

# **Histology of the Eye**

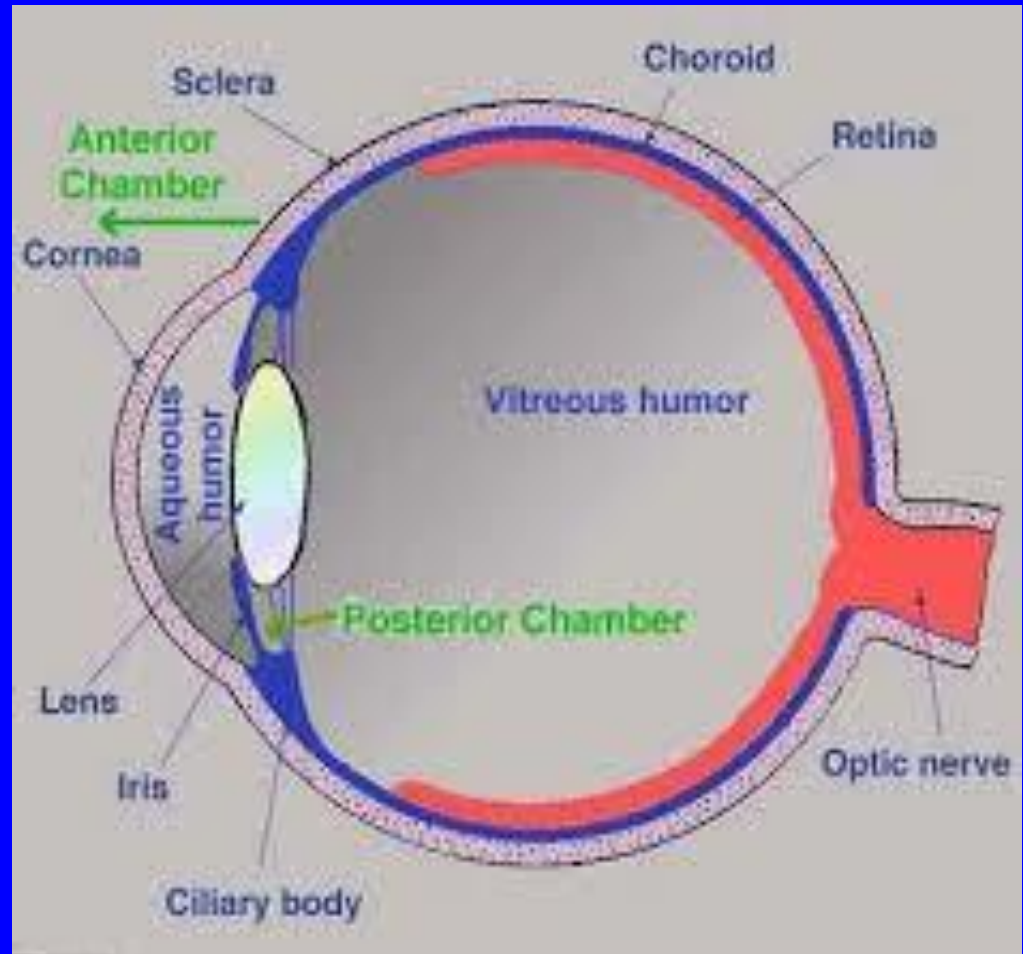
# Objectives

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- **By the end of this lecture, the student should be able to describe:**
  - *The general structure of the eye.*
  - *The microscopic structure of:*
    - » *Cornea.*
    - » *Retina.*

