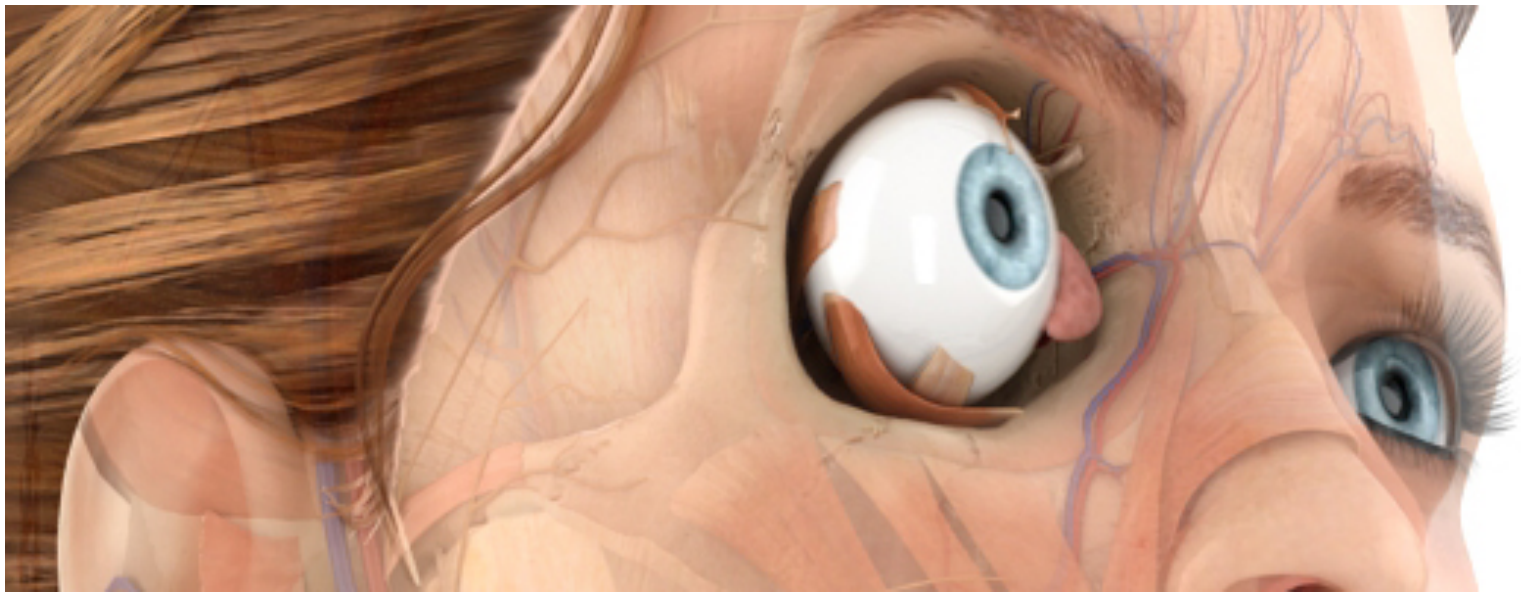
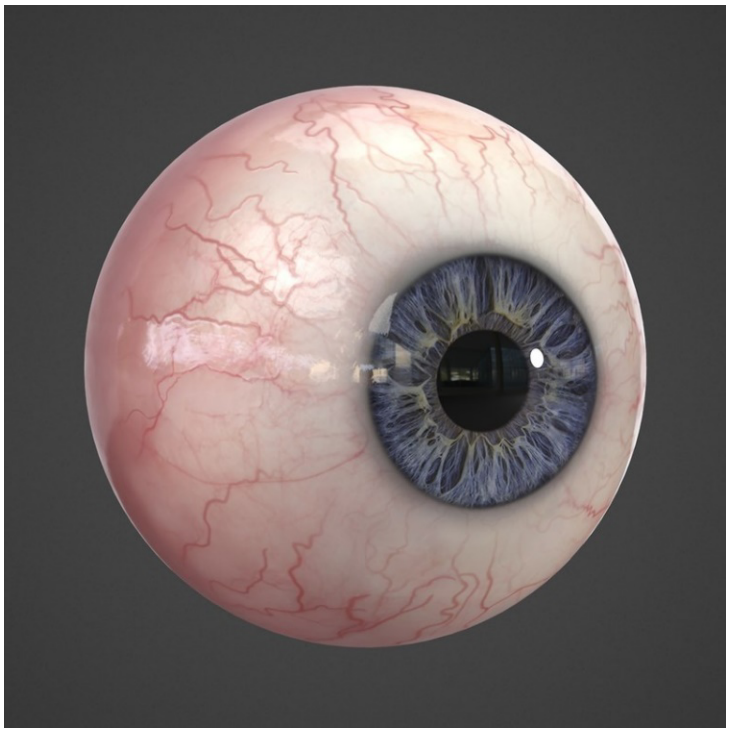
# Introduction to Ophthalmology
## Anatomy of the Eye

# Anatomy the Eye



# Anatomy the Eye

- The eye is a spherical structure that lies within the orbital cavity
- Also known as the **Eyeball** or **Globe**



# Orbit


Frontal bone
(orbital surface)
Sphenoid bone
Zygomatic bone
(orbital surface)
Ethmoid bone
(orbital plate)
Lacrimal bone
Nose
Palatine bone
(orbital surface)
Maxilla
(orbital surface)
K. Holoski

# Orbit: Anatomy and Clinical Relevance

- **Structure**: Pear-shaped cavity with the **optic canal** as its stalk.

•**Roof**: Formed by the **lesser wing of sphenoid** and **frontal bone**; defects may cause **pulsatile proptosis**.

•**Lateral Wall**: Formed by the **greater wing of sphenoid** and **zygomatic bone**; **anterior globe vulnerable to trauma**.

- **Floor**: Made of **zygomatic, maxillary, and palatine bones**; weak **posteromedial maxillary** portion prone to **blowout fractures**; maxillary carcinoma can **displace the globe**.

- **Medial Wall**: Composed of **maxillary, lacrimal, ethmoid, and sphenoid bones**; **lamina papyracea** is thin, allowing **spread of infections (orbital cellulitis)** from the ethmoidal sinus.

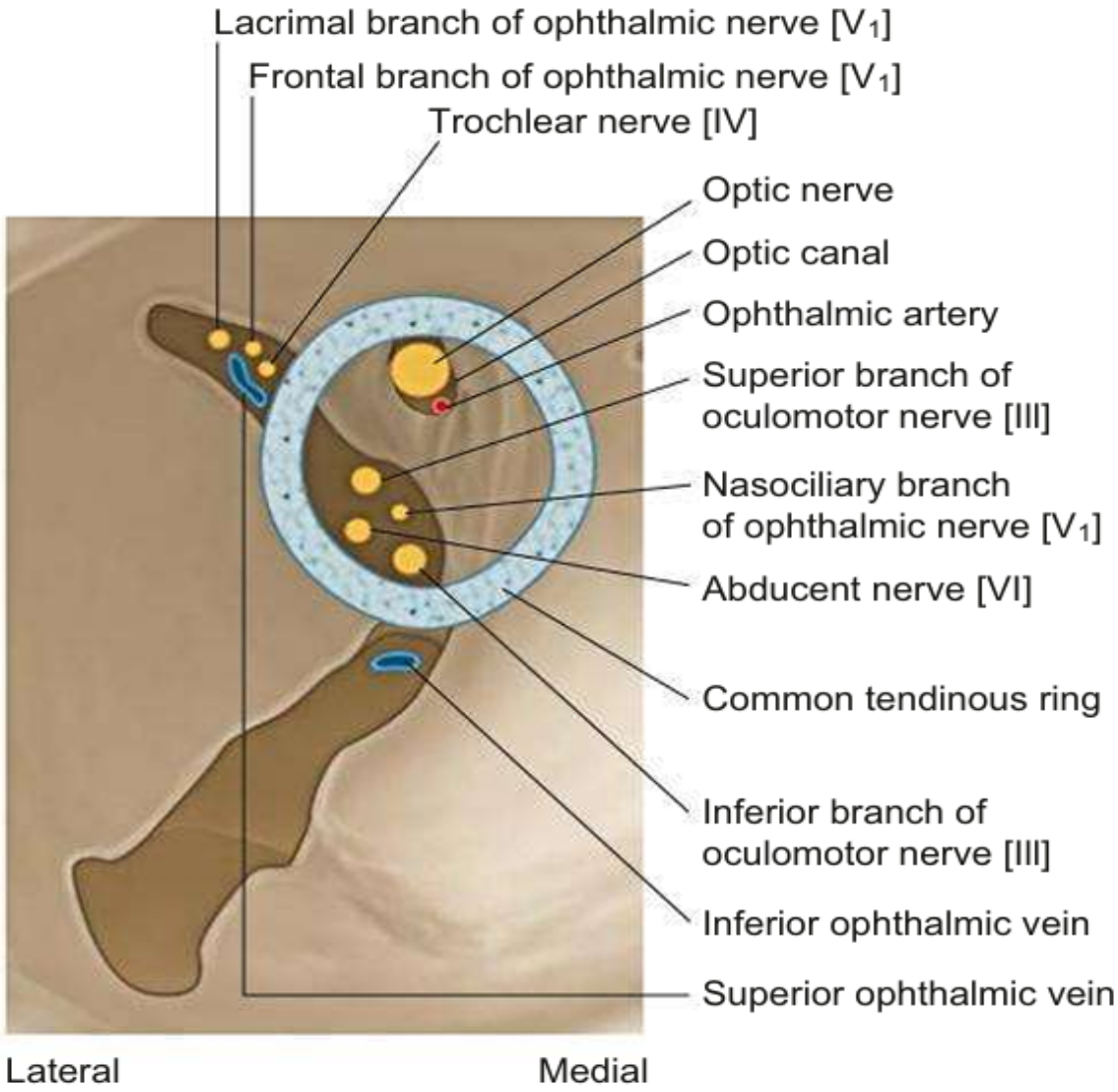
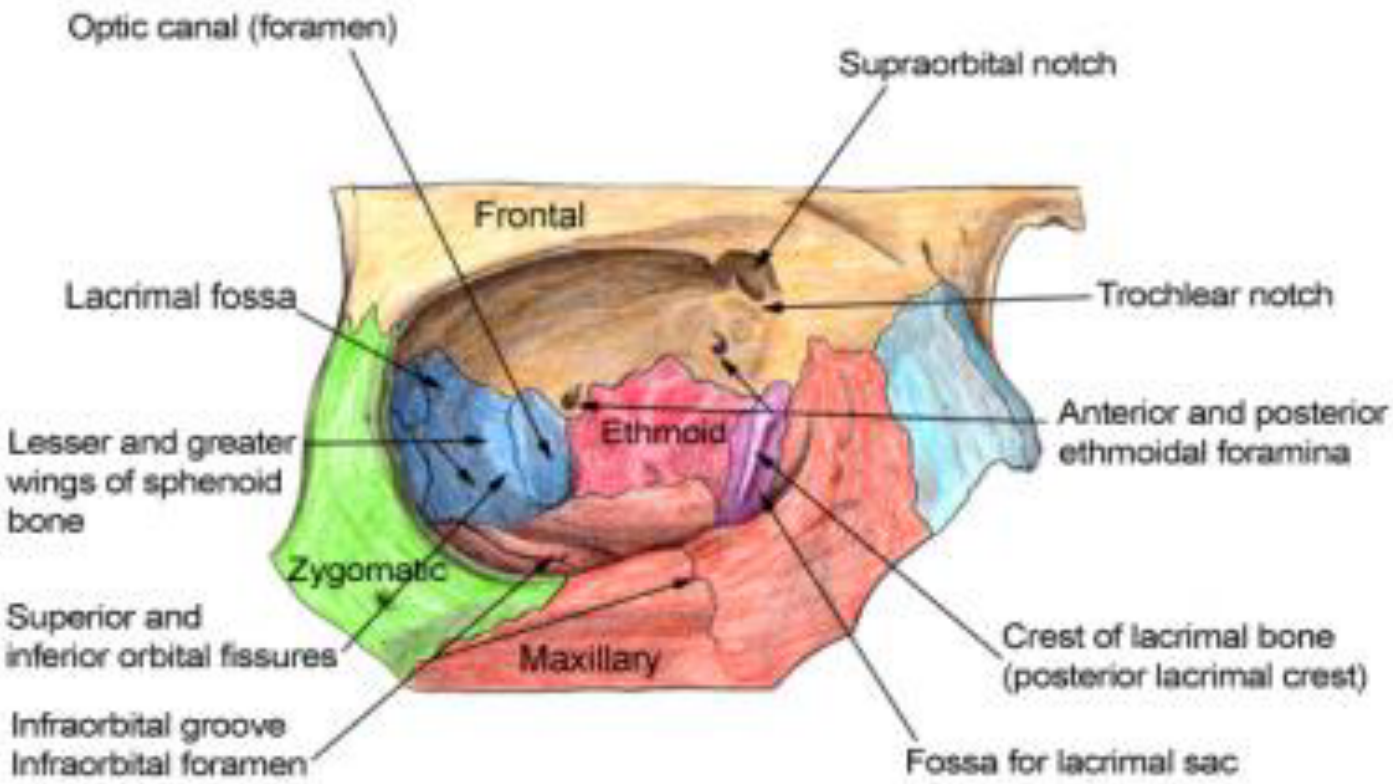



**Fig. 4.2** Innervation of the orbit and eyeball.

•**Superior Orbital Fissure**: Connects orbit to cranium; passage for **cranial nerves & veins**.
•**Superior portion**: Lacrimal, frontal, trochlear nerves, superior ophthalmic vein.
•**Inferior portion**: Oculomotor nerve divisions, abducens nerve, nasociliary nerve, sympathetic fibers.

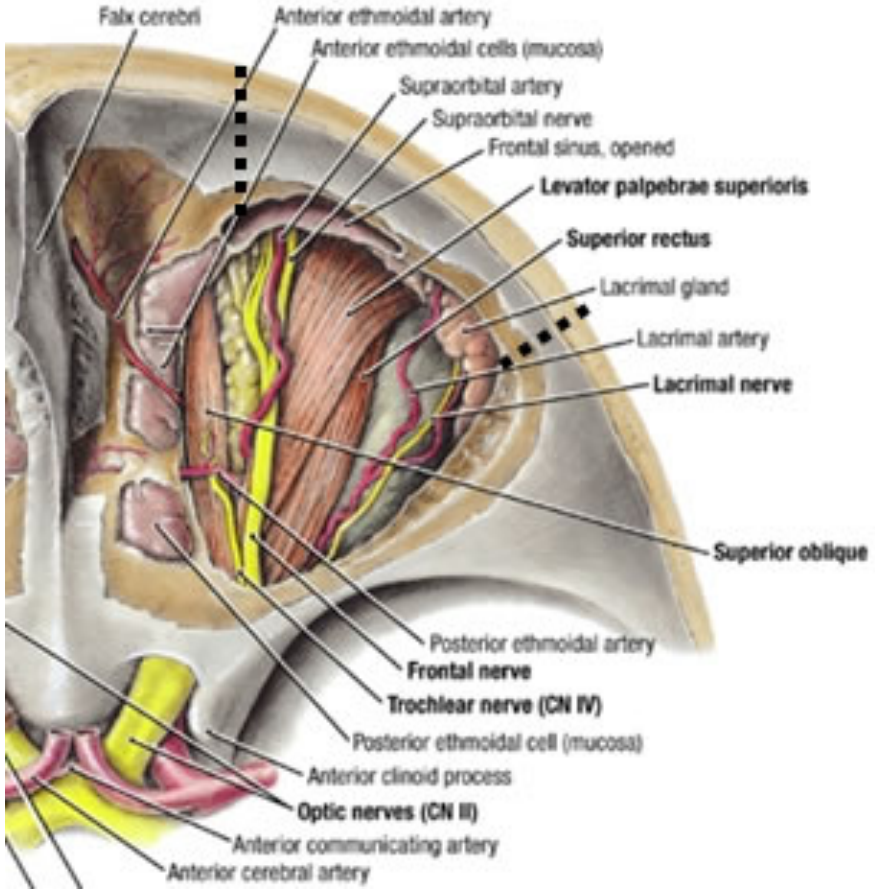
•**Inferior Orbital Fissure**: Connects orbit to pterygopalatine/infratemporal fossae; contains **maxillary nerve, zygomatic nerve, pterygopalatine ganglion branches, and inferior ophthalmic vein**.

# Orbit


Optic canal (foramen)
Supraorbital notch
Frontal
Lacrimal fossa
Trochlear notch
Ethmoid
Anterior and posterior ethmoidal foramina
Lesser and greater wings of sphenoid bone
Zygomatic
Superior and inferior orbital fissures
Maxillary
Crest of lacrimal bone (posterior lacrimal crest)
Infraorbital groove
Infraorbital foramen
Fossa for lacrimal sac

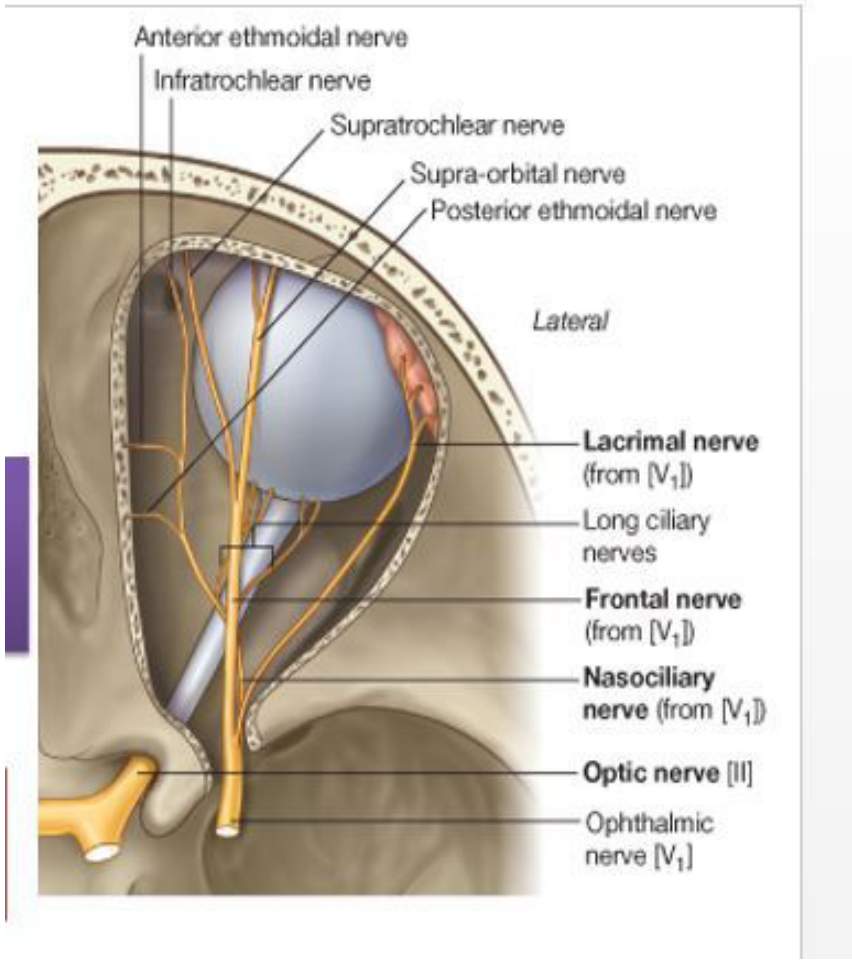
# Orbital Structures

- Eyeball
- Nerves
- Muscles
- Blood Vessels
- Lacrimal Gland
- Fat



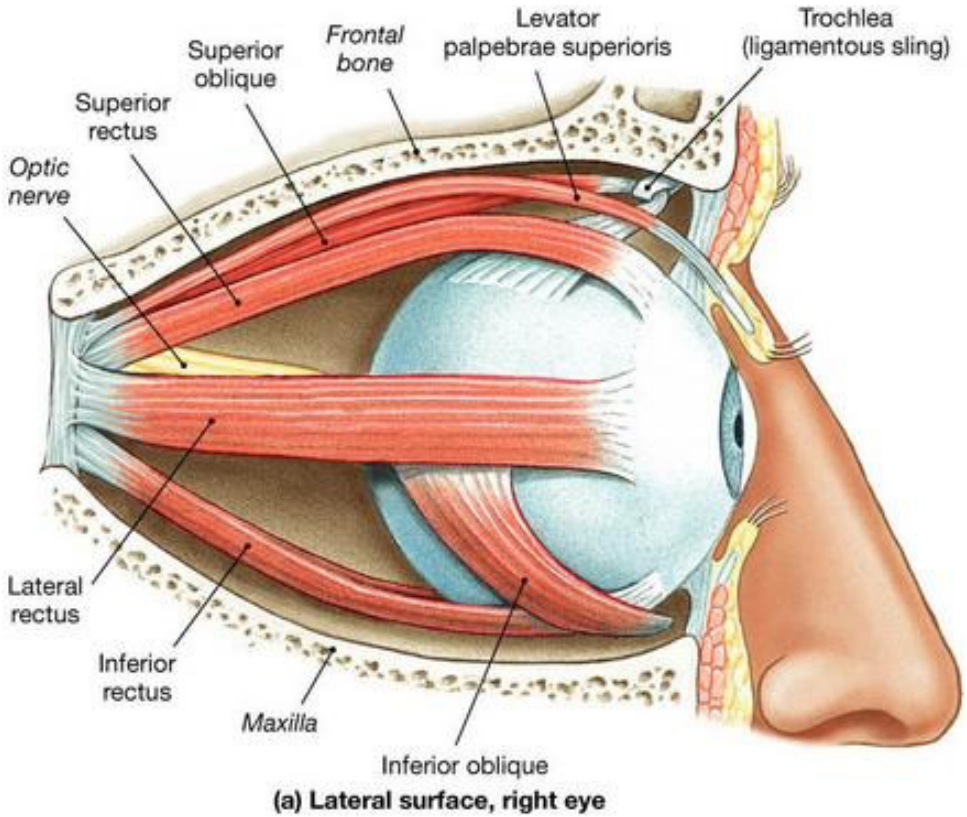
# Orbital Structures- Cranial Nerves

- Optic- CN II
- Oculomotor- CN III
- Trochlear- CN IV
- Trigeminal- CN $V^1$ and $V^2$
- Abducent- CN VI



# Orbital Structures- Muscles

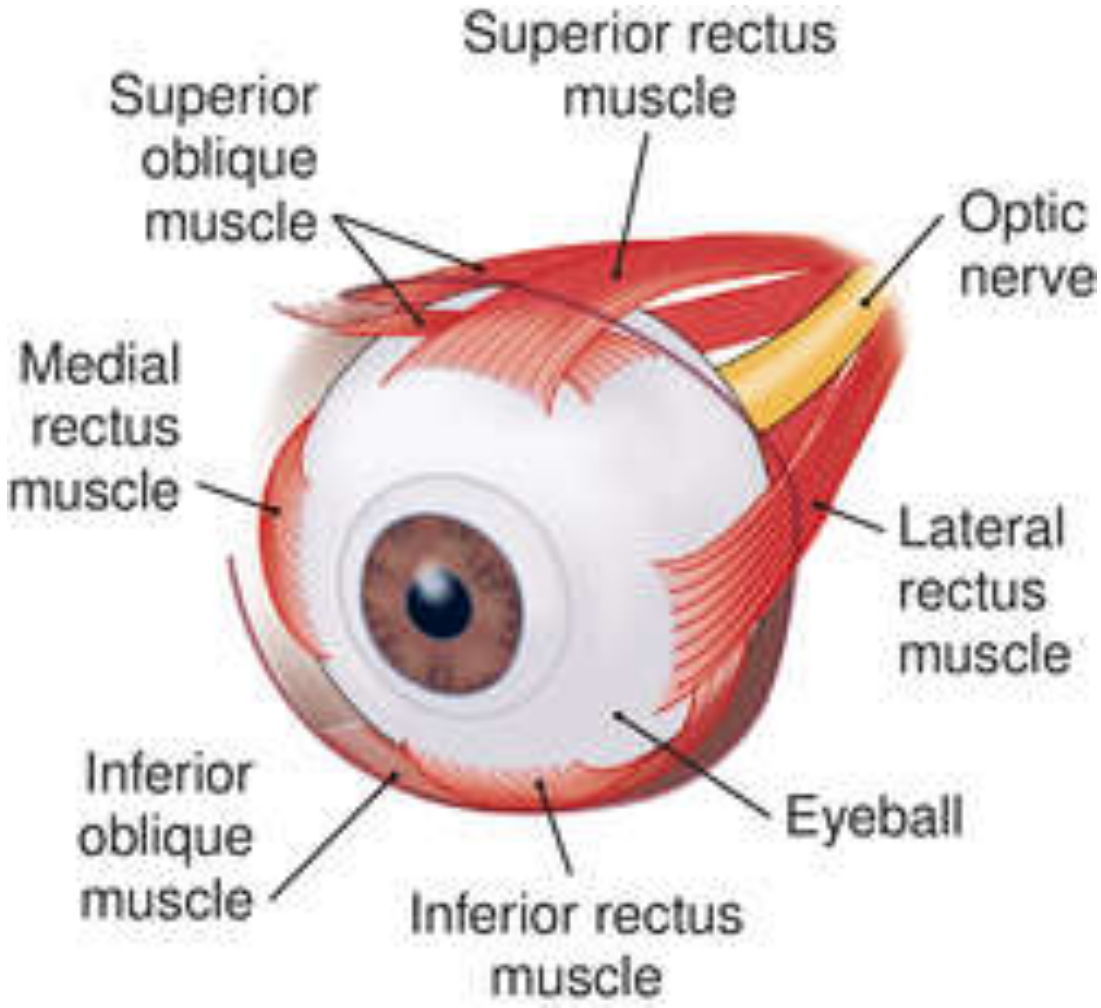
- Extraocular Muscles- EOM
- Levator Palpebrae Superioris



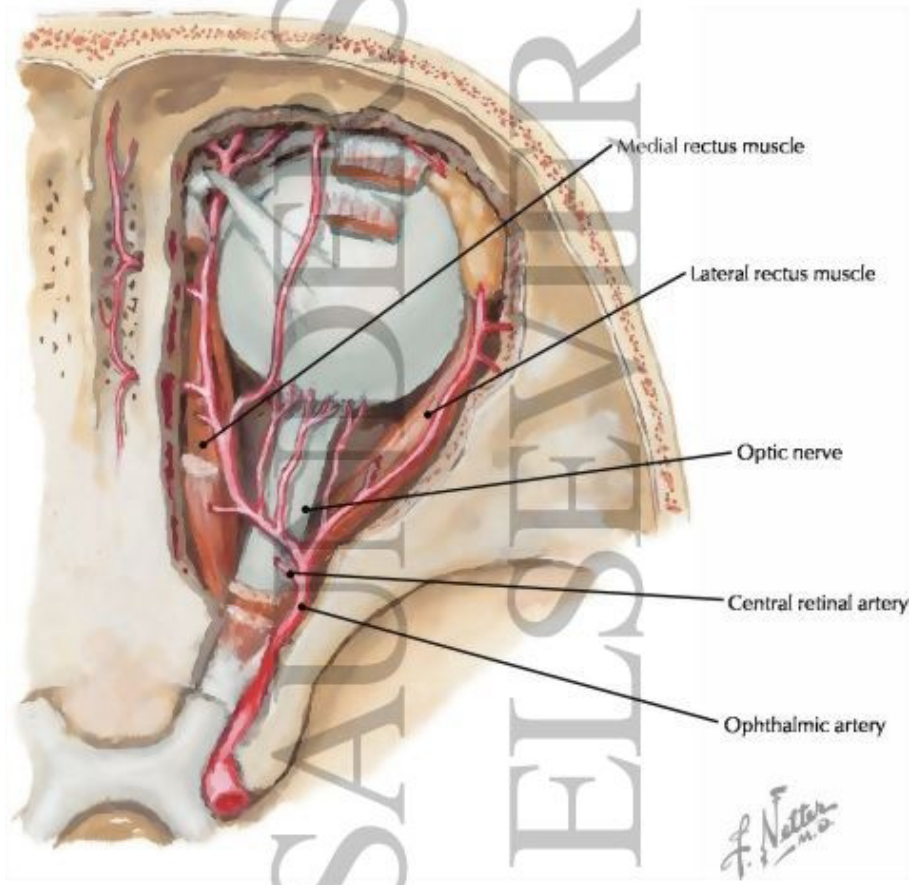
(a) Lateral surface, right eye

# Orbital Structures- Muscles

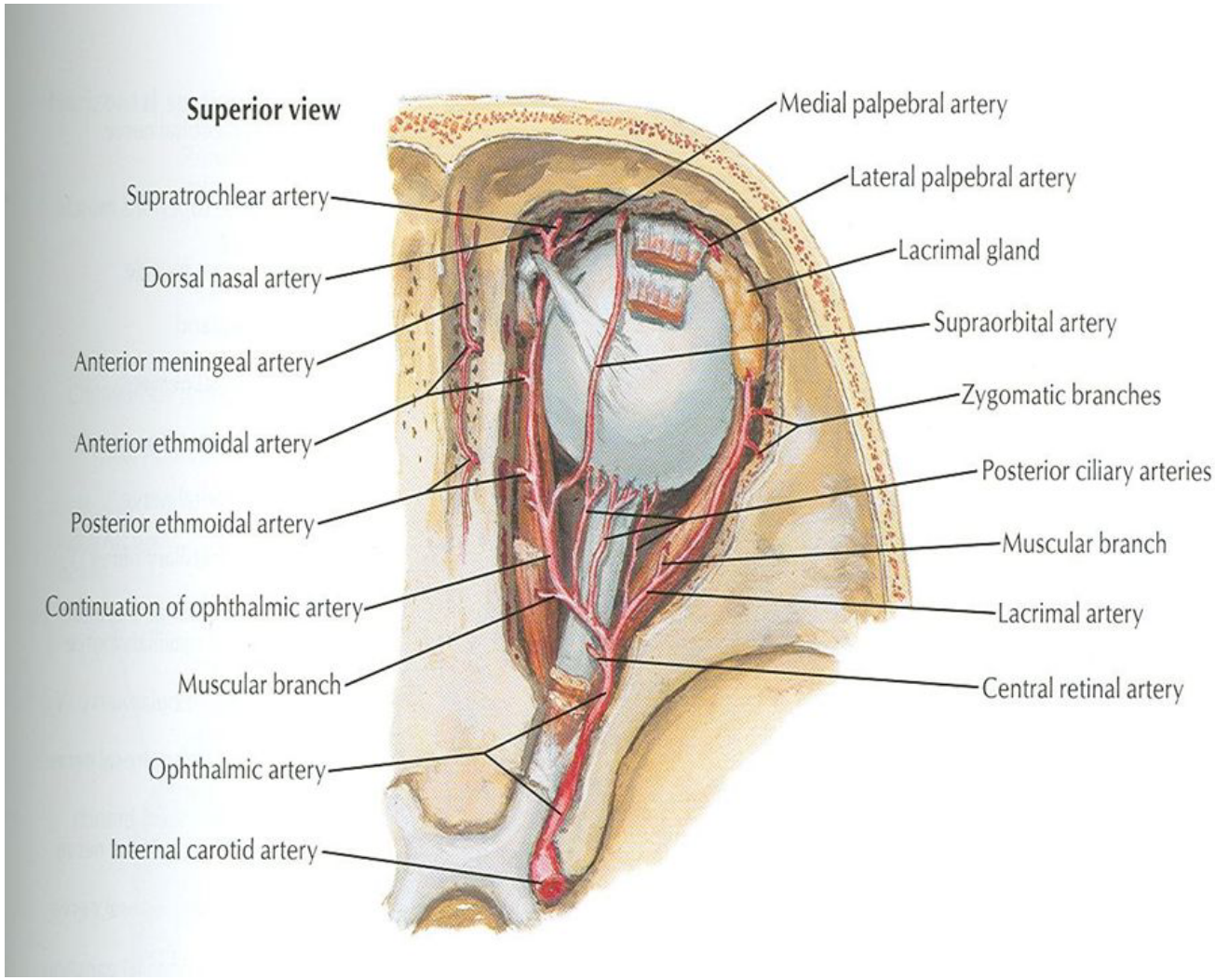
- EOM:
  - Recti : Superior
    Inferior
    Medial
    Lateral
  - Obliques: Superior
    Inferior



# Orbital Structures-Blood Vessels



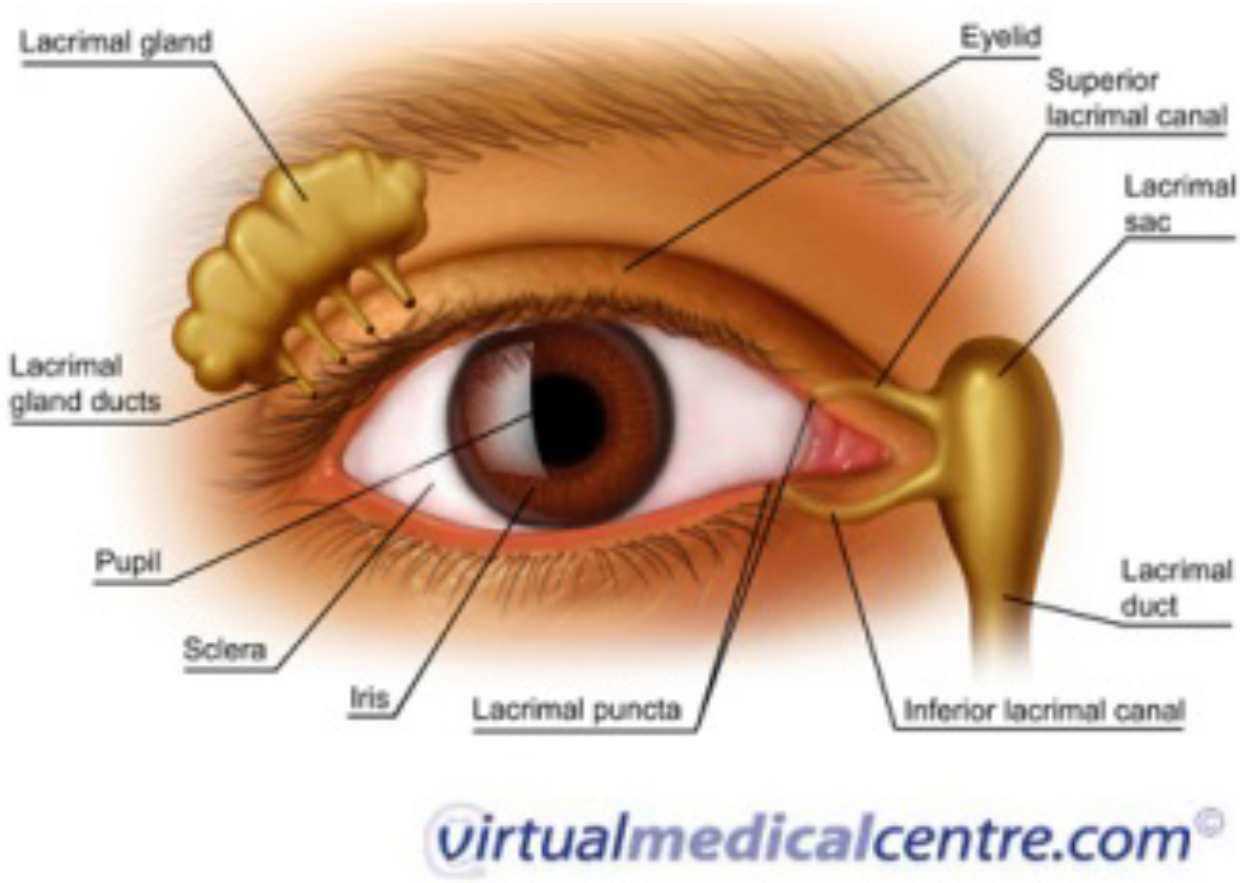
# Orbital Structures-Blood Vessels



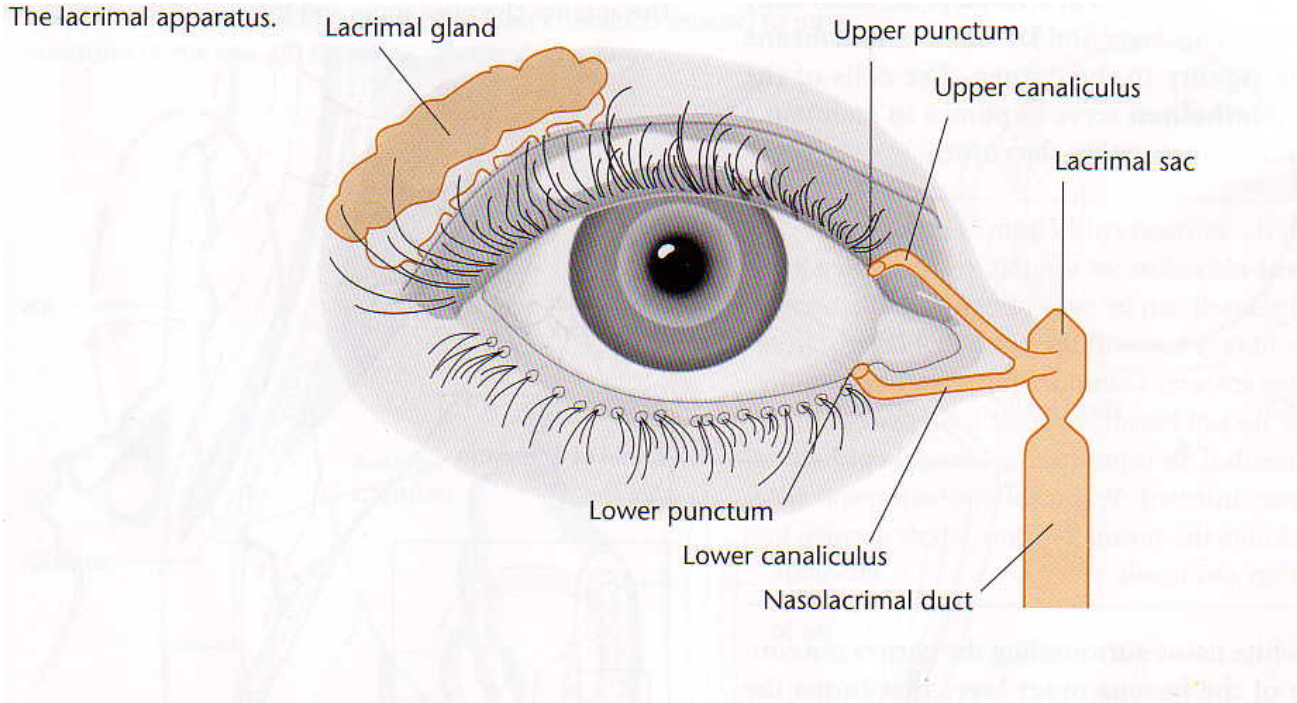
# Blood Supply of the Orbit

- **1. Main Arterial Supply**
- **Ophthalmic artery** (branch of the internal carotid artery)
  - Enters through the **optic canal** alongside the optic nerve
  - Gives off multiple branches supplying the orbit and eye
- **2. Key Branches of the Ophthalmic Artery**
- **Central retinal artery** → Supplies the inner retina
- **Lacrimal artery** → Supplies lacrimal gland, eyelids, and conjunctiva
- **Ciliary arteries**:
  - **Short posterior ciliary arteries** → Supply the choroid & optic nerve head
  - **Long posterior ciliary arteries** → Supply anterior uvea
  - **Anterior ciliary arteries** → Supply the rectus muscles & anterior segment
- **Ethmoidal arteries** (anterior & posterior) → Supply ethmoidal sinuses & nasal cavity
- **Supraorbital & supratrochlear arteries** → Supply forehead and scalp
- **3. Venous Drainage**
- **Superior ophthalmic vein** → Drains into the **cavernous sinus**
- **Inferior ophthalmic vein** → Communicates with **pterygoid venous plexus**
- **Clinical Significance**: Infection from the face (danger triangle) can spread via these veins → **Cavernous sinus thrombosis**

# Orbital Structures- Lacrimal Gland



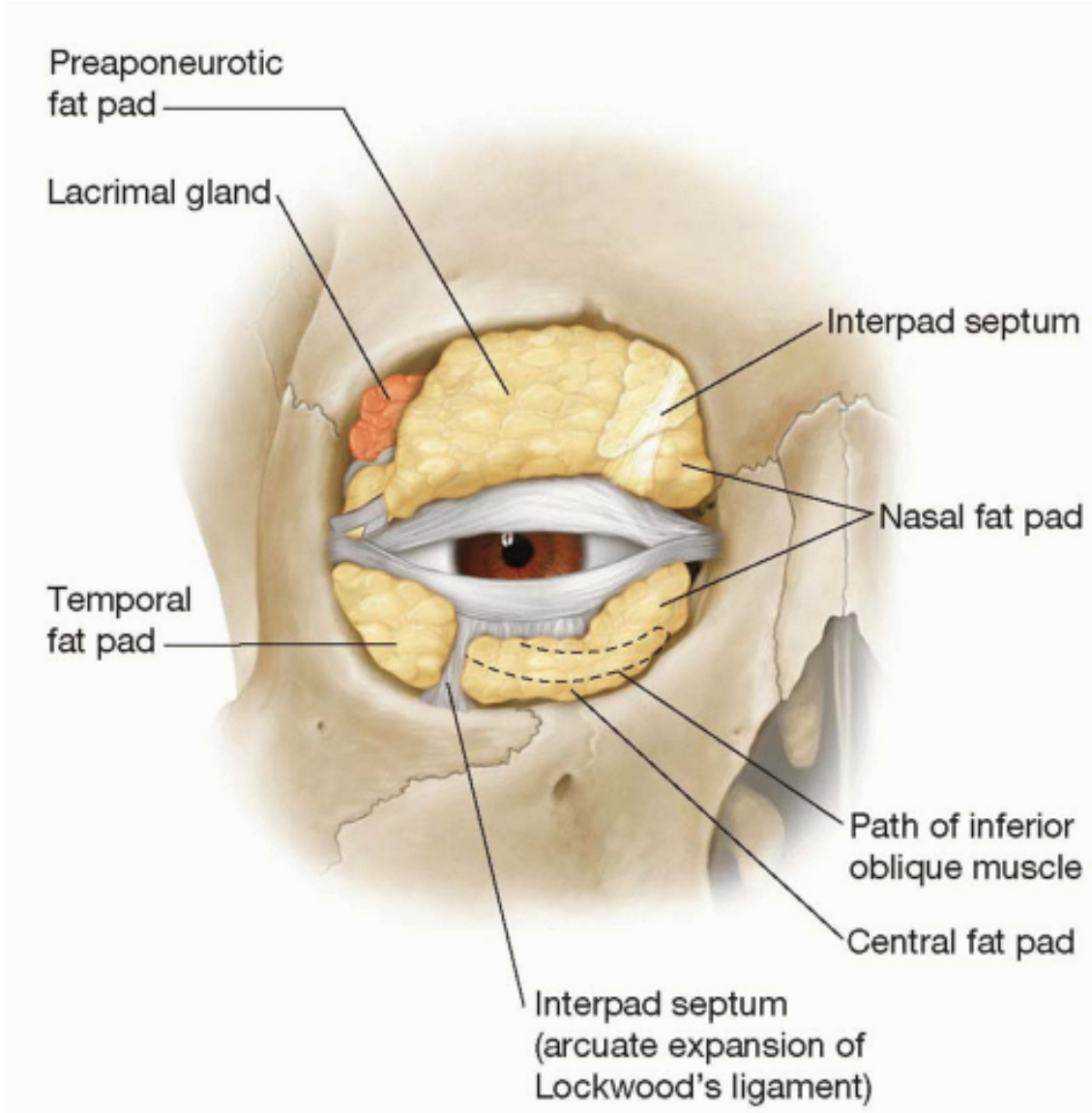
# Lacrimal Apparatus



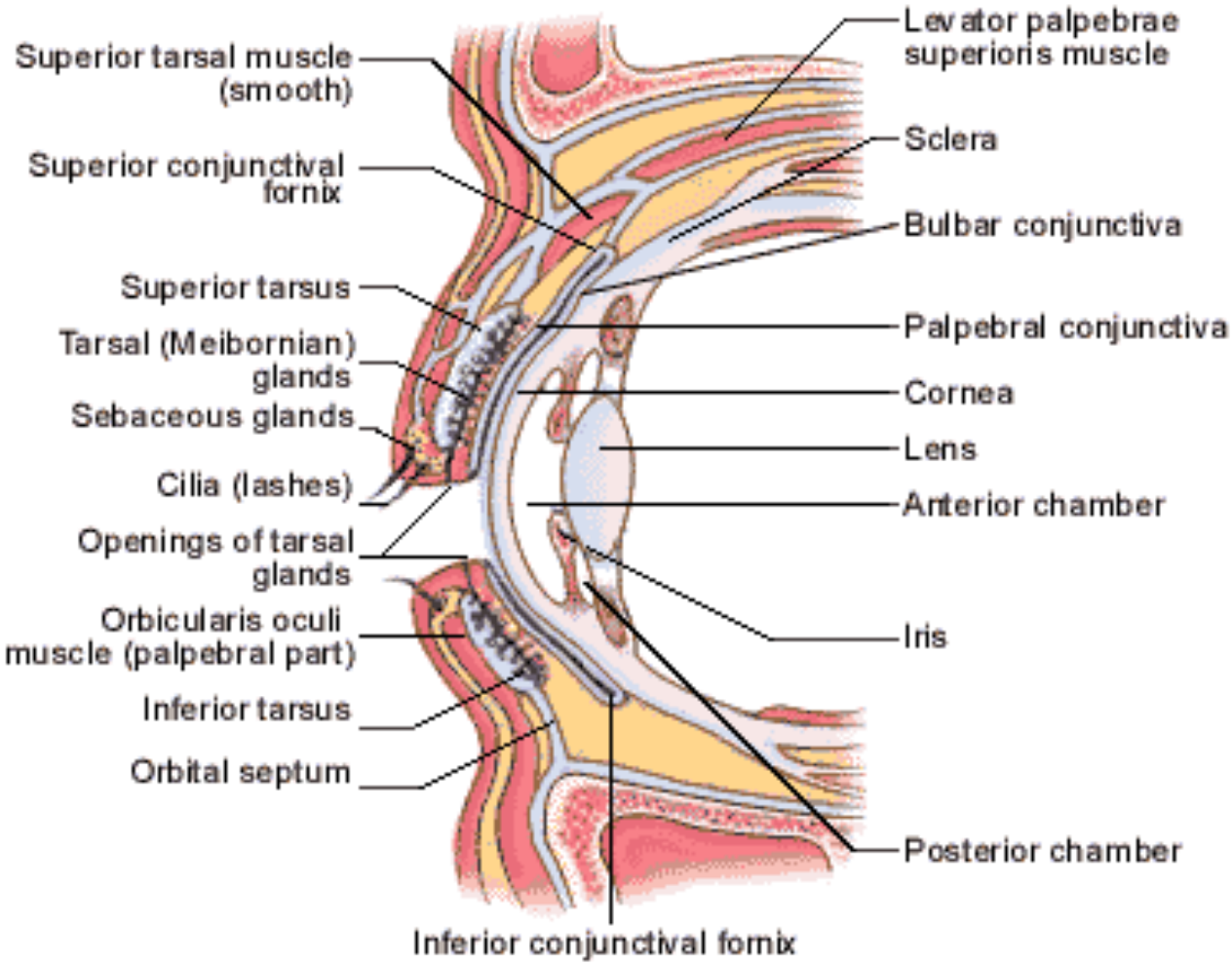
# Lacrimal Gland: Key Points

- **Location**: Superolateral orbit, divided into **orbital** and **palpebral** portions.
- **Function**: Produces tears; drains via **lacrimal puncta** → **canaliculi** → **lacrimal sac** → **nasolacrimal duct** → **inferior meatus** .
- **Blood Supply**: **Lacrimal artery** (ophthalmic branch); venous drainage to **cavernous sinus**.
- **Innervation**:
  - **Parasympathetic (CN VII via pterygopalatine ganglion)** → Stimulates tears.
  - **Sympathetic (superior cervical ganglion)** → Controls blood flow.
  - **Sensory (Lacrimal nerve - V1)** .
- **Clinical Relevance**:
  - **Dry Eye Syndrome** → Tear deficiency.
  - **Dacryoadenitis** → Inflammation (viral/ bacterial).
  - **Lacrimal tumors** → May cause **proptosis & globe displacement**.

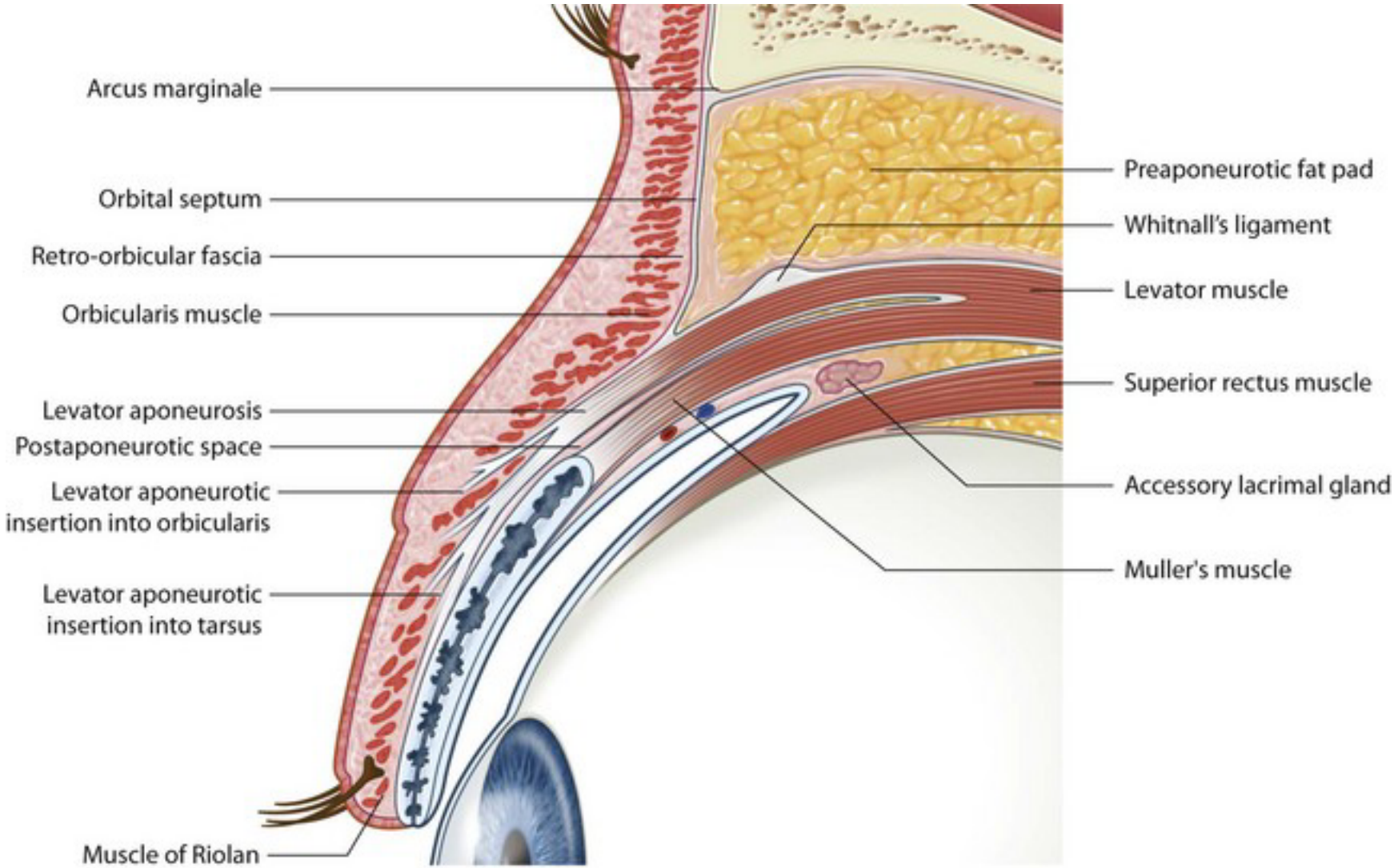
# Orbital Structures- Fat



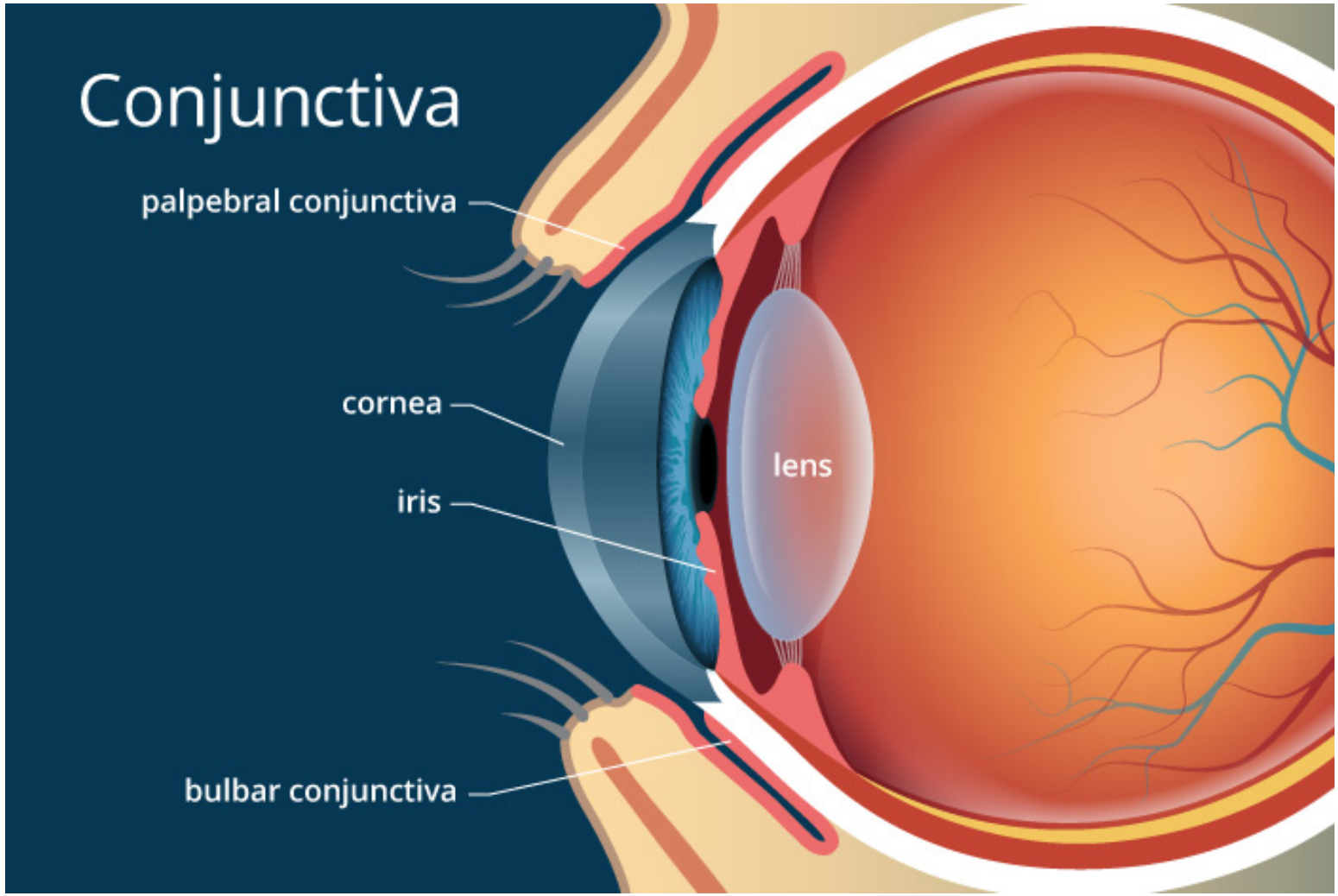
# Eyelid


Levator palpebrae superioris muscle
Superior tarsal muscle (smooth)
Sclera
Superior conjunctival fornix
Bulbar conjunctiva
Superior tarsus
Palpebral conjunctiva
Tarsal (Meibornian) glands
Cornea
Sebaceous glands
Lens
Cilia (lashes)
Anterior chamber
Openings of tarsal glands
Iris
Orbicularis oculi muscle (palpebral part)
Inferior tarsus
Orbital septum
Posterior chamber
Inferior conjunctival fornix

# Eyelid


Arcus marginale
Orbital septum
Retro-orbicular fascia
Orbicularis muscle
Levator aponeurosis
Postaponeurotic space
Levator aponeurotic insertion into orbicularis
Levator aponeurotic insertion into tarsus
Muscle of Riolan
Preaponeurotic fat pad
Whitnall's ligament
Levator muscle
Superior rectus muscle
Accessory lacrimal gland
Muller's muscle

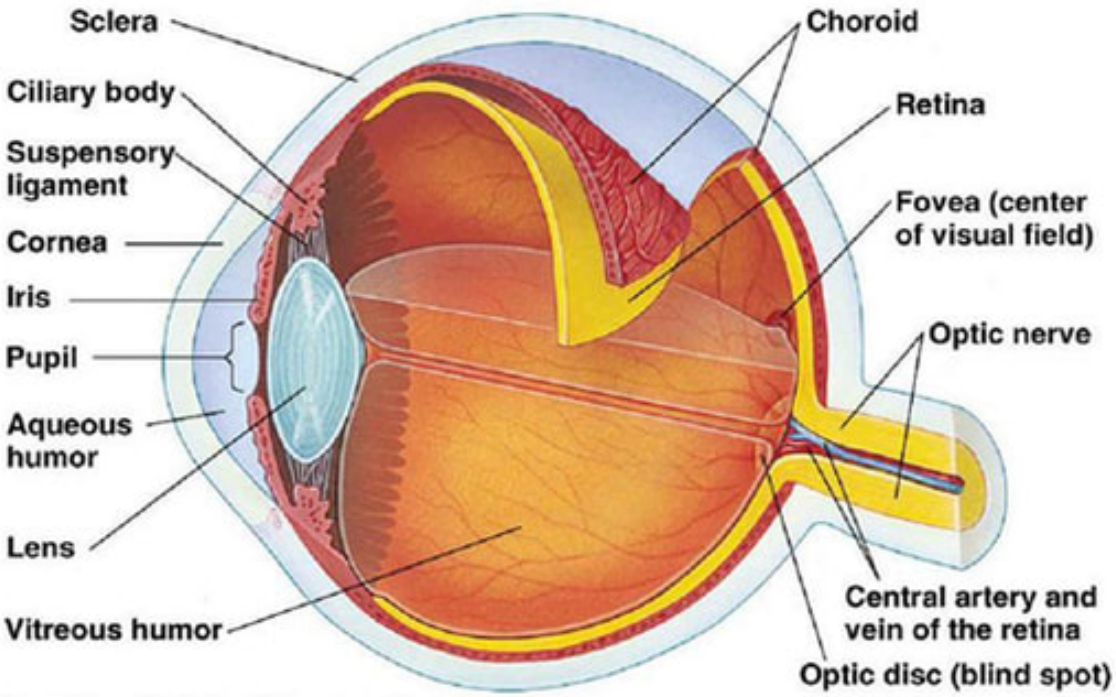
# Conjunctiva

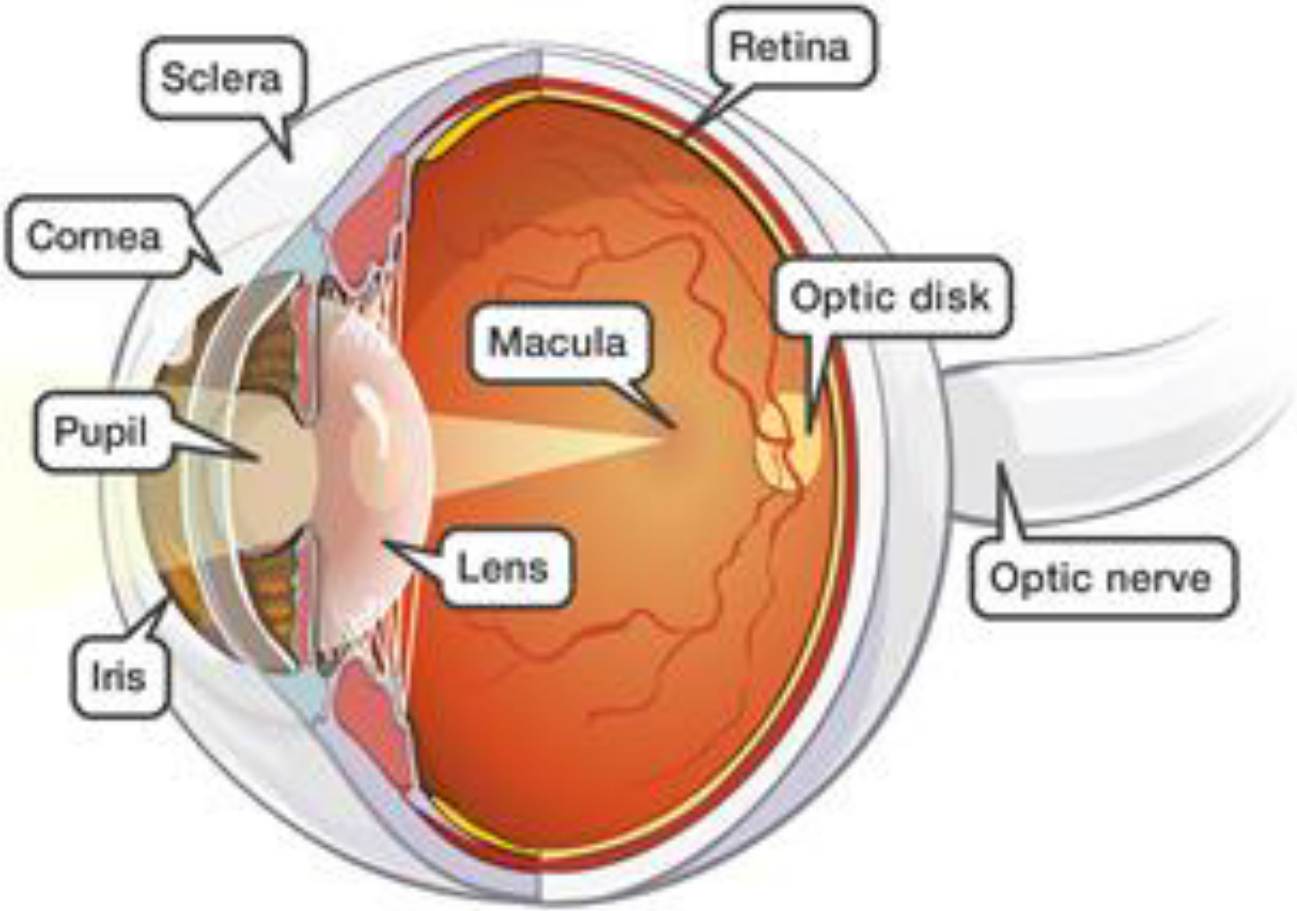


# Conjunctiva: Key Points

- Thin, transparent mucous membrane covering the **anterior sclera** and **inner eyelids**.
- Functions: **Lubrication**, **protection**, and **immune defense**.
- **2. Parts of the Conjunctiva**
- **Palpebral (Tarsal) Conjunctiva** → Lines the inner eyelids.
- **Bulbar Conjunctiva** → Covers the anterior sclera (not the cornea).
- **Fornix (Conjunctival Sac)** → Junction between palpebral and bulbar conjunctiva.
- It has a non-keratinized stratified squamous **epithelium** about five cell layers deep, containing mucus-secreting goblet cells, immune system Langerhans' cells, and occasional melanocytes.

