

Unit

4

Special Senses: The Eye



**ESSENTIALS
OF HUMAN
ANATOMY
& PHYSIOLOGY**

The Senses

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

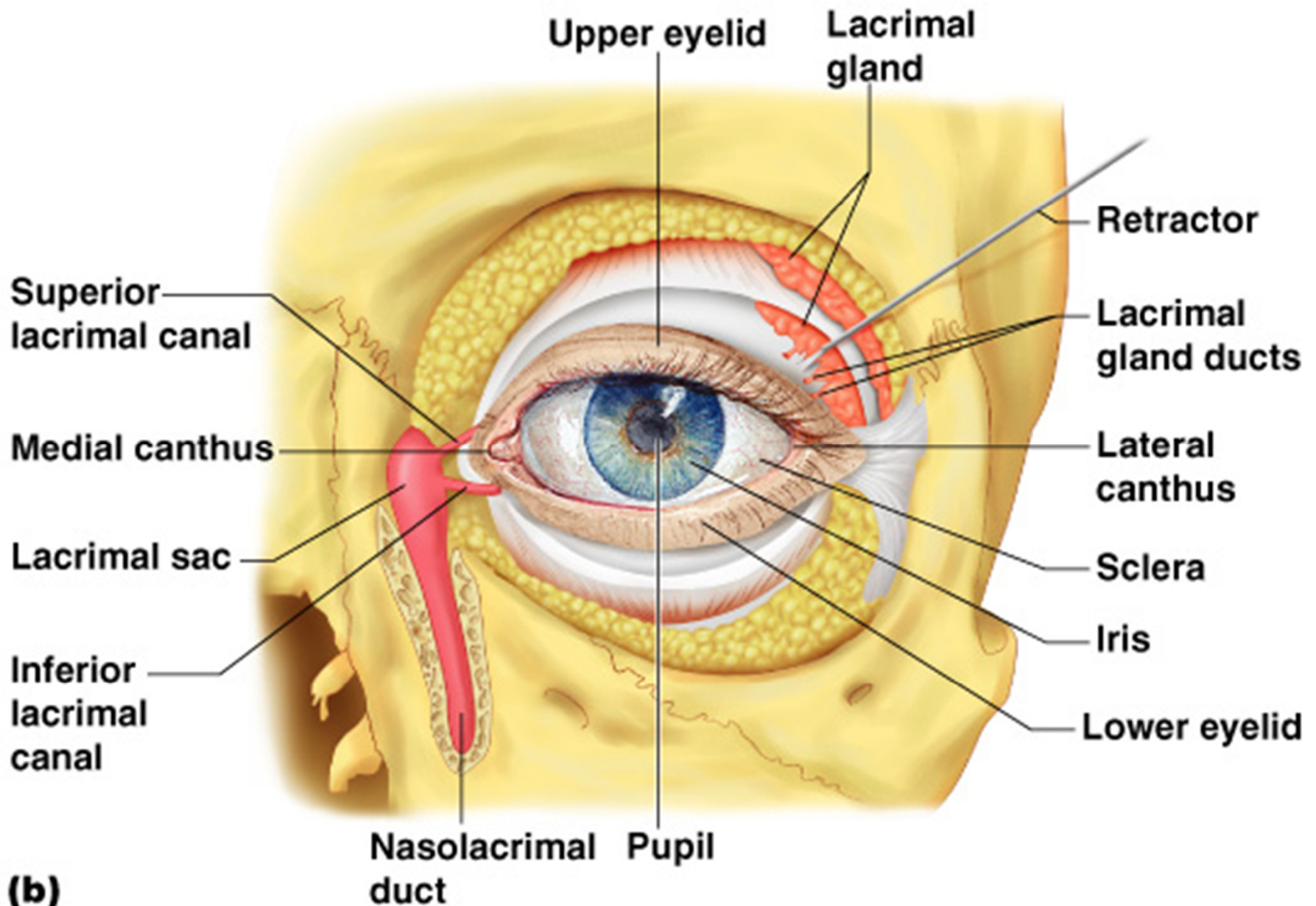
The Eye and Vision

- 70% of all sensory receptors are in the eyes
- Each eye has over a million nerve fibers
- Protection for the eye
 - Mostly enclosed in a bony orbit
 - Surrounded by cushion of fat

Accessory Structures of the Eye

- Eyelids
- Eyelashes
- Meibomian glands- modified sebaceous glands lubricate the eye
- Ciliary glands- modified sweat glands between the eyelashes
- Conjunctiva
 - Membrane that lines the eyelids
 - Connects to the surface of the eye
 - Secretes mucus to lubricate the eye