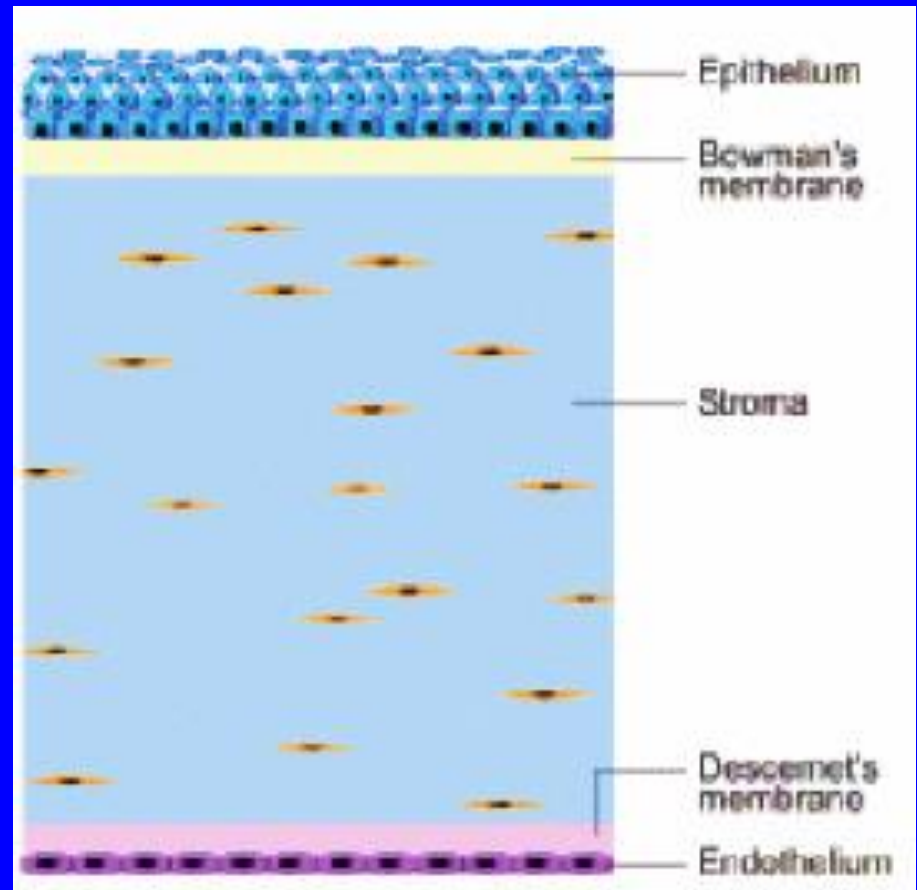
# EYE BULB

- Three coats  
(3 Tunics):
- **1- Fibrous tunic:**
  - Cornea.
  - Sclera.
- **2- Vascular tunic:**
  - Choroid.
  - Ciliary body.
  - Iris.
- **3- Neural tunic:**
  - Retina.



# CORNEA

- It is the transparent, avascular and highly innervated anterior portion of the fibrous coat.
- It is composed of 5 distinct layers:
  1. Corneal epithelium.
  2. Bowman's membrane.
  3. Stroma.
  4. Descemet's membrane.
  5. Corneal endothelium.



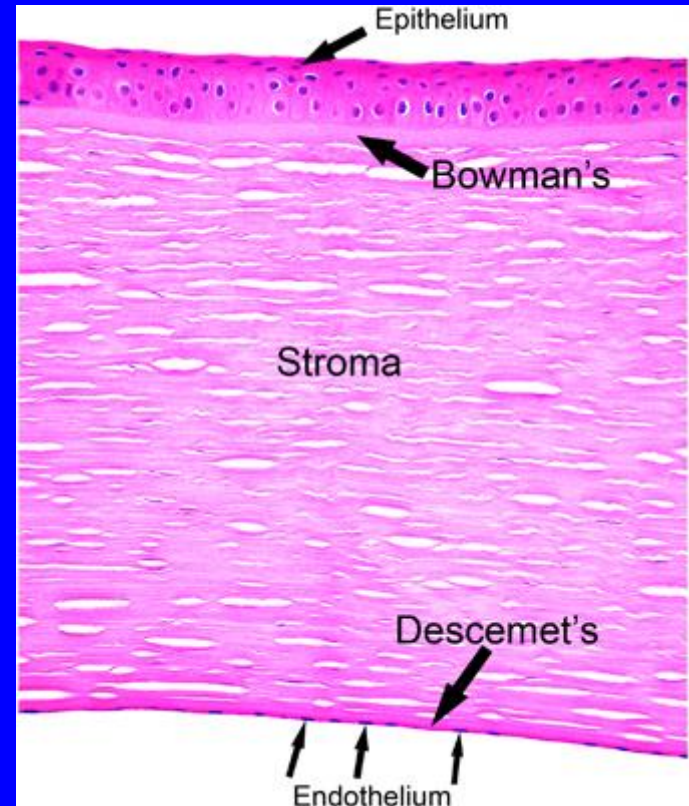
# CORNEA (Cont.)

