Ch. 8: Special Senses

PART I: The Eye and Vision

* ____ % of all sensory receptors are in the eyes.
* Each eye has

I. Anatomy of the Eye (p. 280 - 288)

A. External and Accessory Structures

* Protection for the eye:
  1. 
  2. 

- Conjunctiva
  - Membrane that
  - Connects to the
  - Secretes mucus to _______________ the eye and keep it

- Lacrimal apparatus = lacrimal gland + ducts
  - Lacrimal gland: produces lacrimal fluid; situated on lateral aspect of each eye.
  - Lacrimal canaliculi: drain lacrimal fluid from eyes medially.
  - Lacrimal sac: provides passage of lacrimal fluid towards nasal cavity.
  - Nasolacrimal duct: empties lacrimal fluid into the nasal cavity.
* The Lacrimal Apparatus

* Empties into
* Lacrimal secretions (tears) contain:
  1.
  2.
  3.
  4.

- Extrinsic eye muscles
  * _______ muscles attach to the outer surface of the eye.

  - Produce eye

B. Internal Structures: The Eyeball

1. Layers forming the Eyeball Wall
   a. Fibrous Layer
      - Sclera
      *

   - Cornea
     *
     * Allows for __________ to pass through.
     * Repairs
     * The only human tissue that can be transplanted without fear of
b. Vascular Layer

* Choroid is a blood-rich nutritive layer in the posterior of the eye.
  - Pigment prevents light from scattering.
* Modified anteriorly into two structures:
  2. Iris
    * Regulates the amount of
    * Pigmented layer that gives
    * Pupil: rounded

c. Sensory Layer

- Retina contains two layers:
  1. Outer pigmented layer
  2. Inner neural layer
    * Contains photoreceptor cells called
      - Signals pass from photoreceptors via a two-neuron chain
        1. Bipolar neurons
        2. Ganglion cells
    * Signals leave the retina toward the brain through the
      * Optic disc (blind spot) is where the
        * Cannot see images focused on the optic disc - no

- Neurons of the retina and vision

- Rods

  * Most are found towards the
  * Allow _______ light vision and __________________ vision.
  * All perception is in _________ tones.
- Cones
  * Allow for detailed
  * Fovea Centralis:
    * densest concentration of _______ and no
  * Vision is sharpest here...during the
  * Three Types, each is sensitive to different wavelengths.
  * Color blindness is the result of the lack of

* Cones are sensitive to:
  -
  -
  -

  * These three colors are the primary colors of light - mixing them will give you any color of light.

* Coincidence or Grand Design???

2. The Lens
  * Curved
  * Held in place by a suspensory ligament attached to the ciliary body.
  * Cataracts result when the lens becomes

  * Vision becomes
  * Eventually causes blindness.

- Risk factors include:
  - Diabetes mellitus
  - Frequent exposure to intense sunlight
  - Heavy smoking
  - Running into tree branches when in high school. :)

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3. Anterior & Posterior of the Lens
   a. Anterior (aqueous) segment
      * Contains **Aqueous Humor**: ________________ found between
        lens and cornea. (Similar to
        - Helps maintain intraocular pressure (pressure in the eye...glaucoma).
      * Provides nutrients for the
        - Reabsorbed into venous blood through the scleral venous sinus, or
          canal of Schlemm.
   b. Posterior Segment
      * Contains **Vitreous Humor**: Gel-like substance posterior to the lens.
      * Prevents the eye from collapsing.
      * Helps maintain intraocular pressure.

4. Other Random Thing
   * **Ophthalmoscope**: An instrument used to illuminate the interior of the
     eyeball.
     * Can detect diabetes, arteriosclerosis, degeneration of the optic
       nerve and retina.

II. Physiology of Vision  (p. 288 - 291)

   A. Light's Path & Refraction
      * Light must be focused to a point on the ____________ for optimal vision.
      * The eye is set for distance vision (over 20 feet away).
      * The lens must ________________ to focus on ____________ objects.

![Diagram of eye with light paths and focal point](image.png)
* The image of what you're seeing is a real image on the retina.
* The image is:
  * 
  * 
  *

B. Visual Fields & Pathways to the Brain
* Optic chiasma: Location where the optic nerves cross.
  * Fibers from the medial side of each eye cross over to the opposite side of the brain.
* Optic tracts: Contain fibers from the lateral side of the eye on the same side and the medial side of the opposite eye.