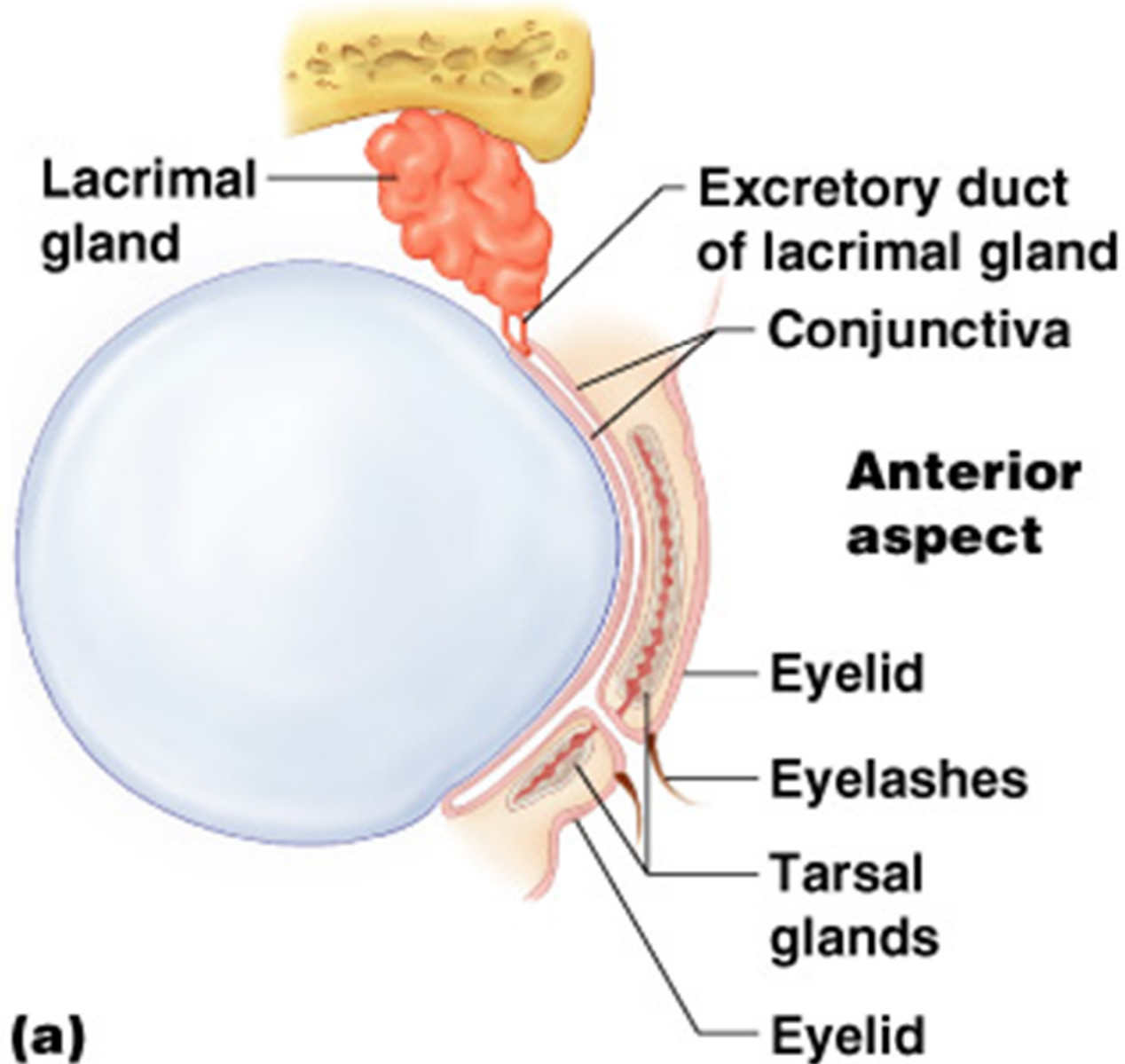
Accessory Structures of the Eye



Accessory Structures of the Eye

- Lacrimal apparatus
 - Lacrimal gland- produces lacrimal fluid
 - Lacrimal canals- drains lacrimal fluid from eyes
- Lacrimal sac- provides passage of lacrimal fluid toward nasal cavity
- Nasolacrimal duct- empties lacrimal fluid into nasal cavity

