Essentials of Human Anatomy & Physiology

Seventh Edition

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Chapter 8

Special Senses

Slides 8.1 – 8.19

Lecture Slides in PowerPoint by Jerry L. Cook

The Senses

- General senses of touch
  - Temperature
  - Pressure
  - Pain
- Special senses
  - Smell
  - Taste
  - Sight
  - Hearing
  - Equilibrium

The Eye and Vision

- 70 percent of all sensory receptors are in the eyes
- Each eye has over a million nerve fibers
- Protection for the eye
  - Most of the eye is enclosed in a bony orbit
  - A cushion of fat surrounds most of the eye

Accessory Structures of the Eye

- Eyelids
- Eyelashes

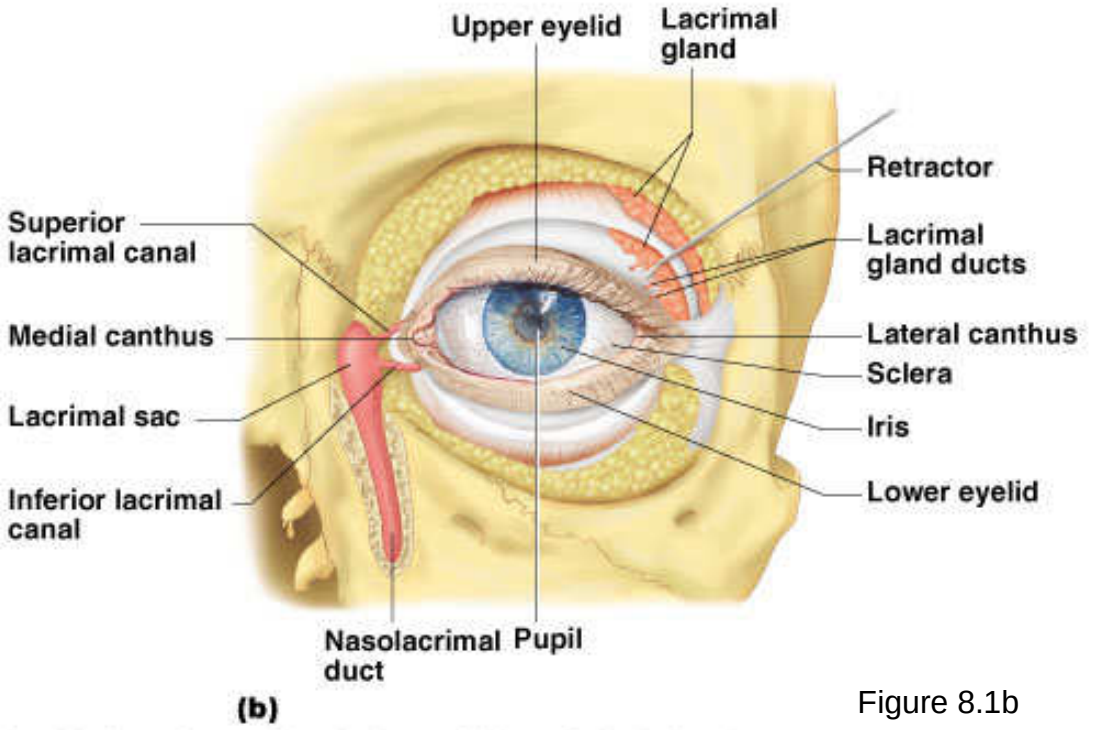

Figure 8.1b

Accessory Structures of the Eye

- Meibomian glands – modified sebacious glands produce an oily secretion to lubricate the eye

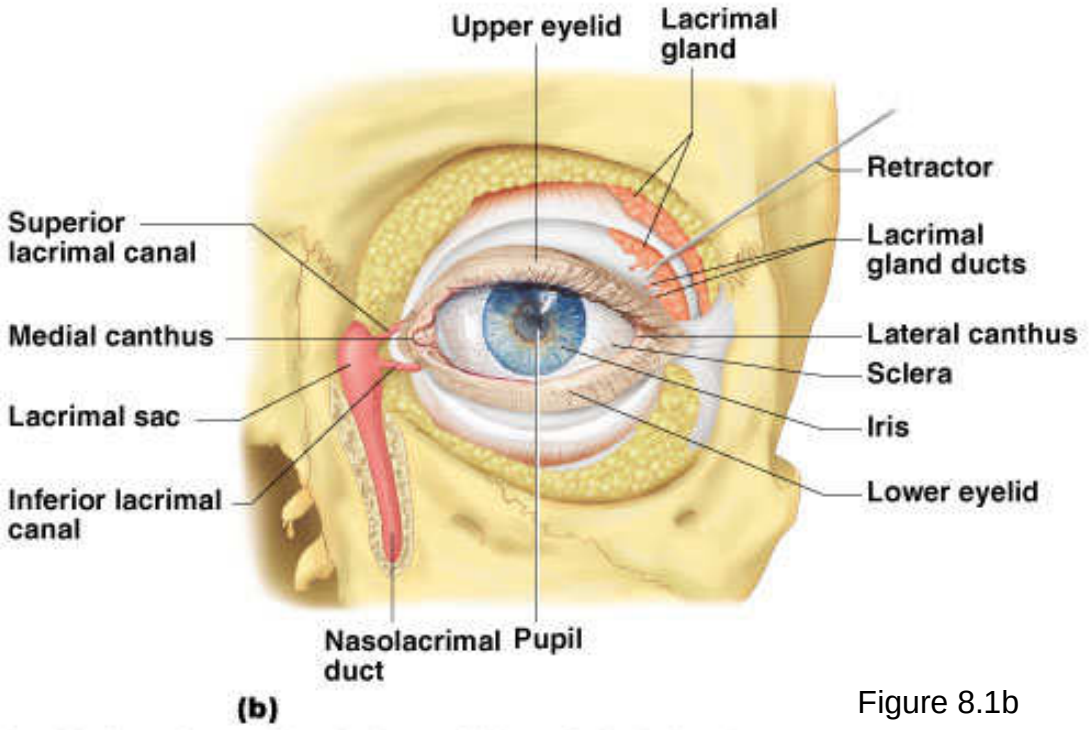

Figure 8.1b

Accessory Structures of the Eye

- Ciliary glands – modified sweat glands between the eyelashes

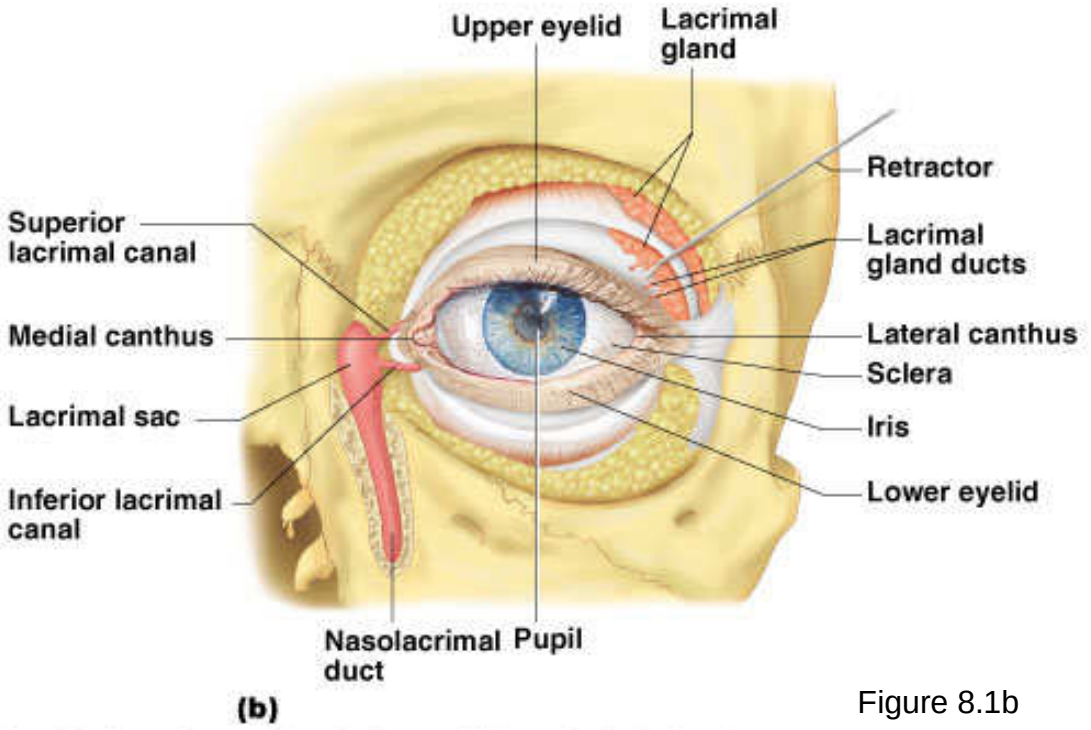

Figure 8.1b

Accessory Structures of the Eye

- Conjunctiva
  - Membrane that lines the eyelids
  - Connects to the surface of the eye
  - Secretes mucus to lubricate the eye

Accessory Structures of the Eye

- Lacrimal apparatus
  - Lacrimal gland – produces lacrimal fluid
  - Lacrimal canals – drains lacrimal fluid from eyes