# Anatomy of The Eye




Sclera
Retina
Cornea
Optic disk
Macula
Pupil
Lens
Optic nerve
Iris
© AboutKidsHealth.ca

# Anatomy of the Human Eye

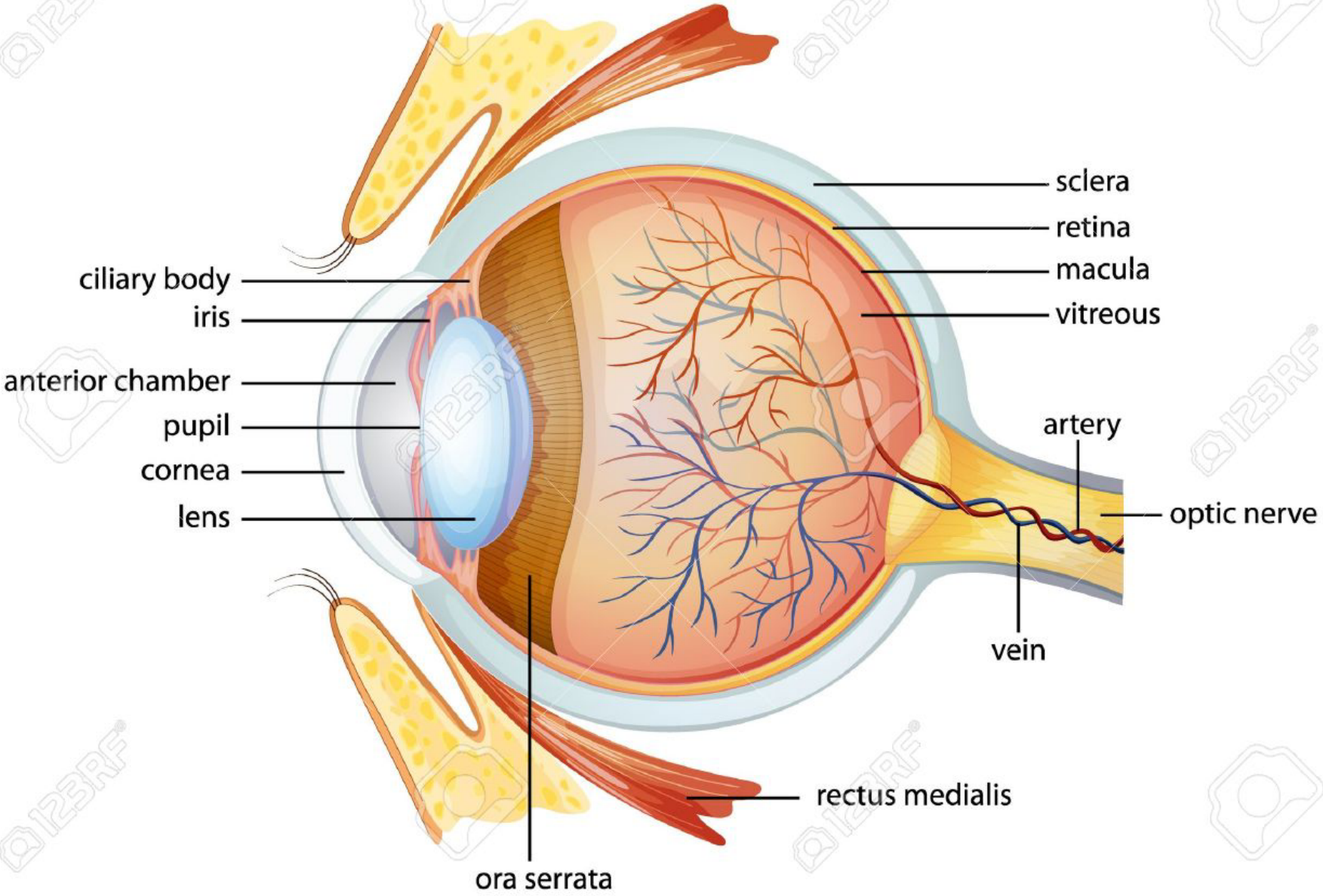
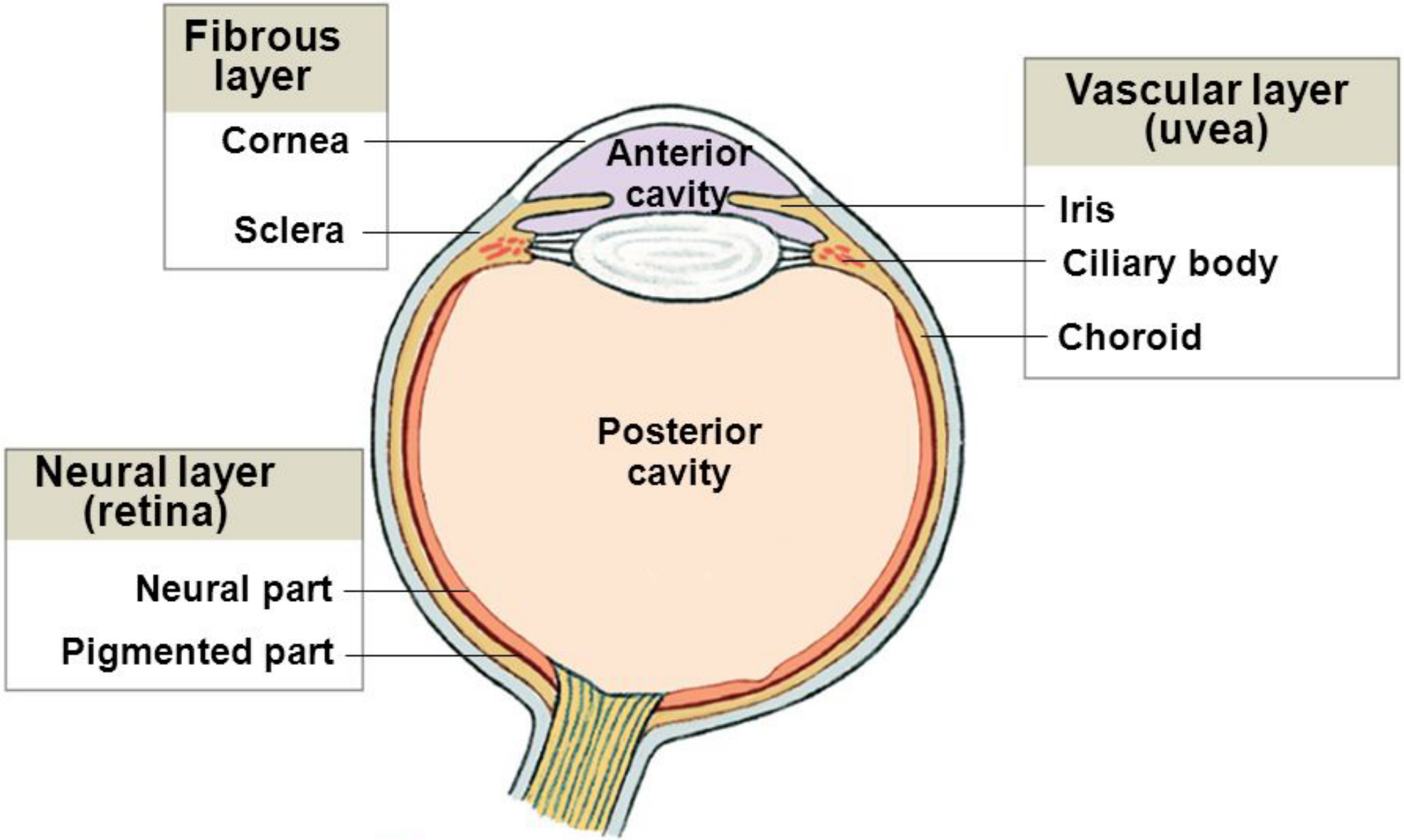


Figure 17-5b The Sectional Anatomy of the Eye




b Horizontal section of right eye

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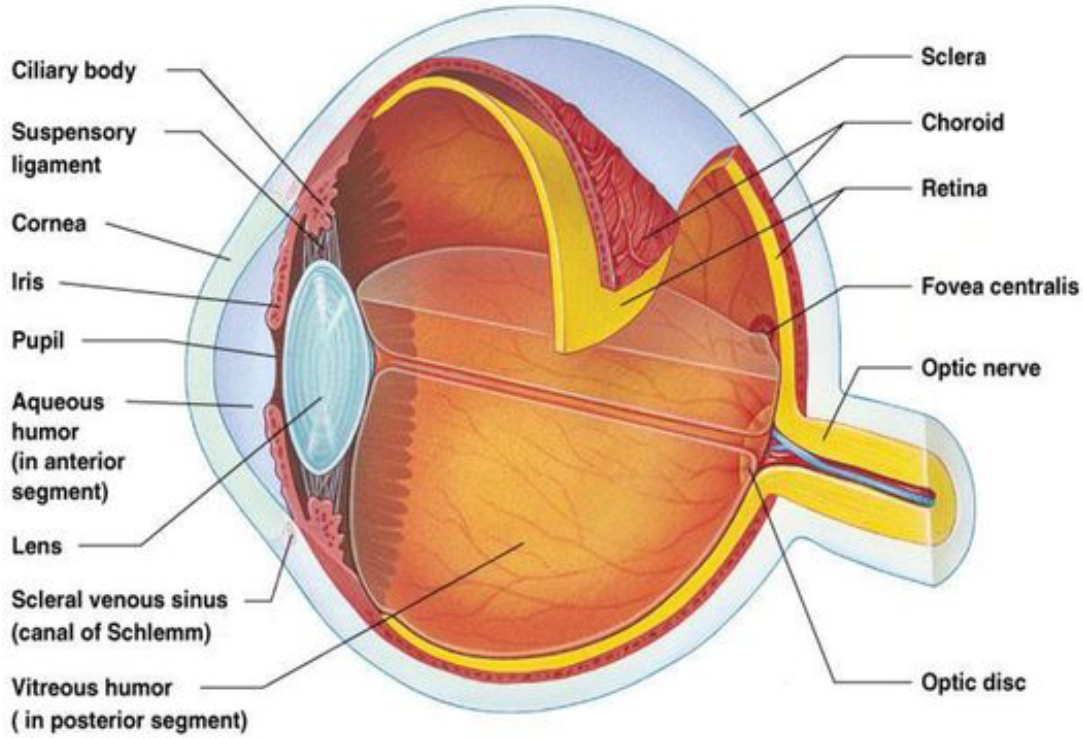
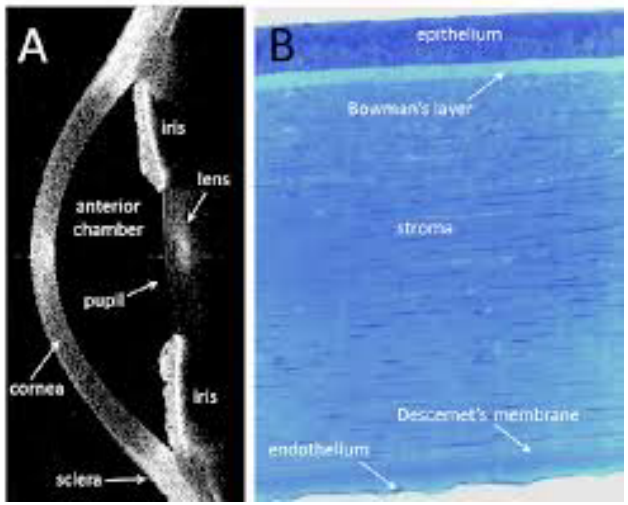
# Structure of the Eye

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

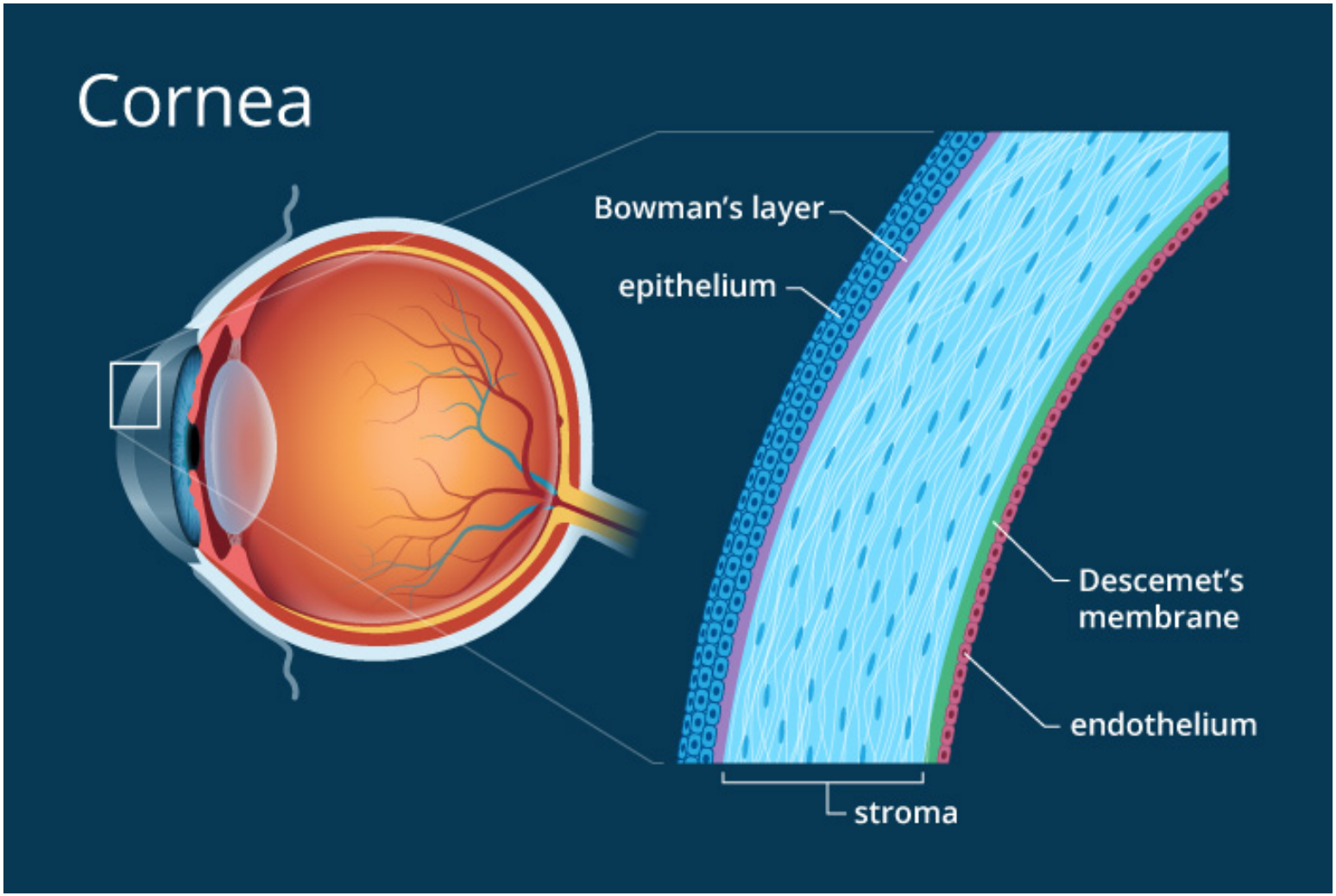


# Cornea

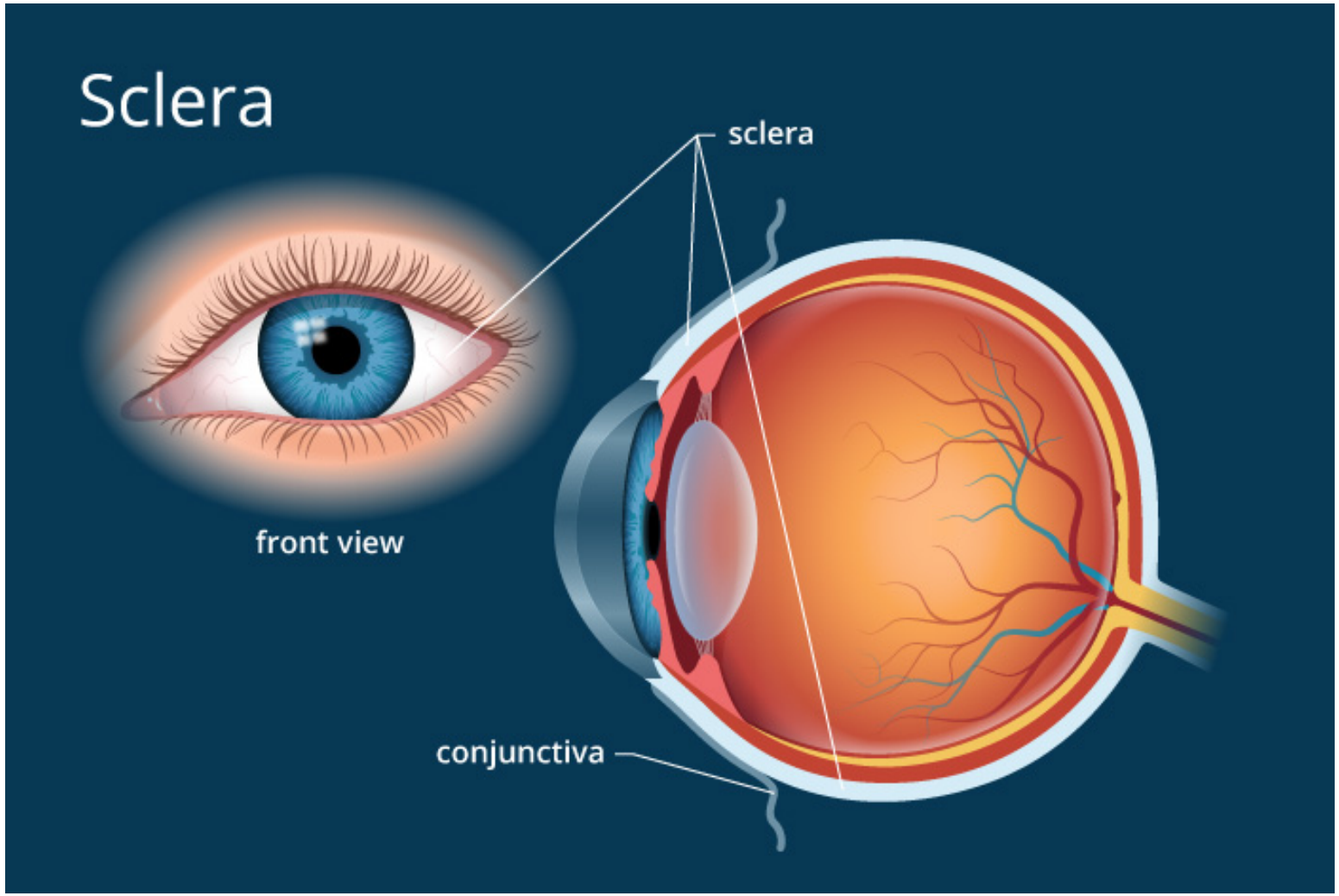
- Transparent dome shaped structure at the front of the eye
- Responsible for 2/3rds of the refractive power of the eye
- Has an important protective role
- Avascular structure
- Mainly made of collagen type 1



# Cornea


Cornea
Bowman's layer
epithelium
Descemet's membrane
endothelium
stroma

# Sclera

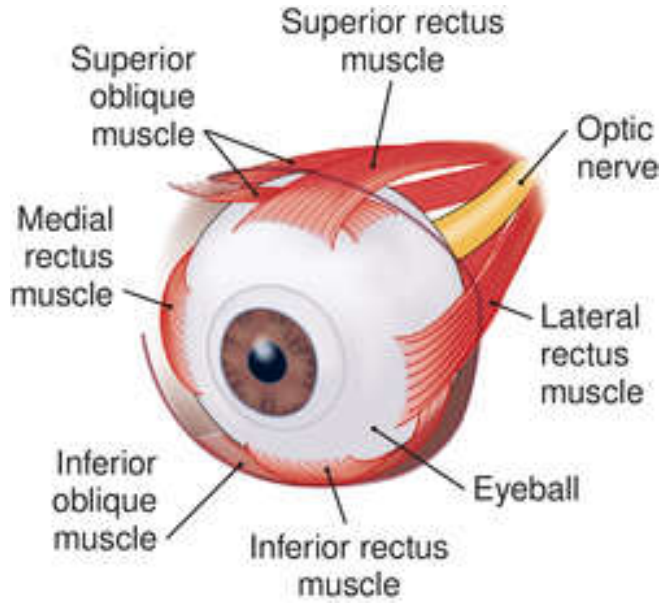


# Sclera

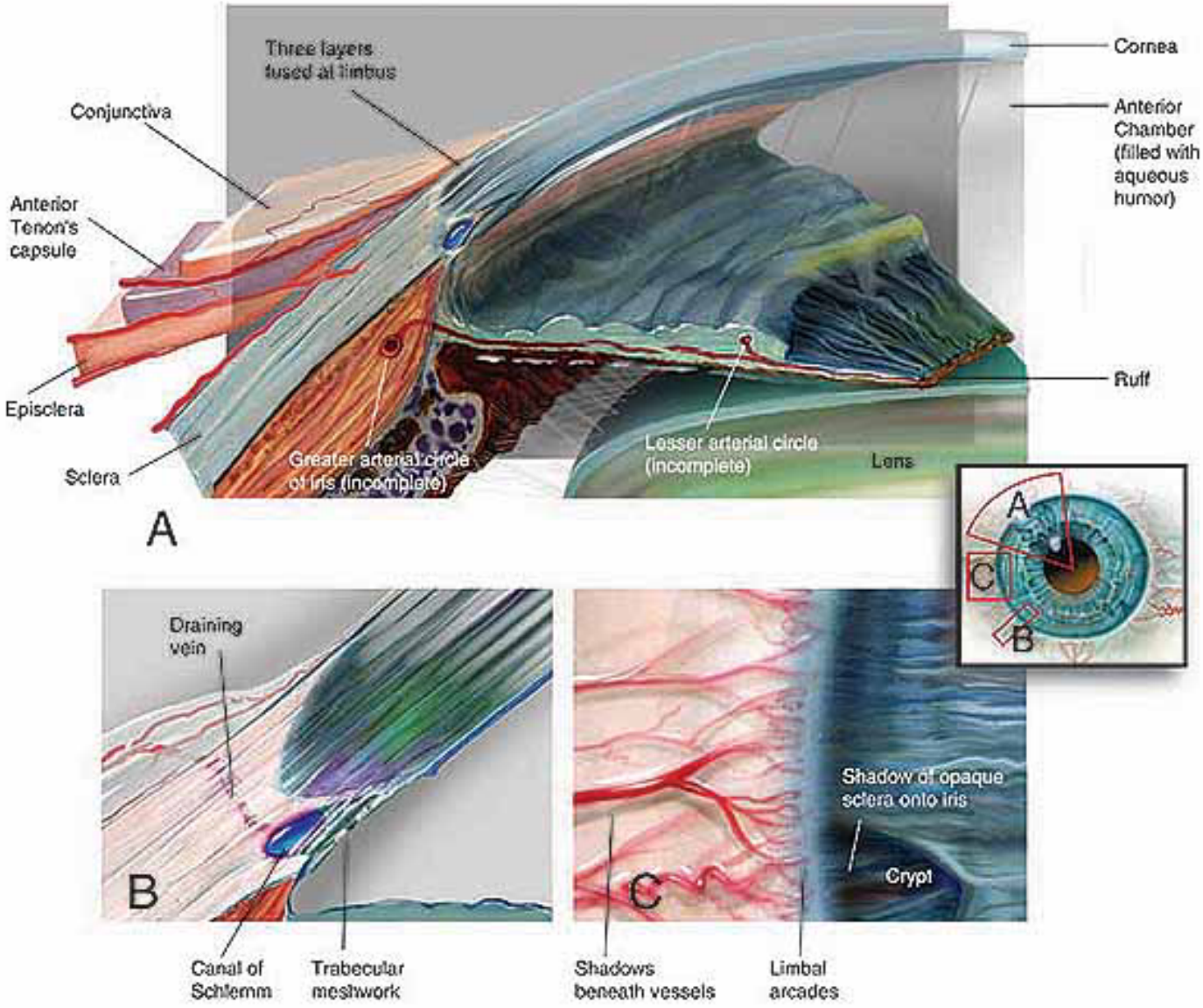
- Also known as the “white” of the eye.
- The sclera is covered by the conjunctiva anteriorly.
- It is thickest in the area surrounding the optic nerve.
- The sclera is made up of three divisions: the **episclera**, loose connective tissue, immediately beneath the conjunctiva; **sclera proper**, the dense white tissue that gives the area its color; and the **lamina fusca**, the innermost zone made up of elastic fibers.

# Sclera

- It is the opaque, fibrous and protective outer layer of the eye containing mainly collagen
- Gives attachment to extraocular muscle
- Allows the passage of the optic nerve posteriorly

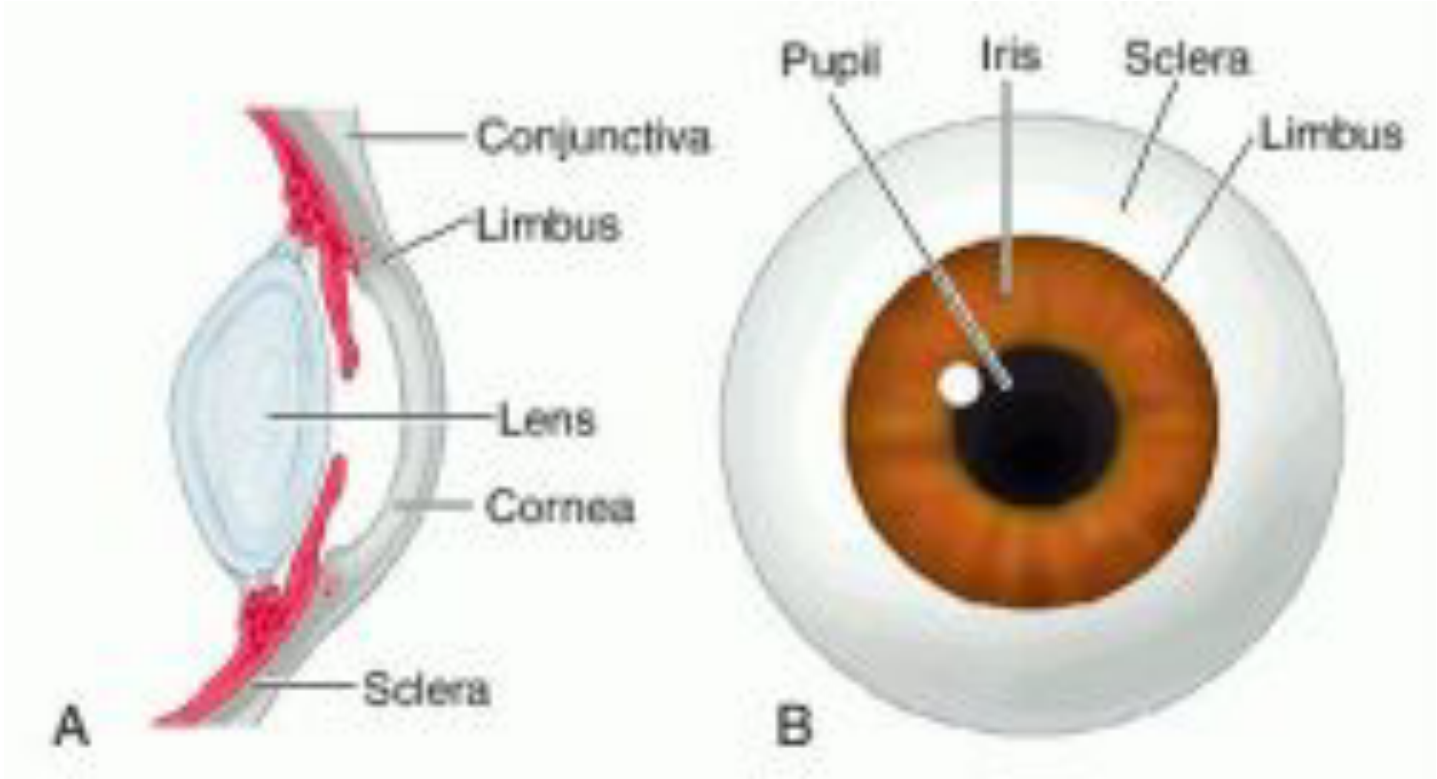


# The Limbus


Three layers fused at limbus
Conjunctiva
Anterior Tenon's capsule
Episclera
Sclera
Cornea
Anterior Chamber (filled with aqueous humor)
Ruff
Greater arterial circle of iris (incomplete)
Lesser arterial circle (incomplete)
Lens
A
A
C
B
Draining vein
B
Canal of Schlemm
Trabecular meshwork
C
Shadow of opaque sclera onto iris
Crypt
Shadows beneath vessels
Limbal arcades

# Limbus-Corneoscleral Junction

- Common site for surgical incisions
- Contains stem cells



# Iris

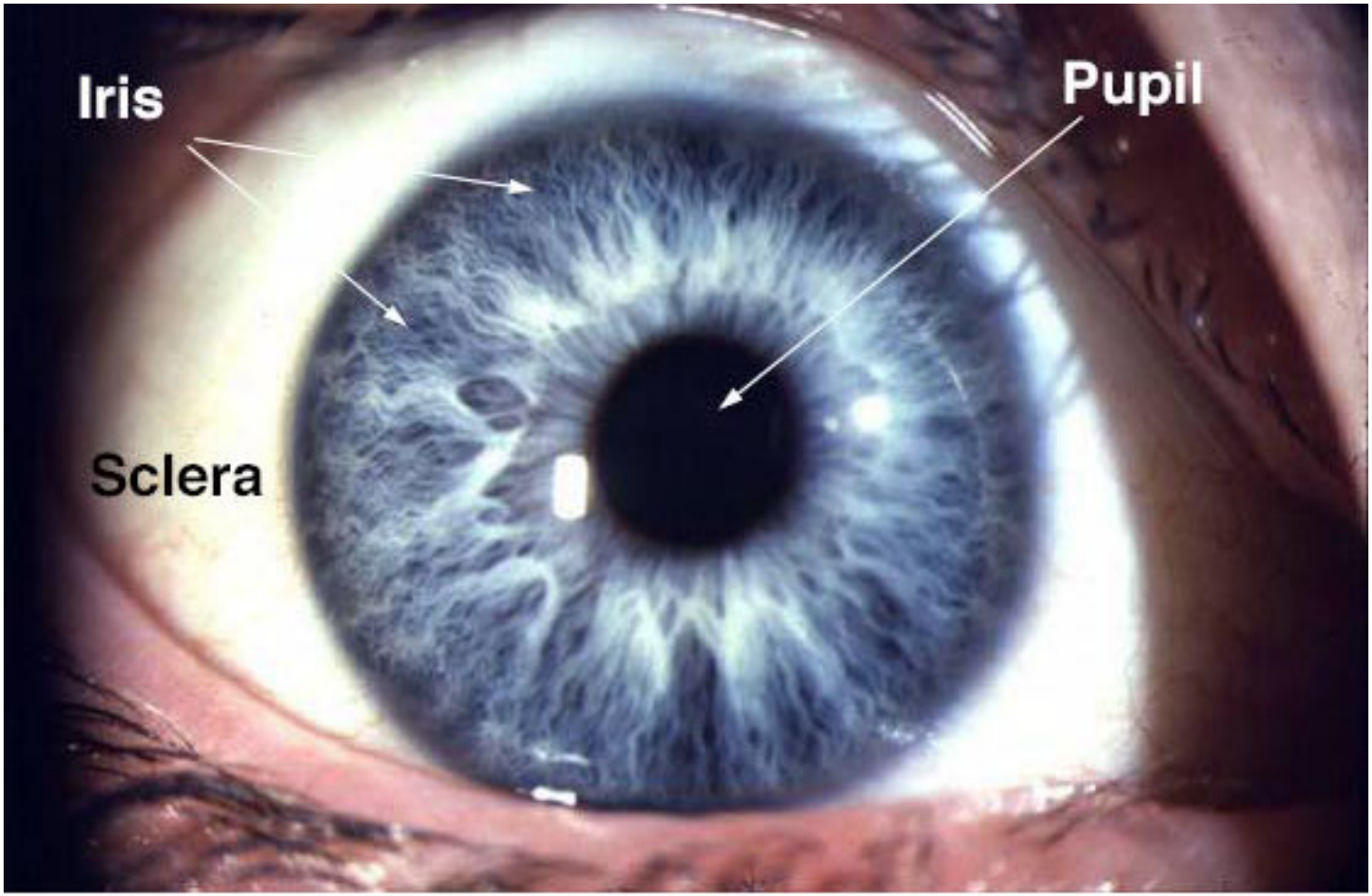
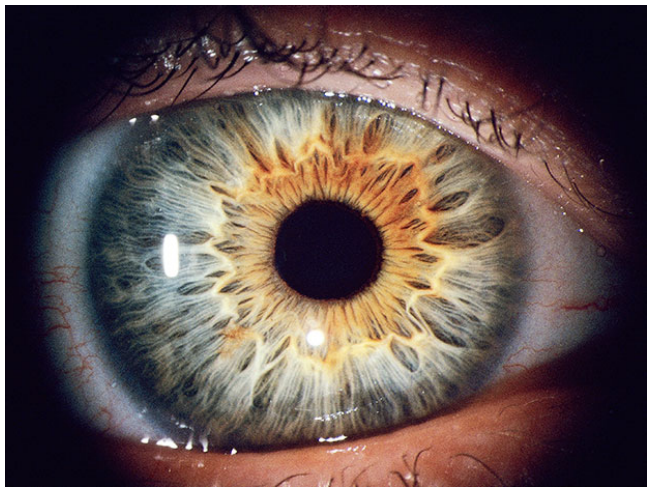
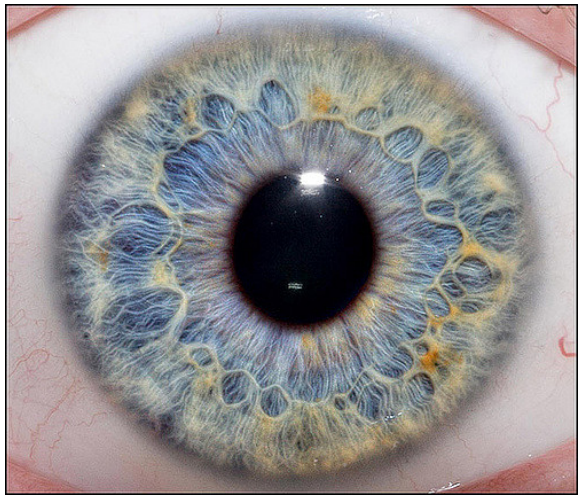



*Fig. 1. View of the human eye*

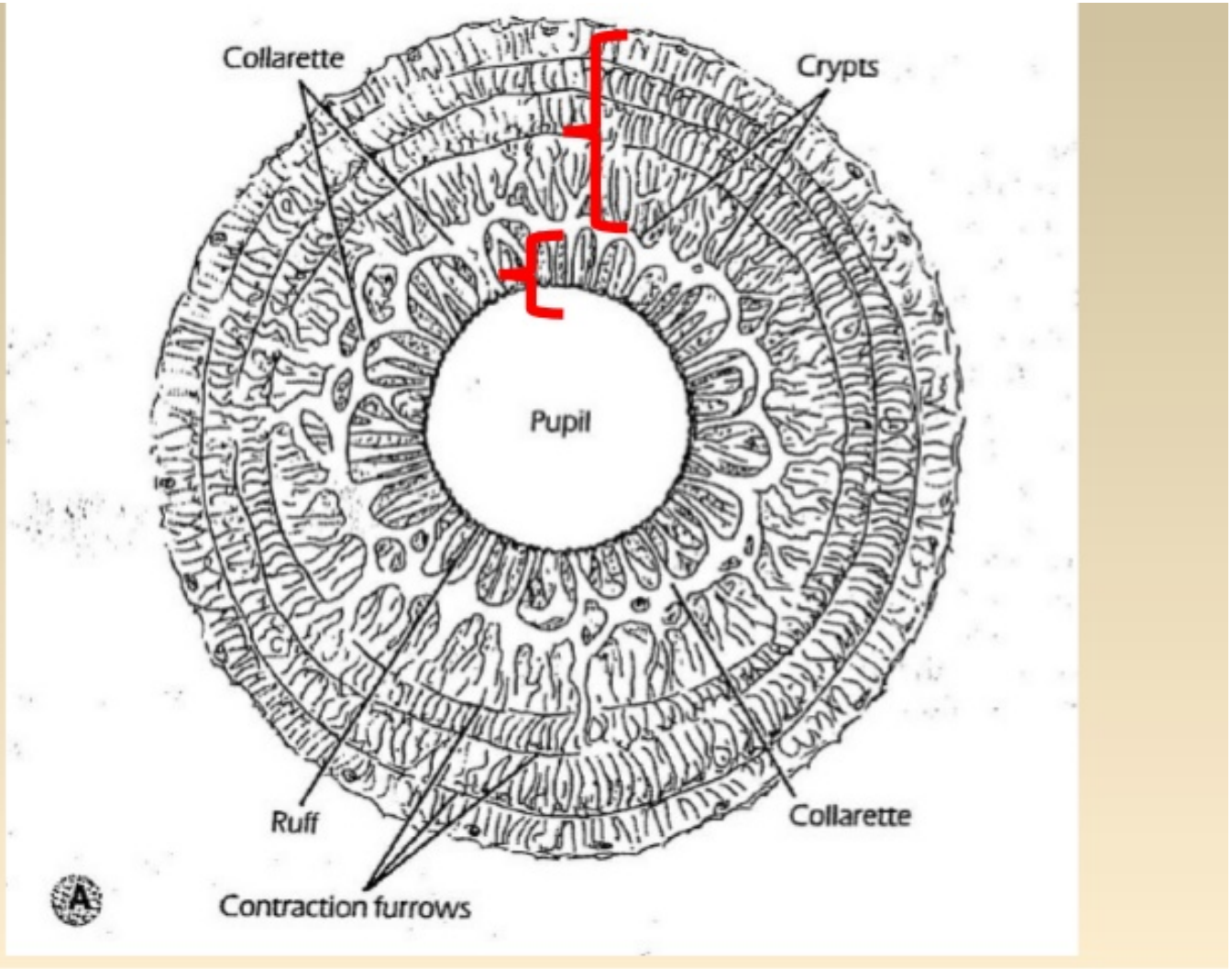
# Iris

- Contains melanin pigment with variable density resulting in different colors





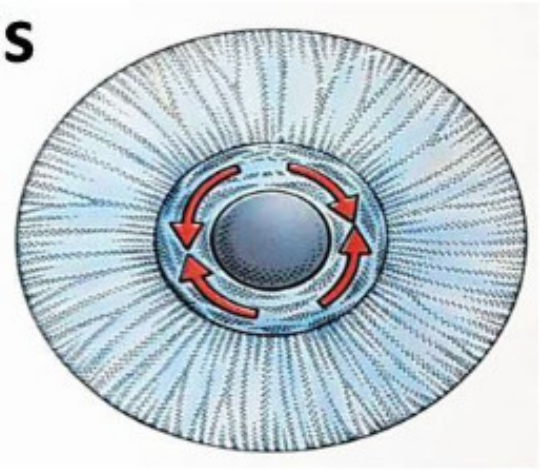
# Iris


Collarette
Crypts
Pupil
Ruff
Collarette
Contraction furrows
A

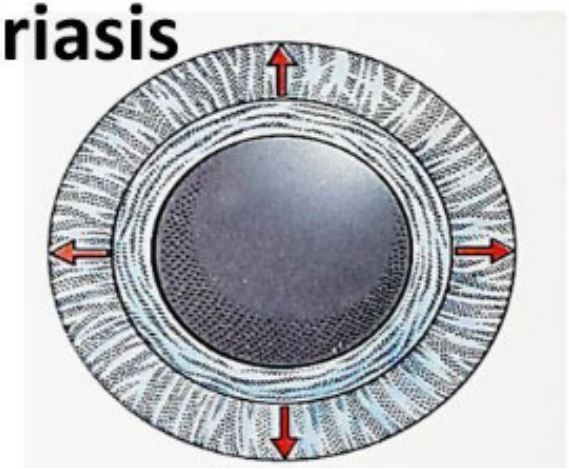
# Iris

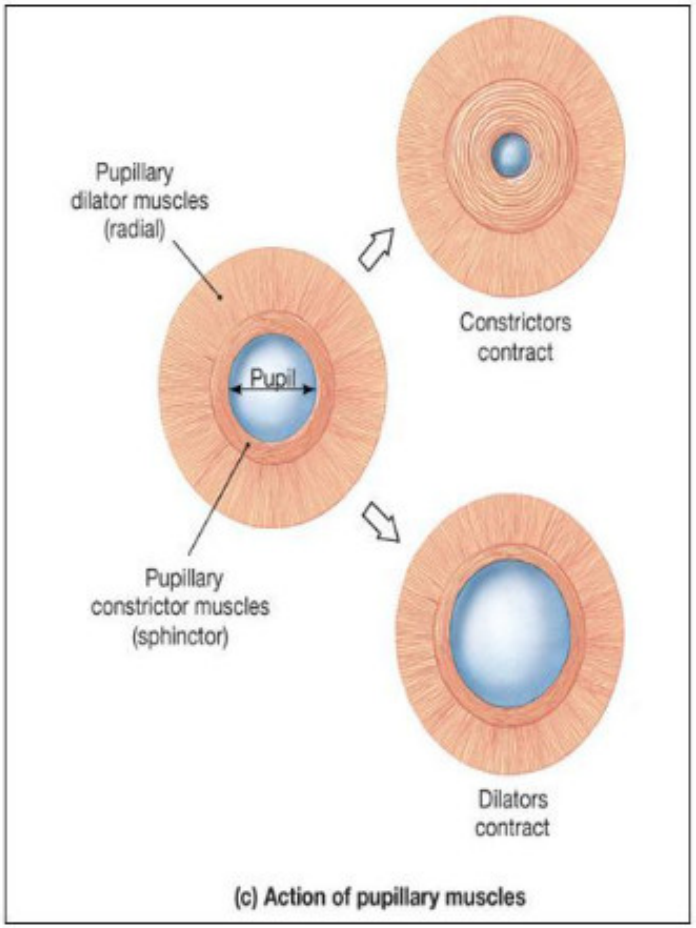
## Pupillary Muscles

**Miosis**



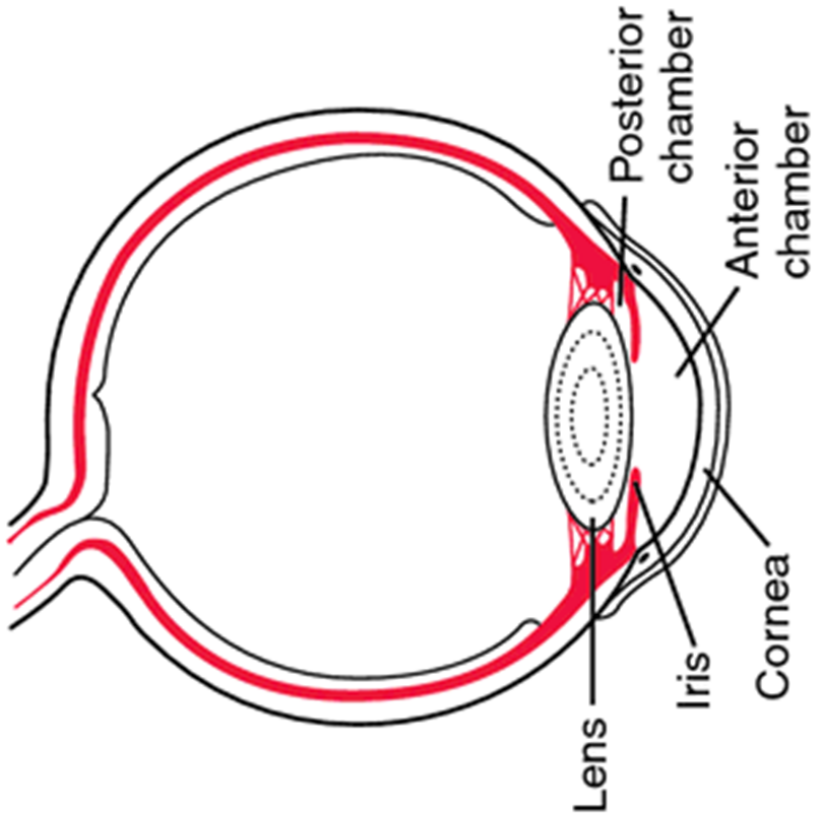
**Mydriasis**





# Anterior Chamber

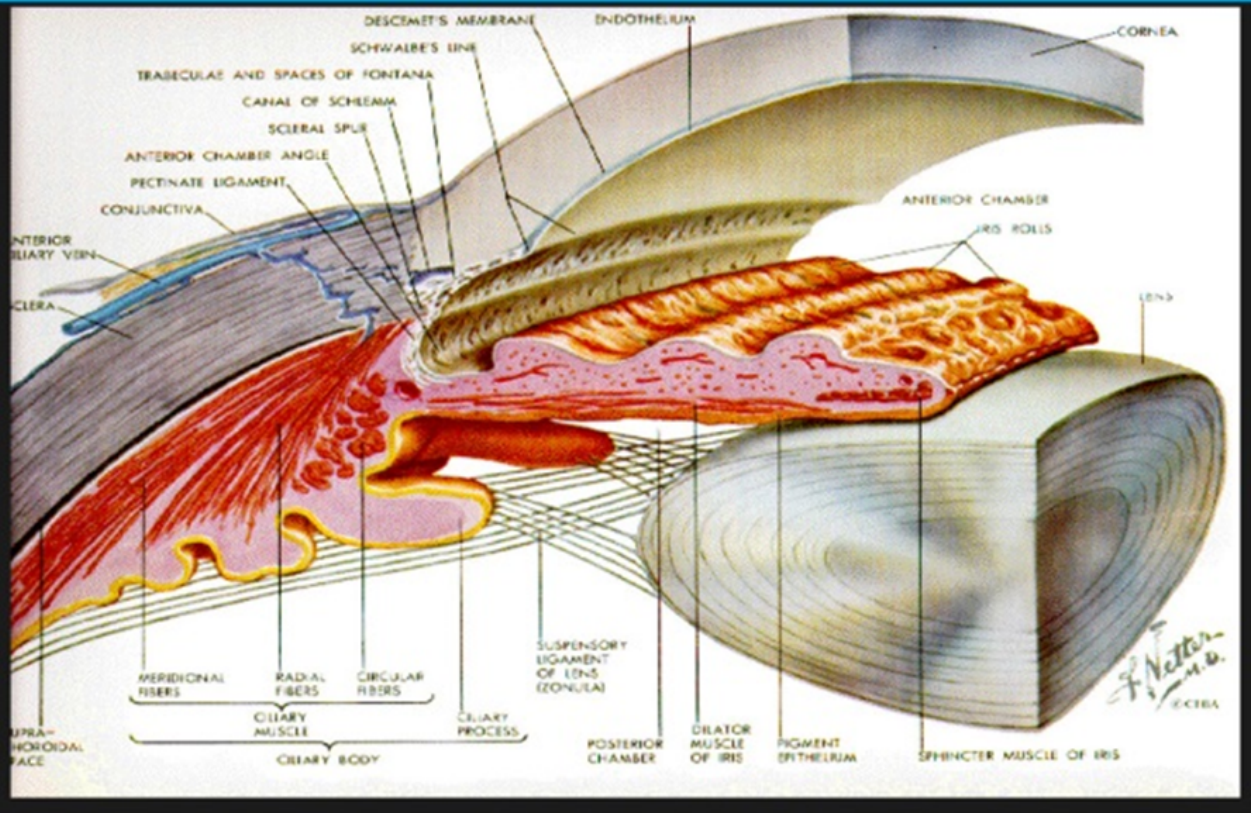
- It is the space bound anteriorly by the back surface of the cornea and posteriorly by the iris and lens
- It is filled by aqueous humor



# Irido-corneal Angle

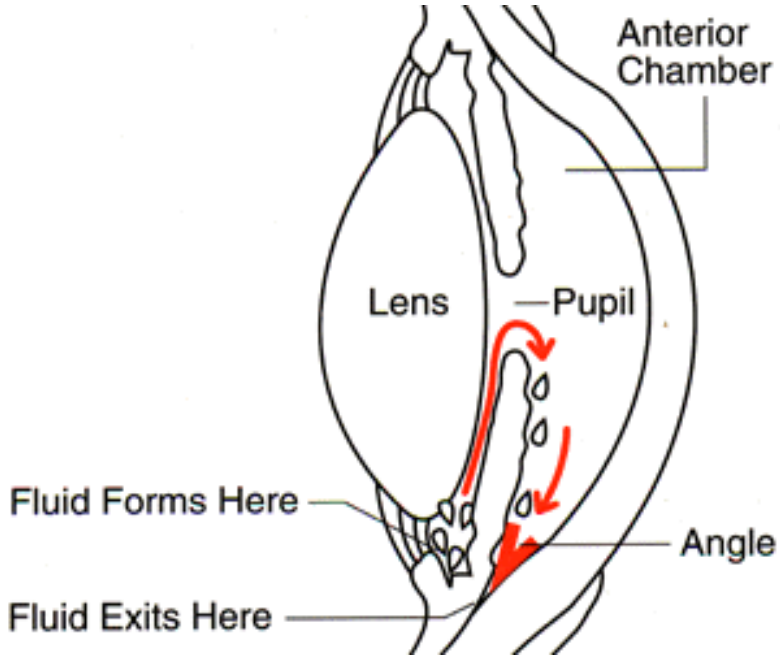
Eye Anatomy

**The Angle**



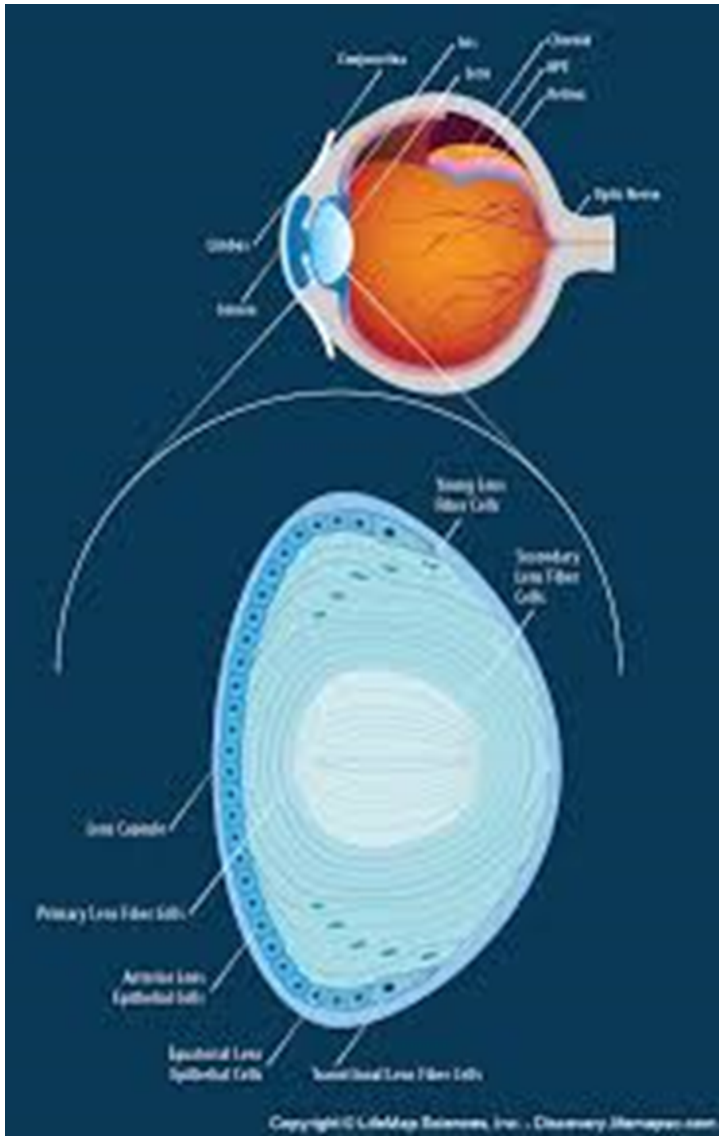
# Irido-corneal Angle

- The area where the iris and the cornea meet
- Contains the trabecular meshwork and Schlem's canal. They constitute the aqeuous drainage system

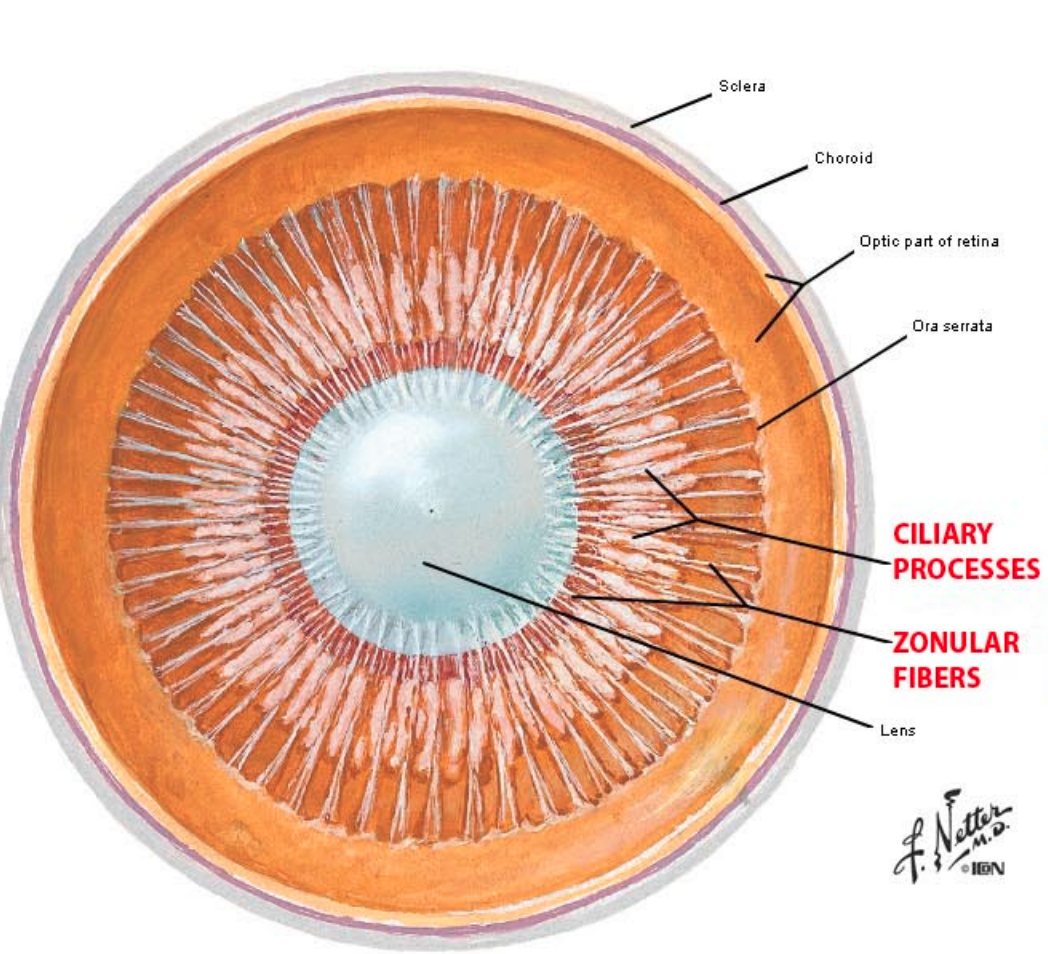


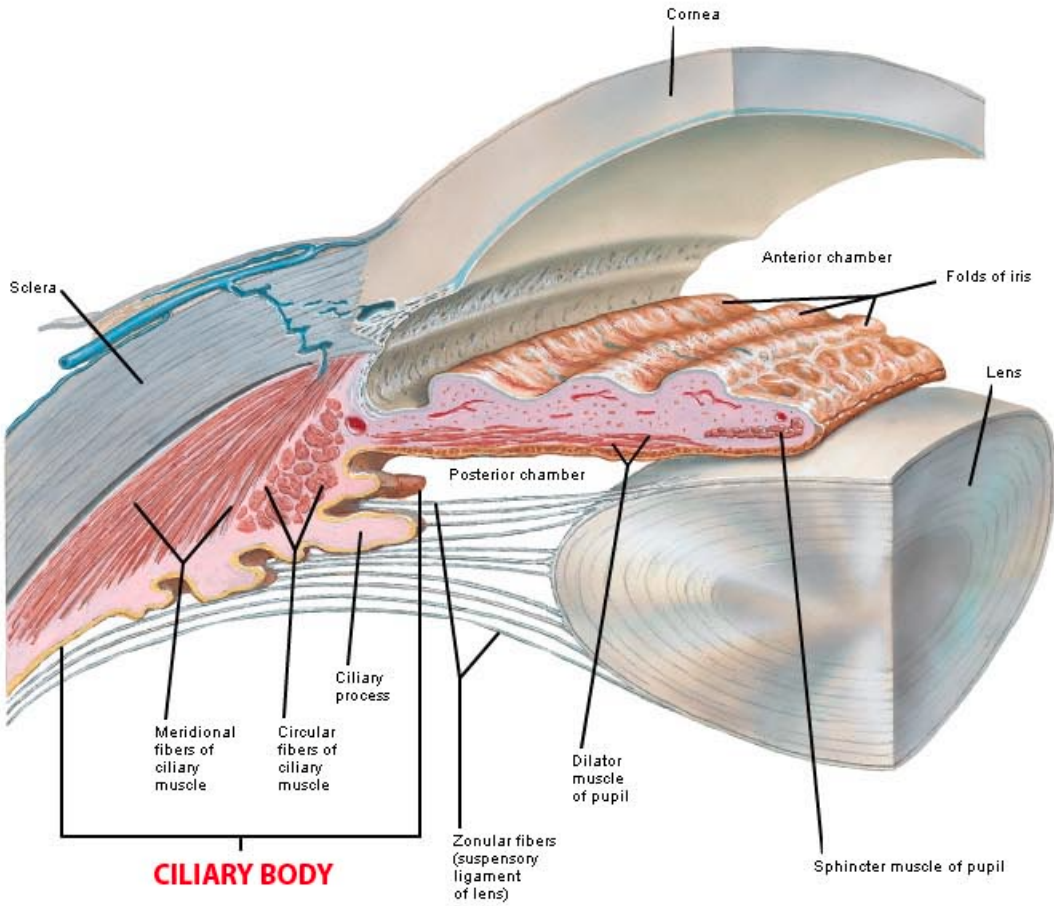
# Crystalline Lens

- Responsible for the remaining 1 / 3 rd of the refractive power of the eye
- Fixed in place by zonules (suspensory ligaments) of the ciliary body



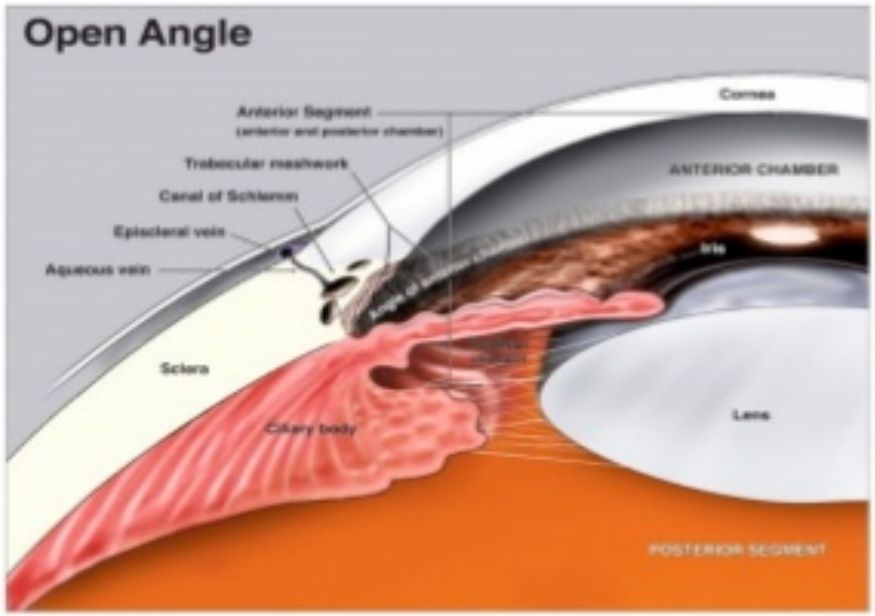
# Ciliary Body



# Ciliary Body

## Ciliary body

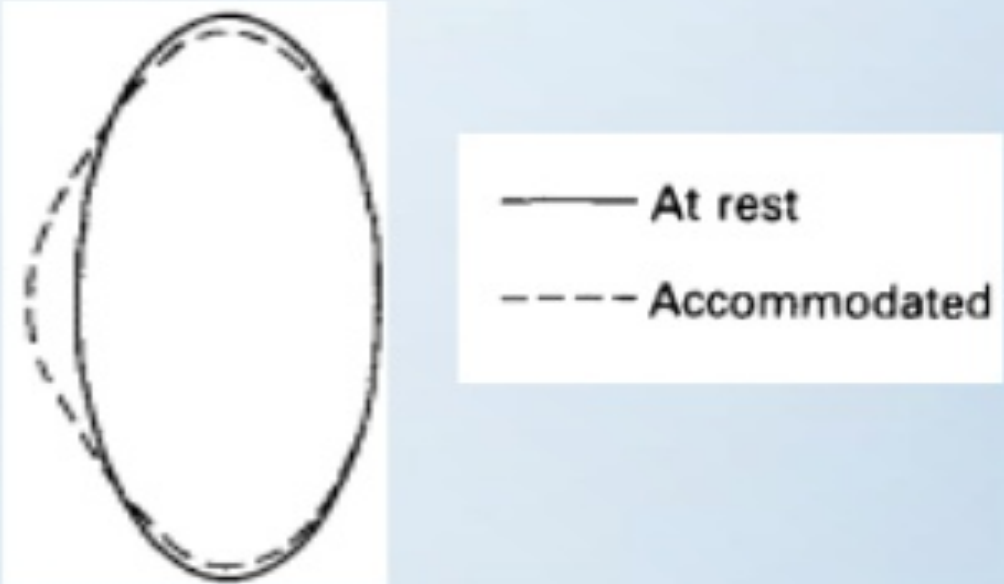



- Connects the iris and the choroid
- 2 parts:
  - Pars plicata (ciliary processes)
  - Pars plana
- Ciliary body has 3 layers:
  - Ciliary epithelium
  - Ciliary stroma
  - Ciliary muscle
- Functions:
  - Aqueous humor production
  - Suspension of lens, accommodation

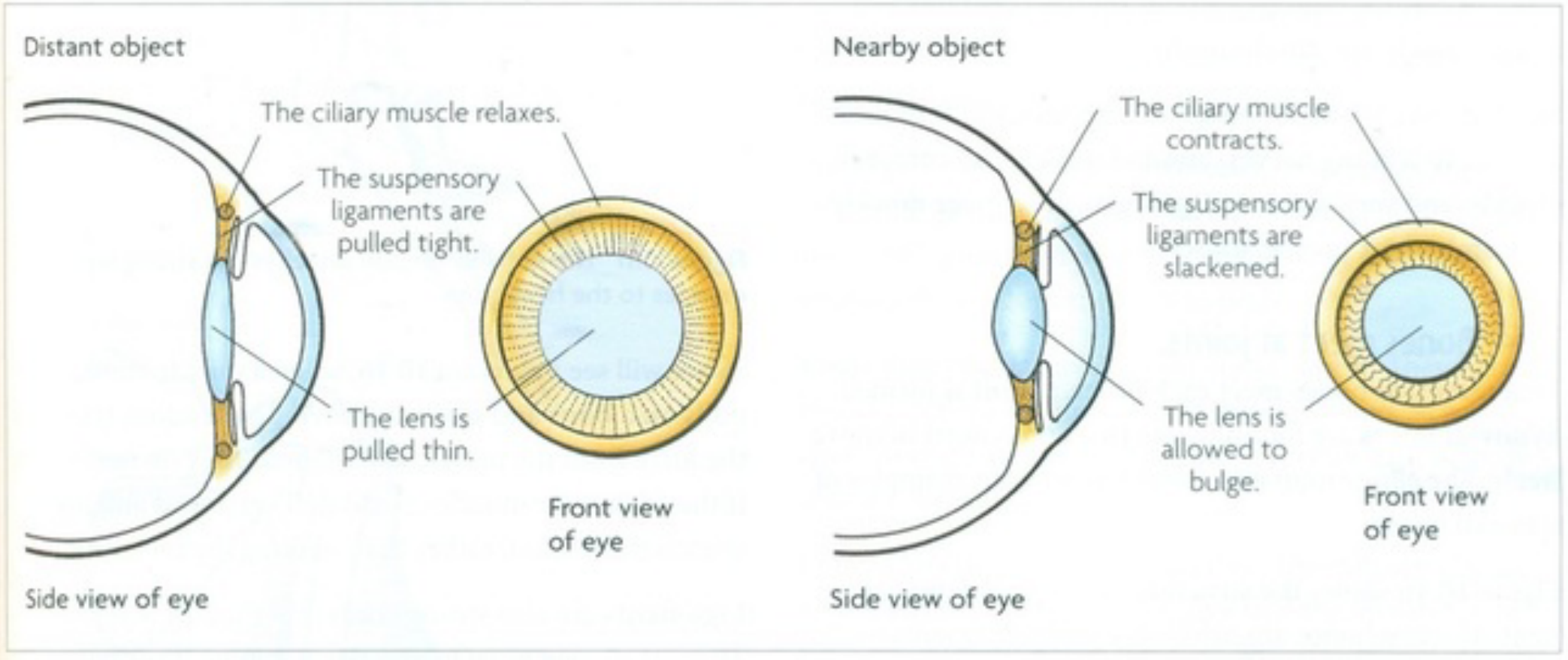
# Accommodation

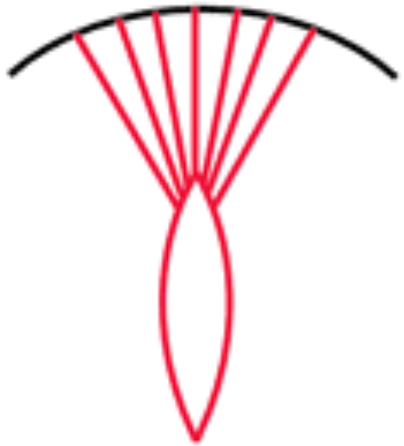
## Definition

*Accommodation* is the mechanism by which the eye changes refractive power by altering the shape of lens in order to focus objects at variable distances

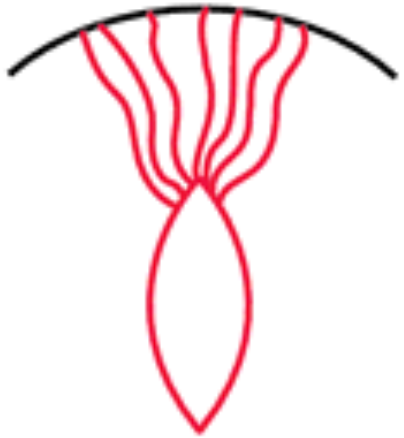


# Accommodation

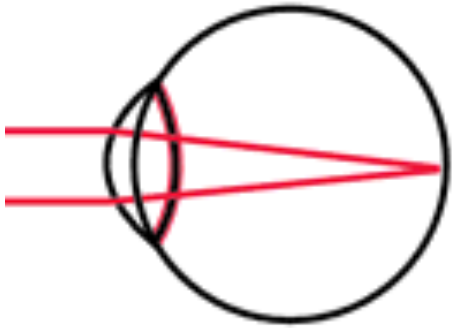




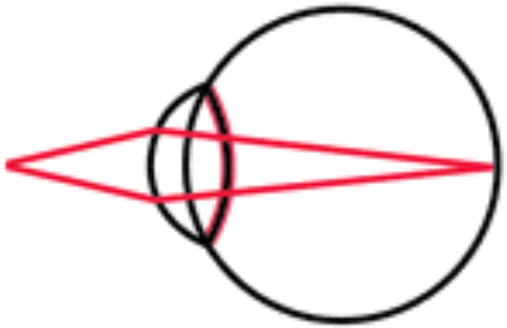
Ligaments tight—lens flattened



Ligaments relaxed—lens more rounded



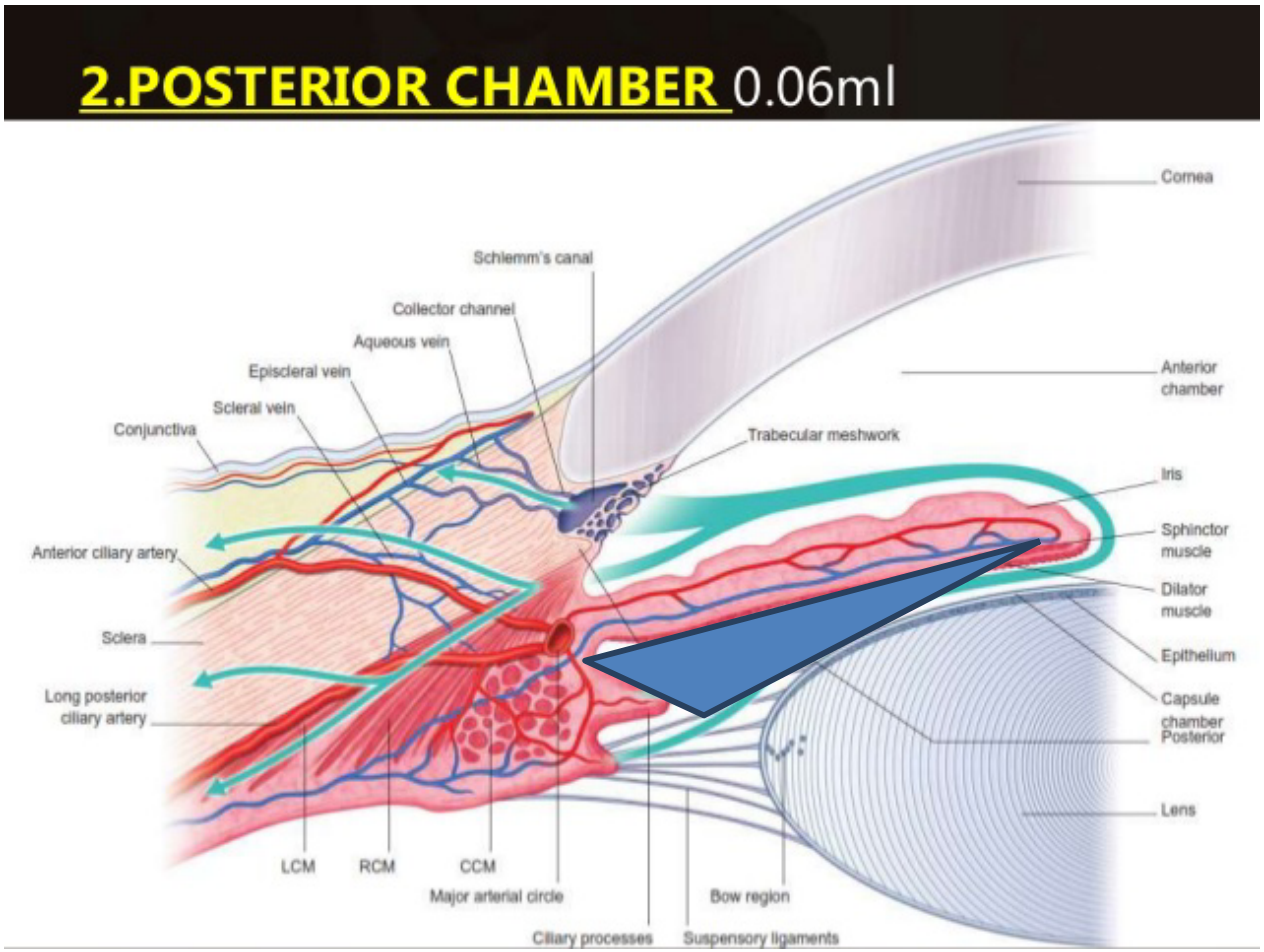
Rays from a *distant* object are focused on the retina by a flattened lens



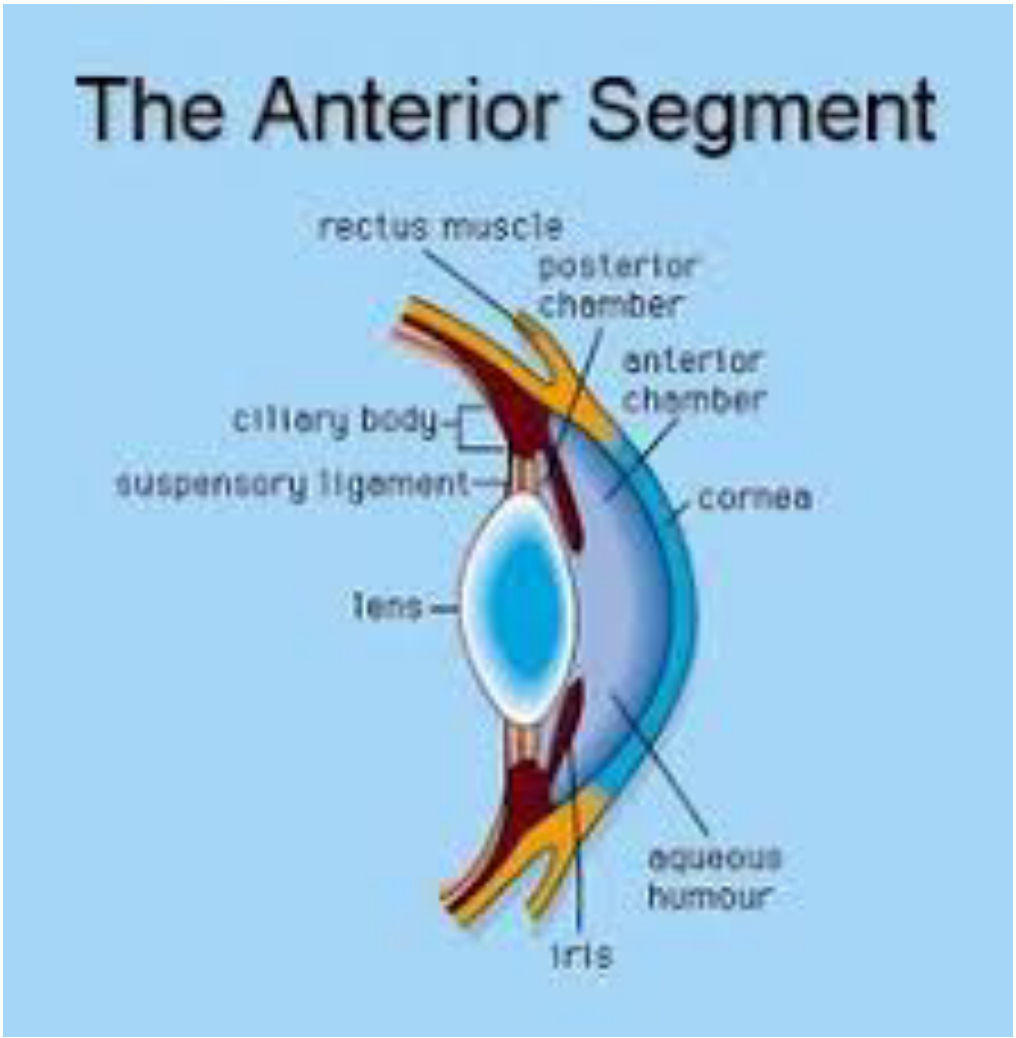
Rays from a *nearby* object are focused on the retina by a more rounded lens

# Posterior Chamber

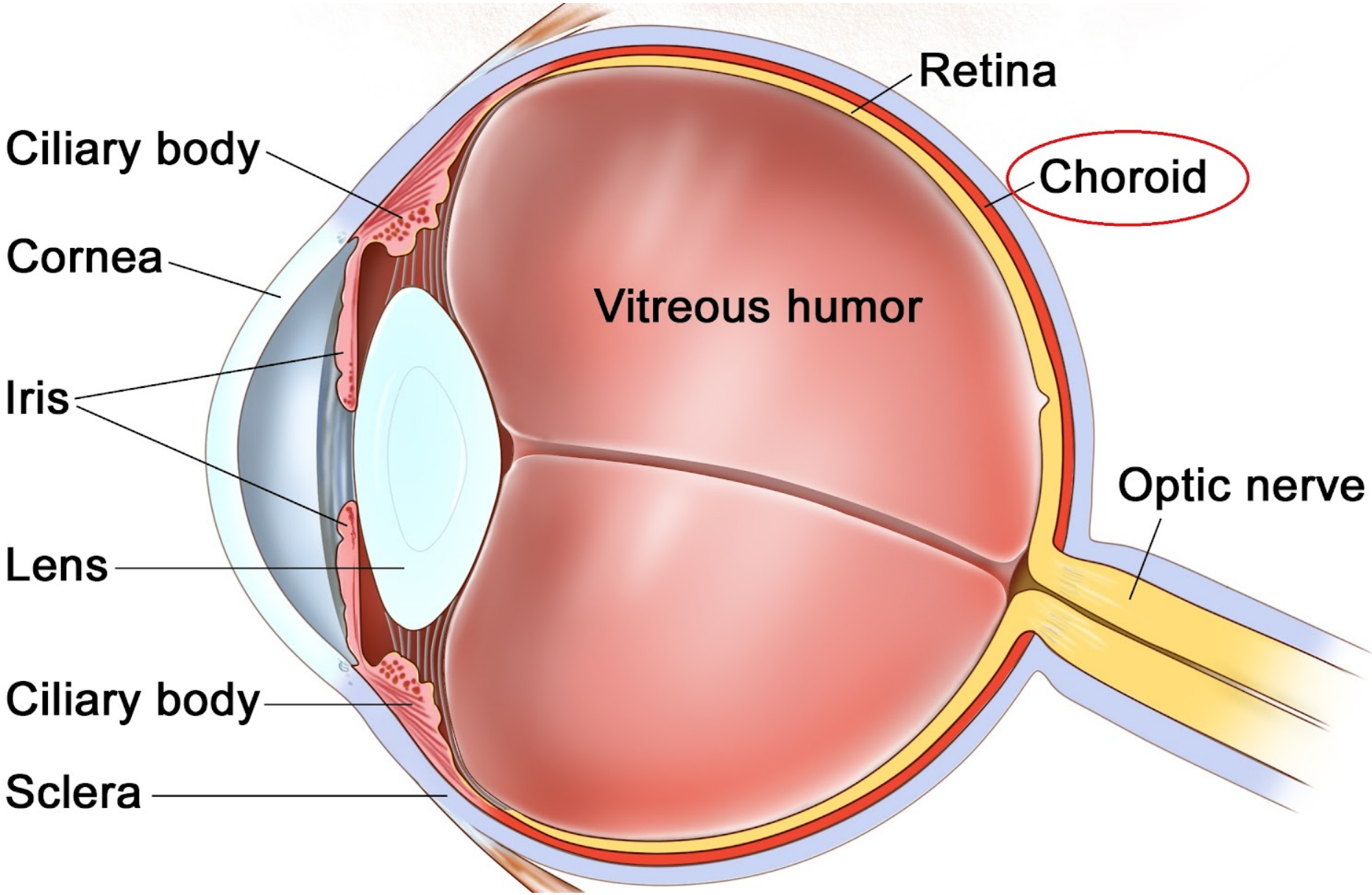
- The space that lies between ciliary body, iris and lens



# Anterior Segment



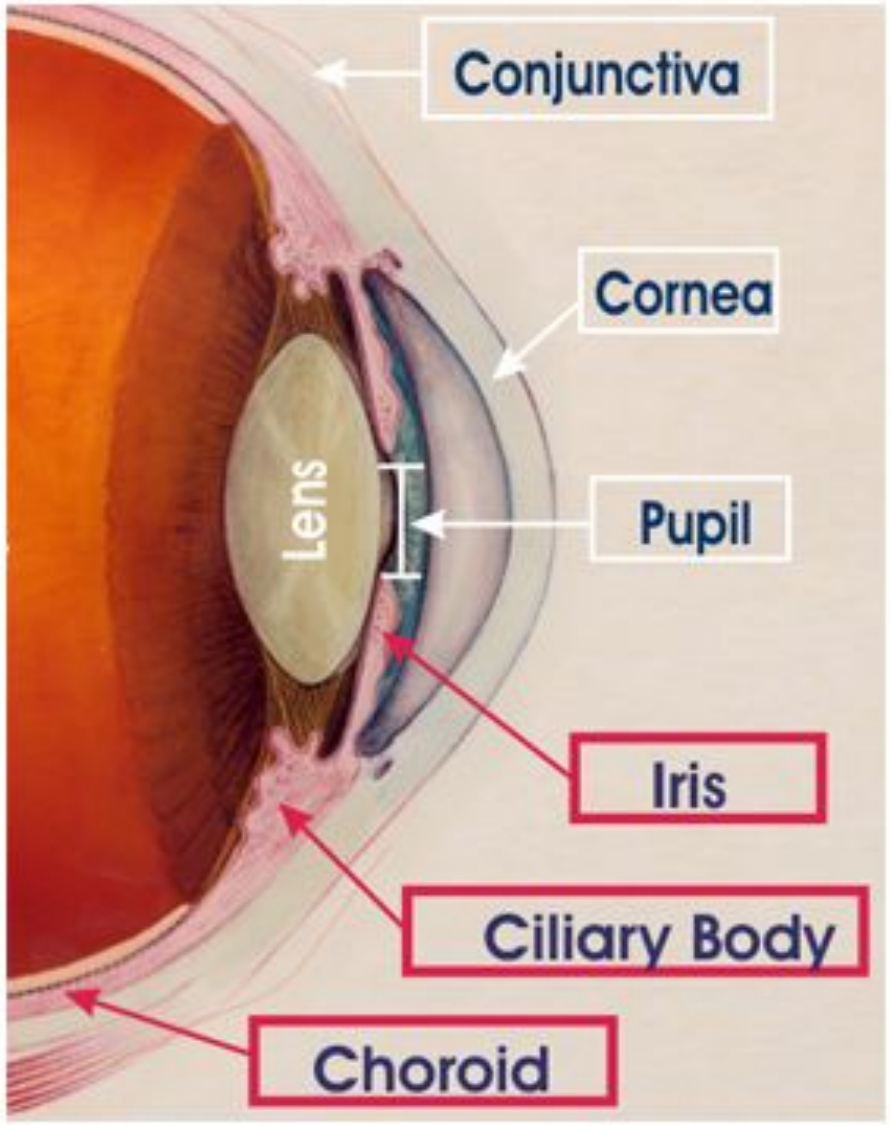
# Choroid


Retina
Ciliary body
Choroid
Cornea
Vitreous humor
Iris
Optic nerve
Lens
Ciliary body
Sclera

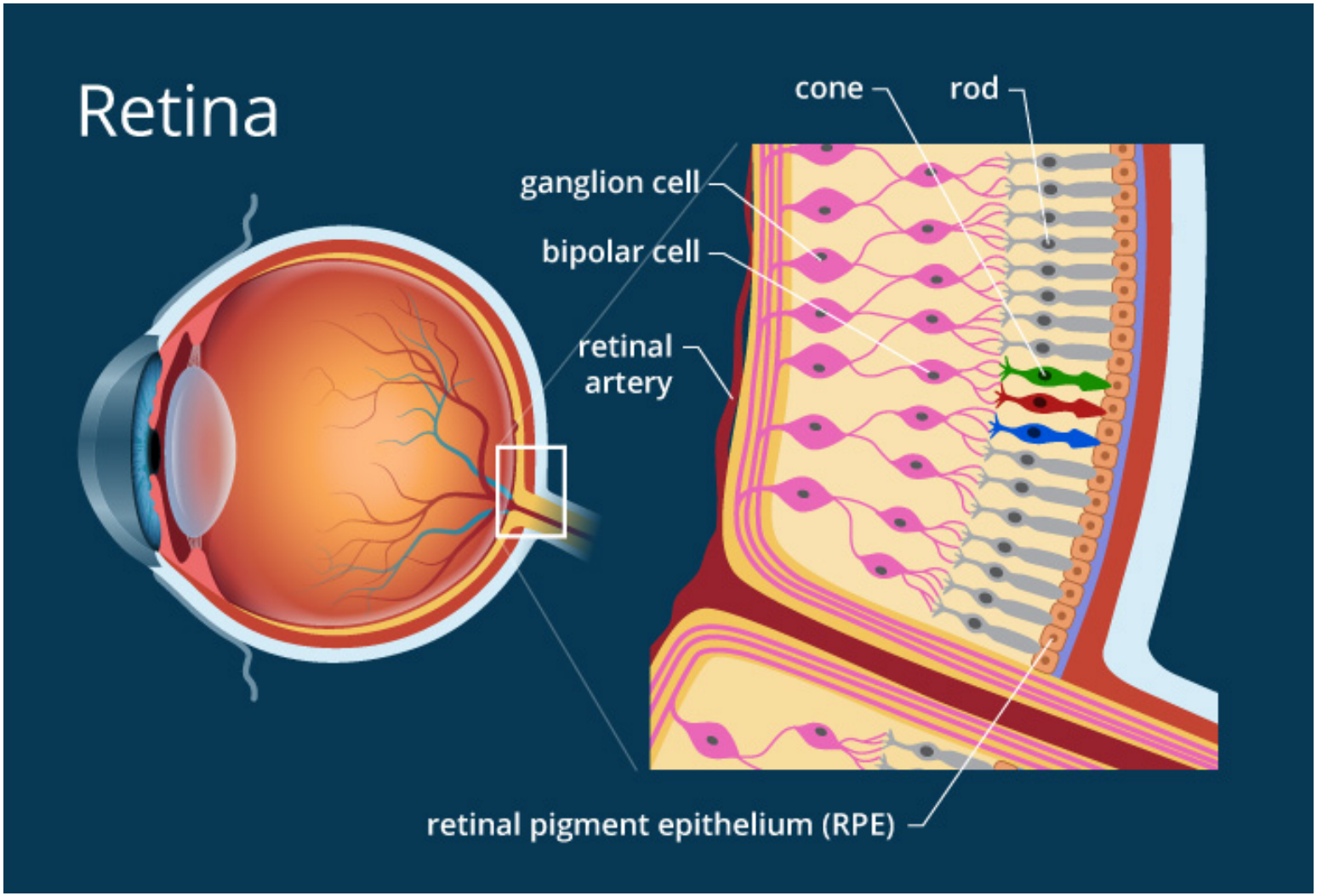
# Choroid

- Thin, highly pigmented, vascular loose connective tissue
- Rich in melanocytes gives characteristic dark color
- Situated between sclera and retina
- Extends from optic nerve to ciliary body (at ora serrata)

# Uveal Tract



# Retina


Retina
cone
rod
ganglion cell
bipolar cell
retinal artery
retinal pigment epithelium (RPE)