Accessory Structures of the Eye

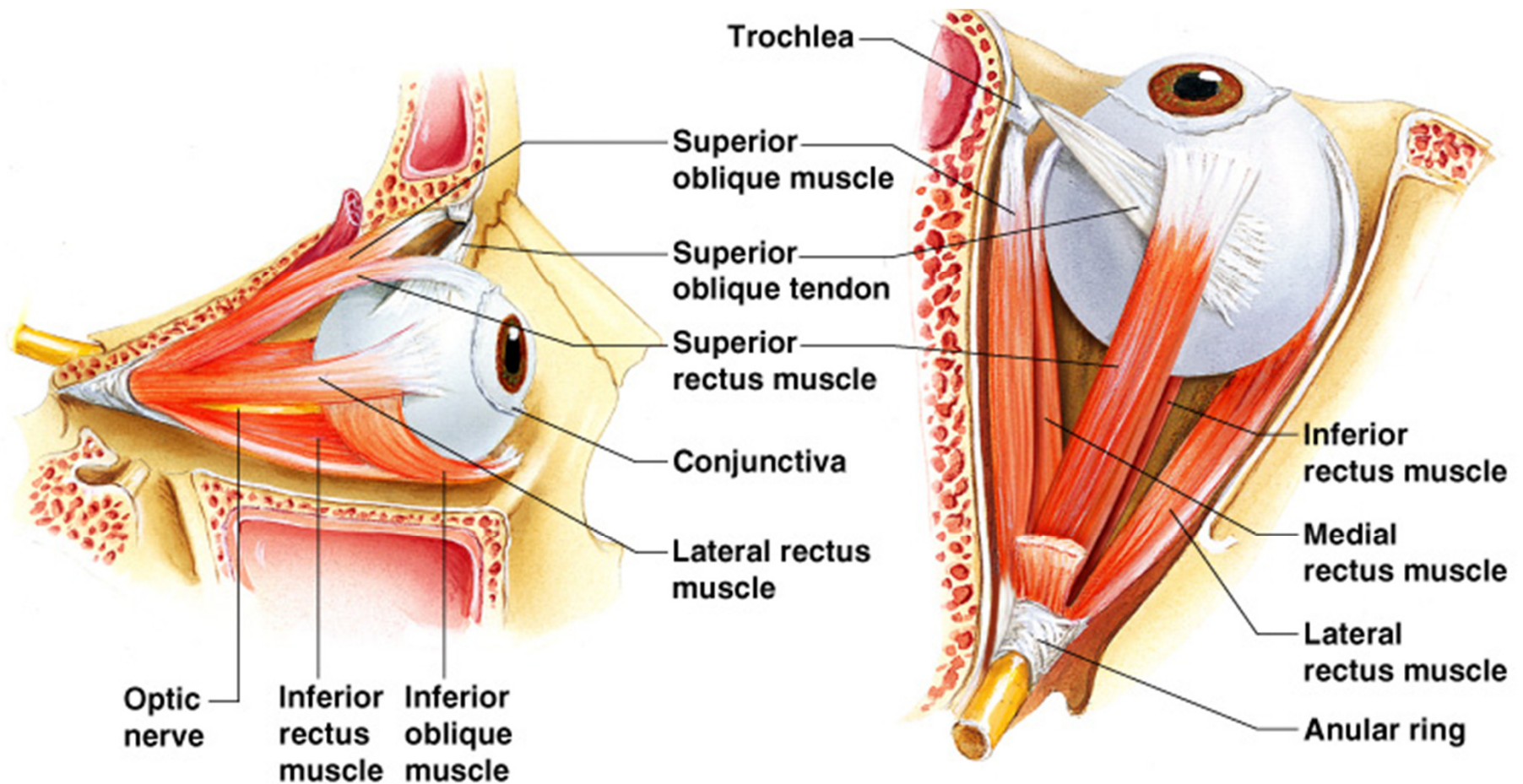


Function of the Lacrimal Apparatus

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

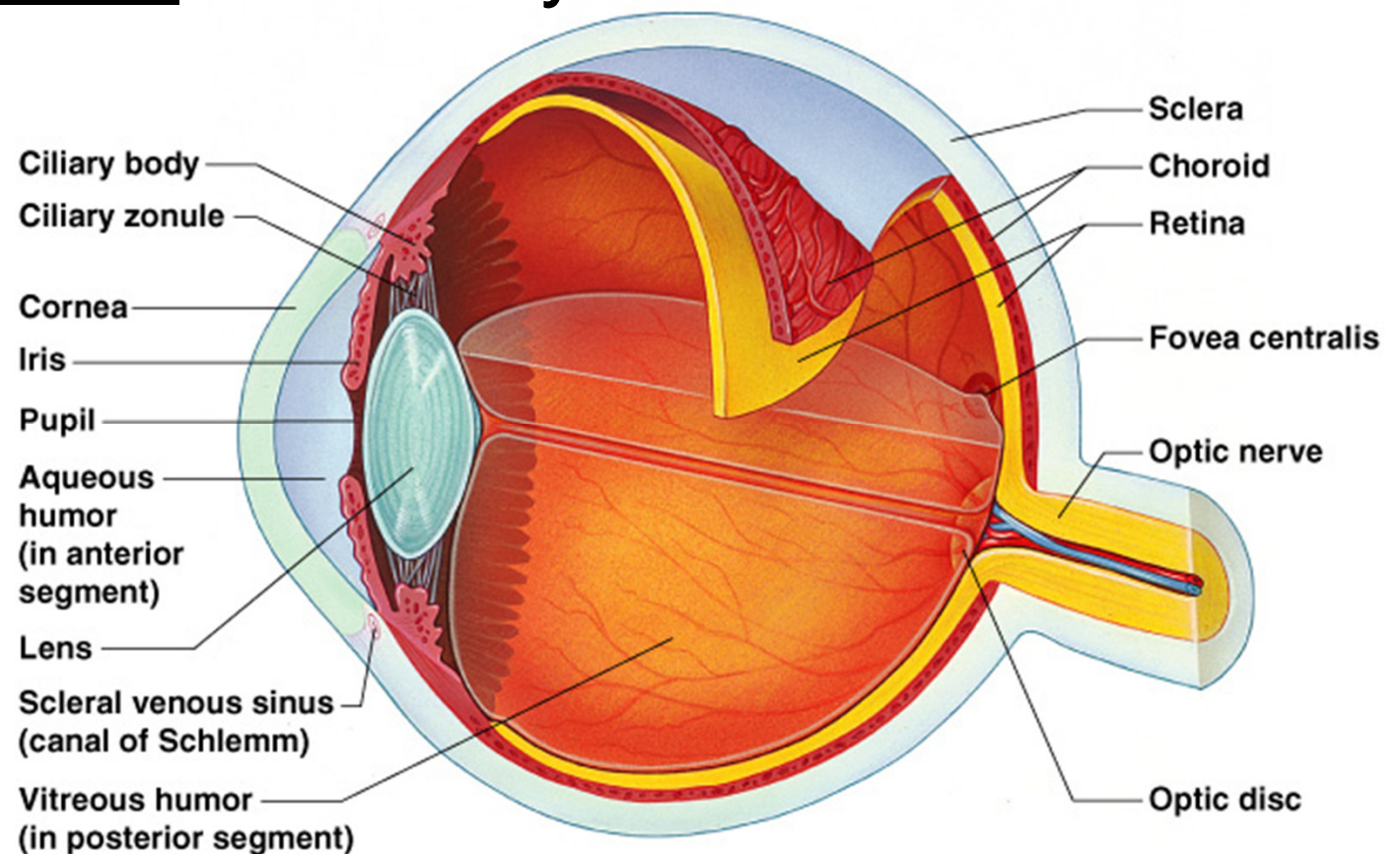
Extrinsic Eye Muscles

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



Structure of the Eye

- Wall is composed of three tunics
 - Fibrous tunic- outside layer
 - Choroid tunic- middle layer
 - Sensory tunic- inside layer



The Fibrous Tunic

■ Sclera

- White connective tissue layer
- Seen anteriorly as the “white of the eye”

■ Cornea

- Transparent, central anterior portion
- Allows light to pass through
- Repairs itself easily
- Only human tissue that can be transplanted without fear of rejection

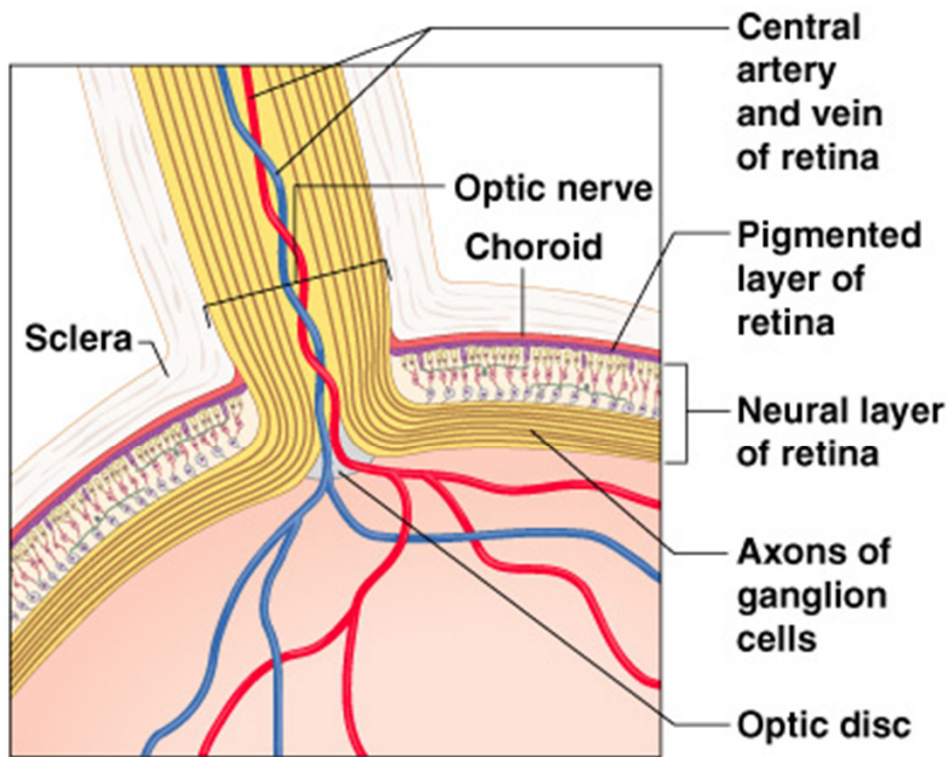
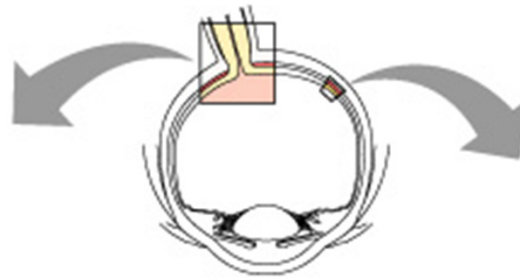
Choroid Layer

