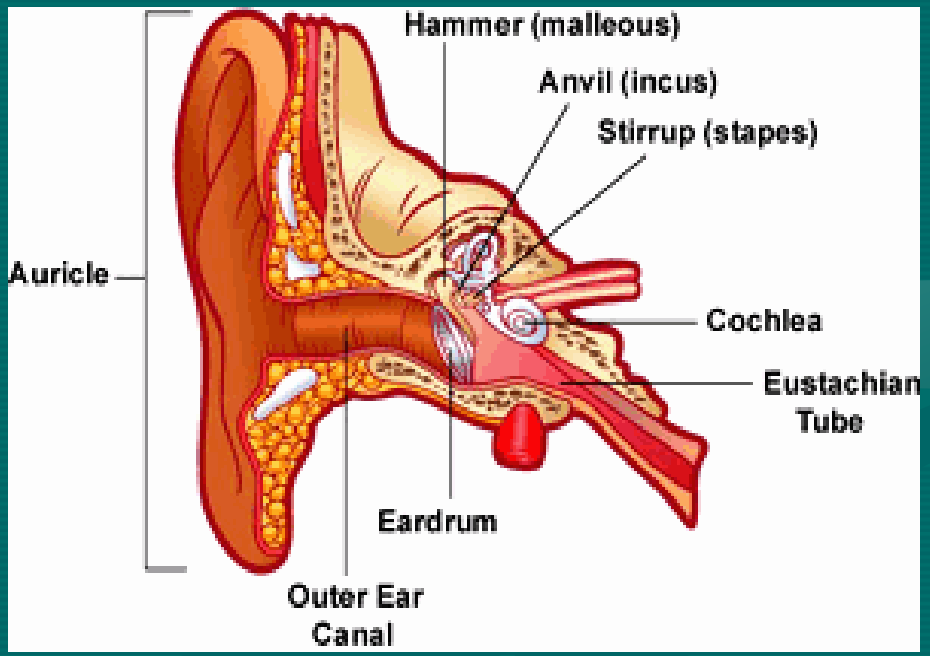
Outline
Deaf and Hearing Impaired

- Physical Structures of the Ear and Degrees of Hearing Loss
- Causes of Hearing Loss
- Types of Hearing Loss

By

Llecenia Navarro, Kimberly Silva, & Evelyn Teran

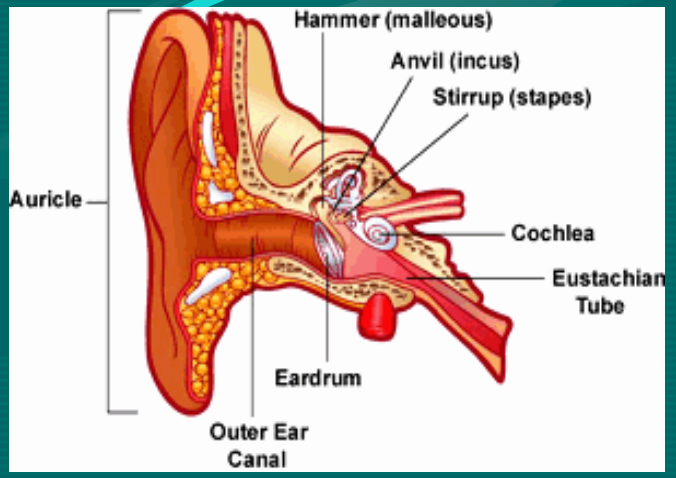
How the ear works



- The ear has three main parts: the outer, middle and inner ear.
- The outer ear (the part you can see) opens into the ear canal.
- The eardrum separates the ear canal from the middle ear.
- Small bones in the middle ear help transfer sound to the inner ear.
- The inner ear contains the auditory (hearing) nerve, which leads to the brain.

