Objectives

To introduce the special senses.
Focus on the anatomy of the eye.
To explore the functions of the photoreceptors and the chemistry that influences these functions.
To relate the physical aspects related to vision and optics.
To list the different disease conditions of the eye.

Special Senses

- Smell
- Taste
- Sight
- Hearing
- Equilibrium

Special senses have specialized receptor cells.
- Chemical
- Photo
- Mechanical
- 70% of all sensory receptors are in the eye
- Nearly half of the cerebral cortex is involved in processing visual information
- Most of the eye is protected by a cushion of fat and the bony orbit

Anatomy of the Eye

I. External
   - Eyebrows, eyelashes, lids
II. Muscular
   - Iris, extrinsic eye muscles, ciliary
III. Tunics
   - Cornea, retina, choroid
IV. Lens
V. Humors
   - Aqueous (anterior), Vitreous (posterior)

Fibrous Layer

Outermost layer; dense avascular connective tissue
Two regions:
1. Sclera – White of the eye
2. Cornea – Transparent anterior
Vascular Layer (Uvea)

Middle pigmented layer

Three regions:
3. Iris - The colored part of the eye

Path of light through the eye

>Cornea
  > Aqueous humor
    > Pupil
      > Lens
        > Vitreous humor
          > Ganglion cells*
            > Bipolar cells
              > Photoreceptors
                > Choroid

*Ganglion cells: Contain the axons that will merge to become the optic nerve.

Retina = Sensory Tunic

The neural tunic of the eyeball, → containing the photoreceptors.

Said to be an outpocketing of the brain.

- Only the neural layer plays a role in vision.
  - Photoreceptors
  - Bipolar cells
  - Ganglion cells

Receptors of the eye

Exteroceptors – stimuli arising from outside of the body.

During visual processing light is converted to nerve impulses → light is said to have modality.

Photoreceptors

Characteristics of Rods:
- Retinal neurons
- Contain unique visual pigments
- Absorb wavelengths of light in dim conditions.
  - In greater abundance further from the optic nerve/fovea.
- Handle peripheral vision
- Gray tones
Photoreceptors

Characteristics of cones:
- Retinal neurons
- In greatest concentration near the fovea
- Operate best in bright light
- Provide high acuity color vision.
- Have special pigments that are sensitive to different wavelengths of light.

Refraction

The bending of light through different media, when it meets a different surface at an oblique angle.

4 refracting media (fluids) encountered:
- Cornea
- Aqueous humor (anterior segment)
- Lens*
- Vitreous humor (posterior segment)

* The thicker (more convex) the lens the more the light is bent and the shorter the focal distance.

Accommodation & Convergence

Process that increases refractory power of lenses.

Mechanism: contraction of the ciliary muscles to recoil and bulge the lens.

Completion is controlled by parasympathetic fibers
- Oculomotor nerves

Bulging lens: focus on items close up. → eye strain
Flattened lens: focus on items at a distance.

Convergence – Focusing on a close object using both eyes
Visual Acuity

The ability to discern detail.

20/40 means…. A person sees at 20 feet what others see at 40 feet.

Photoreception revisited

Rhodopsin – pigment that combines with proteins called opsins.

Chemically related to Vitamin A.

Converts light energy into electrical signals picked up by the photoreceptors.

Forms and accumulates in the dark. In light it bleaches out.

Diseases and Disorders of the Eye

Conjunctivitis
Myopia
Macular degeneration
Trachoma