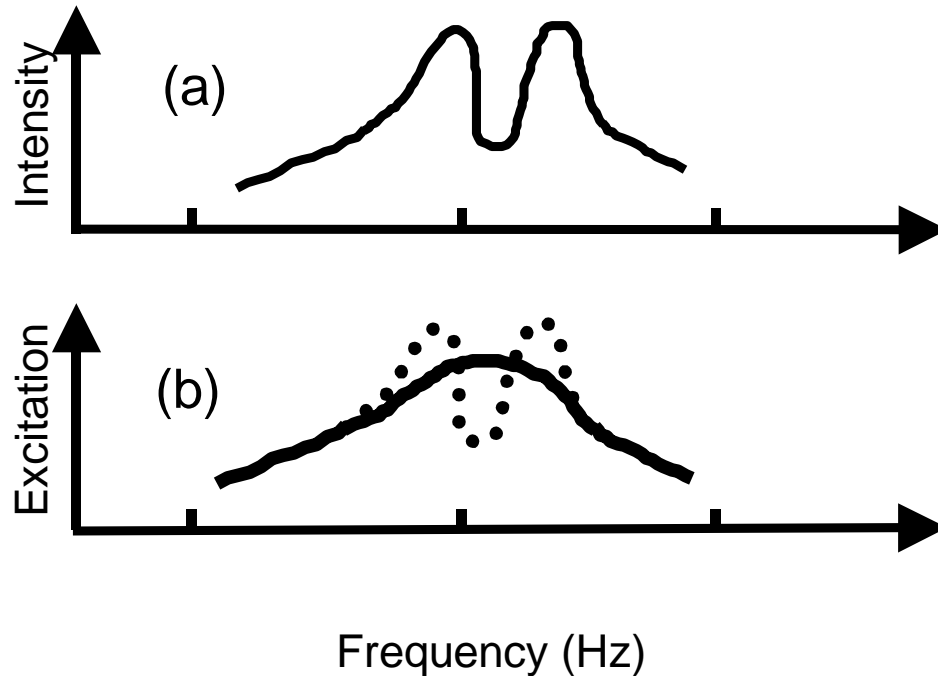


**Figure 1.2** The relationship between the dynamic range of sounds in the environment and the dynamic range of hearing for (a) normal hearing, (b) sensorineural hearing loss without amplification, and (c) sensorineural hearing loss with a constant amount of amplification for all input levels

# Decreased Frequency Resolution

- A clearly defined region of relatively strong vibration at one position on the basilar membrane which produces a clearly defined region of activity within the auditory cortex

# Decreased Frequency Resolution



**Figure 1.3** (a) Sound spectrum, and (b) representation in the auditory system for normal hearing (dotted line) and sensorineural hearing impairment (solid line).

# Decreased Temporal Resolution

- Difficulty in extracting useful information during the weaker moments of the background noise