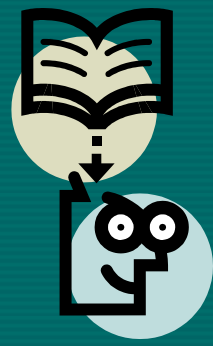
Process of hearing

- Any source of sound sends vibrations or sound waves into the air.
- These funnel through the ear opening, down the ear, canal, and strike your eardrum, causing it to vibrate.
- The vibrations are passed to the small bones of the middle ear, which transmit them to the hearing nerve in the inner ear. Here, the vibrations become nerve impulses and go directly to the brain, which interprets the impulses as sound (music, voice, lawnmower etc.).



Common measures of hearing loss

- The audiologist will conduct tests of hearing tones.
- Pure-tone audiometry
- The results are recorded on a graph called an audiogram.
- The audiologist will also determine *speech reception threshold* or the faintest speech that can be heard half the time.
- Then the audiologist will determine *word recognition* or ability to recognize words at a comfortable loudness level



- ***Tests of Middle Ear Function***
  - Test measurements provide information about the status of the outer and middle ear. These tests are called acoustic immittance measures.
  - One type is called Tympanometry which can detect fluid in the middle ear, perforation of the eardrum, or wax buildup in the ear canal.

- ***Pure-tone Audiometry***
  - Test is completed in a soundproof booth where noise does not affect tests results.
  - Sounds are sent through a special head set called the "vibrator" that has been placed behind the ear or on the forehead.
  - Audiologist may also use a machine called an audiometer to present different tones at different frequencies (pitches) and a different intensities (loudness)

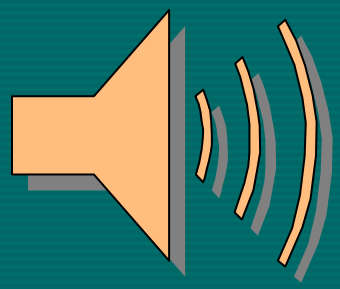
Speech audiometry includes determining *speech reception threshold* (SRT) and testing of *word recognition*.

- *Speech reception threshold* testing determines the faintest level at which a person can hear and correctly repeat easy-to-distinguish two-syllable (spondaic) words.
- Examples of spondaic words are "baseball", "ice cream", "hot dog", "outside", and "airplane." Spondaic words have equal stress on each syllable.
- The individual repeats words (or points to pictures) as the audiologist's voice gets softer and softer.
- The faintest level, in decibels, at which 50% of the two-syllable words are correctly identified, is recorded as the Speech Reception Threshold (SRT). A separate SRT is determined for each ear.

Tests of *word recognition* attempt to evaluate how well a person can distinguish words at a comfortable loudness level

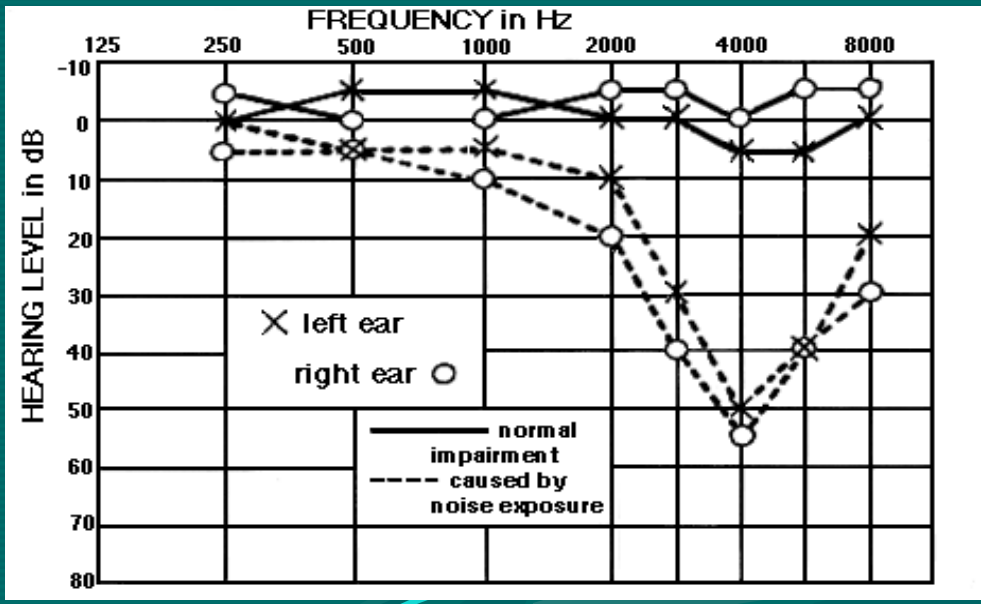
- It relates to how clearly one can hear single-syllable (monosyllabic) words when speech is comfortably loud.
- Examples of words used in this test are "come", "high", "knees", "chew." In this test, the audiologist's voice (or a recording) stays at the same loudness level throughout.
- The individual being tested repeats words (or points to pictures). The percentage of words correctly repeated is recorded for each ear

- The frequency or pitch of the sound is referred to in Hertz (Hz).
- The intensity or loudness of the sound is measured in decibels (dB).
- The responses are recorded on a chart called an *audiogram* that provides a graph of intensity levels for each frequency tested



Audiogram

- Each line on the audiogram from top to bottom represents loudness or intensity in units of decibels (dB). Lines at the top of the chart (small numbers starting at minus 10 dB and 0dB) represent soft sounds. Lines at the bottom of the chart represent very loud sounds.



- At each frequency tested, the "O" represents the softest tone you can hear in your right ear and the "X" represents the softest tone you can hear in your left ear.
- If the "X' s" and "O' s" all fall in the -10dB to 15 dB range, your hearing lies in the normal range.
- If the "X' s" and "O' s" all fall in the 16 dB to 25dB range, you have a slight/minimal loss.
- If the "X' s" and "O' s" all fall in the 31dB to 51dB range, you have a moderate loss. If the "X' s" and "O' s" all fall in the 91dB and above range, you have a profound loss.

- Once the audiogram is completed, the audiologist computes the pure tone average for each ear.
- It is the average of hearing thresholds at 500, 1000, and 2000 Hz, which are considered to be the major frequencies for speech.
- The pure-tone average represents the degree of hearing loss in decibels. It is not a percentage.

Category	Hearing Loss (dB)
Normal	0-25
Mild	26-54
Moderate	55-69
Sever	70-89
Profound	90+

Hearing Impairment

- Hearing impairment is a full or partial decrease in the ability to detect or understand sounds. It is caused by a wide range of biological and environmental factors. Losing the ability to detect some frequencies, or very soft sounds, that an organism detects creates some form of hearing impairment.

Deaf

- Deafness generally refers to a physical condition characterized by lack of sensitivity to sound.
- Notated as *deaf* with a lowercase *d*, this refers to the audiological experience of someone who is partially or wholly lacking hearing.
- In legal terms, deafness is defined by degree of hearing loss. These degrees include profound or total deafness (90 dB - 120 dB or more of hearing loss), severe (60 dB - 90 dB), moderate (30 dB - 60 dB), and mild deafness (10 dB - 30 dB of hearing loss). Both severe and moderate deafness can be referred to as partial deafness or as hard of hearing, while mild deafness is usually called hard of hearing.

What are the major causes of Hearing Loss?

CAUSES

- Infancy

- Later in Life

Causes

- Heredity & genetics
- Meningitis
- Otitis Media
- Noise

Infancy

- **Heredity and genetics:** **(most common cause)**
  - Cleft Palate:
  - Cytomegalovirus:
  - Down syndrome
  - Herpes Simplex virus
  - Hyperbilirubinemia

Infancy –cont'd

- Syphilis -Sexually transmitted bacterial infection
- Toxoplasmosis-
  - by a parasite contracted by the mother and passed on to the developing fetus
- Treacher-Collins syndrome- genetic defect
- Usher syndrome - genes altered or mutated in hearing related systems
- Waardenburg syndrome - genetic defect that may result in hearing loss and changes in skin and hair pigmentation

Infancy – cont'd

- **Meningitis:** 2nd most common cause for deafness
  - Brain infection that affects the central system

- **Otitis Media:**
  - is an infection of the middle ear that results in an accumulation of fluid behind the eardrum and interrupts the process of hearing

Later in Life

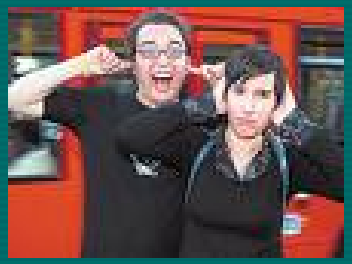
- **Noise:**
  - major contributor to hearing loss in teenagers and adults
  - can be prevented

  Males are more likely to acquire noise-induced hearing loss as they engage in activities such as
    - City or freeway traffic 70 dB
    - Hair dryer/alarm clock 80 dB
    - Mowing the lawn- 90 dB
    - Riding a motorcycle – 90 dB
    - Race car/dance club- 110 dB
    - Firecracker 140 dB
    - Levels 85 and up are considered unsafe





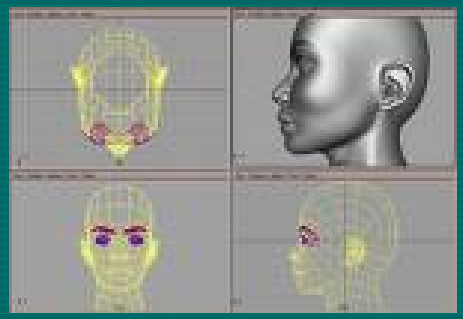
Later in Life- cont'd



- Other causes
  - Acoustic Neurinoma.
  - Sudden deafness hearing is lost w/o warning
  - TMJ Temporo-Mandibular Joint-
  - CAPD Central Auditory Processing Disorder
  - AIED Autoimmune Inner Ear Disease

Later in Life- cont'd

- Mondini Syndrome incomplete cochlea
- Auditory Neuropathy nerves can not
  Process sound
- Presbycusis Age-related hearing loss.
- Ototoxicity when drugs cause hearing loss
- Late deafness person has language and loses hearing later on
- Glue Ear : untreated ear infection
  causing hearing loss



Other causes

- **Asphyxia:**
  - is a lack of oxygen or excess of CO2 in the body
- **Premature birth** before 36 wks of gestation w/ low birth weight
- **Rh incompatibility**
- **Rubella**
  - is an infectious disease that has a high risk of causing congenital abnormalities

What does the world sound like to someone with a hearing loss?

What does the world sound like to someone with a hearing loss?

- Examples
  - http://www.hearingcenteronline.com/sound.shtml
  - Class activity
  - Or Refer to Audiogram example

Types of Hearing Loss

Types of Hearing Loss

- Conductive
- Sensorineural
- Mixed
- Central (aka. Central Auditory Processing Disorder)

Specific Types of Hearing Loss

- Conductive
  - Sound levels are reduced, making it difficult to hear faint sounds
    - Causes: buildup of fluid in the middle ear, wax in the ear canal, puncture of the eardrum, or injuries to the bones or membranes that impede sound conduction
  - Medical or surgical intervention, as well as hearing aids may be helpful

Types of Hearing Loss

- Sensorineural
  - Sound levels are reduced, making it difficult not only to hear faint sounds, but also to hear clearly and to understand speech
    - Causes: Damage to the inner ear or auditory nerve associated with birth injuries, toxic drugs, exposure to loud noises, infection or other diseases, genetic disorders, head trauma, tumors or aging.
  - This is a permanent hearing loss
  - Treated with hearing aids or cochlear implants

Types of Hearing Loss

- Mixed
  - Combines the elements of both conductive and sensorineural hearing loss
    - The outer or middle ear and the inner ear are involved in the hearing loss
    - Causes: A person with a sensorineural hearing loss develops a conductive hearing loss
  - Interventions include medical or surgical intervention, hearing aids, or cochlear implants

Types of Hearing Loss

- Central (aka. Central Auditory Processing Disorder)
  - Difficulty hearing when there is background noise. Also, difficulty localizing sounds, following directions, and paying attention
    - People with CAPD usually have normal hearing when taking traditional hearing tests, but they are unable to process speech effectively in everyday situations (classrooms, workplaces, community gatherings, etc.)
    - Causes: Damage to or impairment of the nerves of the central nervous system, either the pathway to the brain or to the brain itself, tumors or genetic abnormalities. Most often the cause is unknown.
  - Interventions include:
    - Training in phonological awareness skills, language processing skills, functional organization, and study skills.

Educational Implications

- Communication
- Learning
- Social Interactions

Educational Implications

- Communication (Classroom Implications)
  - Consider how the child communicates and the opportunities available for the child to share in communication
  - Identify the child's best communication mode
  - Early language intervention and ongoing language exposure is critical

Educational Implications

- Communication (Classroom Implications)
  - Strong reliance on the student's visual field
    - Classroom needs to be well lit
    - Students seated close to the teacher
      - Best seating arrangement is placing tables or seats in a horseshoe shape
    - Gain the student's attention the following ways:
      - Tap on their shoulder, hand movement in the child's visual field, or a flick of the overhead lights
    - Limit simultaneous presentation of material
    - Have someone take notes for the student
    - Eliminate background noise

Educational Implications

- Communication (Forms used by students)
  - Speech and Language
  - Assistive Listening Devices (ALDs)
    - FM systems, hearing aids, cochlear implants
  - Cued Speech
  - American Sign Language (ASL)
  - Interpreters

Educational Implications

- Learning
  - Development of literacy skills necessary for students who are deaf and hard-of-hearing
    - First, student's language development is critical
  - Teach the student about his/her hearing loss
    - They become a self advocate and understand their learning style, strengths and weaknesses.

Educational Implications

- Social Interaction
  - Consider the child's needs and how their placement can affect their social-emotional development
  - Teach students how to ask questions, take turns and listen
  - Incorporate small group activities
    - Dyad cooperative exercises are best for equal interaction to take place
  - Foster home-school collaboration

Testing Accommodations

- Use the student's preferred mode of communication
- Seat within 2-3 feet
- Provide a well lit room that avoid glare
- Use distinct speech but don't exaggerate
- Minimize visual distraction and background noise
- Ensure assistive listening devices are working and used before beginning assessment

Taken from Steve's lecture on Deaf and Hearing impairment ☺

Assessments Tools

- UNIT
- Wechsler Performance Scale
- Raven Coloured Progressive Matrices
- KABC-II
- Test of Non-Verbal Intelligence
- Pictorial Test of Intelligence
- Columbia Mental Maturity Scale
- Verbal Tests are almost always inappropriate

Taken from Steve's lecture on Deaf and Hearing impairment ☺

THE END

Any questions?

References

- Bradley-Johnson, S & Evans, L.(1991). Psychoeducational assessment of hearing-impaired students. Austin, Texas: Pro-Ed.
- California Department of Education. (2000). *Programs for deaf and hard of hearing students: Guidelines for quality standards.* Sacramento, CA: Author; (Retrieved May 3, 2007 from http://www.cde.ca.gov/sp/ss/dh/.)
- Davis, H. (1986) Physicians' guide to the education of hearing-impaired children Washington, D.C: Alexander Graham Bell.
- Sattler, J.M. & Hoge, R.D. (2006). Assessment of children: Behavioral, Social, and Clinical Foundations 5th Edition. La Mesa, CA: Sattler Publishing.
- Smith, D. D. (2007). Introduction to Special Education: Making a Difference 6th Edition. New York, NY: Pearson Education.
- Thomas, A. & Grimes, J. (Eds.) (2004). *Best practices in school psychology.* Bethesda, MD: National Association of School Psychologists.
- http://www.asha.org/public/hearing/disorders/types.htm
- http://www.stronghealth.com/services/Audiology/hearing/typeshearingloss.cfm
- http://www.kidshealth.org/kid/health_problems/sight/hearing_impairment.html
- http://www.ci.maryville.tn.us/mhs/MCSSped/deafHear.htm

References

- http://www.nidcd.nih.gov/health/hearing/usher.htm
- http://www.nidcd.nih.gov/health/hearing/waard.asp
- http://www.chargesyndrome.org/
- http://deafness.about.com/cs/earbasics/f/causes.htm
- http://www.otal.umd.edu/uupractice/hearing/