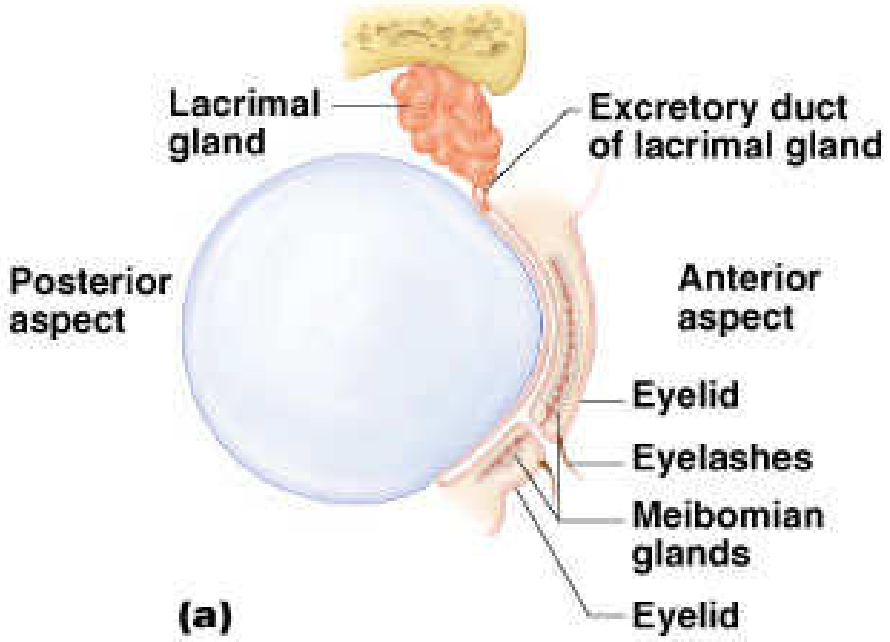

Figure 8.1a

Accessory Structures of the Eye

- Lacrimal sac – provides passage of lacrimal fluid towards nasal cavity

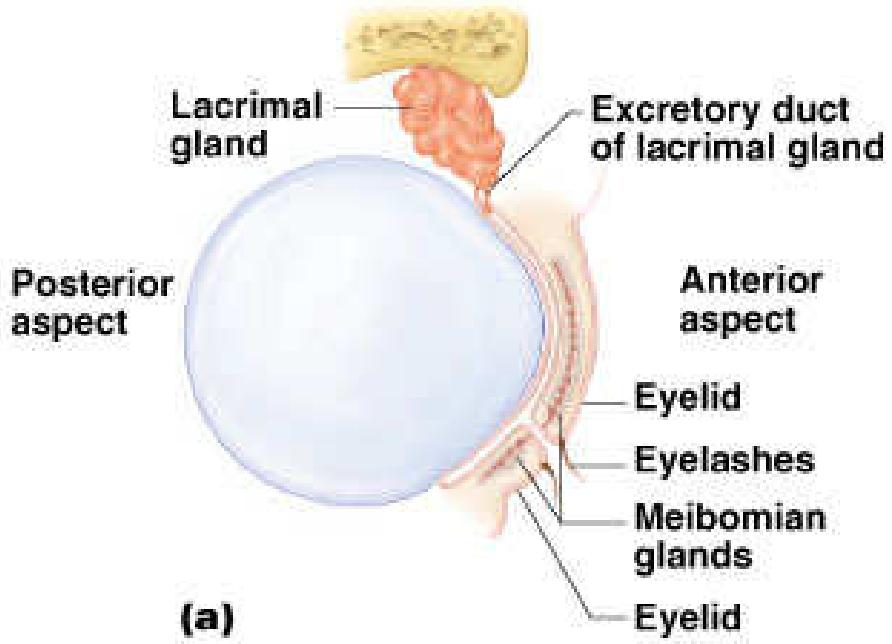

Figure 8.1a

Accessory Structures of the Eye

- Nasolacrimal duct – empties lacrimal fluid into the nasal cavity

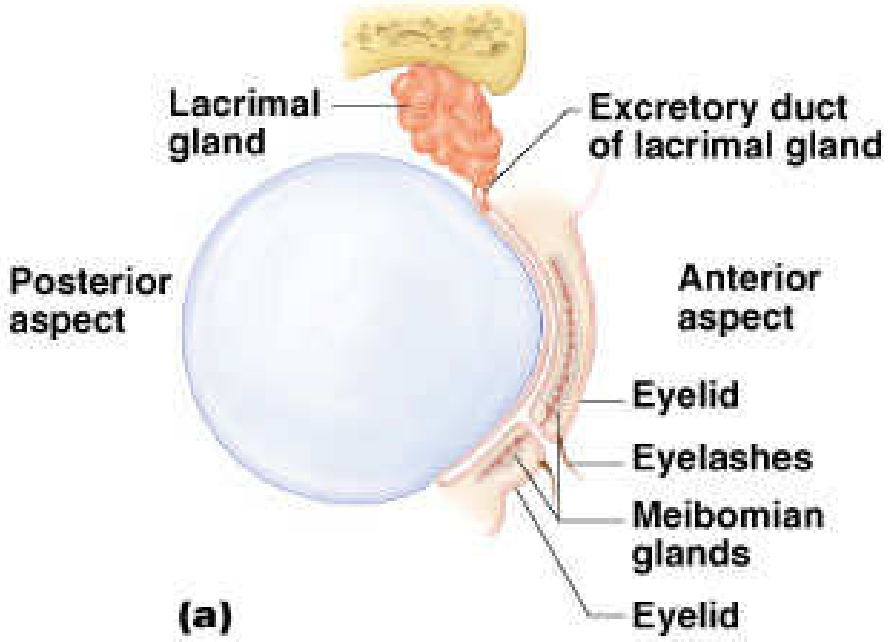

Figure 8.1a

Function of the Lacrimal Apparatus

- Properties of lacrimal fluid
  - Dilute salt solution (tears)
  - Contains antibodies and lysozyme
- Protects, moistens, and lubricates the eye
- Empties into the nasal cavity