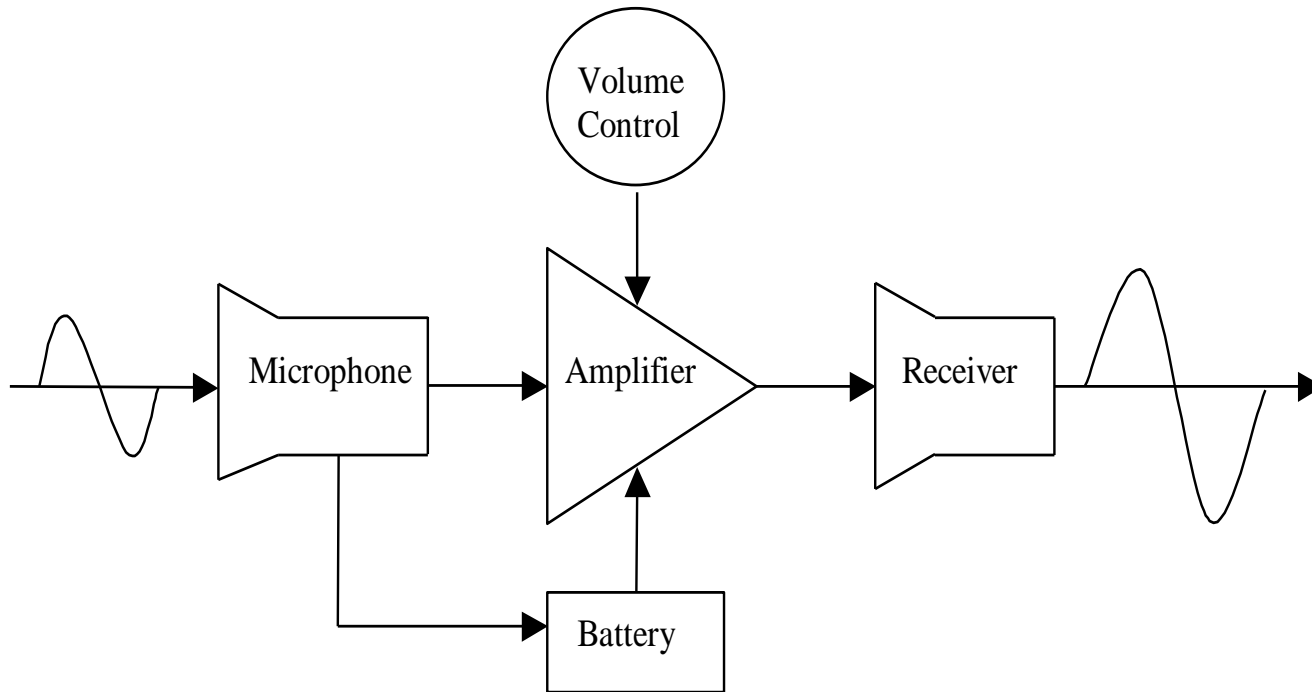
# Function of Hearing Aids

- Sound is picked up from environment by the microphone and converted into electrical signal
- Electrical signal is amplified by the amplifier
- Amplified signal is delivered to the earphone

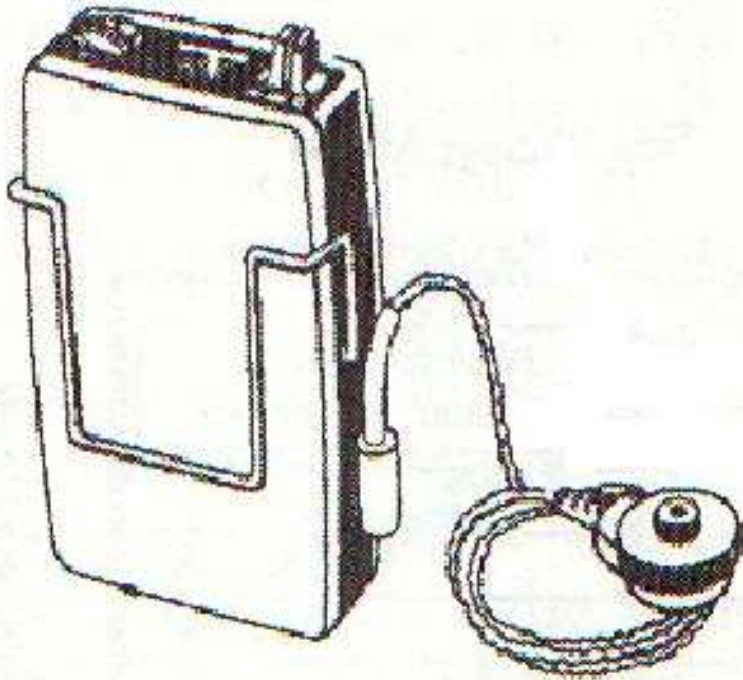
- Earphone converts amplified electrical signal back into sound
- Sound is then delivered to the ear canal via the earmold system

- The amplifier is also generally equipped with a gain control (volume control) operable by the user
- It may also provide for other adjustments such as frequency and maximum output controls that can be preset
- The hearing aid system is powered by a battery

# Hearing Aid Block Diagram



# Body-type Hearing Aids

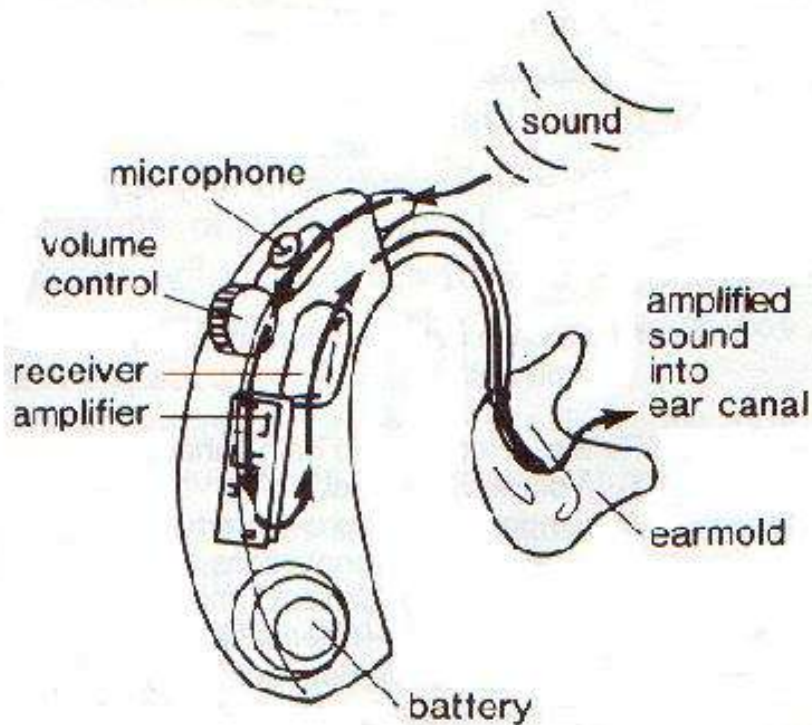


- Use a separate button receiver connected by a cord
- Uses earmold with metal socket that clips to receiver
- Powerful hearing aid – good for profound losses

# Body-type hearing Aids

- Large controls easy to manage
- Receivers generally don't have as much high-frequency range as other hearing aid types – usually not a problem for profound hearing losses
- Uses AA batteries – may be easier to obtain
- Can be quite inexpensive hearing aid

# Behind-the-ear Hearing Aids

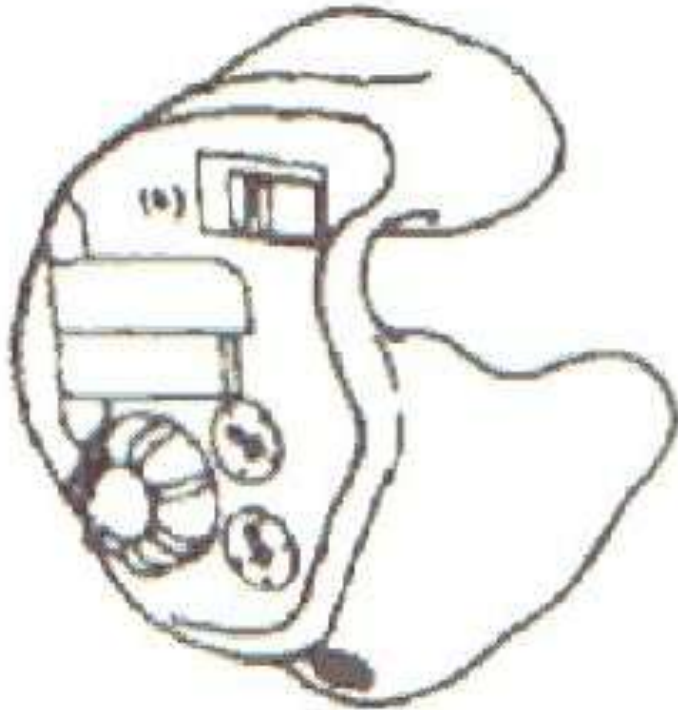


- Connected via earhook and tubing to earmold
- Earmold easily replaceable as required
- More comfortable and less cumbersome than body aid