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

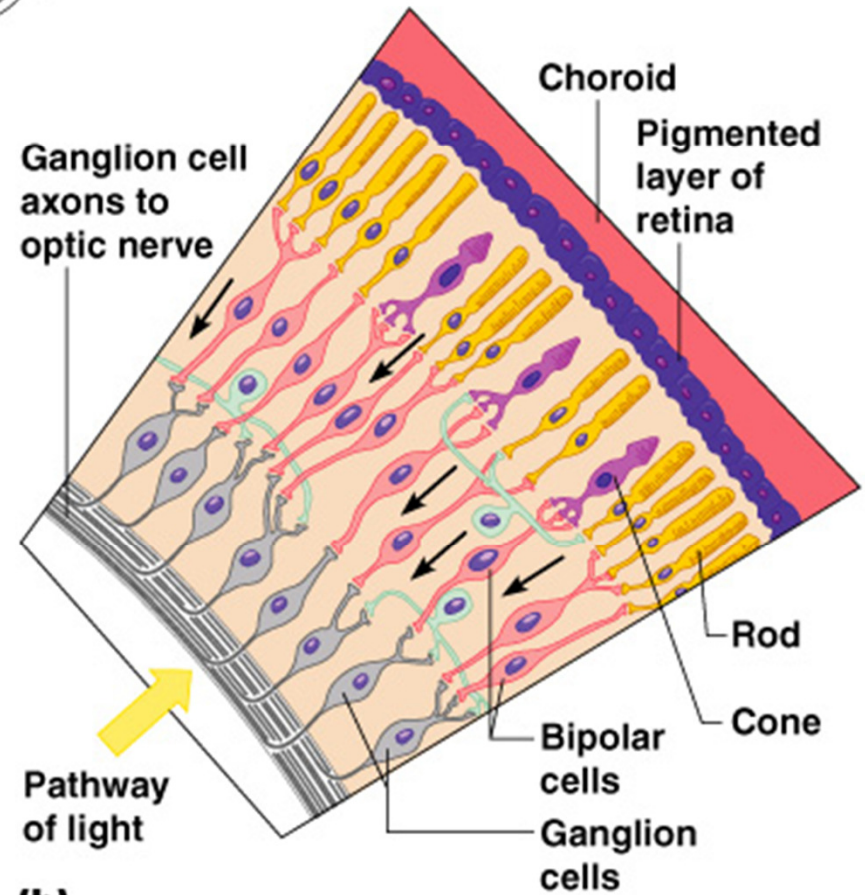
Sensory Tunic (Retina)

- 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



(a)



(b)

Neurons of the Retina and Vision

■ Rods

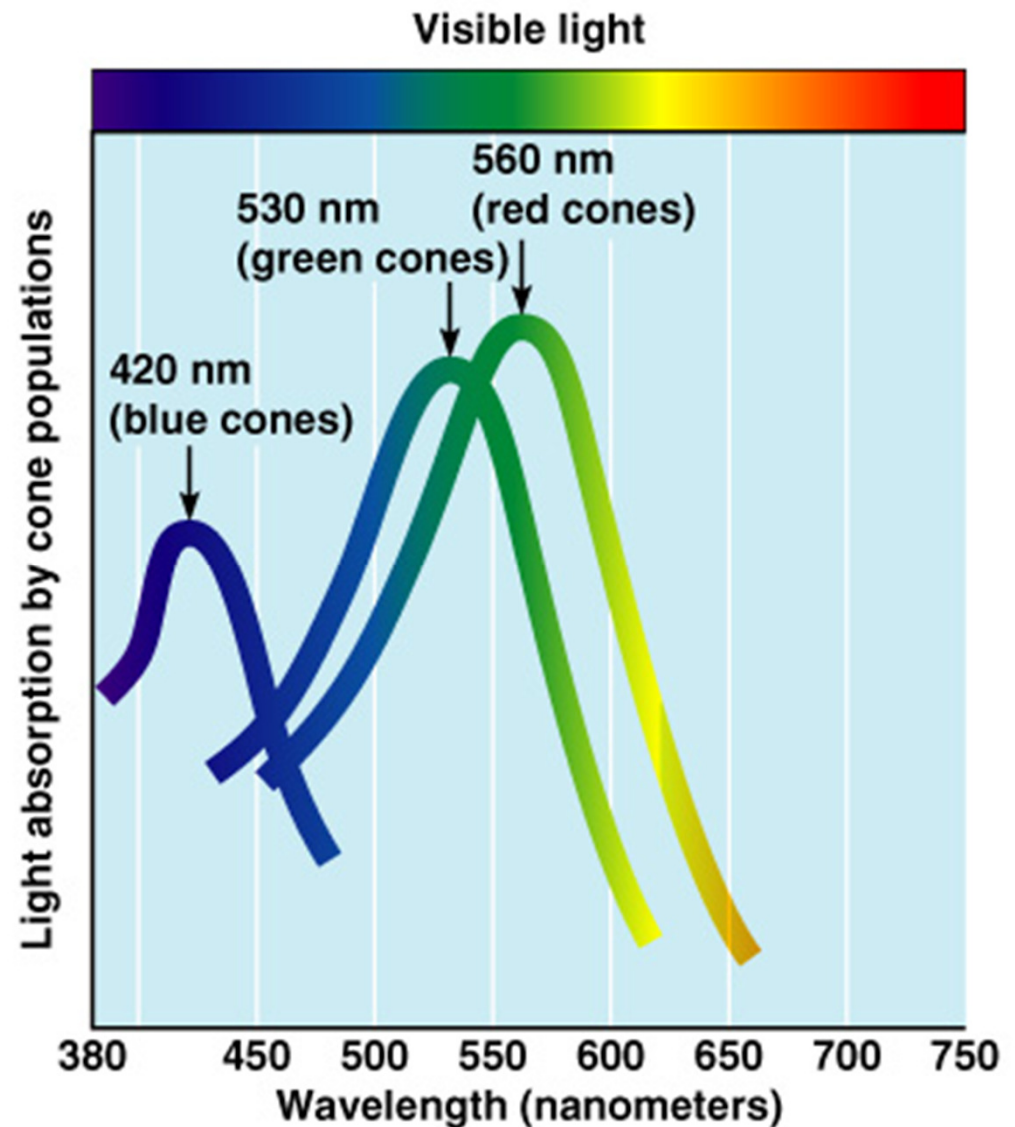
- Found mostly toward retinal edges
- Dim light vision and peripheral vision
- Perception is all in gray tones