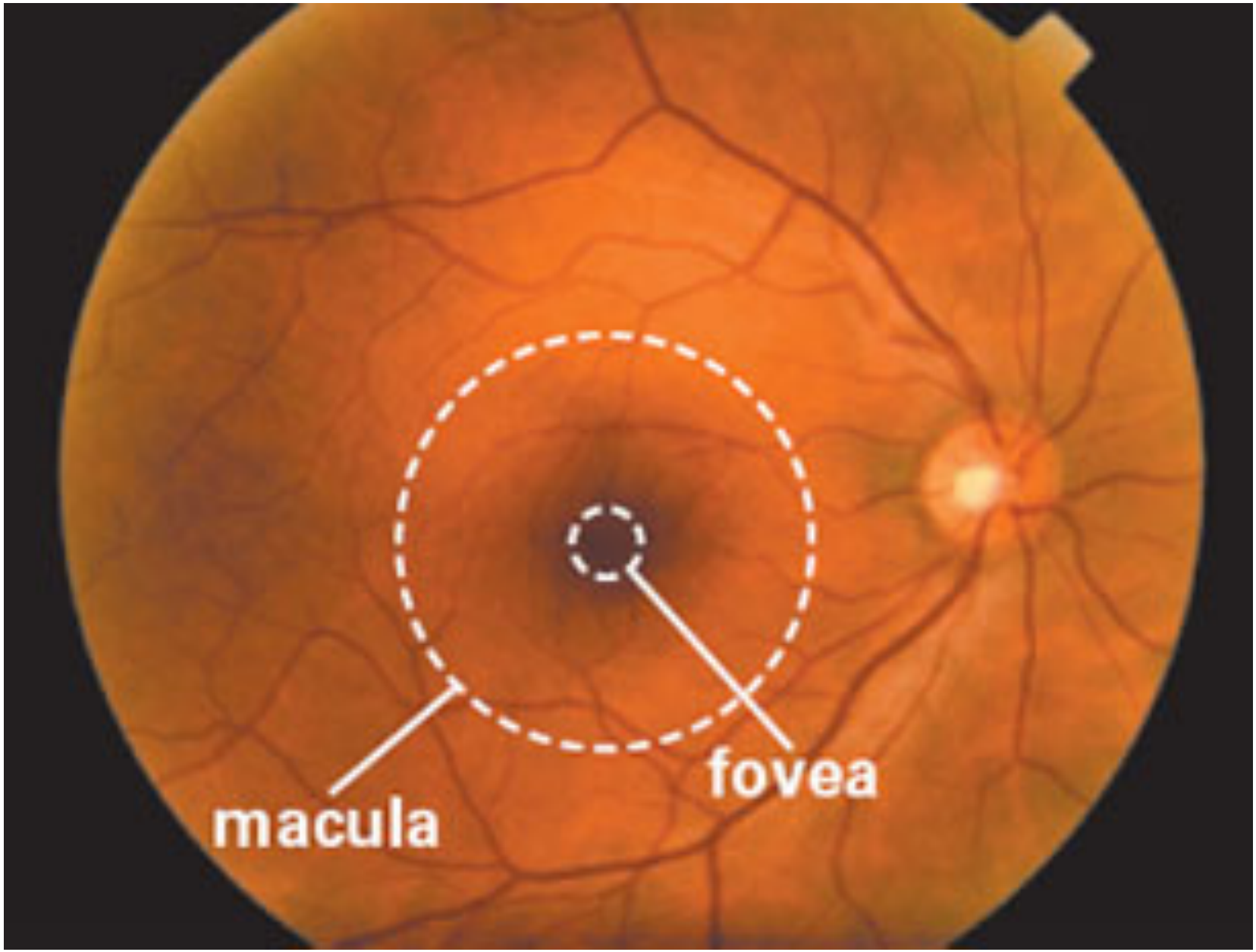
# Retina

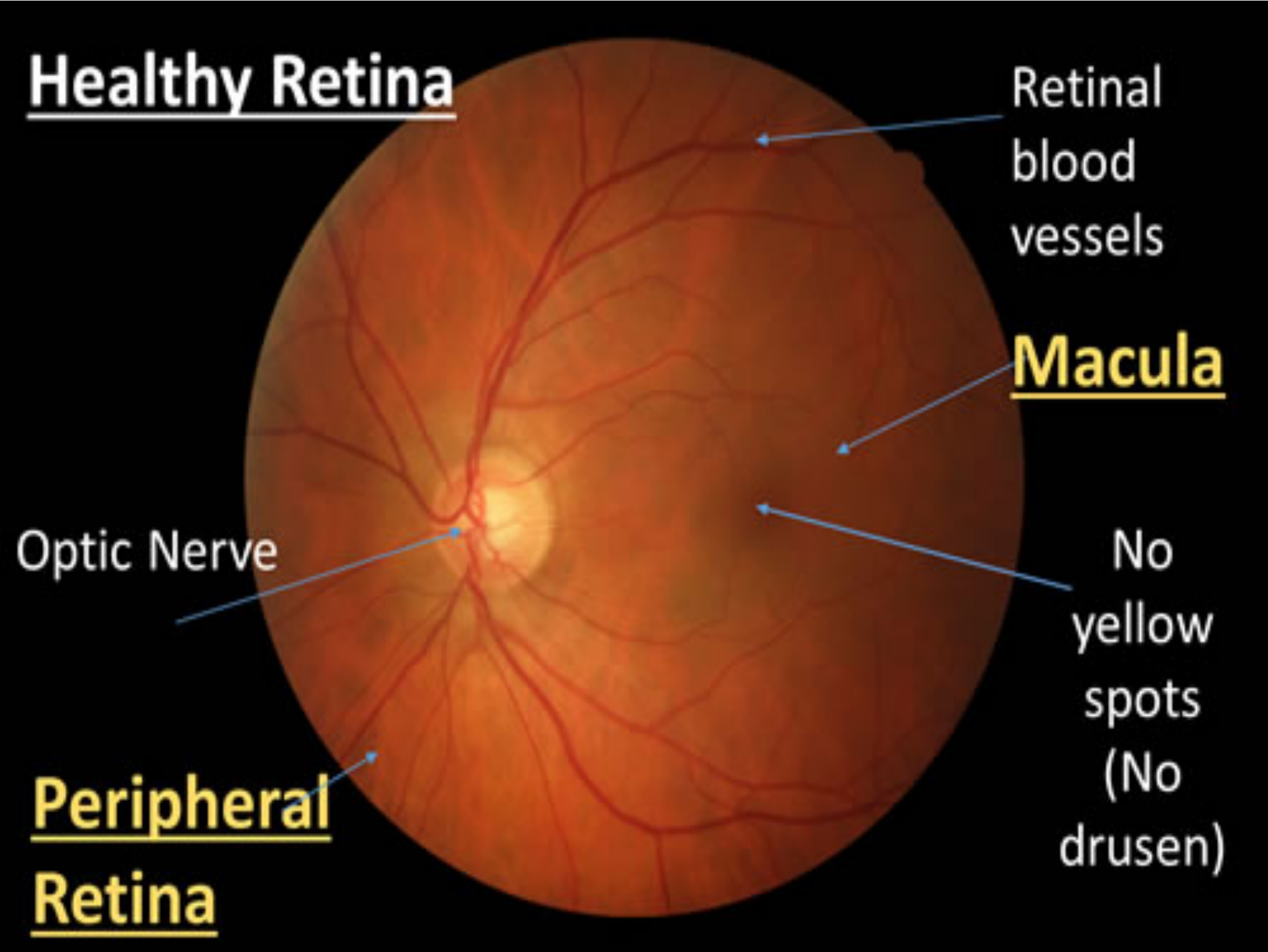
- The retina is the light-sensitive tissue that lines the inside of the eye
- Functions in a manner similar to film in a camera
- The optical elements within the eye focus an image onto the retina , initiating a series of chemical and electrical events
- Nerve fibers within the retina send electrical signals to the brain, which then interprets these signals as visual images

# Retina

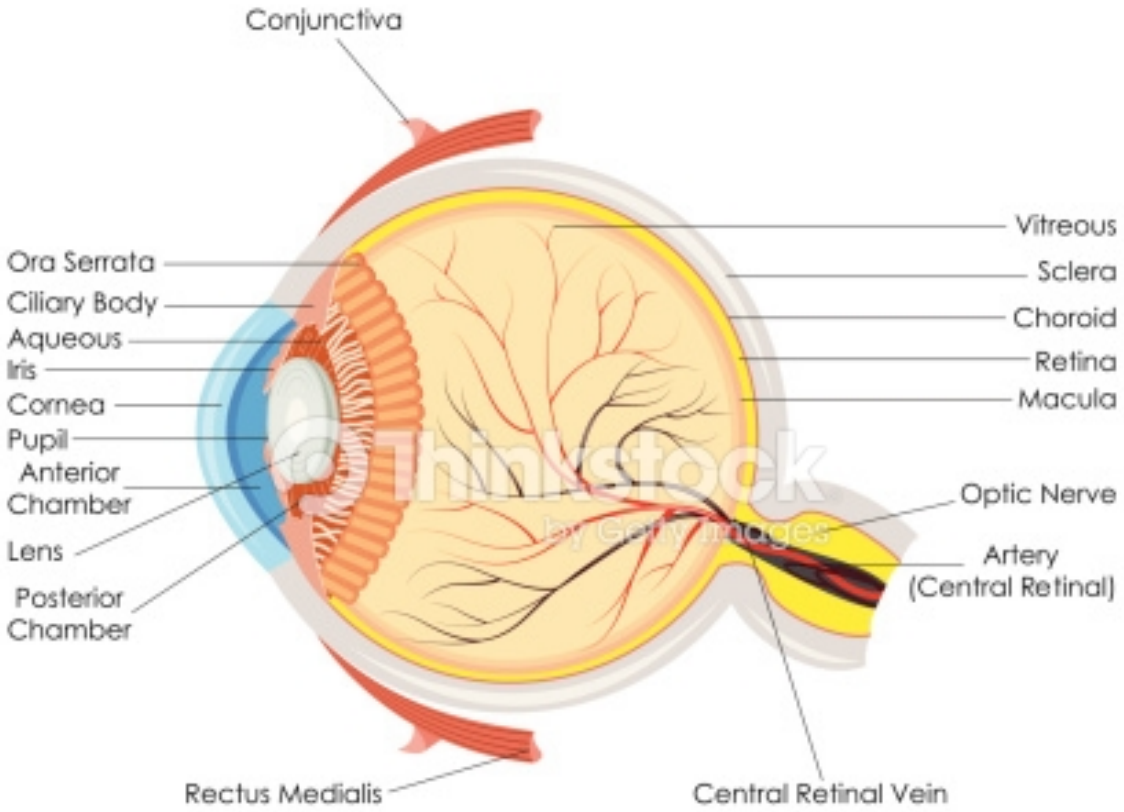
- The center of the retina provides the greatest resolving power of the eye
- This area, responsible for central vision, is known as the macula
- The center of the macula is called the fovea

# Retina



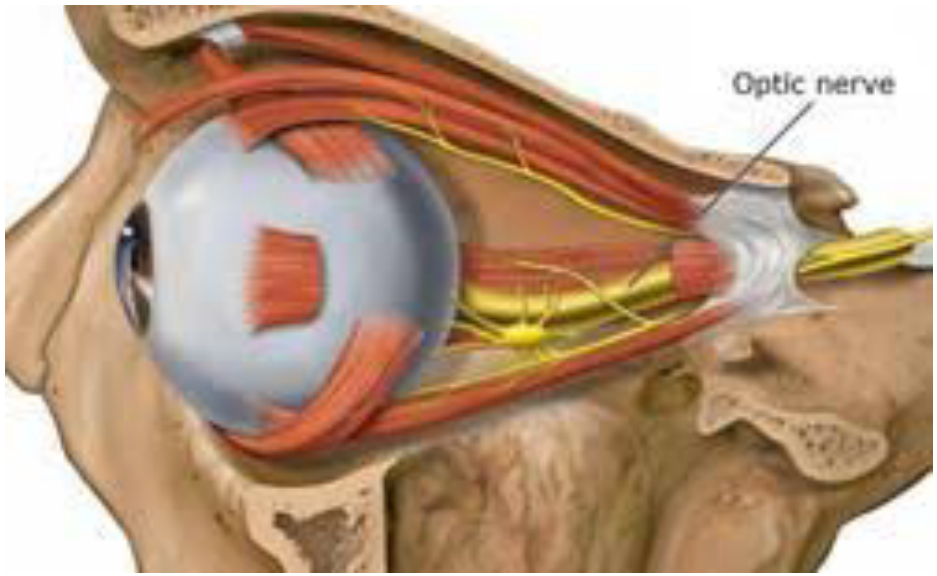

Healthy Retina
Retinal blood vessels
Macula
Optic Nerve
No yellow spots (No drusen)
Peripheral Retina

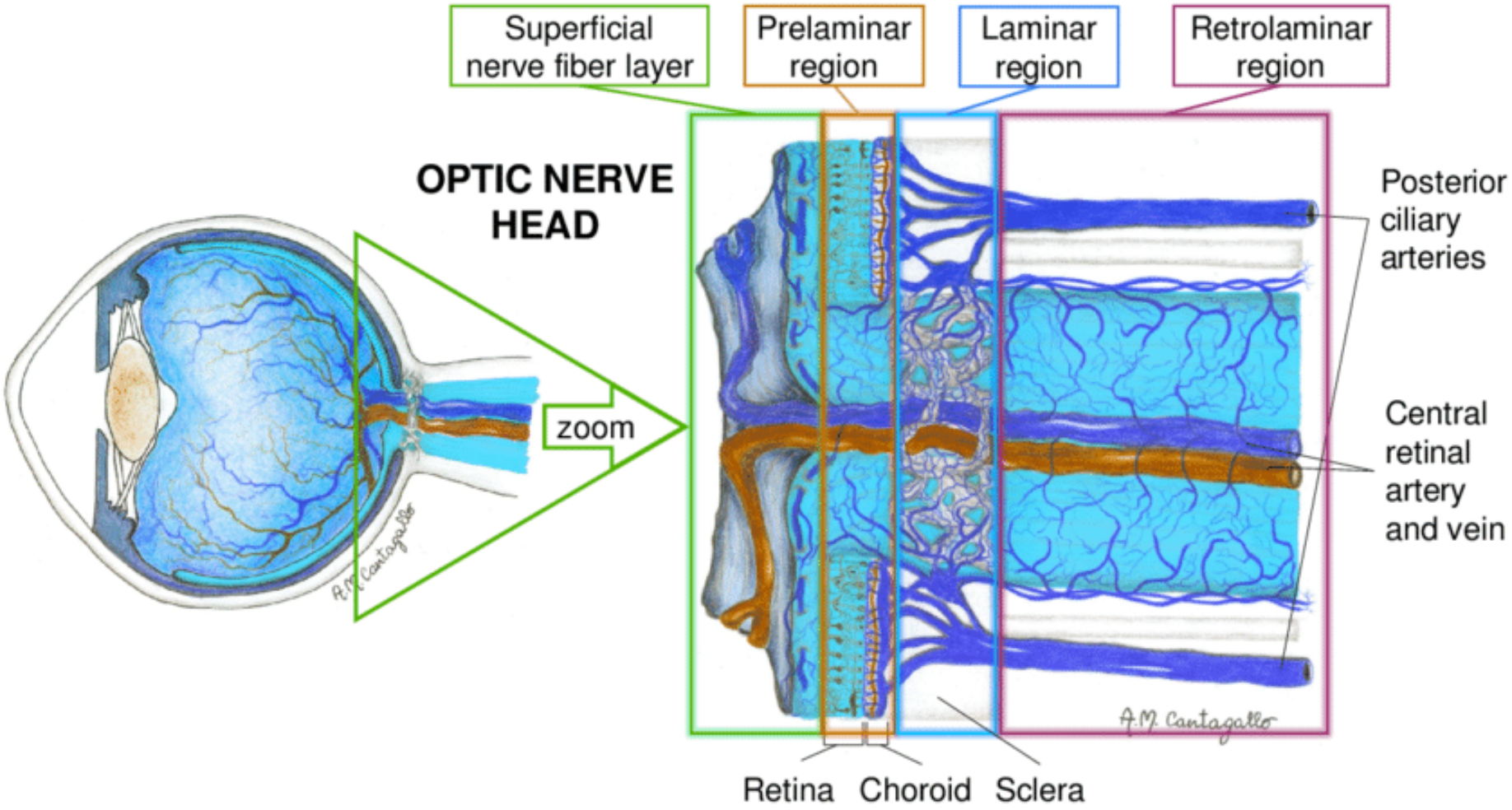
- Peripherally, retina has dentate/ teeth like processes called Ora Serrata



# The Optic Nerve- CN 2

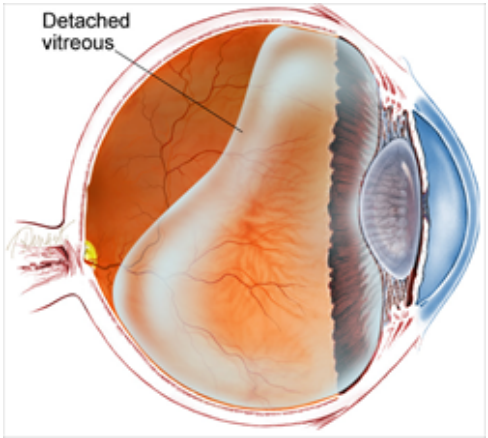
- The optic nerve is formed by the convergence of axons from the retinal ganglion cells.
- These cells in turn receive impulses from the photoreceptors of the eye (the rods and cones).

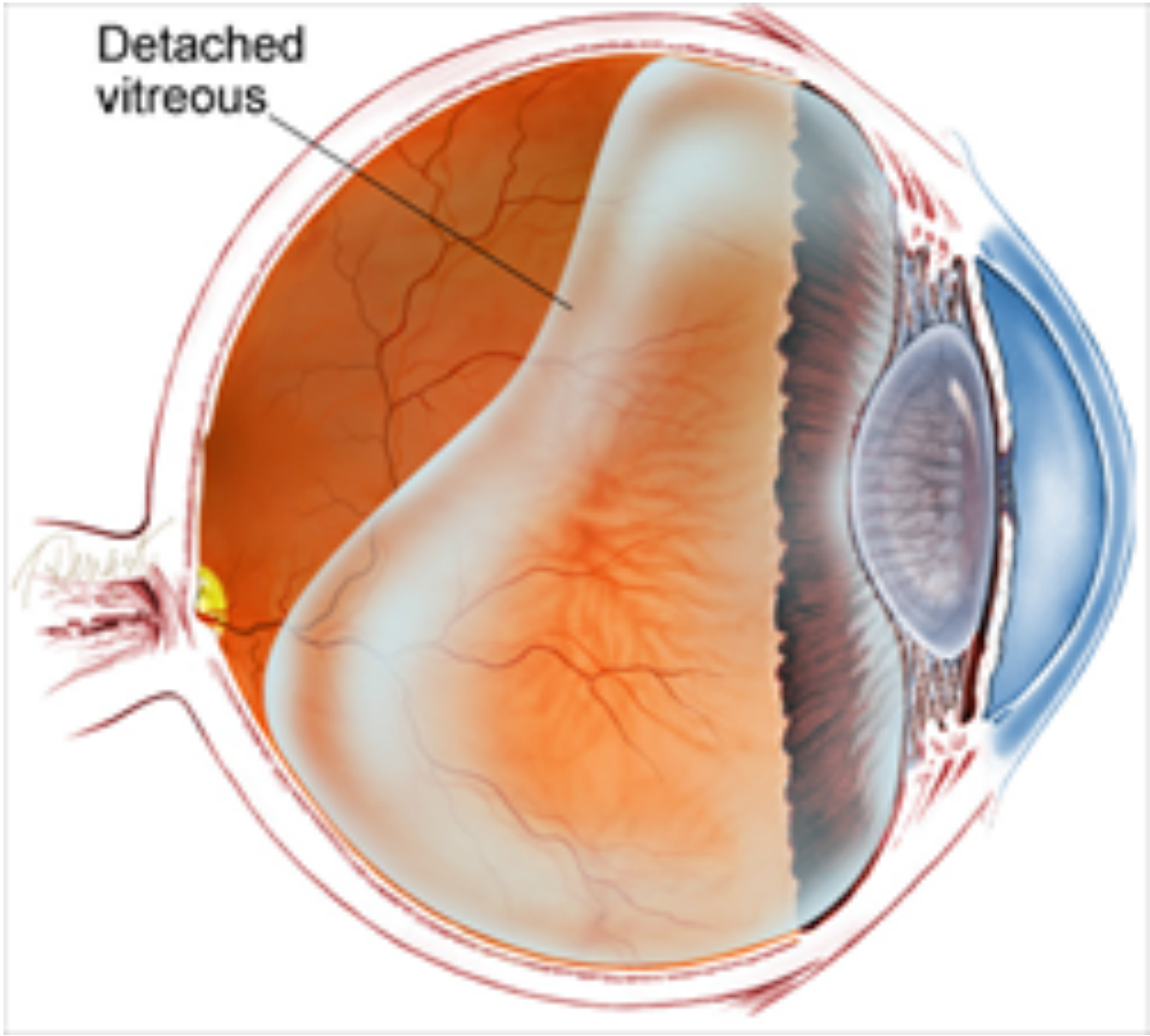



Superficial nerve fiber layer
Prelaminar region
Laminar region
Retrolaminar region
OPTIC NERVE HEAD
zoom
Posterior ciliary arteries
Central retinal artery and vein
Retina
Choroid
Sclera

# Vitreous Body

- The vitreous body is the clear gel that fills the space between the lens and the retina.
- Occupies 80% of the volume of the eye
- It is a clear matrix composed of collagen, hyaluronic acid, and water
- Often referred to as the vitreous humour or simply "the vitreous"




Detached
vitreous

The End