# Behind-the-ear Hearing Aids

- Wide range of features and amplification range (mild to profound hearing losses)
- Easily serviceable

# In-the-ear Hearing Aids

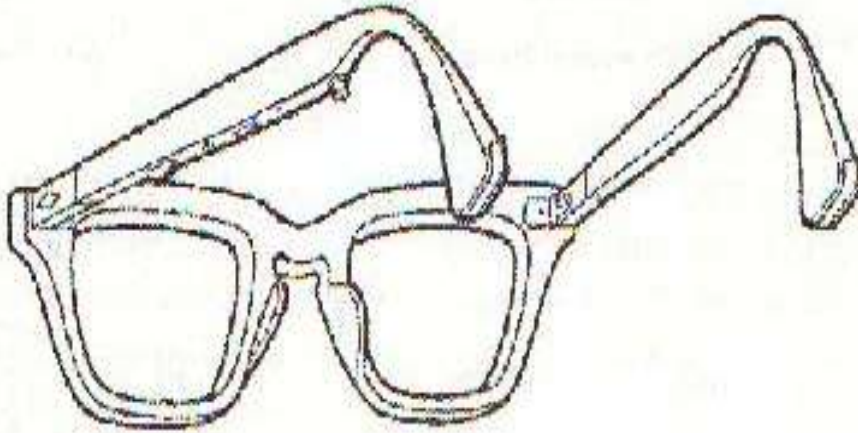


- Includes in-the-ear (ITE), in-the-canal (ITC) & completely-in-the-canal (CIC)
- Generally more expensive than BTE hearing aids
- More difficult to service
- Less adjustments available due to size

# In-the-ear Hearing Aids

- Not recommended for children – require multiple remakes as ears grow, concha physically not large enough for hearing aid
- Cannot be fitted with discharging ears
- Less wind noise and better directionality than BTE if deep in ear
- More cosmetically appealing

# Eyeglass Hearing Aids



- Hearing aid is built into eyeglass handles
- Sound directed to ear via tubing and earplug
- Bulky
- If hearing aid breaks then without eyeglasses and vice versa

# Bone Conductor Hearing Aids

- Hearing aid uses bone-conductor receiver rather than air conduction receiver
- Used mainly for cases where patient has chronic discharge or where partly/fully obstructed external auditory canal

# CROS Hearing Aid

- Generally used where patient has no useable hearing in one ear
- Sound on side of unaidable or “dead” ear is picked up by microphone on that side and routed good (or better) ear
- Two hearing aids connected by wire
- Eliminates head shadow effect

# Limitations of Hearing Aids

- The hearing aid does not compensate fully for the loss. It is only a little help if the hearing loss is very great
- Hearing aid users may have speech discrimination problems especially in noisy conditions even with the best hearing aid

# Suggested Protocol for Audiological and Hearing Aid Evaluation

For Pediatric Patients

- Recommended for use with children
- Recommends a Battery of Audiological Test
- Parents should be present for and participate in the administration of all assessment procedures

# Test Battery

- Case History/Parent Observation Report
- Otoscopic Inspection
- Acoustic Immittance: Tympanometry and Acoustic Reflexes

**Cautious interpretation is recommended if the child is younger than six months**

# 0 to 6 months

## AUDITORY BRAINSTEM RESPONSE (ABR)

- Alternating click and tone pip response by air conduction and by bone conduction

**ABR should not stand alone for diagnostic purposes. Lack of response to ABR testing does not necessarily indicate an absence of usable hearing.**

# 6 to 12 months

## BEHAVIORAL OBSERVATION/VISUAL REINFORCEMENT AUDIOMETRY

- Detection/Awareness of voice and warbled tones from 250-6000 Hz in the sound field and/or 250-8000 Hz under headphones.
- Startle response in sound field, under headphones, and by bone conduction.
- Evaluation of auditory skill development.

# 2 to 5 years

## CONDITIONED PLAY AUDIOMETRY

- Response to pure tones from 250-12,000 Hz by air conduction and bone conduction from 500-4000 Hz with masking (at 3 1/2 years+).
- Speech Awareness Threshold (Speech Recognition Threshold if language development allows) using Ling Five Sounds, body parts, speech perception tasks, or formal tests such as the WIPI.