■ Cones

- 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 (blind spot)

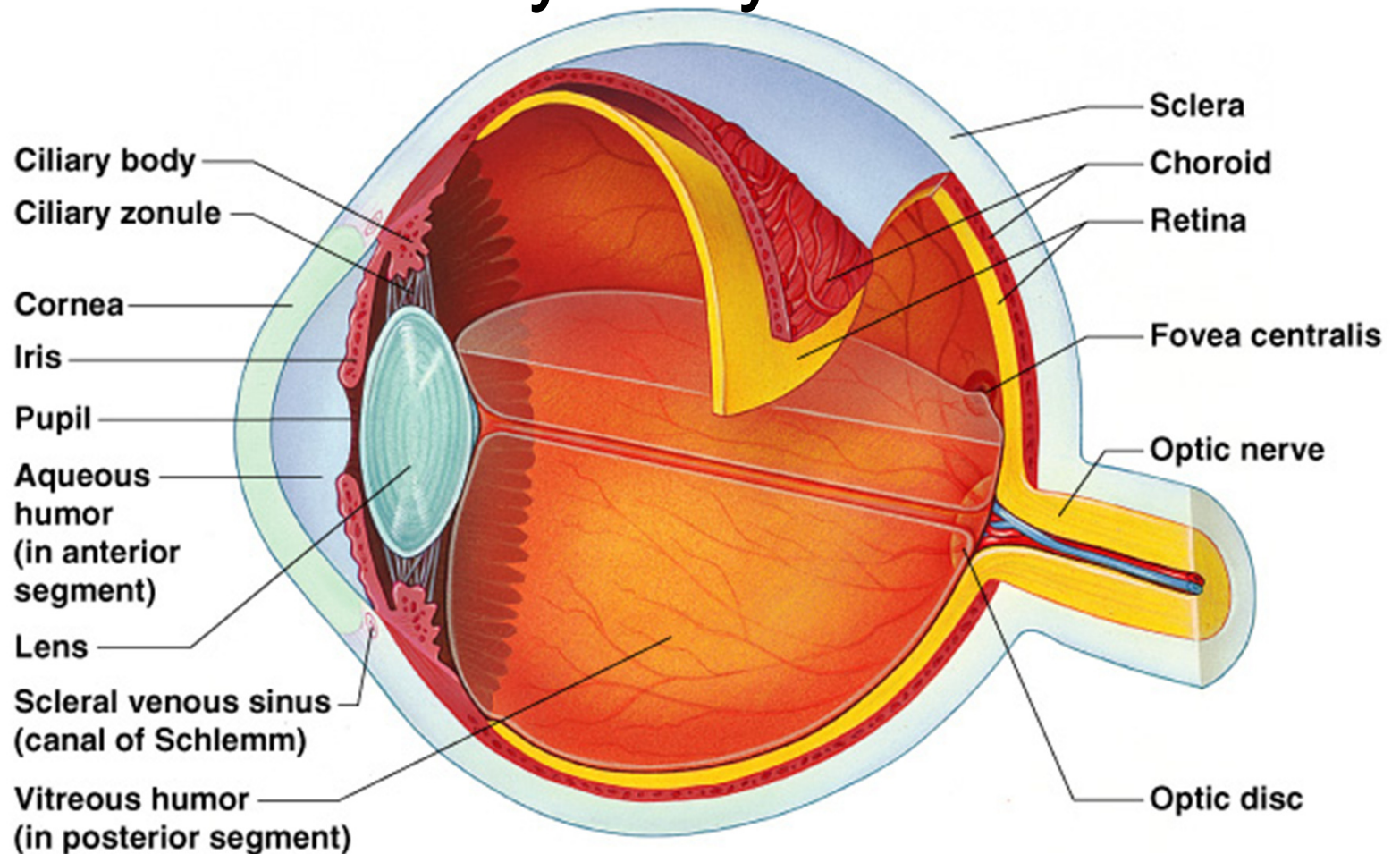
Cone Sensitivity

- Three types of cones
- Each sensitive to different light wavelengths
- Color blindness-result of lack of one cone type