## ■ Corneal epithelium:

- Non-keratinized Stratified squamous epithelium.
- Contains numerous free nerve endings.

## ■ Bowman's membrane:

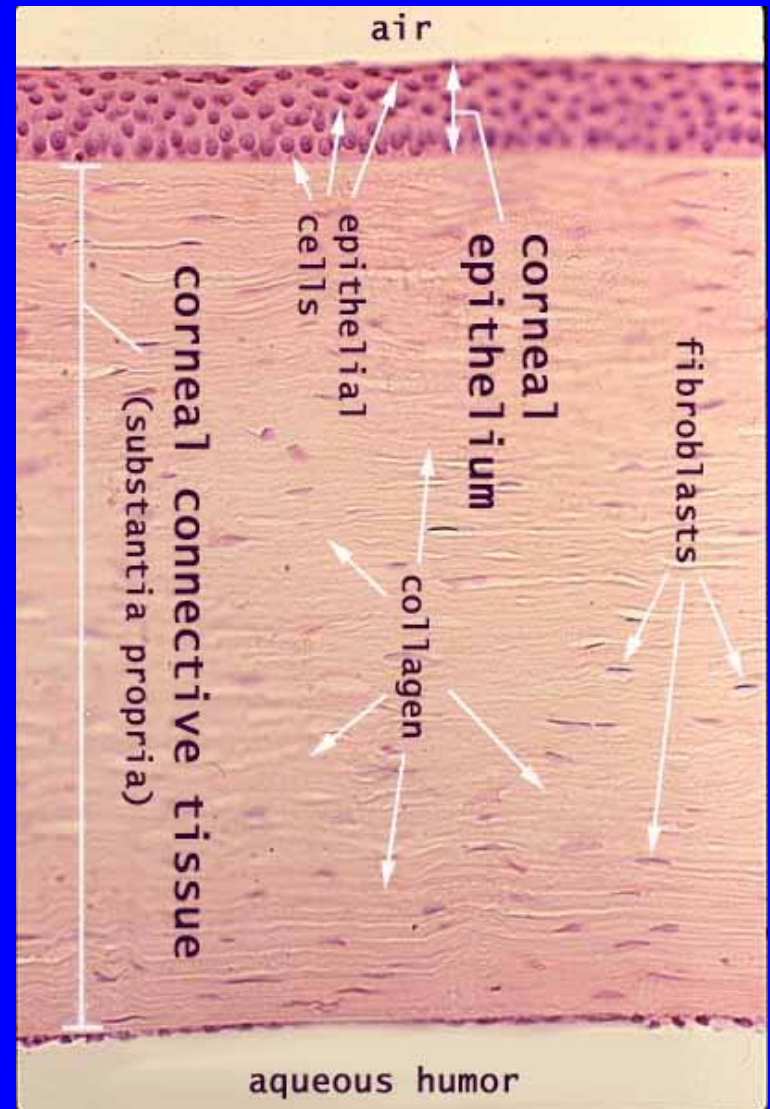
- It is homogenous non-cellular layer containing type I collagen fibrils.



# CORNEA (Cont.)

## ■ Stroma:

- It is the thickest layer (about 90%).
- It is composed of parallel lamellae of dense collagenous C.T.
- Each lamella is composed mainly of parallel type I collagen fibers with long fibroblasts.



# CORNEA (Cont.)

- **Descemet's membrane:**

- It is a thick basement membrane.

- **Corneal endothelium:**

- It is a simple squamous epithelium.

- **Functions:**

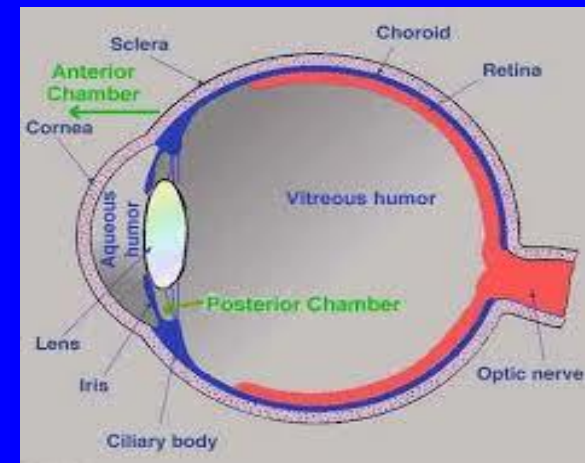
- 1- Formation of Descemet's membrane.