5 years +

## STANDARD PURE TONE AUDIOMETRY

- Air and bone conduction, Speech Recognition and Speech/Word Identification.

# Frequency of Assessment

- Every 90 days once diagnosis is confirmed and amplification fitted, until age 3..
- As early as possible, but at least by age 2, a complete unaided and aided audiogram should be obtained (preferably under headphones, but at least in the sound field.)

# Frequency of Assessment

- New earmolds may need to be obtained at 90 day intervals or sooner until age 3-4 in view of the typically rapid growth rate during this time.
- Assessment every 6 months from age 4-6 is appropriate if progress is satisfactory.

# Frequency of Assessment

- Above age 6, assessment at 6-12 month intervals is appropriate with earmolds at the same intervals.
- Immediate evaluation should be scheduled if parents or caretakers suspect a change in hearing or hearing aid function.

# Hearing Aids

- The hair cells receive vibrations from the cochlear fluids and convert these into electrical energy which passes through the auditory nerve
- In order to receive significant input from a hearing aid, there needs to be enough hair cell survival in the cochlea

# Hair Cell Death

- If these hair cells are dead, as is the case with the more severe hearing losses, a hearing aid will not help much
- The aid will amplify sound, the sound will enter the cochlea as vibrations in the cochlear fluids and these vibrations cannot be converted into nervous impulses as the hair cells are dead. The adult or child hears very little with the aid

# When Hearing Aids are not enough...

- An electrode is used to stimulate the auditory nerve directly with electric current, bypassing the damaged cochlear structures.
- Habilitative device of choice for the profoundly hearing impaired, especially if implanted at an early age

# Early Attempts at Electrical Stimulation of the Ear

1790 Volta placed metal rods in his ears

Applied 50 volts

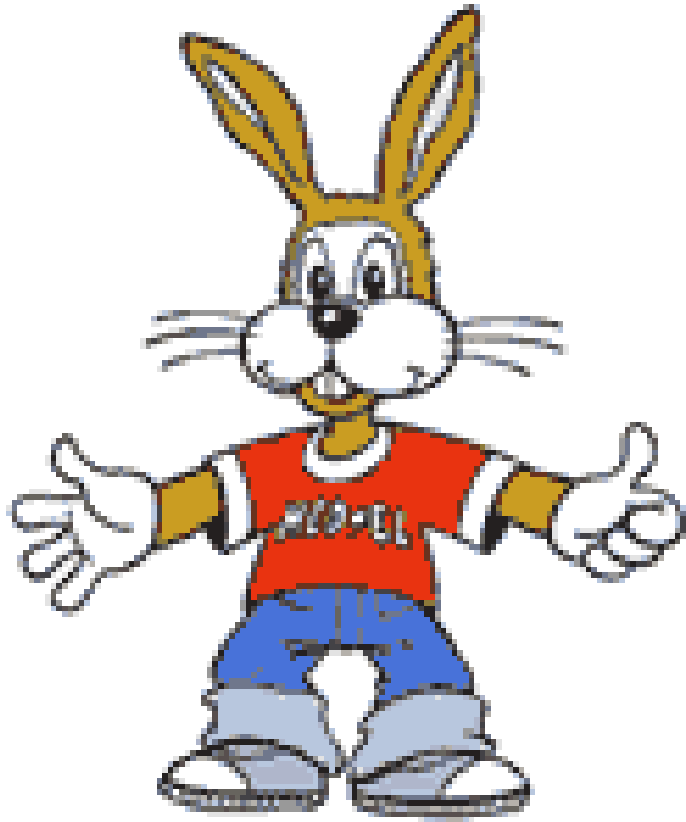
“Like a blow to the head”

“Sound like boiling liquid”



# Summary

- The importance of amplification to the hearing impaired child cannot be overemphasized
- If hearing impaired children are to develop speech and language in manner somewhat similar to that of the normal hearing child, everything possible must be done to provide the best auditory stimulation available



Thank You