Lens

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

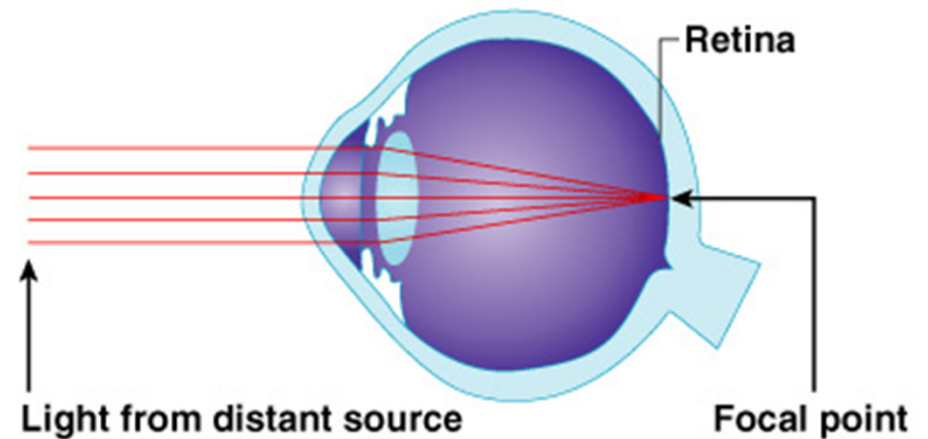


Internal Eye Chamber Fluids

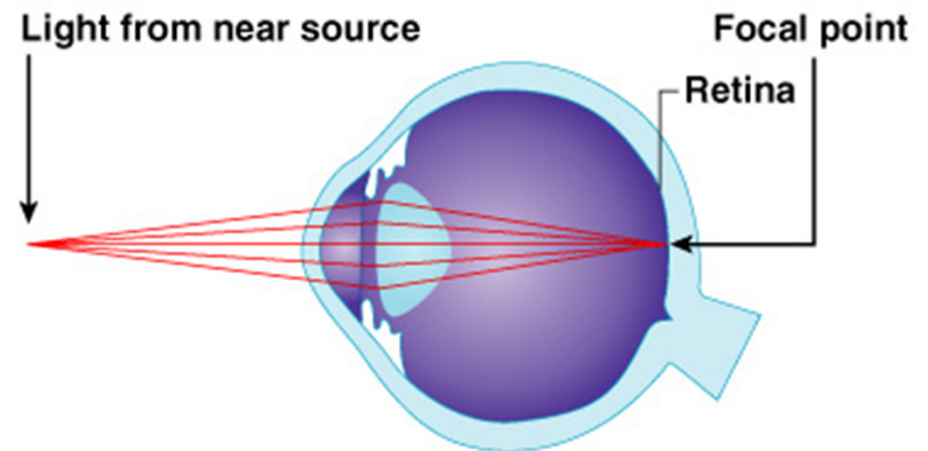
- Aqueous humor
 - Watery fluid between the lens and cornea
 - Similar to blood plasma
 - Maintains intraocular pressure
 - Provides nutrients for the lens and cornea
 - Reabsorbed into venous blood through the canal of Schlemm
- Vitreous humor
 - Gel-like substance behind the lens
 - Keeps the eye from collapsing
 - Lasts a lifetime and is not replaced

Lens Accommodation

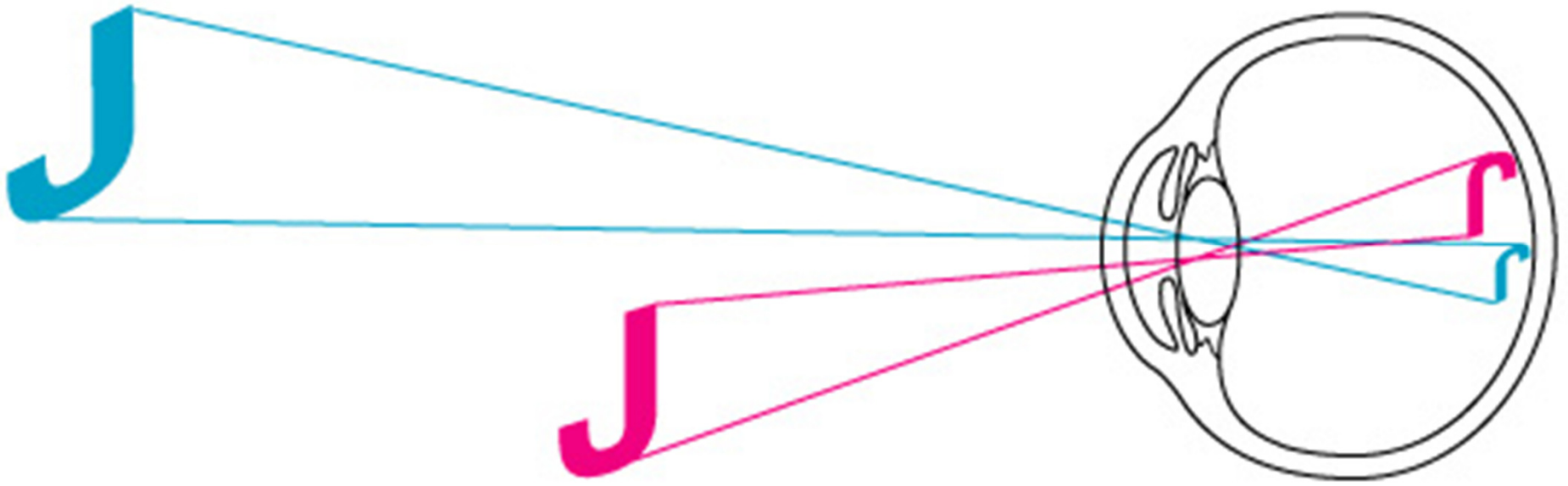
- Light must be focused on the retina for optimal vision
- Eye is set for distance vision (over 20 ft away)
- Lens must change shape to focus for closer objects



