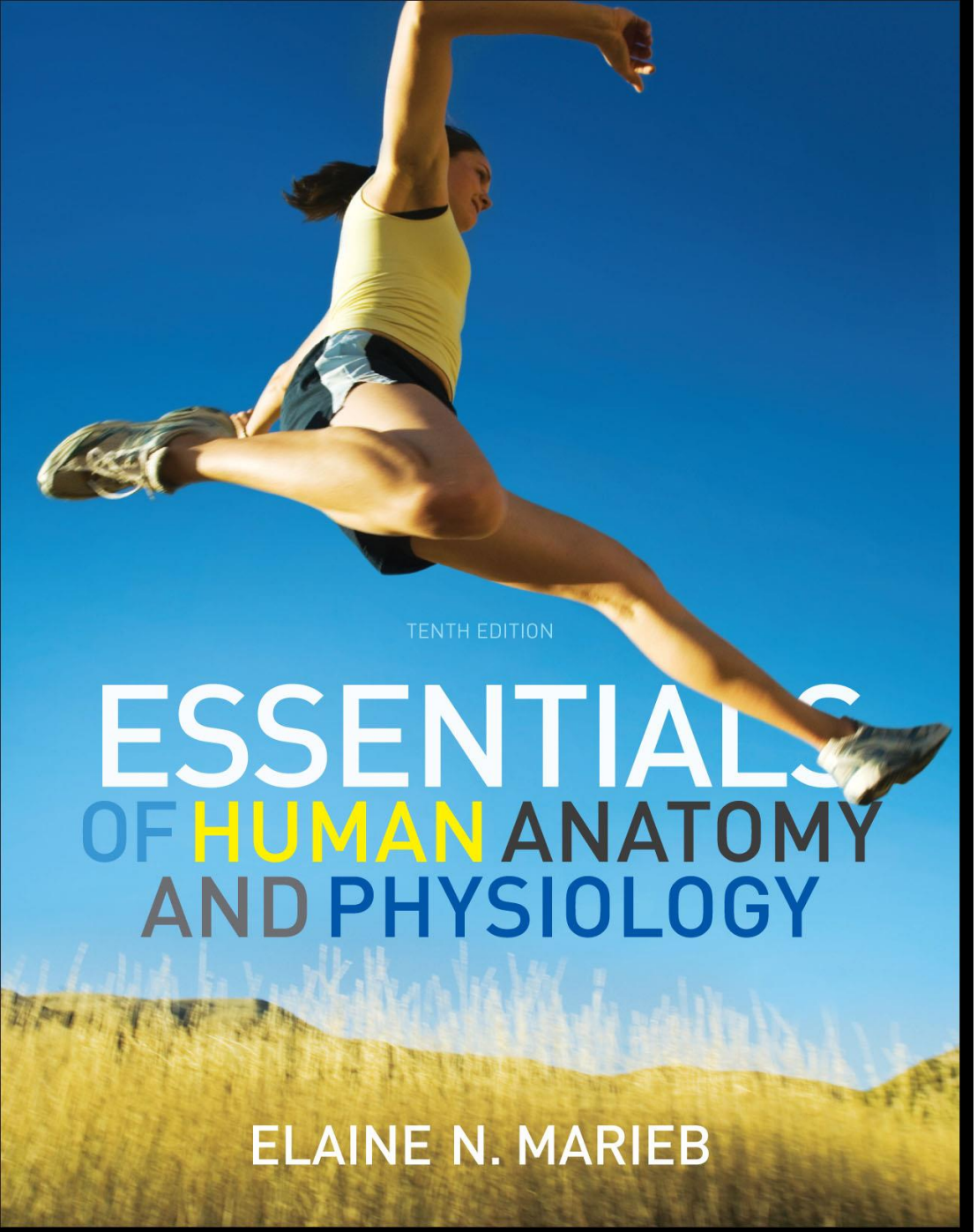

PowerPoint® Lecture Slides

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Florence-Darlington Technical College

CHAPTER 8

Special Senses

The Senses

- Special senses
  - (1) Sight
  - (2) Hearing / Equilibrium
  - (3) Smell
  - (4) Taste

SENSE OF SIGHT

(1) 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

- (a) Eyelids and eyelashes
- (b) Conjunctiva
- (c) Lacrimal apparatus
- (d) Extrinsic eye muscles

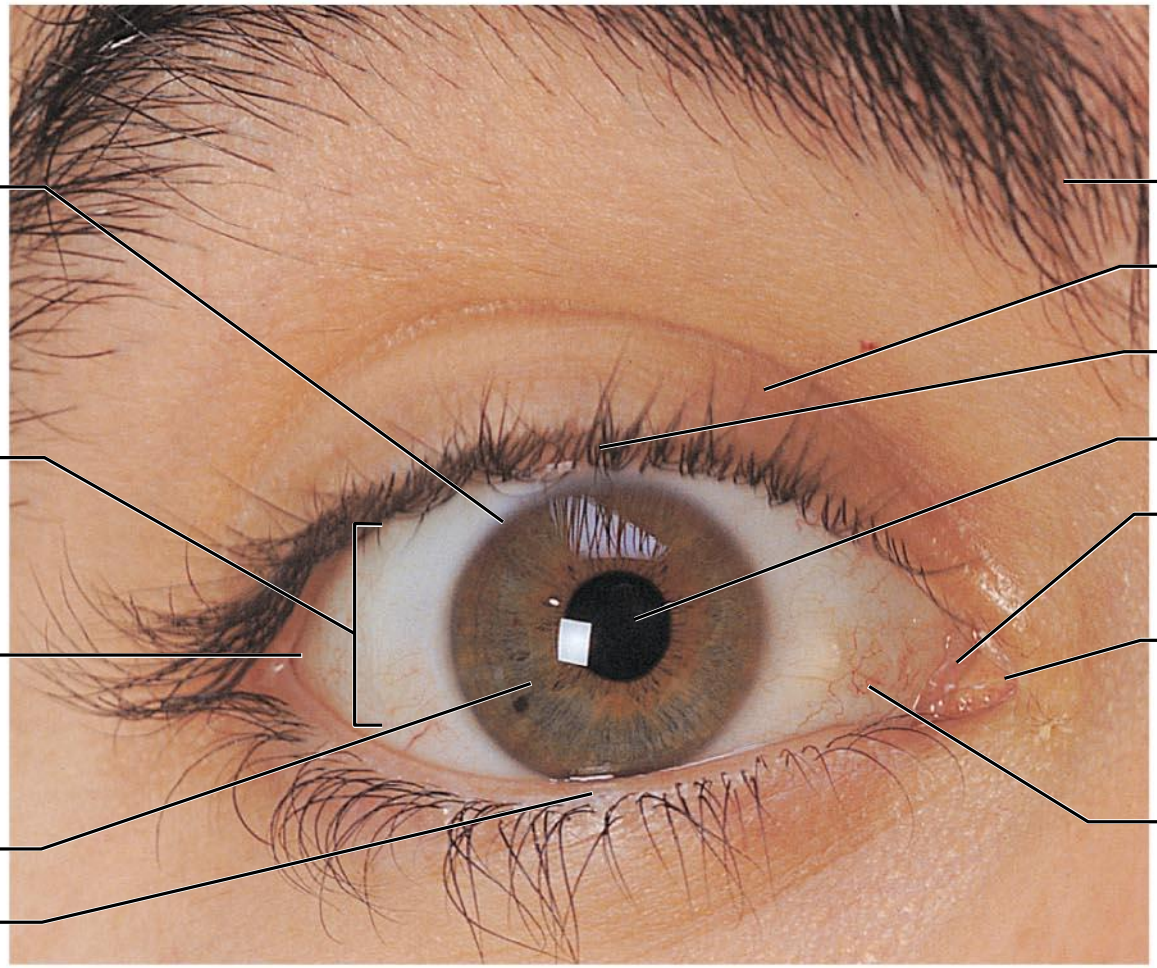


Figure 8.1

Accessory Structures of the Eye

- (a) Eyelids
  - meet at the medial and lateral commissure (canthus)

- (a) Eyelashes
  - tarsal glands produce an oily secretion that lubricates the eye
  - ciliary glands are located between the eyelashes

Accessory Structures of the Eye

- (b) Conjunctiva
  - Membrane that lines the eyelids
  - Connects to the outer surface of the eye
  - Secretes mucus to lubricate the eye and keep it moist

Accessory Structures of the Eye

- (c) 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

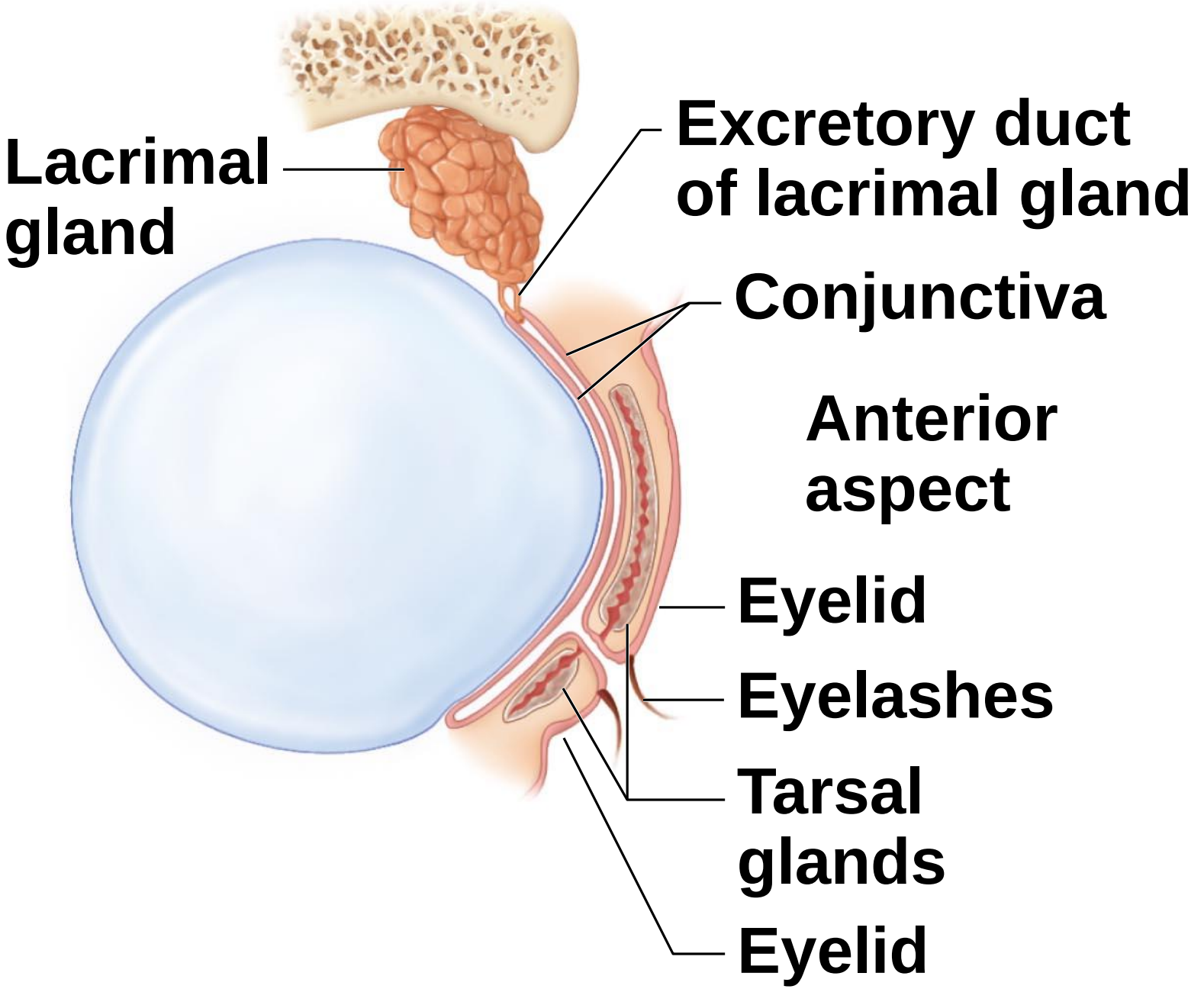


Figure 8.2a

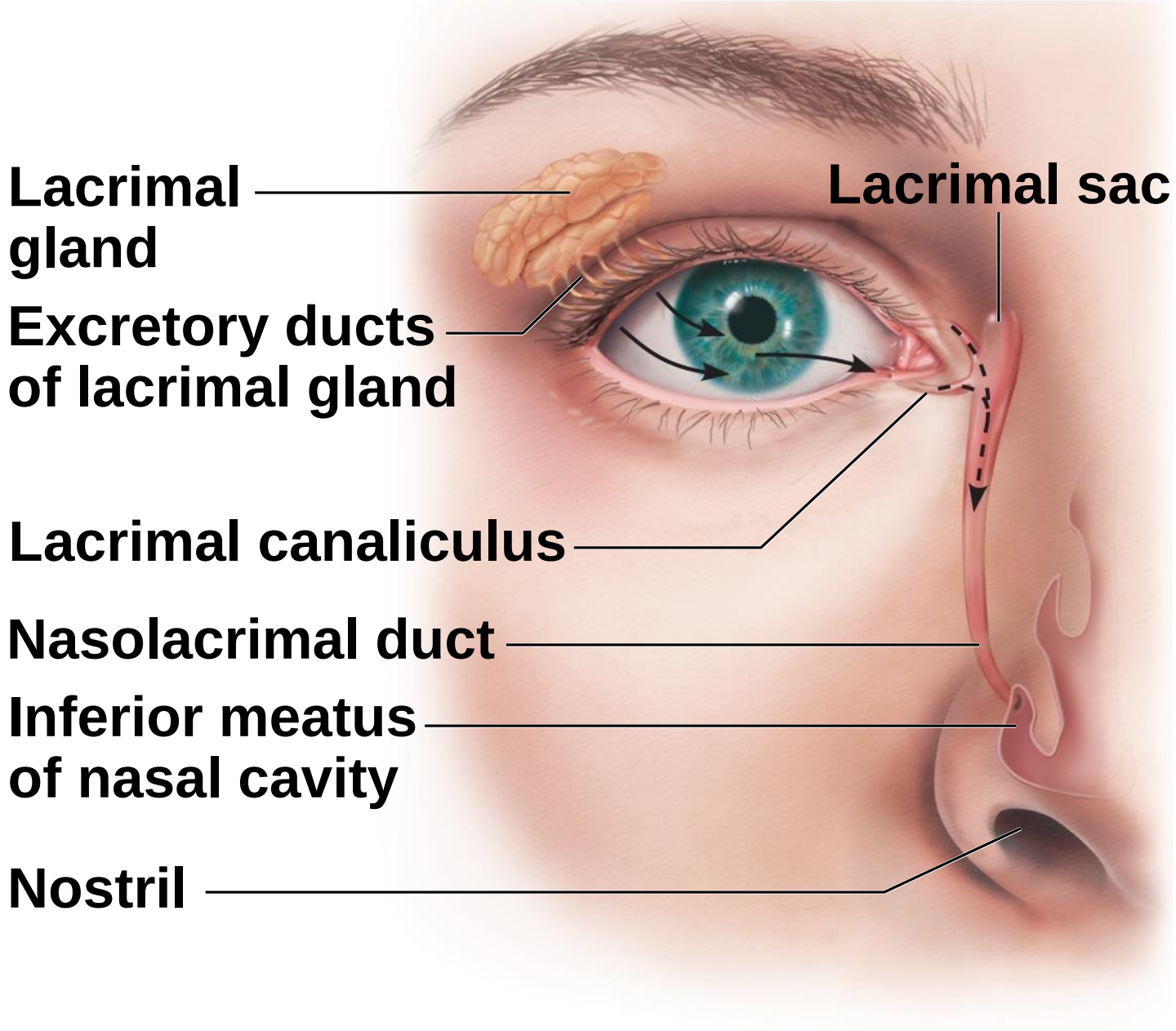


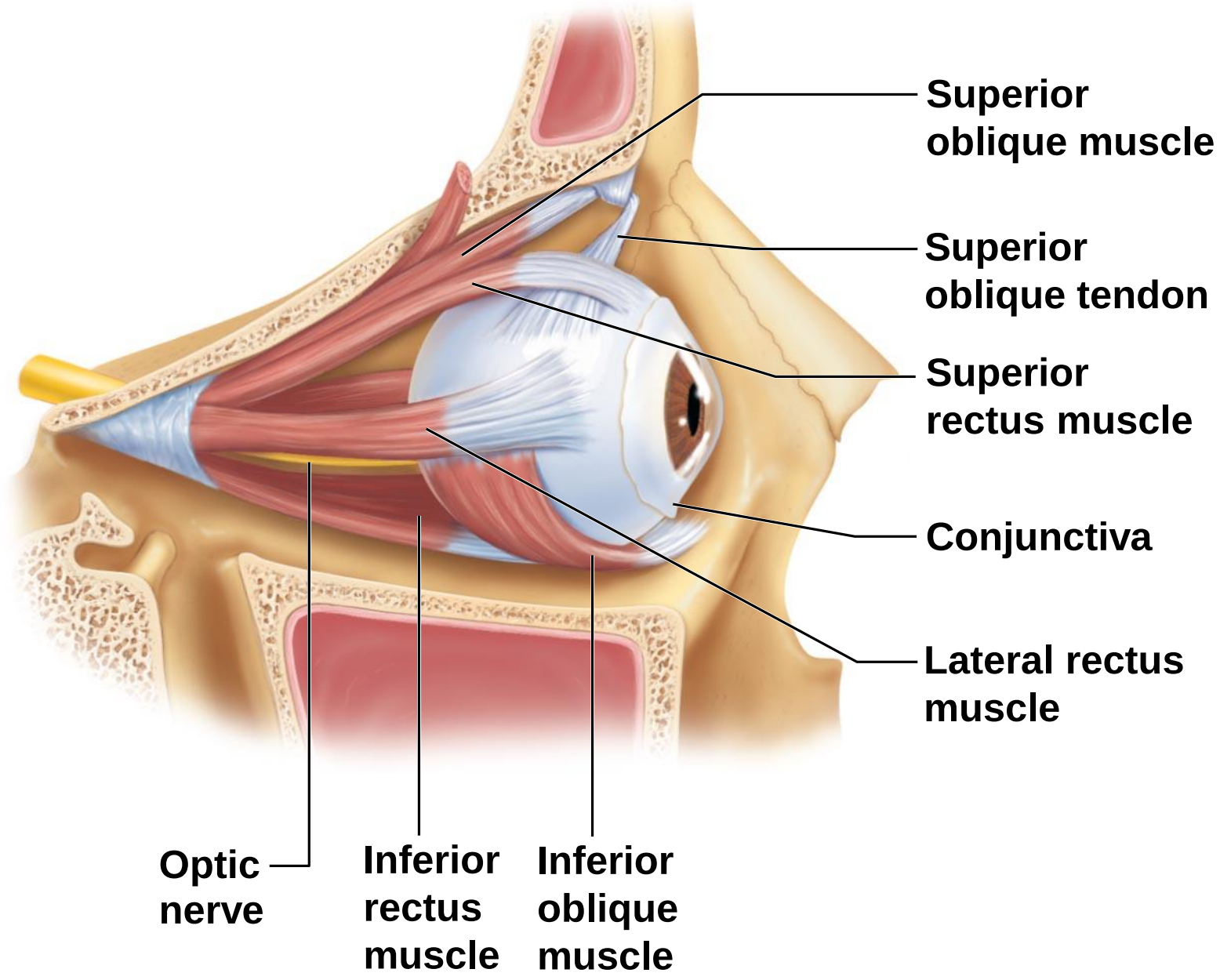
Figure 8.2b

Accessory Structures of the Eye

- Function of the lacrimal apparatus
  - Protects, moistens, and lubricates the eye
  - Empties into the nasal cavity
    - Lacrimal secretions (tears) contain:
      - Dilute salt solution
      - Mucus
      - Antibodies
      - Lysozyme (enzyme that destroys bacteria)

Accessory Structures of the Eye

- (d) Extrinsic eye muscles
  - Six muscles attach to the outer surface of the eye
  - Produce eye movements



(a)

Figure 8.3a

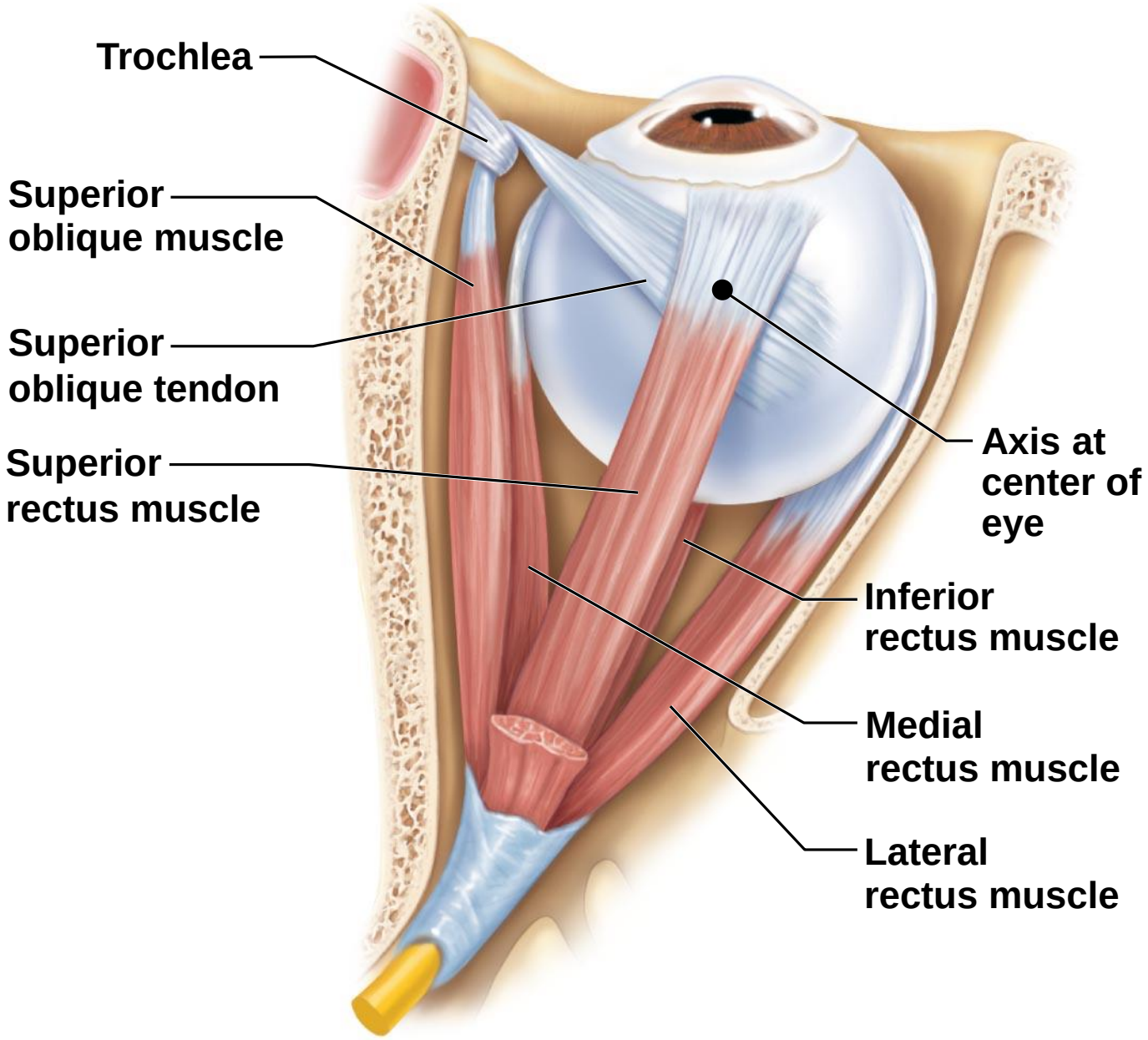


Figure 8.3b

Name	Action	Controlling cranial nerve
Lateral rectus	Moves eye laterally	VI (abducens)
Medial rectus	Moves eye medially	III (oculomotor)
Superior rectus	Elevates eye and turns it medially	III (oculomotor)
Inferior rectus	Depresses eye and turns it medially	III (oculomotor)
Inferior oblique	Elevates eye and turns it laterally	III (oculomotor)
Superior oblique	Depresses eye and turns it laterally	IV (trochlear)

(c)

Figure 8.3c

Page 161 #1

1. Extrinsic

2. Eyelids

3. Tarsal

4. Conjunctiva

Page 162 #4

1. Tarsal Glands – Secrete oil

2. Conjunctive – Secretes mucus

3. Lacrimal – Secretes lacrimal fluid

Structure of the Eye

- Layers forming the wall of the eyeball
  - Fibrous layer
    - Outside layer
  - Vascular layer
    - Middle layer
  - Sensory layer
    - Inside layer

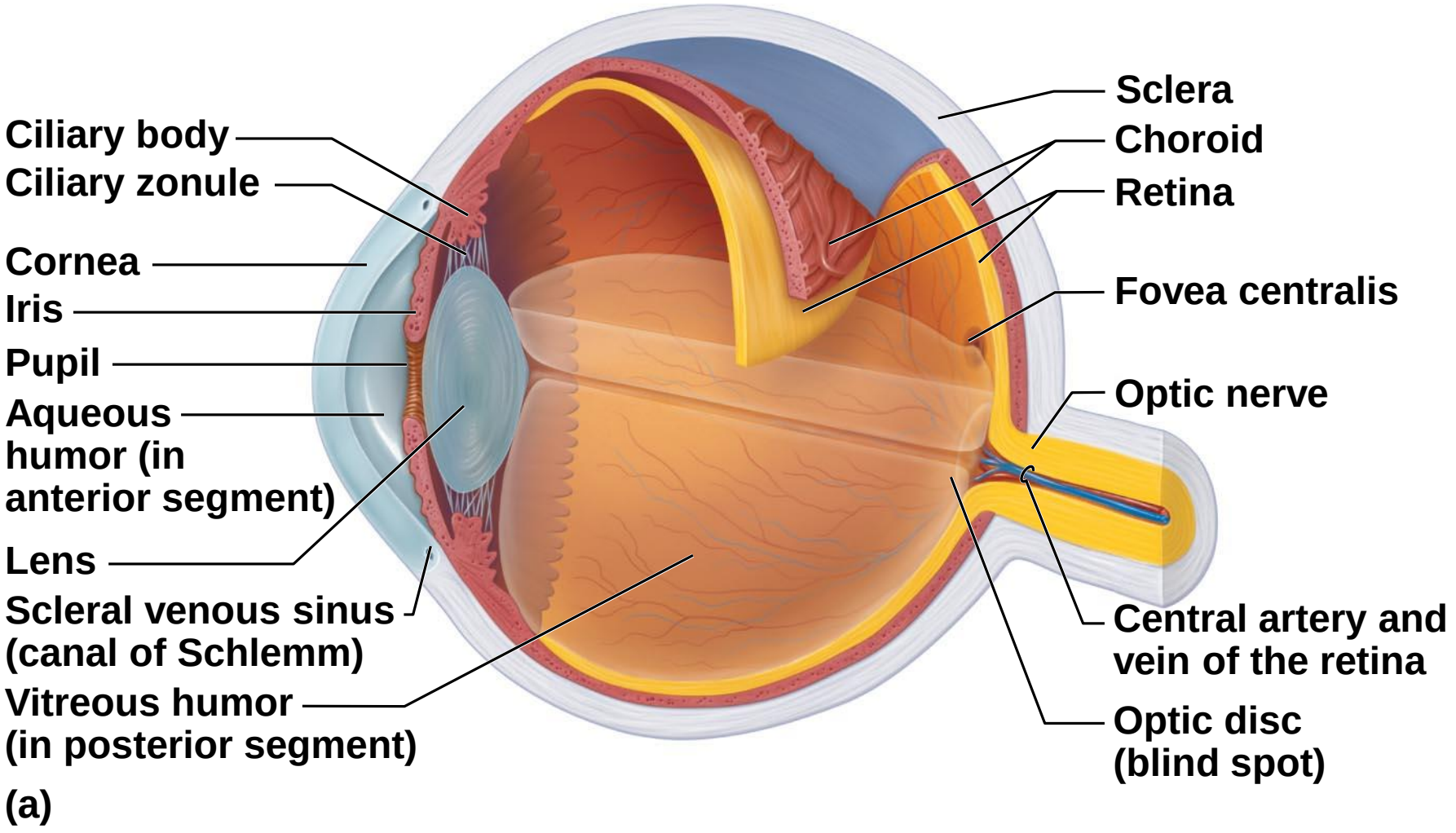


Figure 8.4a

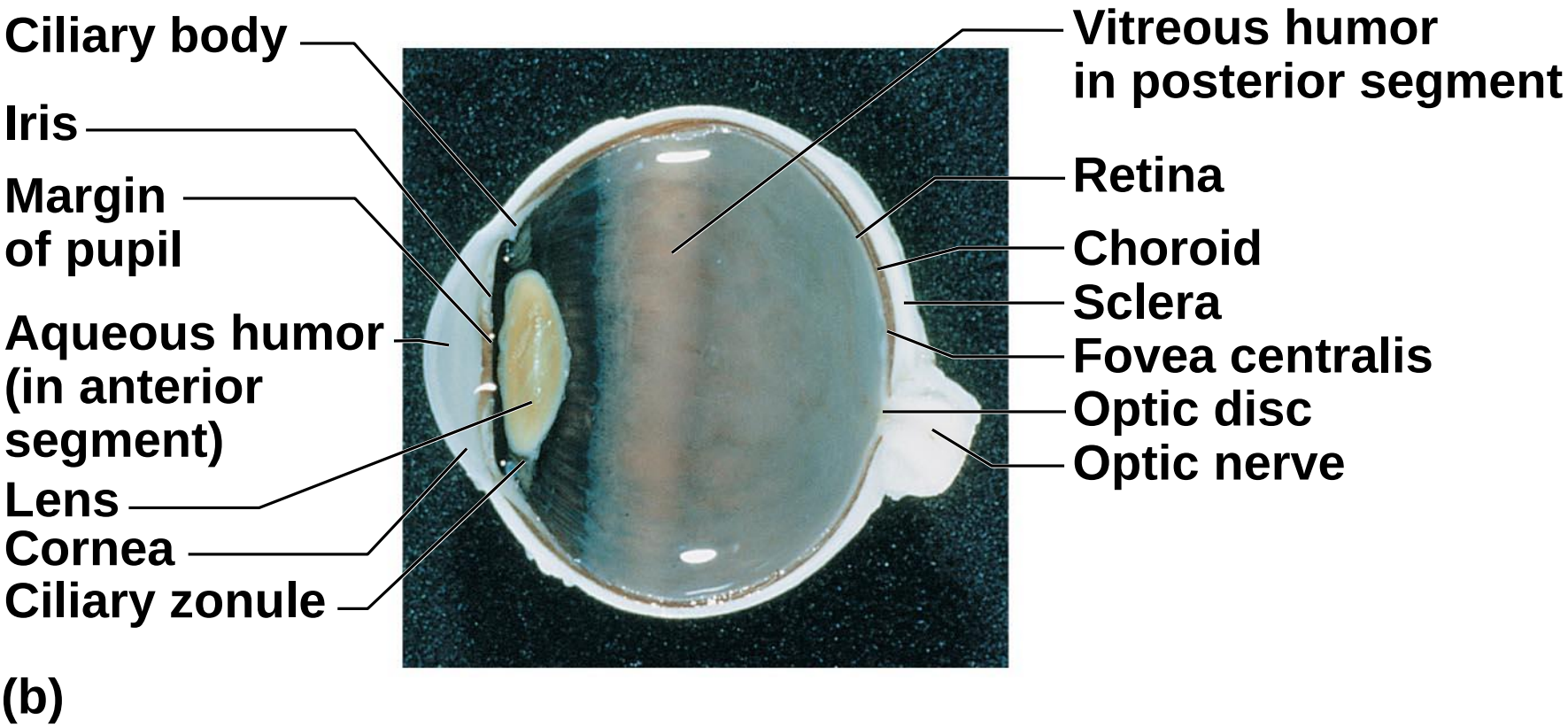


Figure 8.4b

Structure of the Eye: The Fibrous Layer

- 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

Structure of the Eye: 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
  - Ciliary body —smooth muscle attached to lens
  - Iris —regulates amount of light entering eye
    - Pigmented layer that gives eye color
    - Pupil —rounded opening in the iris

Structure of the Eye: Sensory Layer

- Retina contains two layers
  - Outer pigmented layer
  - Inner neural layer
    - Contains receptor cells (photoreceptors)
      - Rods
      - Cones

Structure of the Eye: Sensory Layer

- Signals pass from photoreceptors via a two-neuron chain
  - Bipolar neurons
  - Ganglion cells
- Signals leave the retina toward the brain through the optic nerve
- Optic disc (blind spot) is where the optic nerve leaves the eyeball
  - Cannot see images focused on the optic disc

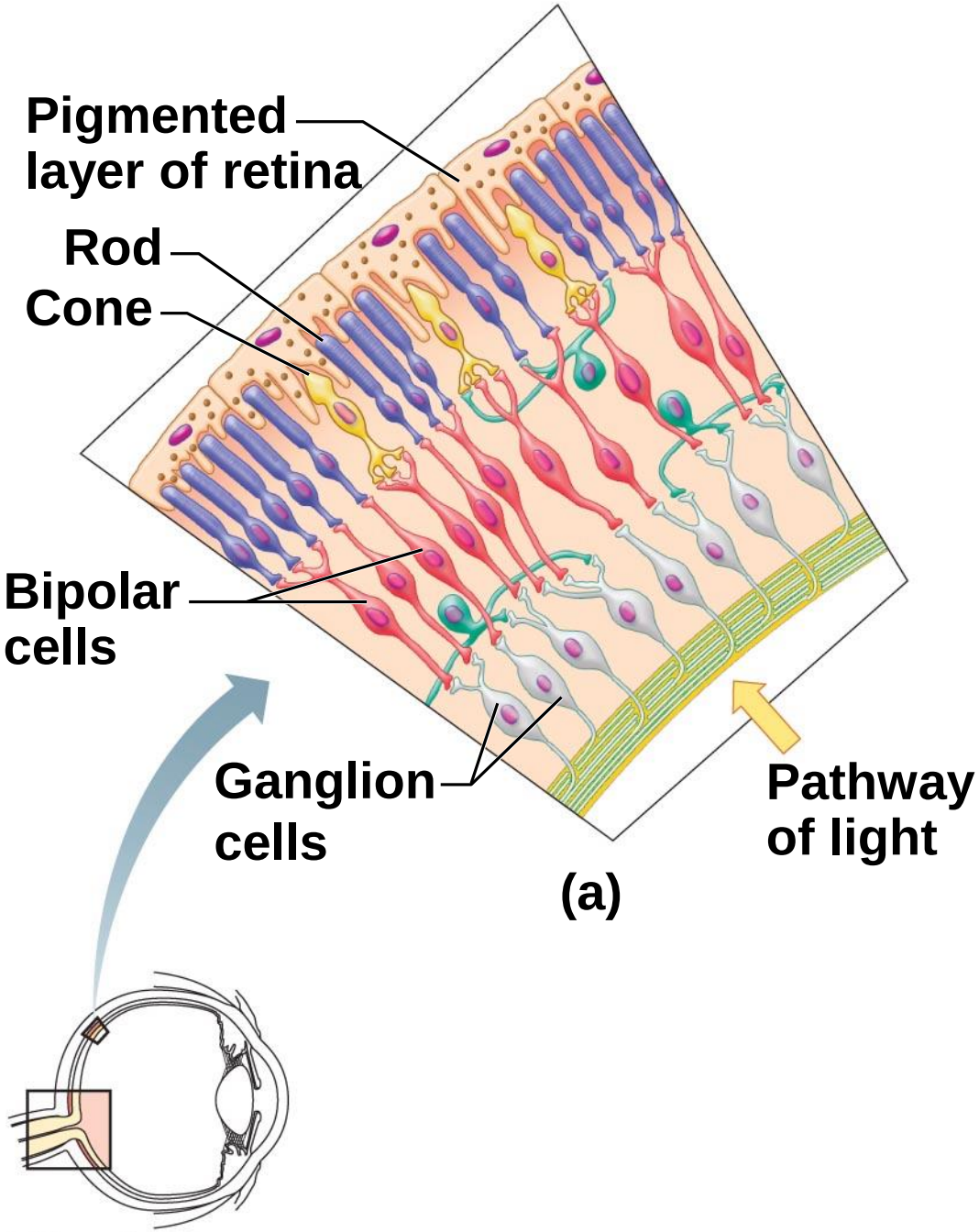


Figure 8.5a

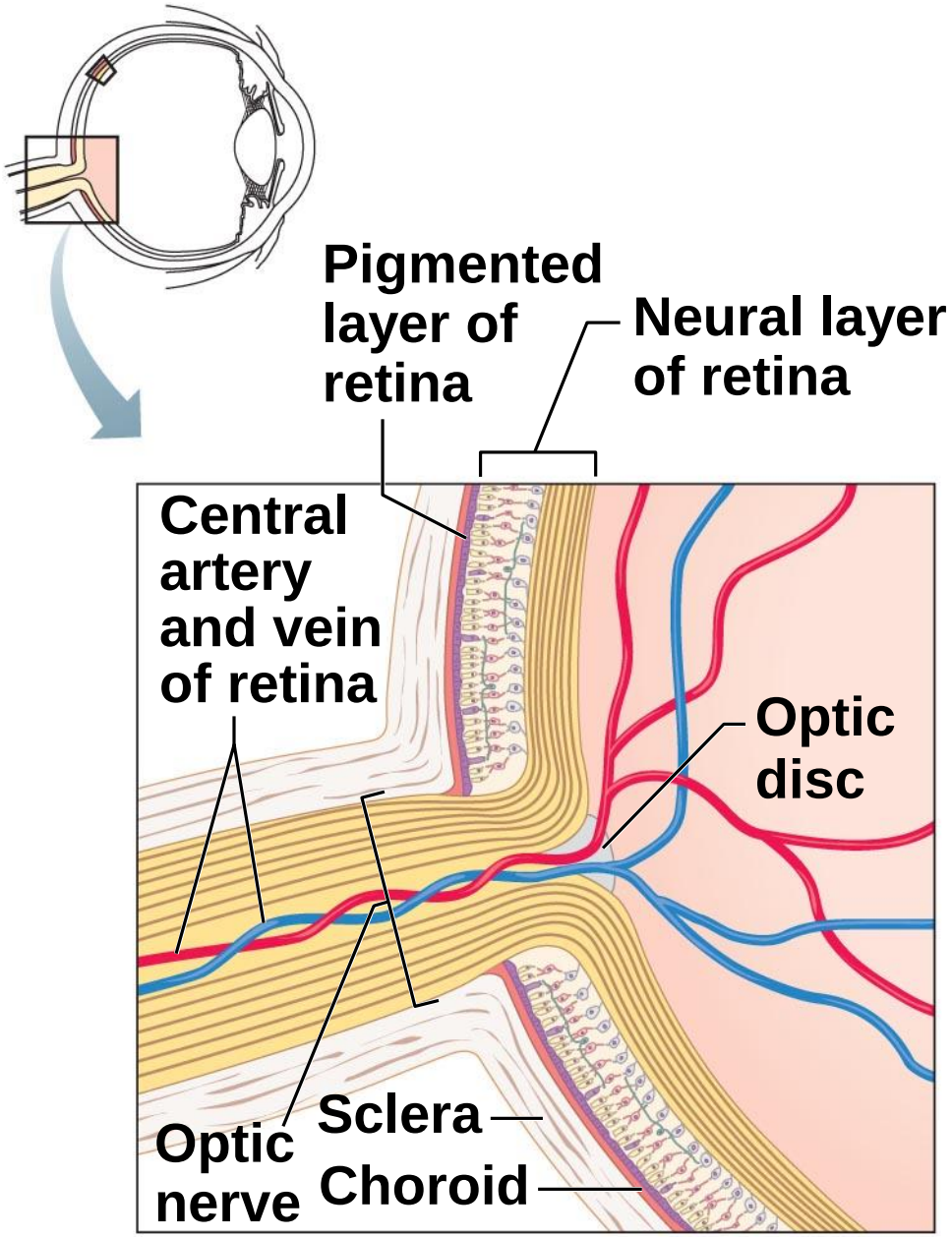


Figure 8.5b

Structure of the Eye: Sensory Layer

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

Structure of the Eye: Sensory Layer

- Neurons of the retina and vision
  - Cones
    - Allow for detailed color vision
    - Densest in the center of the retina
    - Fovea centralis–lateral to blind spot
      - Area of the retina with only cones
      - Visual acuity (sharpest vision) is here
- No photoreceptor cells are at the optic disc, or blind spot

Structure of the Eye: Sensory Layer

- Cone sensitivity
  - Three types of cones
  - Different cones are sensitive to different wavelengths
  - Color blindness is the result of the lack of one cone type

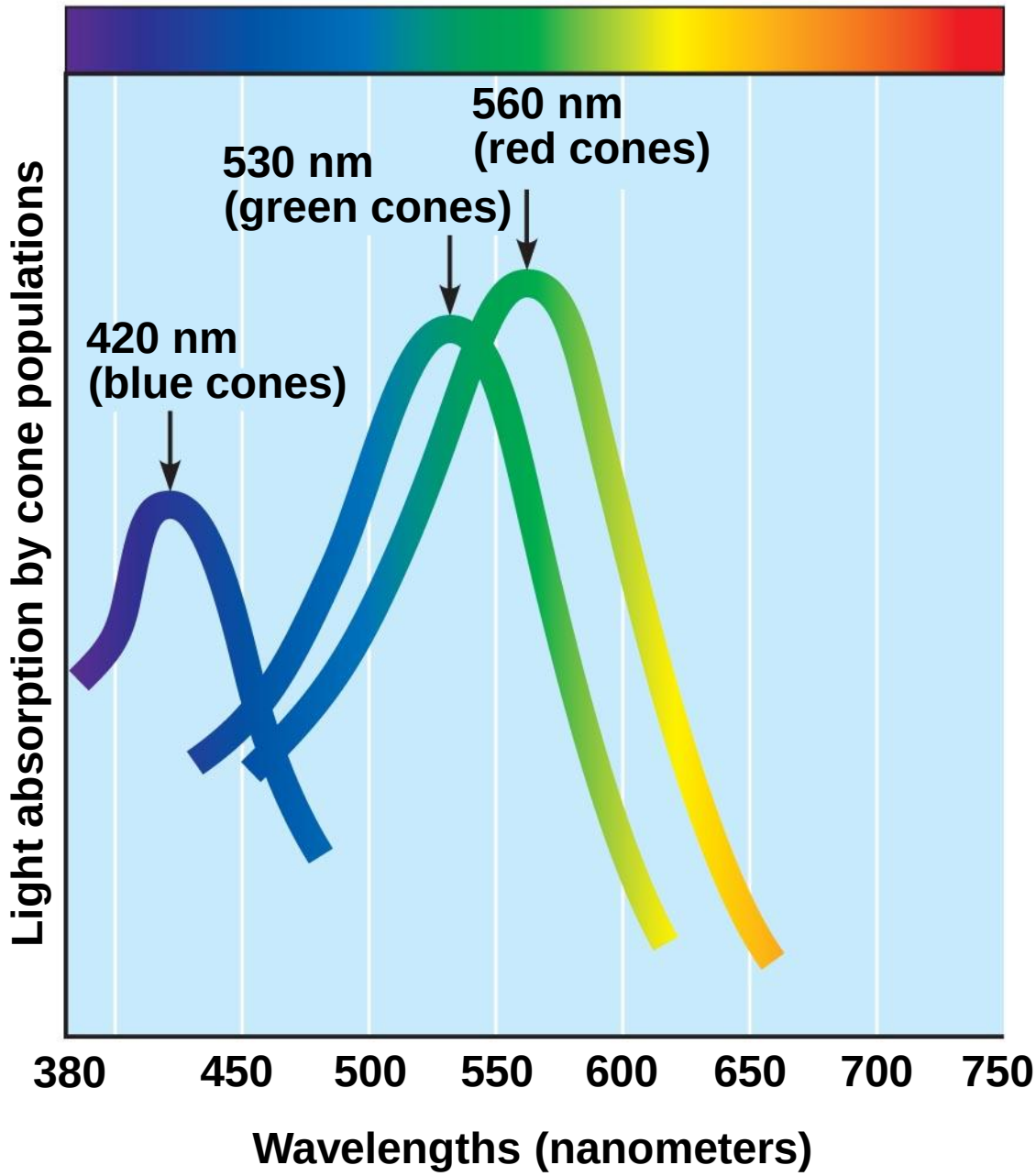


Figure 8.6

Lens

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

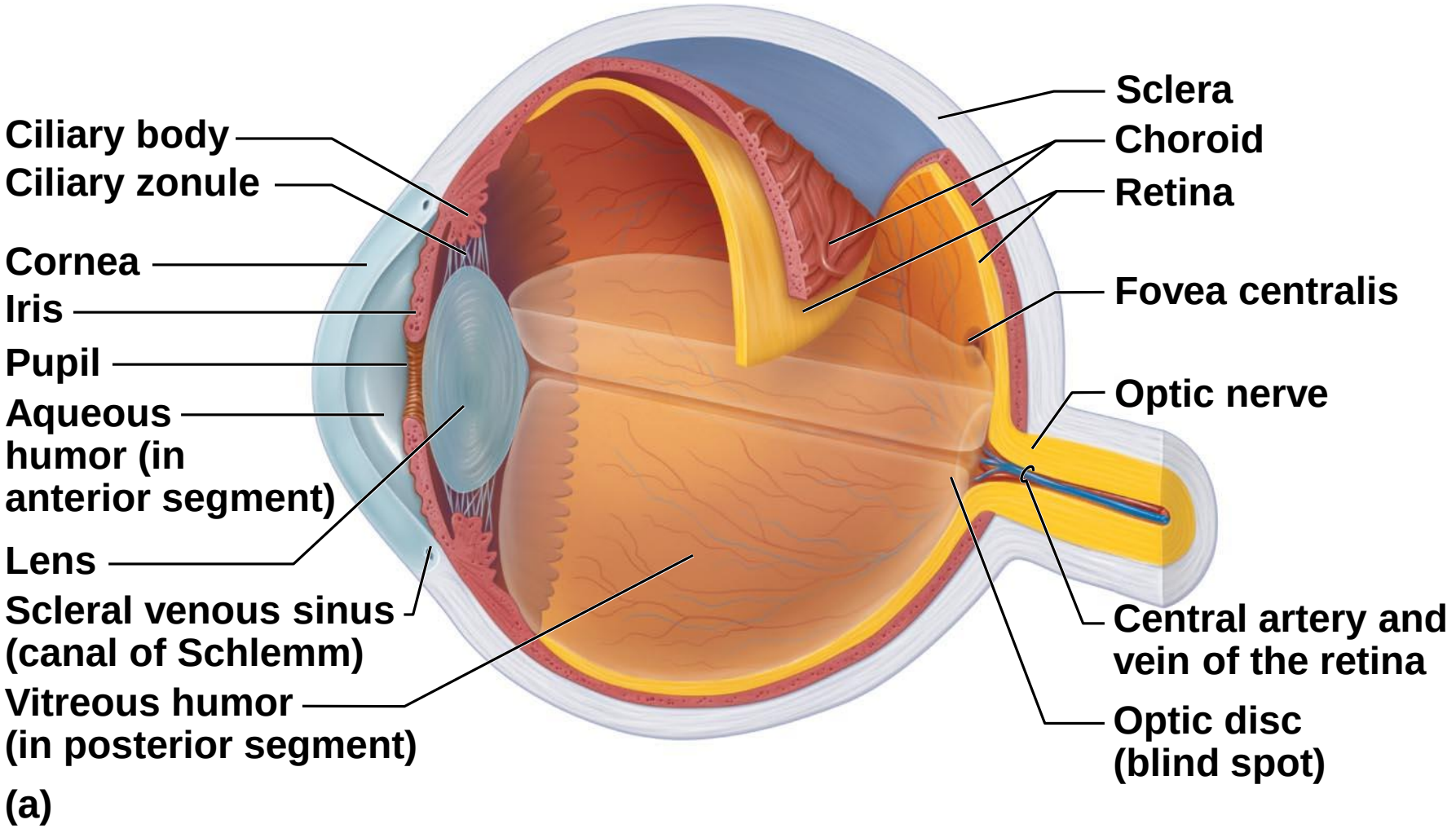


Figure 8.4a

Lens

- Cataracts result when the lens becomes hard and opaque with age
  - Vision becomes hazy and distorted
  - Eventually causes blindness in affected eye
- Risk factors include:
  - Diabetes mellitus
  - Frequent exposure to intense sunlight
  - Heavy smoking

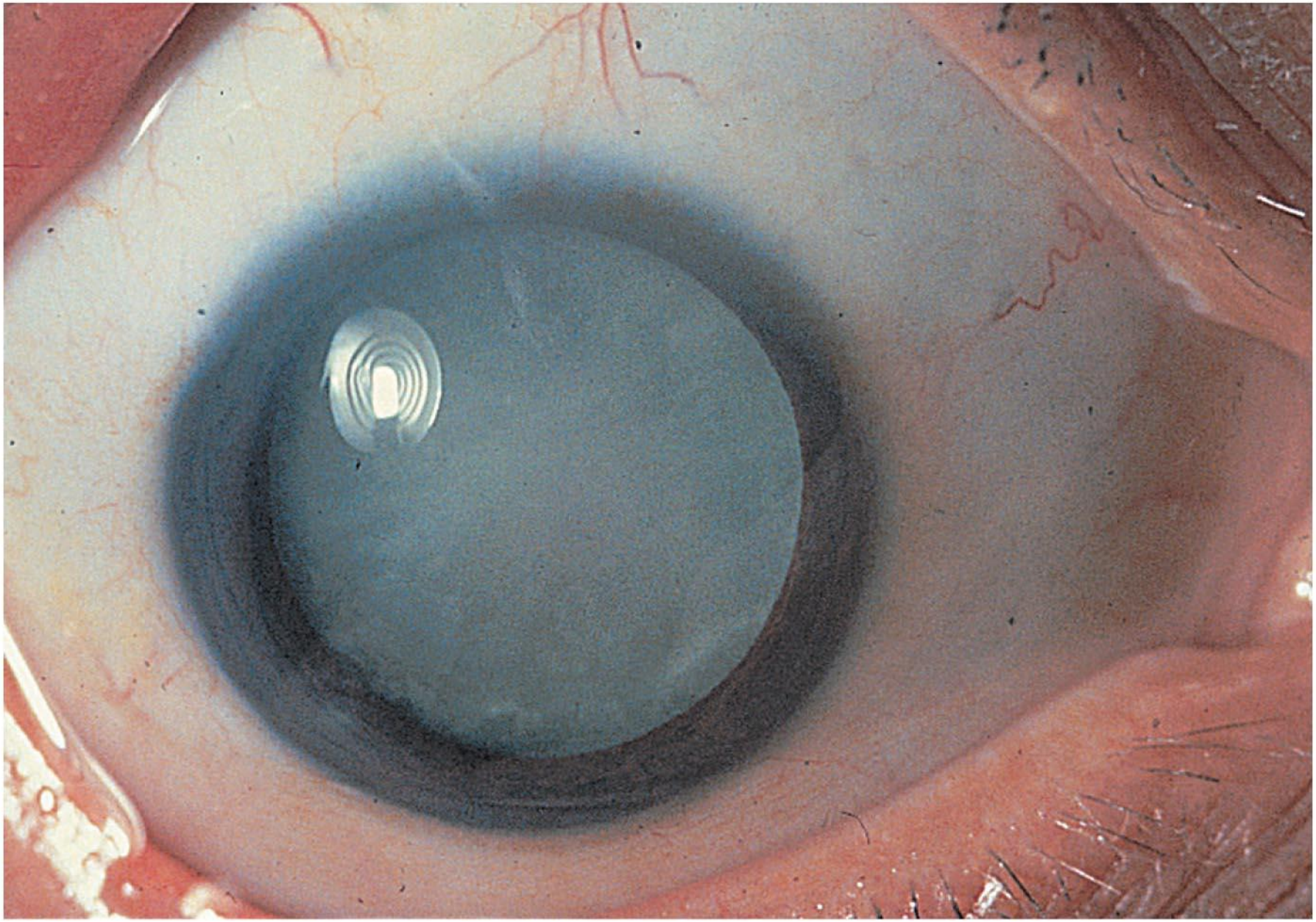


Figure 8.7

Two Segments, or Chambers, of the Eye

- Anterior (aqueous) segment
  - Anterior to the lens
  - Contains aqueous humor
- Posterior (vitreous) segment
  - Posterior to the lens
  - Contains vitreous humor

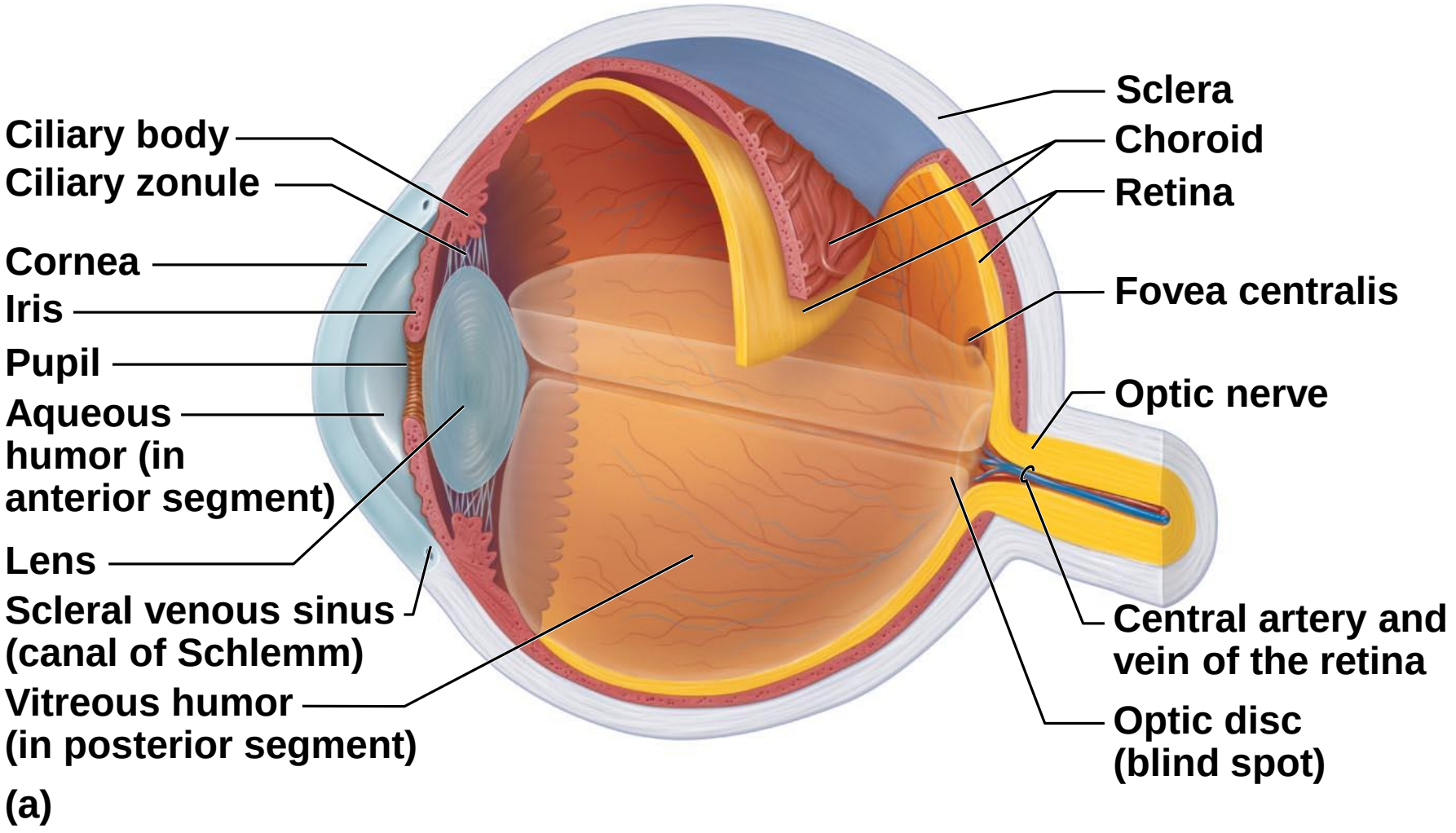


Figure 8.4a

Anterior Segment

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

Posterior Segment

- Vitreous humor
  - Gel-like substance posterior to the lens
  - Prevents the eye from collapsing
  - Helps maintain intraocular pressure

Ophthalmoscope

- Instrument used to illuminate the interior of the eyeball
- Can detect diabetes, arteriosclerosis, degeneration of the optic nerve and retina

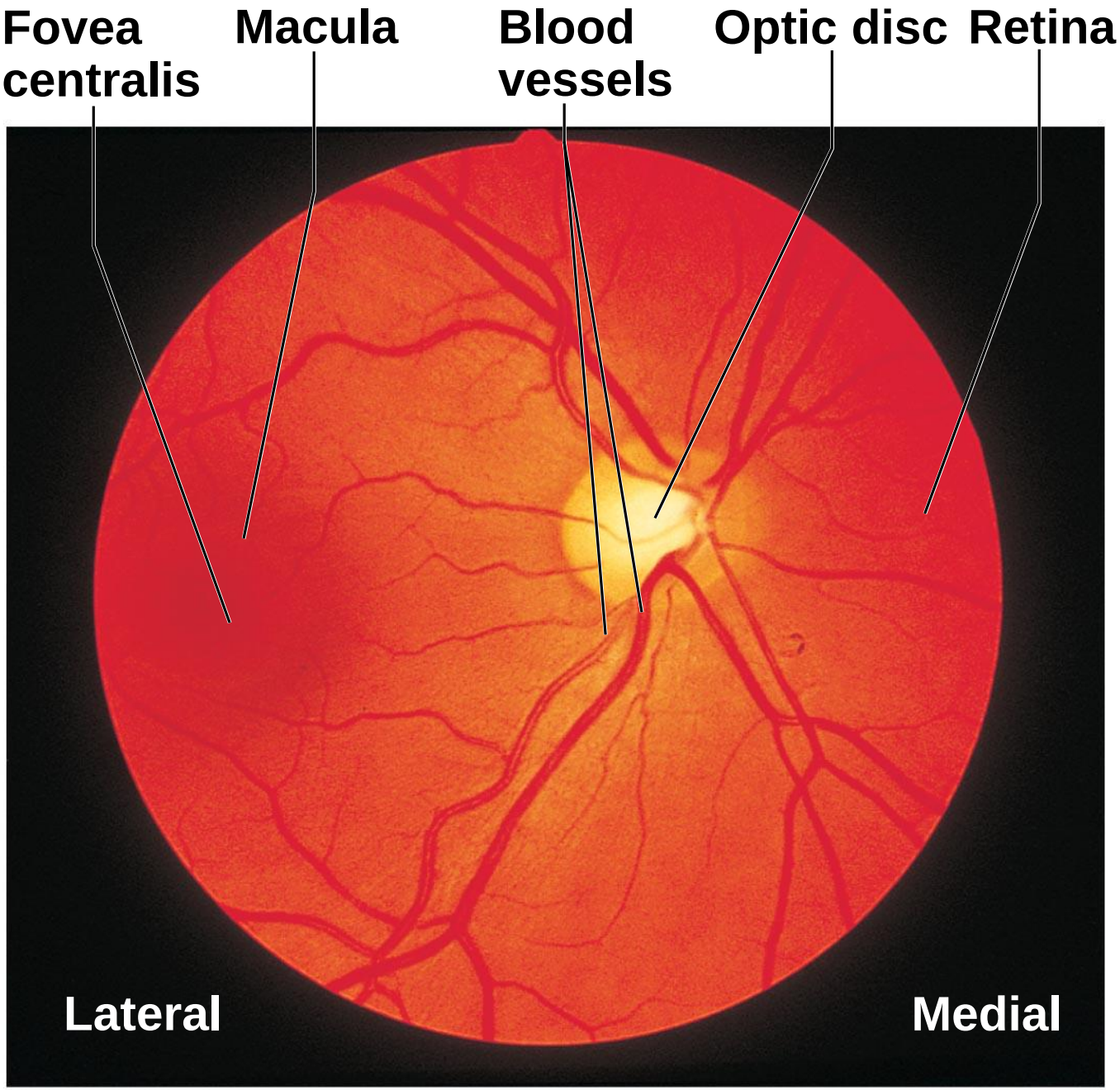
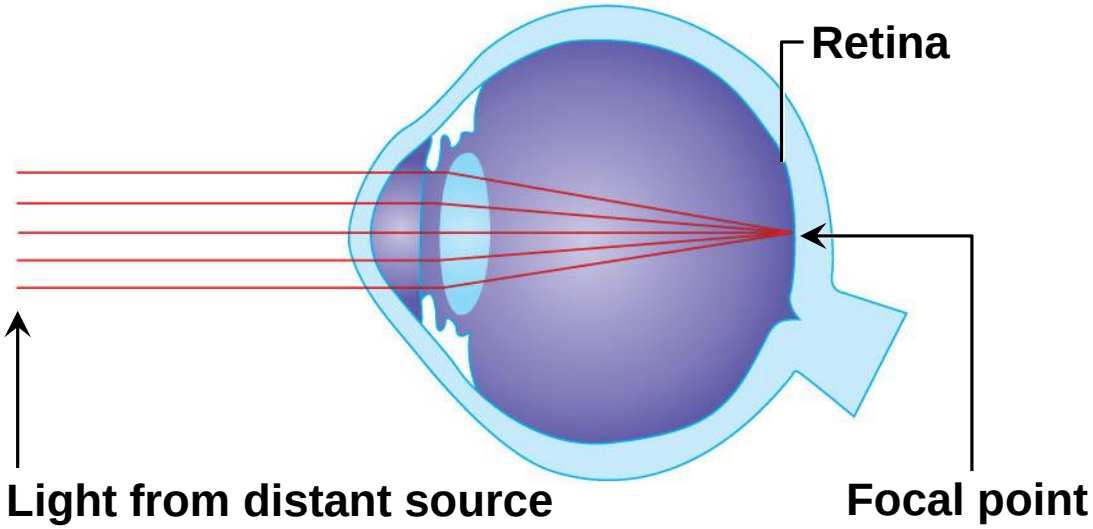


Figure 8.8

Pathway of Light Through the Eye

- Light must be focused to a point on the retina for optimal vision
  - Refracted – bending of light
- The eye is set for distance vision (over 20 feet away)
- Accommodation —the lens must change shape to focus on closer objects (less than 20 feet away)



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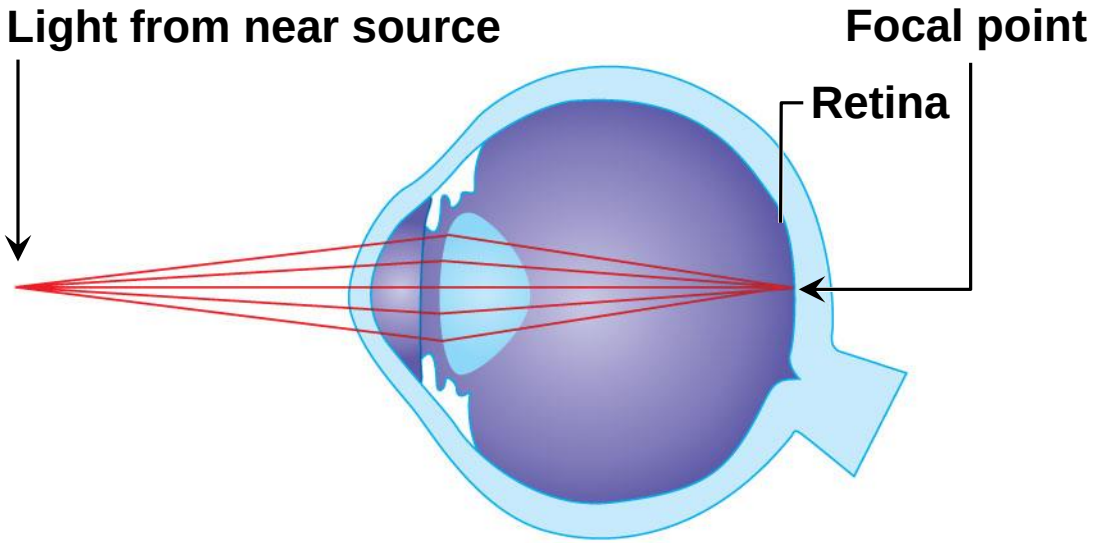


(b)

Figure 8.9

Pathway of Light Through the Eye

- Image formed on the retina is a real image

- Real images are:
  - Reversed from left to right
  - Upside down
  - Smaller than the object (obviously)

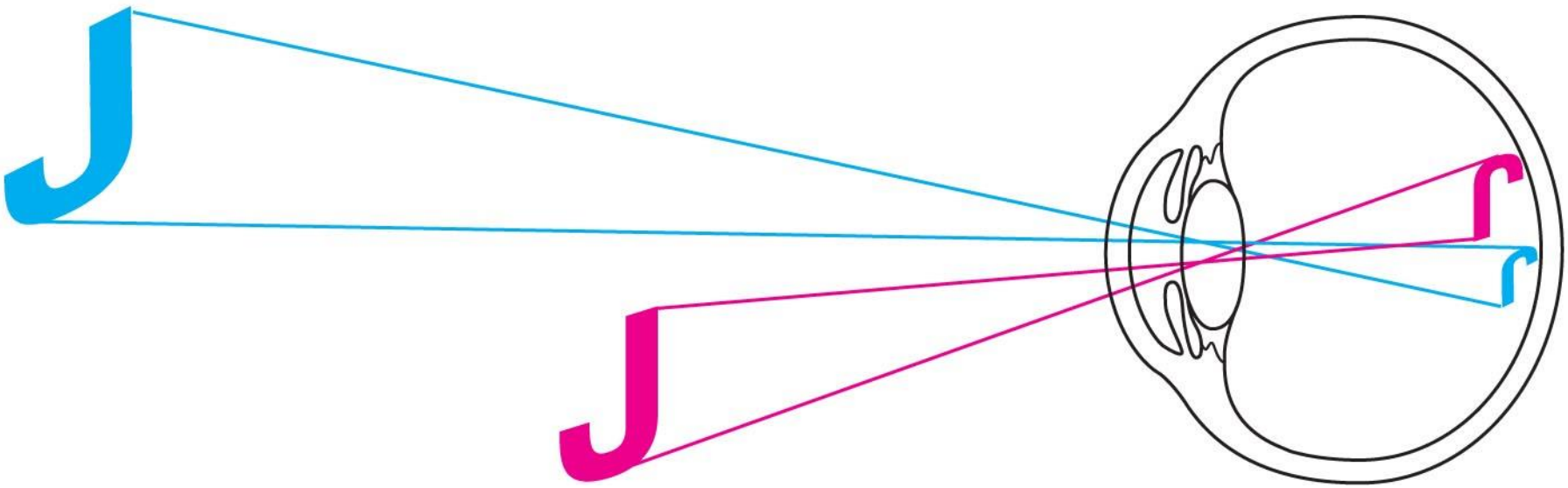


Figure 8.10

Visual Fields and Visual Pathways

- 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

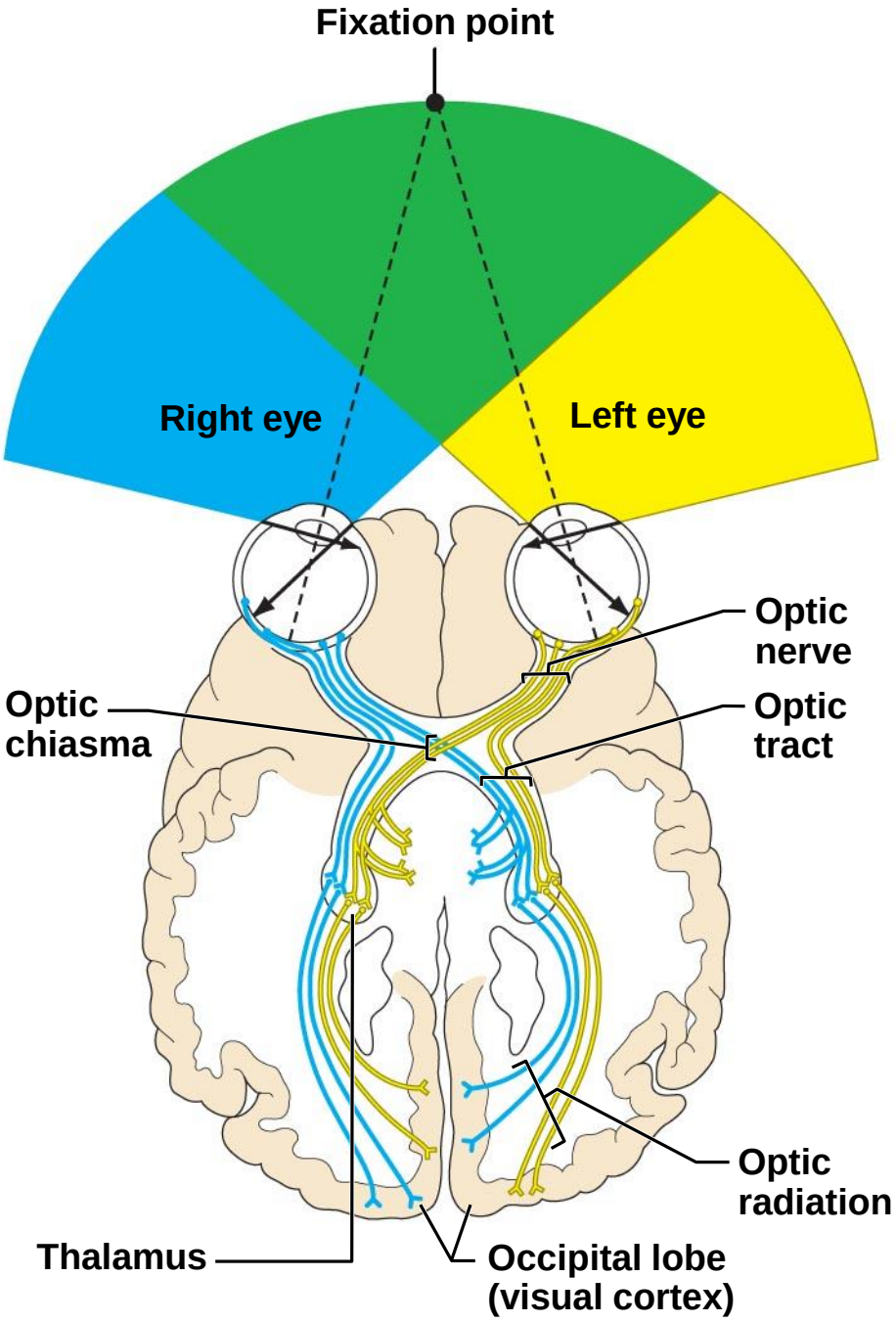


Figure 8.11

Eye Reflexes

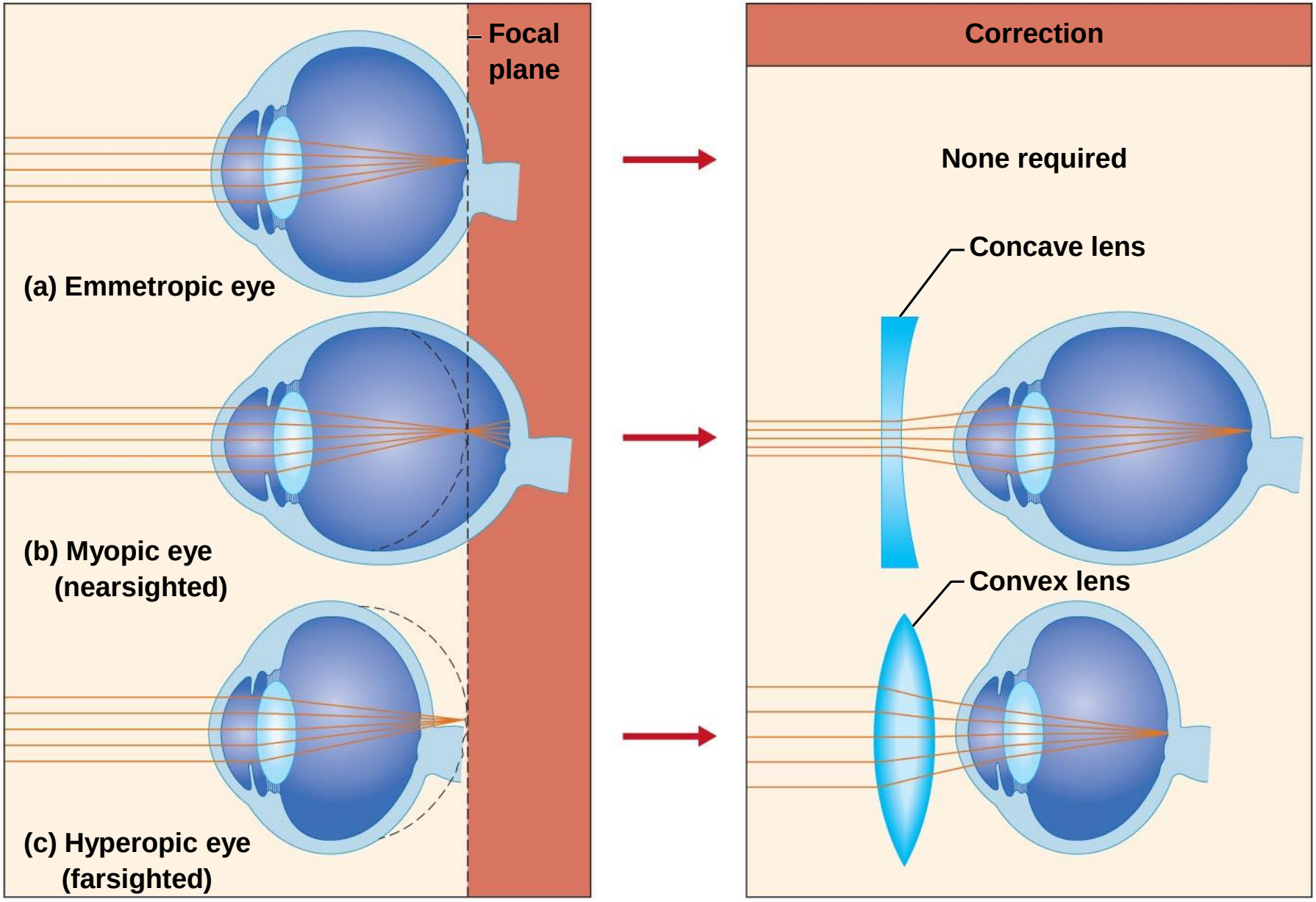
- Internal muscles are controlled by the autonomic nervous system
  - Photopupillary Reflex: Bright light causes pupils to constrict through action of radial, circular, and ciliary muscles
  - Accomodation Pupillary Reflex: Viewing close objects causes accommodation
- External muscles control eye movement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

A Closer Look

- Emmetropia —eye focuses images correctly on the retina

- Myopia (nearsighted)
  - Distant objects appear blurry
  - Light from those objects fails to reach the retina and are focused in front of it
  - Results from an eyeball that is too long

- Hyperopia (farsighted)
  - Near objects are blurry while distant objects are clear
  - Distant objects are focused behind the retina
  - Results from an eyeball that is too short or from a “lazy lens”



A Closer Look

- Astigmatism
  - Images are blurry
  - Results from light focusing as lines, not points, on the retina due to unequal curvatures of the cornea or lens

Homeostatic Imbalances of the Eyes

- Night blindness — inhibited rod function that hinders the ability to see at night
- Color blindness — genetic conditions that result in the inability to see certain colors
  - Due to the lack of one type of cone (partial color blindness)
- Cataracts —when lens becomes hard and opaque, our vision becomes hazy and distorted

Homeostatic Imbalances of the Eyes

- Glaucoma —can cause blindness due to increasing pressure within the eye

- Hemianopia —loss of the same side of the visual field of both eyes; results from damage to the visual cortex on one side only

Developmental Aspects of the Special Senses

- Eye problems
  - Strabismus — “crossed eyes” results from unequal pulls by the external eye muscles in babies
  - Ophthalmia neonatorum — conjunctivitis resulting from mother having gonorrhea. Baby’s eyelids are swollen and pus is produced
  - Presbyopia — “old vision” results from decreasing lens elasticity that accompanies aging

Page 163 #5

1. L Refraction
2. A Accommodation
3. F Emmetropia
4. H Hyperopia
5. K Photopupillary Reflect
6. D Cataract
7. I Myopia
8. C Astigmatism
9. G Glaucoma
10. E Convergence
11. B Accommodation pupillary reflex
12. J Night blindness

Page 164 #8

1. E Ciliary Zone
2. A Aqueous Humor
3. L Sclera
4. J Optic Disk
5. D Ciliary Body
6. C Choroid
7. B Canal of Schlemm
8. K Retina
9. M Vitreous Humor
10. C Choroid
11. D Ciliary Body
12. H Iris
13. G Fovea Centralis
14. A Aqueous Humor
15. F Cornea
16. I Lens
17. M Vitreous Humor
18. F Cornea
19. H Iris