Objectives

- To identify the major structures of the ear.
- To identify the primary functions of the ear.

Anatomy of the Ear

I. External ear:
   - Pinnae: “auricle”
     - acts as funnel for sound.
   - External auditory meatus: “ear canal”
     - transfers sound to inner ear
   - Tympanic membrane: “ear drum”
     - connective tissue membrane
     - vibrates in response to sound
     - partition between external/middle

Middle ear

- Located in tympanic cavity
- Contains three ear bones/ossicles:
  a. malleus (hammer)
  b. incus (anvil)
  c. stapes (stirrup)
    - this bone attaches to oval window separating middle and inner ear
    - Auditory tube – for pressure equalization connects with nasopharynx

Inner ear

I. Bony labyrinth
   - membrane-lined cavity
     - within temporal bone
     - membrane secretes perilymph
II. Membranous labyrinth
   - hollow tube lies within bony labyrinth
   - contains endolymph
Organs within inner ear

Vestibule (equilibrium)
Semi-circular canals (equil. & orientation)
Cochlea (hearing) – Organ of corti

Vestibule
- Central egg-shaped cavity of the bony labyrinth
- Contains two membranous sacs
  - Saccule is continuous with the cochlear duct
  - Utricle is continuous with the semicircular canals
These sacs
  - House equilibrium receptor regions (maculae)
  - Respond to gravity and changes in the position of the head

Semicircular Canals

Three canals
  - anterior
  - lateral
  - posterior
Ampulla of each canal houses equilibrium receptor region called the crista ampullaris*

The Cochlea

Spiral, conical chamber
- Modiolus: a bony inner pillar
- Cochlear duct: houses the spiral organ (of Corti) and ends at the cochlear apex, at site of helicotrema.
Canals: Vestibular & tympanic

Sound

A pressure disturbance
- A sound wave – series of compressions (high pressure area) with rarefactions (low pressure area).
Physiology of Hearing

1. Sound waves enter ear via external acoustic meatus.
2. Cause vibrations of tympanic membrane.
3. Ossicles in middle ear amplify vibrations ~ 20 x’s stronger before passing pressure waves to oval window.
4. Pressure waves stimulate & displace basilar membrane of cochlea.
5. Hair cells in Organ of Corti bent, this generates a nerve impulse
6. NI sent via vestibulocochlear nerve.

Organ of Corti

Within cochlear duct:
- tectorial membrane
- basilar membrane
- hair cells
  projecting stereocilia (sense receptor)
  Respond when bent by the movement of surrounding endolymph set in motion by sound waves

Received by cochlear nerve
works in cooperation with vestibular nerve to send info via cranial nerve VIII

Excitation of Hair Cells in the Spiral Organ

The stereocilia (hair cells / sensory receptors)
- Protrude into the endolymph
- Enmeshed in the gel-like tectorial membrane

Bending stereocilia
- Opens mechanically gated ion channels
- Inward K⁺ and Ca²⁺ current causes a graded potential and the release of neurotransmitter glutamate

Cochlear fibers transmit impulses to the brain