(a)

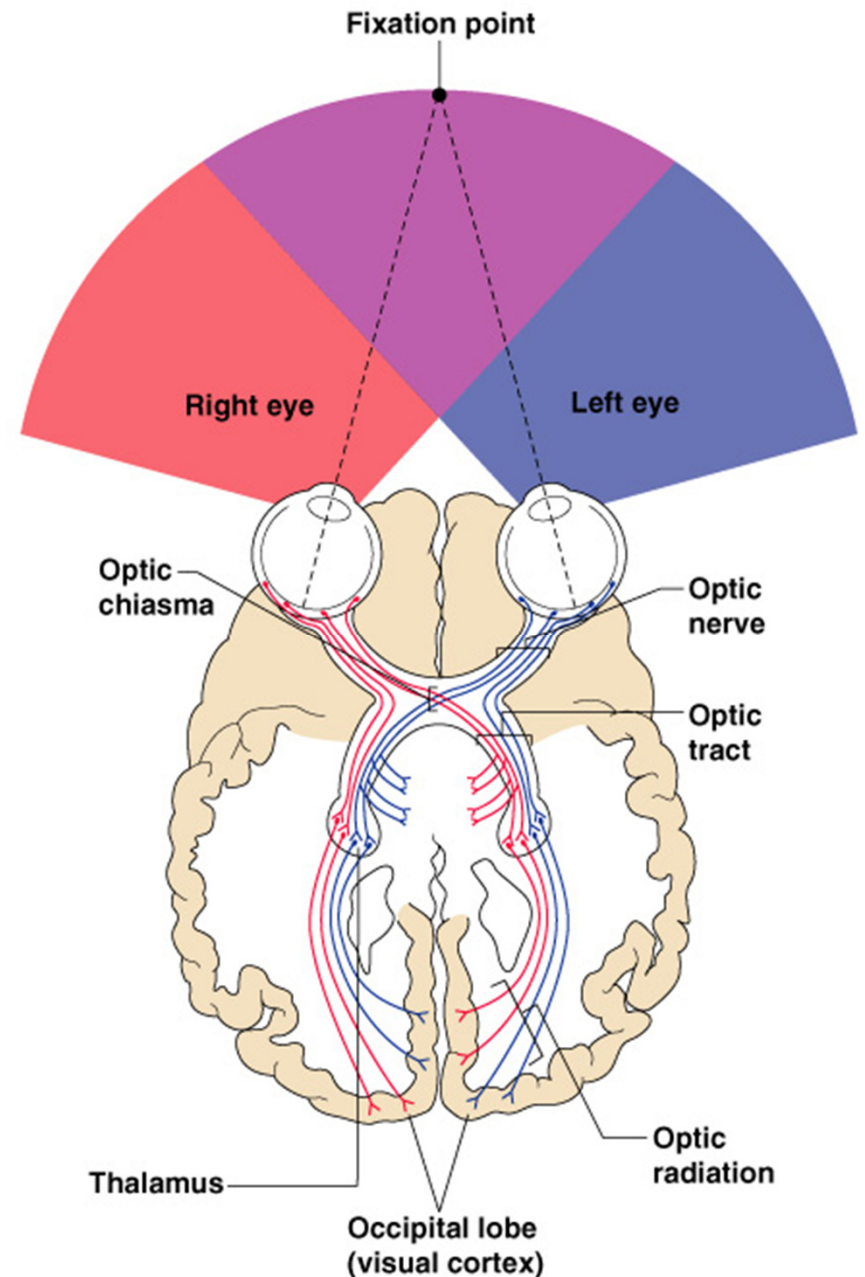


Images Formed on the Retina



Visual Pathway

- Photoreceptors of the retina
- Optic nerve
- Optic nerve crosses at the optic chiasma
- Optic tracts
- Thalamus (axons form optic radiation)
- Visual cortex of the occipital lobe



Eye Reflexes

- Internal muscles controlled by autonomic nervous system
 - Radial and ciliary muscles constrict pupils in bright light
 - Viewing close objects causes accommodation
- External muscles control eye movement to follow objects
- Viewing close objects causes convergence (medial movement)

Myopia and Hyperopia