C. Eye Reflexes
* Internal muscles are controlled by the autonomic nervous system.
  * Bright light causes pupils to ____________ through action of radial, circular, and ciliary muscles.
  * The changing shape of the ________ to adjust for focal distance.
* External muscles control eye movement to follow objects.
* Viewing close objects causes convergence (eyes moving toward each other medially).
  * This is how your brain processes

D. Defects in Vision
1. Myopia (nearsighted)
   * Near is ___________, distant objects appear
   * Light focuses too ________ the lens.
   * Happens when the eye is

2. Hyperopia (farsighted)
   * Far away objects are ___________, near objects are
   * Light doesn't come into focus by the time it reaches the retina.
   * Caused by an eyeball that is too short or from a "lazy lens".
3. Astigmatism
   * ____________ ______________ of the cornea or lens
     results in a blurry image.

4. Night Blindness
   * Inhibited ______ function that hinders the ability to see at night.

5. Color Blindness
   * ______________ conditions that result in the inability to see
     certain ____________.
   * Due to the lack of one type of ________ (partial color blindness).

6. Cataracts
   * The lens becomes hard and _____________, making vision
     hazy and distorted.

7. Glaucoma
   * Increasing ______________ within the eye; can cause
     blindness.

Part II: The Ear: Hearing & Equilibrium

I. Anatomy of the Ear
   A. External (Outer) Ear
      * Involved in ______________ only.
      - Structures of the external ear:
        1. Auricle (pinna)
        2. External acoustic meatus (auditory canal)
           * Narrow chamber in the temporal bone.
           * Lined with ________ and ceruminous (_______) glands.
           * Ends at the ______________ ________________.
   B. Middle Ear (Tympanic Cavity)
      * ______ - ______________ Air-filled cavity within the temporal bone.
      * Only involved in the sense of hearing.
- Two tubes are associated with the inner ear:
  1. The opening from the auditory canal is covered by the tympanic membrane.
  *2. The auditory (Eustachian) tube connecting the middle ear with the throat.
     * Allows for ________________ ________________ during yawning or swallowing.
     * This tube is otherwise ________________.
  * Three bones (ossicles) span the Middle Ear Cavity:
    1. Malleus (__________)
    2. Incus (__________)
    3. Stapes (__________)
     * The three bones connect the ________________ to the ________________
        ...transfer vibrations from the outer ear to the inner ear for sound detection.
  C. Inner Ear (Bony Labyrinth)
      * Includes sense organs for ________________ and ________________.
      * Contains a maze of bony chambers within the temporal bone.
  
II. Organs of Equilibrium
- Equilibrium receptors of the inner ear are called the vestibular apparatus.
- Vestibular apparatus has two functional parts - Static & Dynamic Equilibrium.
  A. Static Equilibrium
     * Maculae—receptors in the vestibule.
        * Report on the position of the head.
  B. Dynamic Equilibrium
     * Receptors respond to angular or rotary movements.
III. Hearing  (p. 297 - 298)
- Organ of Corti
  - Located within the cochlea.
  - Receptors = hair cells on the basilar membrane.
  - Gel-like tectorial membrane is capable of bending hair cells.
  - Cochlear nerve attached to hair cells transmits nerve impulses to auditory cortex on temporal lobe.
  - Vibrations from sound waves move tectorial membrane.
  - Hair cells are bent by the membrane.
  - An action potential starts in the cochlear nerve.
    - Impulse travels to the temporal lobe.
  - Continued stimulation can lead to adaptation.

PART 3: Chemical Senses: Taste & Smell  (p. 300 - 302)

I. Olfactory Receptors and the Sense of Smell
- Olfactory receptors are in the
  - Neurons with long cilia.
  - Chemicals must be dissolved in mucus for detection.
  - Impulses are transmitted via the olfactory nerve.
  - Interpretation of smells is made in the cortex.

II. Taste Buds and the Sense of Taste
- Taste buds house the receptor organs.
  - Most are on the tongue, some are on the Soft palate and Cheeks.
  - The tongue is covered with projections called papillae.
  - Taste buds are found on the sides of papillae.
- Taste Sensations:
  - Sweet receptors (sugars)
  - Sour receptors
  - Bitter receptors
  - Salty receptors
Body Parts to Know: