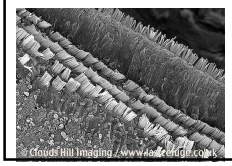
The Ear

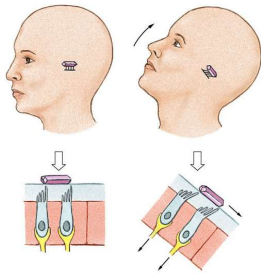
Basic Functional Unit

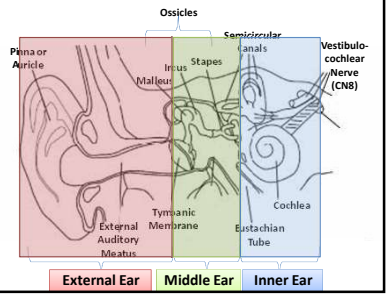
- Recall: what is the function of cilia?
- BFU of the ear = Hair Cell+



The Ear Functions

- Detection of rotational movements
- Detection of gravity
- Detection of sound
- Aide in speech
  - Sorry, you do sound like your voice mail recording!



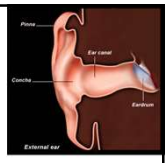


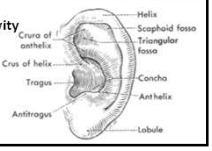
The Ear

- Sensory Organ
- Hearing & Equilibrium
- 3 sections
  - External
  - Middle
  - Inner

External Ear

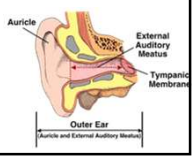
- Auricle or Pinna
  - Funnels, amplifies, and transmits sound waves
    - Directional sensitivity (cup your ears)
  - Made of skin & cartilage



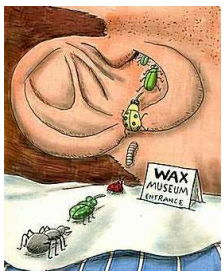


External Ear

- External Auditory Meatus (Canal)
  - ~2cm long "tube"
  - Encompassed by cartilage & bone
  - Lined with hair & glands (cerumen & sweat)
    - Antimicrobial, insect repellant

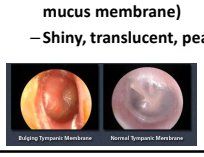


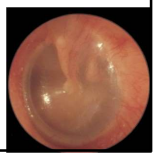
Not always in balance!



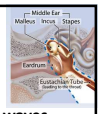
External Ear

- Tympanic Membrane (eardrum)
  - Covers the proximal end of the canal
  - Made of layers of skin (fibrous tissue & mucus membrane)
  - Shiny, translucent, pearly

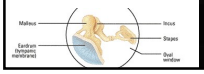




Middle Ear

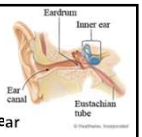


- Air-filled cavity in temporal bone
  - Detects vibrations, amplifies sound waves
- 3 bones – auditory ossicles
  - Malleus (hammer)
  - Incus (anvil)
  - Stapes (stirrup)



Middle Ear

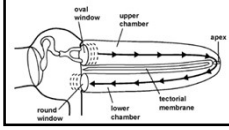
- Eustachian Tubes
  - Connects throat with middle ear (1 continuous membrane)
  - Drains any fluid build up to throat
    - Infections can travel via tube…

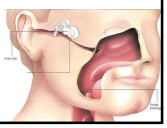


Middle Ear

Structures that Equalize Pressure

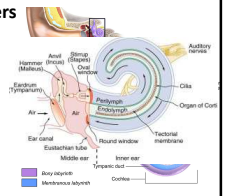
- Oval Window & Round Window
- Eustachian Tube: equalizes pressure behind the tympanic membrane





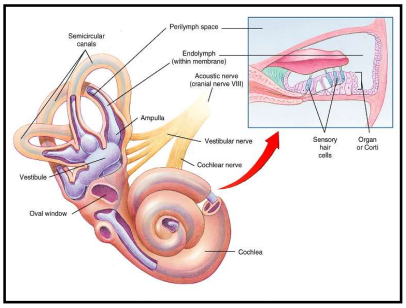
Inner Ear

- Fluid filled chambers
  - Perilymph (between membranous & bony labyrinth)
  - Endolymph (within membranous labyrinth)
- Activation of mechanoreceptors generates nervous impulses = hearing & equilibrium



Inner Ear

- Vestibule
  - Nerves leave this area to go to the brain
- Semicircular canals
  - Balance & equilibrium
  - Hair-like receptors in fluid detect movement
- Cochlea
  - Organ of Corti responsible for hearing
  - Hair-like receptors in fluid detect sound waves

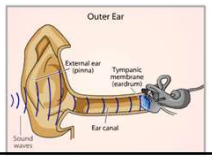


Hearing

1. Sound waves enter the outer ear & travel through the ear canal to the tympanic membrane

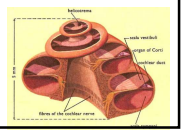
Hearing

2. **Tympanic membrane vibrates, passing those vibrations on to the ossicles in the middle ear**



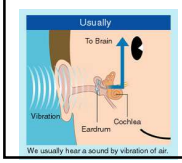
Hearing

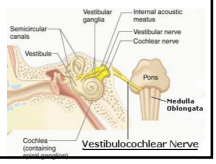
3. **Ossicles amplify the sound vibrations & send them to the cochlea. The vibrations activate the tiny hair cells, which in turn release neurochemical messengers .**



Hearing

4. **The auditory nerve carries the signal to the brain, which translates it into a sound you can understand.**





Mechanism of Hearing

The_____ directs sound waves to the _____, and sets the _____ membrane vibrating. This vibration passes through the _____, _____, and _____ bones. The footplate of the _____ moves backwards/forwards over the _____ window. This sets up fluid vibrations of the _____ within the cochlea. Vibrations of the basilar membrane stimulate the _____ cells of the organ of corti. An electrical impulse is than carried via the _____ nerve to the _____ nerve and to the brain where interpretation occurs.

Answers

- **Auricle**
- **External auditory canal**
- **Tympanic**
- **Malleus**
- **Incus**
- **Stapes**
- **Stapes**
- **Oval**
- **Endolymph**
- **Hair**
- **Cochlear**
- **Vestibulocochlear**

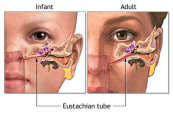
Putting it all Together!

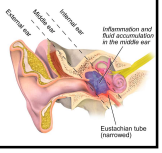
Ear Conditions

- **Otitis Externa ("Swimmer's Ear")**
  - **Inflammation of the external auditory meatus**
  - **Common Causes**
    - **Bacterial infection**
    - **Fungal infection**
    - **Irritation or Allergies**
  - **Possible triggers:**
    - **Moisture, damage, chemicals, skin conditions…**

Ear Conditions

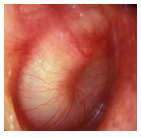
- **Otitis Media (Middle Ear Infection)**
  - **Caused by bacterial or viral infection**
  - **Common in young children due to immature anatomy**





Ear Conditions

- **Myringotomy –**
  - **tubes in the tympanic membrane to allow drainage of infection**



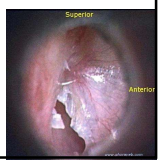
Ear Conditions

- Hearing Loss
  - –Commonly caused by:
    - ✓Overexposure to loud sounds
    - ✓Physical injury to the ear
    - ✓Infections
    - ✓Aging

Ear Conditions

Deafness

- Conductive Deafness: interference with the transfer of vibrations
  - – Many treatments
  - – Limitations?



Ear Conditions

Deafness

- Nerve (sensorineural) Deafness: problem lies within the cochlea/nerve
  - – Limited treatments (because neural tissue does not regenerate well)

Cochlear Implants (3 short video clips)

- What is it?
- Surgery
- 1st Time: