Special Senses

- Sight
- Hearing
- Equilibrium (balance)
- Smell
- Taste

Sensory Receptors

5 Types
1. Photoreceptors
   - Seeing
2. Mechanoreceptors
   - Hearing & equilibrium
3. Chemoreceptors
   - Smell and taste
4. Nociceptors
   - Pain
5. Thermoreceptors
   - Temperature
Anatomy of the Eye

External and Accessory Structures
- Eyebrows
- Eye lids
  - Eyelashes
  - Meibomian glands
  - Ciliary glands
- Conjunctiva
- Lacrimal apparatus
  - Lacrimal glands

Internal Structures: The Eyeball
- Tunics (coats)
  - Three (3) covering of the eye walls
- Humors
  - Two (2) fluid filled interior spaces
3 Tunics of the Eyeball

1. Sclera – (fibrous tunic)
   - Cornea

2. Choroid – (vascular tunic)
   - Ciliary body
   - Suspensory ligament
   - Lens
   - Iris and Pupil

3. Retina – (sensory tunic)
   - Rods and cones

Eye Disorders

- Cataracts
  - Lens becomes hard and opaque
- Glaucoma
  - Drainage of aqueous humor blocked, pressure increases
- Color blindness
  - Lacking one or more cone receptors

Cavities of the Eye

- Anterior cavity
  - Aqueous humor
- Posterior cavity
  - Vitreous humor
Retina Anatomy

- Three retinal layers
  1. Rod and cone layer
  2. Bipolar cell layer
  3. Ganglion cell layer
- Fovea centralis
  - macula lutea
- Optic disc - Blind spot
- Optic nerve
Visual Pathway in the Eye

Light refracts as it passes through each eye structure
- cornea
- aqueous humor/anterior cavity
- pupil/iris
- lens
- vitreous humor
- retina
  - ganglion cell layer
  - bipolar cell layer
  - rods/cones → action potential
Visual Pathways to the Brain

- ganglion cell axons from both eyes
- optic nerves
- optic chiasma
- optic tracts
- thalamus
- visual cortex in occipital lobe
- frontal lobe

Focusing—General

Focusing—Far and Near
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**Nearsightedness**

- Normal eyeball
- Long eyeball: rays focus in front of retina when viewing distant object.
- Concave lens allows subject to see distant objects.

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**Farsightedness**

- Normal eyeball
- Short eyeball: rays focus behind retina when viewing close objects.
- Convex lens allows subject to see close objects.

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**Two Types of Astigmatism**

- Uneven cornea: rays do not focus evenly.
- Uneven lens allows subject to see objects clearly.
- Uneven lens: rays do not focus evenly.
- Uneven lens allows subject to see objects clearly.
Anatomy of the Ear

- Outer (external) Ear
  - Pinna (auricle)
  - External auditory canal
  - Tympanic membrane (eardrum)
- Middle ear
  - Ossicles - malleus, incus, and stapes
  - Eustachian tube
- Inner Ear
  - Cochlea
  - Semicircular canals
  - Vestibule
Pathway to Hearing part 1

- External sound waves
- Eardrum moves (vibrates)
- Malleus (hammer) moves
- Incus (anvil) moves
- Stapes (stirrup) moves
- Stapes (stirrup) moves**
- Oval window moves (inner ear)
- inner ear fluids move
- Hearing receptors excited
- Action potential created

Human Ear Anatomy

Inner Ear Anatomy

- Cochlea
  - Organ of Corti
- Vestibule
  - Utricle
  - Saccule
- Semicircular canals
  - Ampullae
  - Vestibulocochlear nerve
Location and Structure of Organ of Corti

tectorial membrane

nerve fibers

hair cells

basilar membrane

Anatomy of Cochlea

tectorial membrane

cochlear canal

basilar membrane

Cochlea, cross section
Pathway to Hearing part 2

- Ossicles move
- Fluid in vestibular & tympanic canals (perilymph) moves
- Fluid in cochlear canal (endolymph) moves
- Basilar membrane moves
- Hair cells displaced
- Microvilli bend
- Stimulation of hair cells
- Action potential from hair cell to cochlear N
- Nerve impulse to brain

Mechanisms of Equilibrium

1. Static Equilibrium
   - Position of the head with respect to gravity
   - Vestibule
2. Dynamic Equilibrium
   - Angular or rotational body movements
   - Semicircular canals
Pathway for Static Equilibrium

Reports position of head with respect to gravity when the body is still

- Bend over
- Gel moves
- Microvilli bend

- Stimulation of hair cell
- Action potential from hair cell to vestibular nerve
- Nerve impulse to cerebellum
Hearing and Equilibrium Deficits

Deafness
- Hearing loss of any degree
  1. Conduction deafness
     - Interference with conduction of sound waves to inner ear
  2. Sensorineural deafness
     - Damage to receptor cells in Organ of Corti, cochlear nerve, or neurons of auditory cortex

Equilibrium problems
- Nausea, dizziness, vertigo
**Taste and Smell**

- Chemoreceptors
- Olfactory receptor cells
  - Olfactory nerve
    - cribriform plate (of ethmoid bone)
    - close to temporal lobe
- Taste buds
  - Papillae
    - Gustatory cells
    - Gustatory hairs

**Olfactory Cell Anatomy**

**Taste**

**Contributors to the sense of taste**

- Taste buds
  - salty, sweet, sour & bitter
  - locations
- Olfactory cells
  - stuffy nose
- Spicy & Pungent
  - trigeminal N
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Taste Bud Locations on Tongue

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The End