Extrinsic Eye Muscles

- Muscles attach to the outer surface of the eye
- Produce eye movements

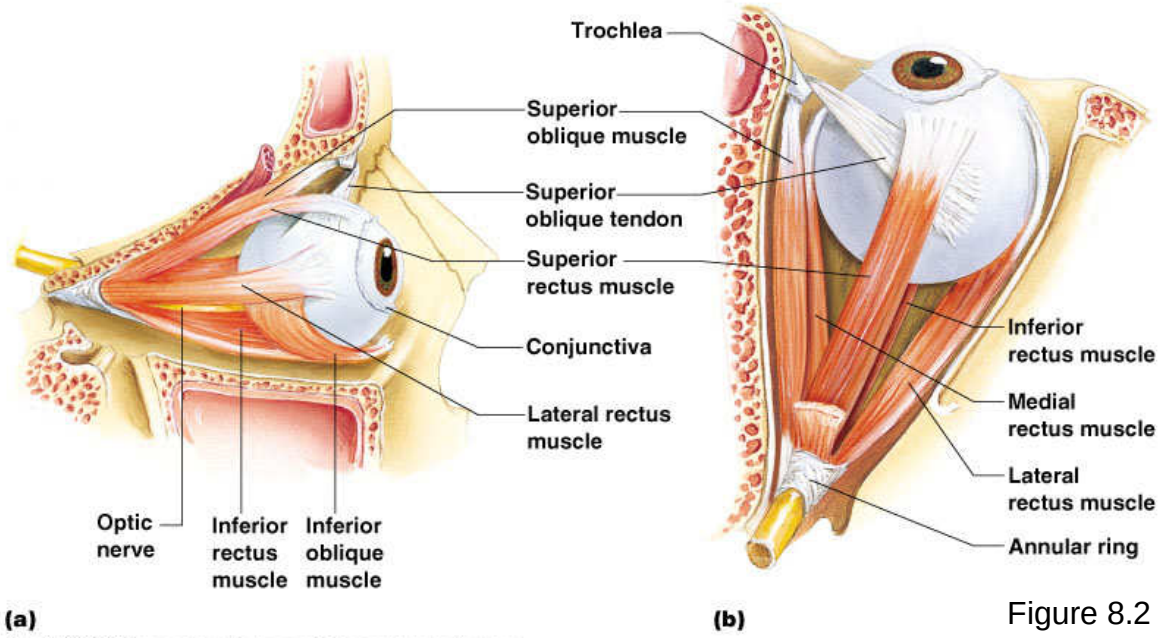

Figure 8.2

Structure of the Eye

- The wall is composed of three tunics
  - Fibrous tunic – outside layer
  - Choroid – middle layer
  - Sensory tunic – inside layer

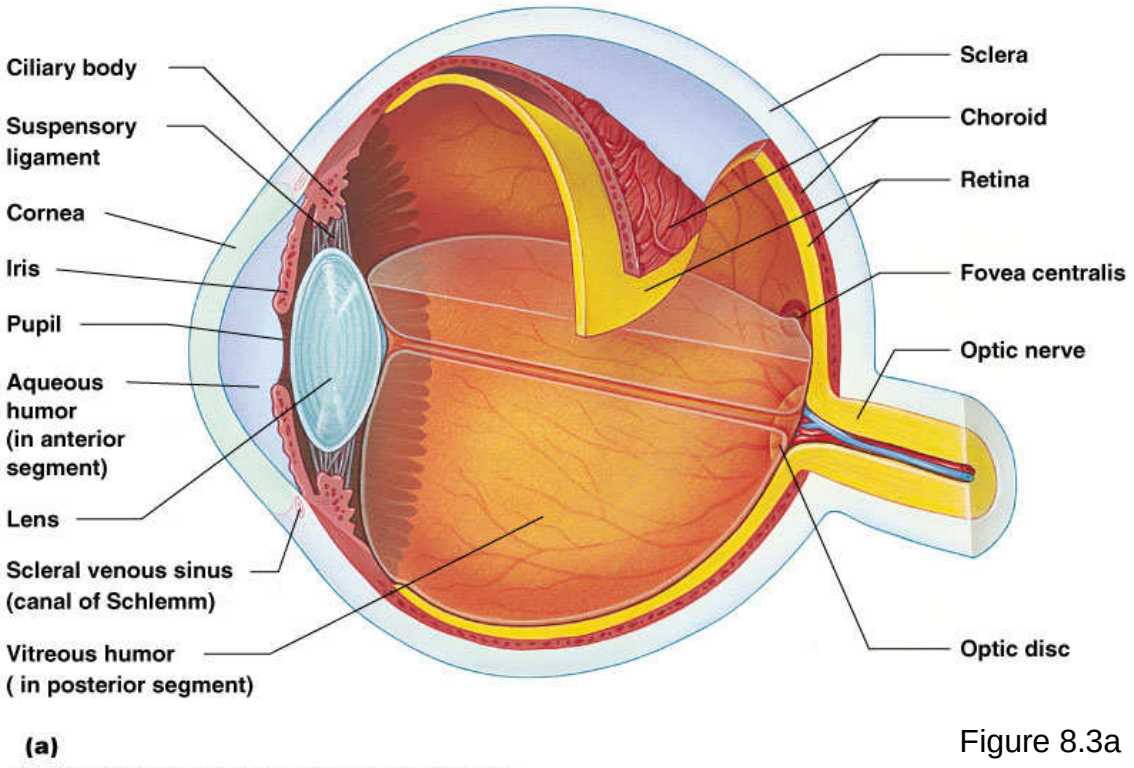

Figure 8.3a

The Fibrous Tunic

- Sclera
  - White connective tissue layer
  - Seen anteriorly as the “white of the eye”
- Cornea
  - Transparent, central anterior portion
  - Allows for light to pass through
  - Repairs itself easily
  - The only human tissue that can be transplanted without fear of rejection

Choroid Layer

- Blood-rich nutritive tunic
- Pigment prevents light from scattering
- Modified interiorly into two structures
  - Cilliary body – smooth muscle
  - Iris - Pigmented layer that gives eye color
  - Pupil – rounded opening in the iris

Sensory Tunic (Retina)

- Contains receptor cells (photoreceptors)
  - Rods
  - Cones
- Signals pass from photoreceptors via a two-neuron chain
  - Bipolar neurons
  - Ganglion cells
- Signals leave the retina toward the brain through the optic nerve

Neurons of the Retina

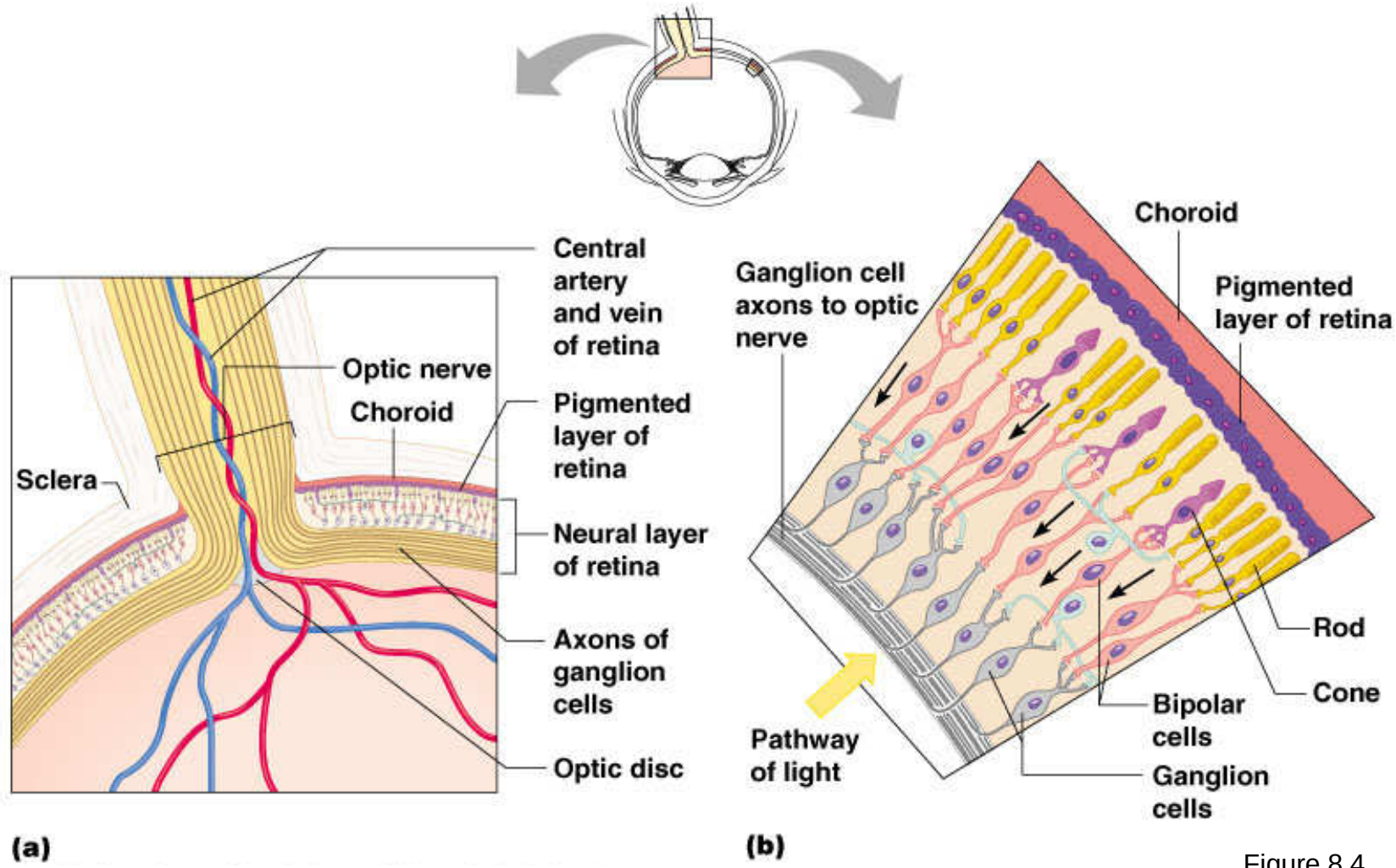

Figure 8.4

Neurons of the Retina and Vision

- Rods
  - Most are found towards the edges of the retina
  - Allow dim light vision and peripheral vision
  - Perception is all in gray tones

Neurons of the Retina and Vision

- Cones
  - Allow for detailed color vision
  - Densest in the center of the retina
  - Fovea centralis – area of the retina with only cones
- No photoreceptor cells are at the optic disk, or blind spot

Cone Sensitivity

- There are three types of cones
- Different cones are sensitive to different wavelengths
- Color blindness is the result of lack of one cone type

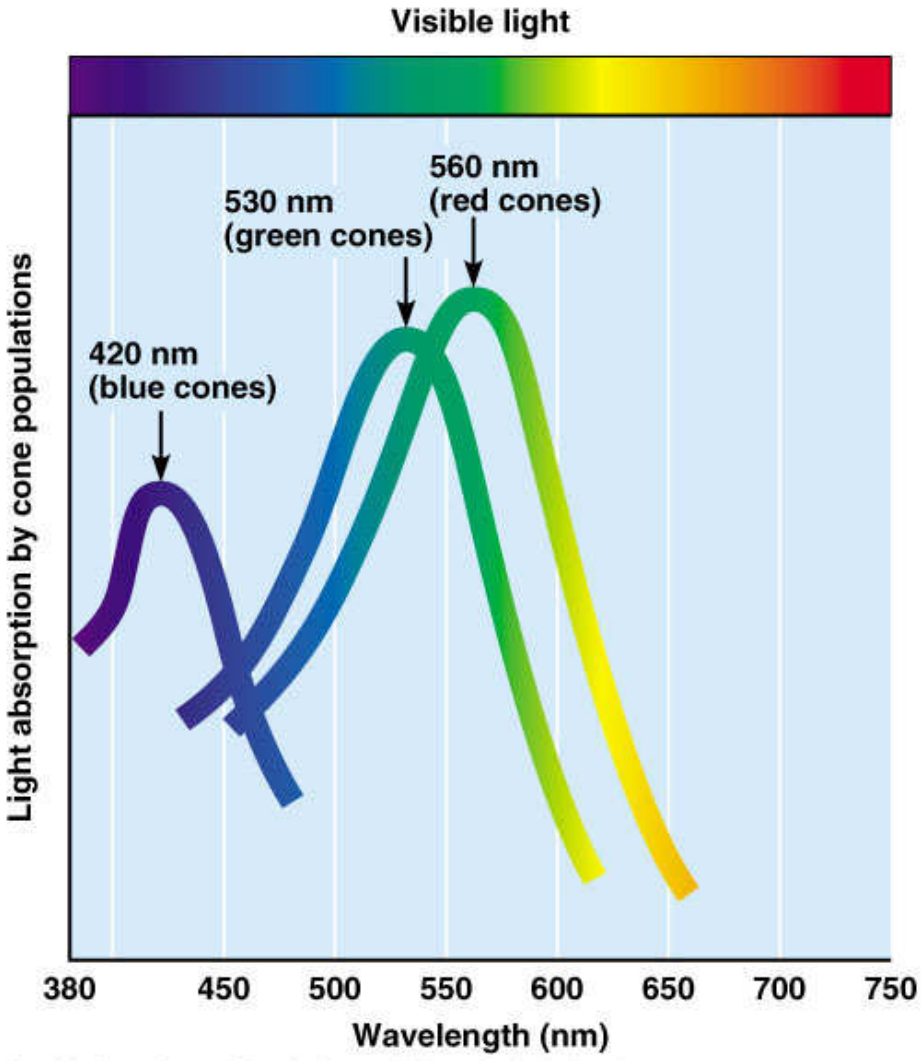

Figure 8.6

Lens

- Biconvex crystal-like structure
- Held in place by a suspensory ligament attached to the ciliary body

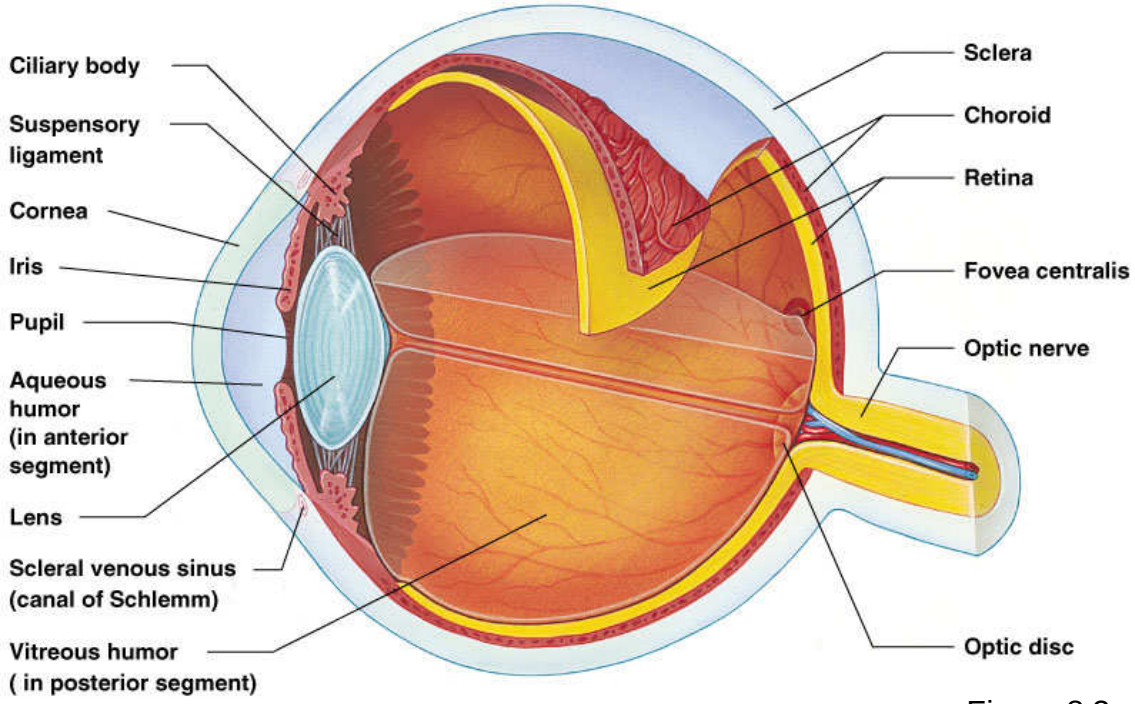

Figure 8.3a

Internal Eye Chamber Fluids

- Aqueous humor
  - Watery fluid found in chamber between the lens and cornea
  - Similar to blood plasma
  - Helps maintain intraocular pressure
  - Provides nutrients for the lens and cornea
  - Reabsorbed into venous blood through the canal of Schlemm

Internal Eye Chamber Fluids

- Vitreous humor
  - Gel-like substance behind the lens
  - Keeps the eye from collapsing
  - Lasts a lifetime and is not replaced

Lens Accommodation

- Light must be focused to a point on the retina for optimal vision
- The eye is set for distance vision (over 20 ft away)
- The lens must change shape to focus for closer objects

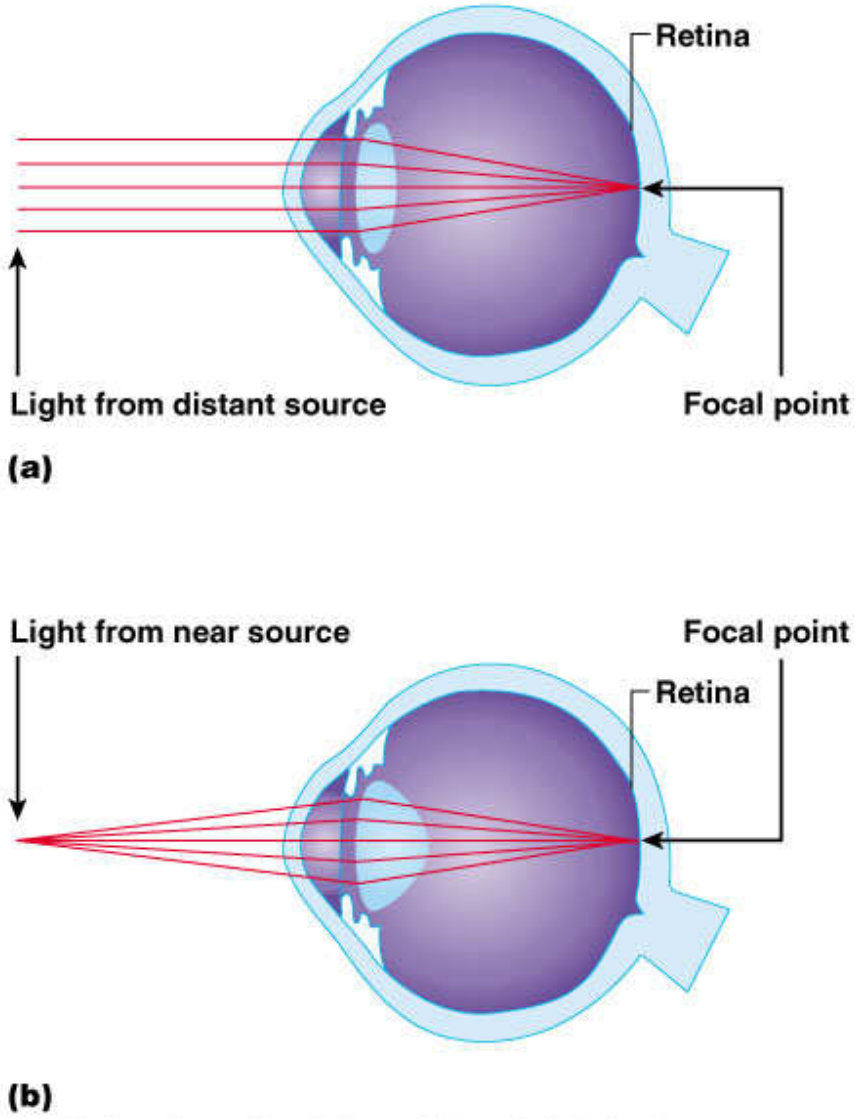

Figure 8.9

Images Formed on the Retina

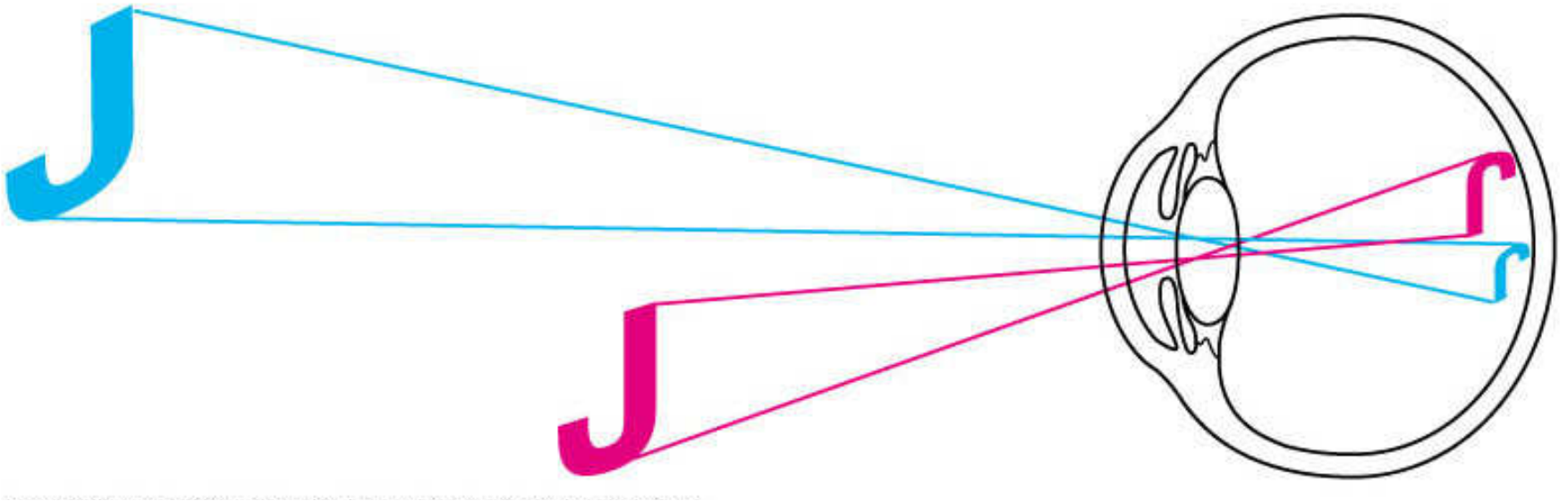

Figure 8.10

Visual Pathway

- Photoreceptors of the retina
- Optic nerve
- Optic nerve crosses at the optic chiasma

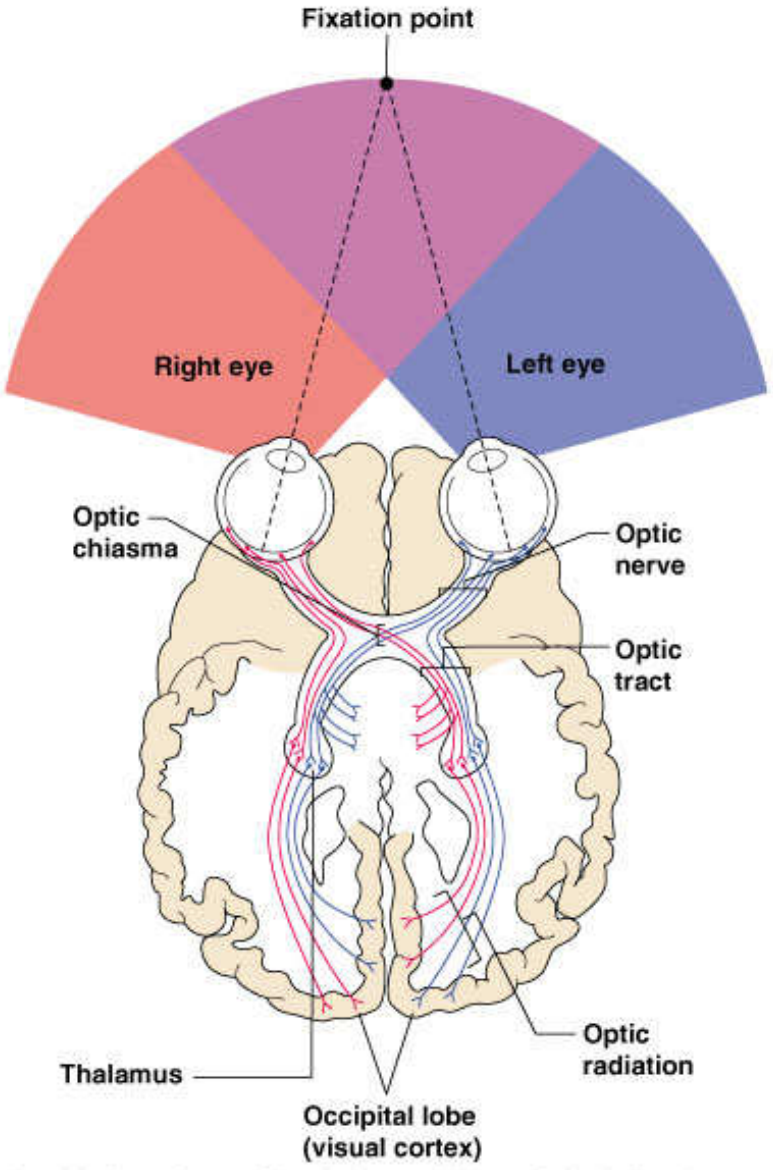

Figure 8.11

Visual Pathway

- Optic tracts
- Thalamus (axons form optic radiation)
- Visual cortex of the occipital lobe

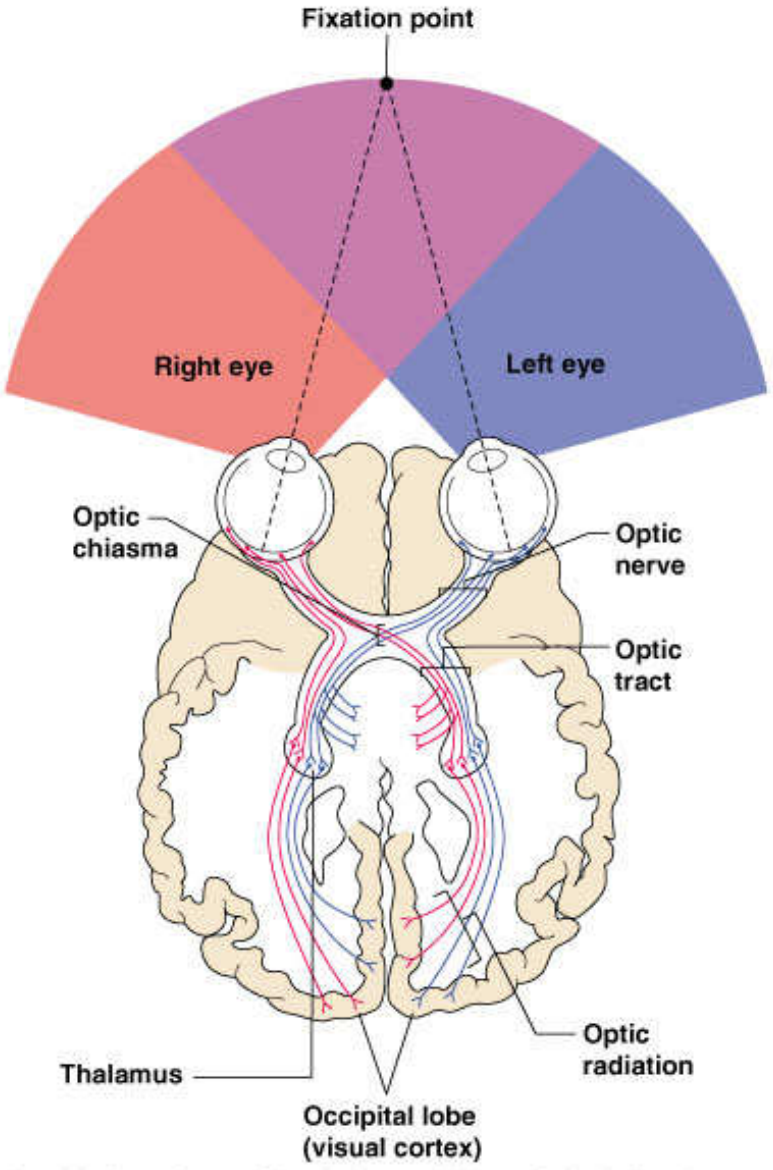

Figure 8.11

Eye Reflexes

- Internal muscles are controlled by the autonomic nervous system
  - Bright light causes pupils to constrict through action of radial and ciliary muscles
  - Viewing close objects causes accommodation
- External muscles control eye movement to follow objects
- Viewing close objects causes convergence (eyes moving medially)