- 2- Keeping the stroma relatively dehydrated

- (sod. pump → water withdrawal from the stroma).

# LIMBUS (CORNEO SCLERAL JUNCTION)

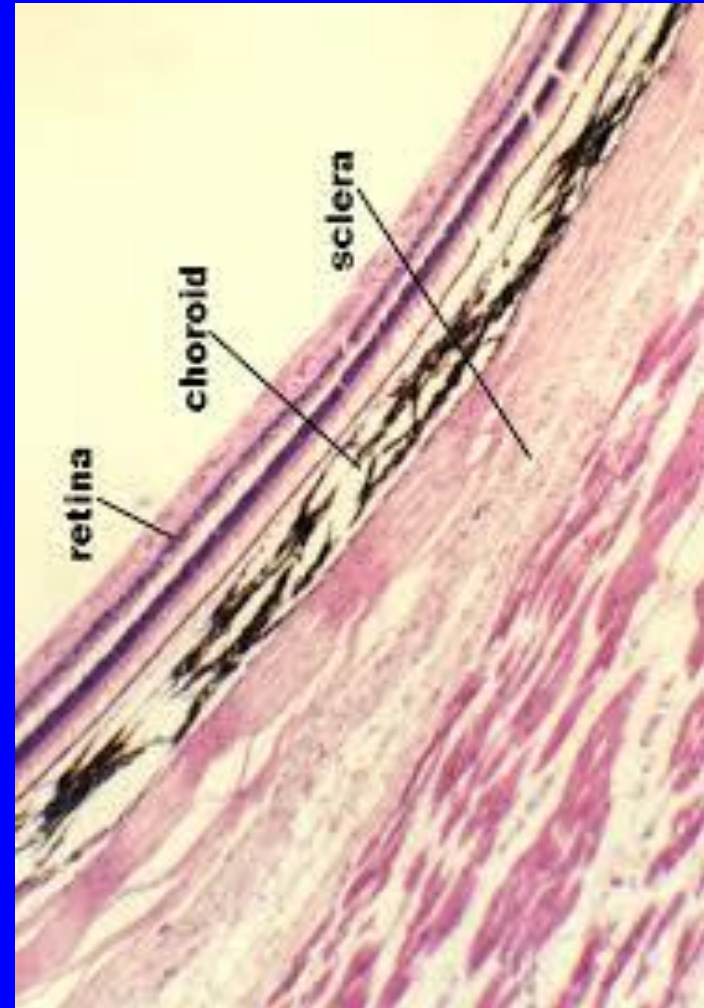
- It is the transition region between the cornea and sclera.
- It is about 1.5 mm width.
- It is highly vascular.
- It contains:
  1. Trabecular meshwork:  
Endothelium-lined spaces. It leads to canal of Schlemm.
  2. Canal of Schlemm:  
It drains the aqueous humor into the venous system.





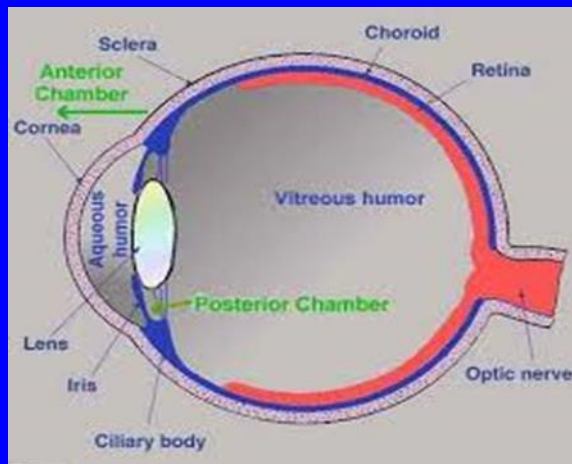
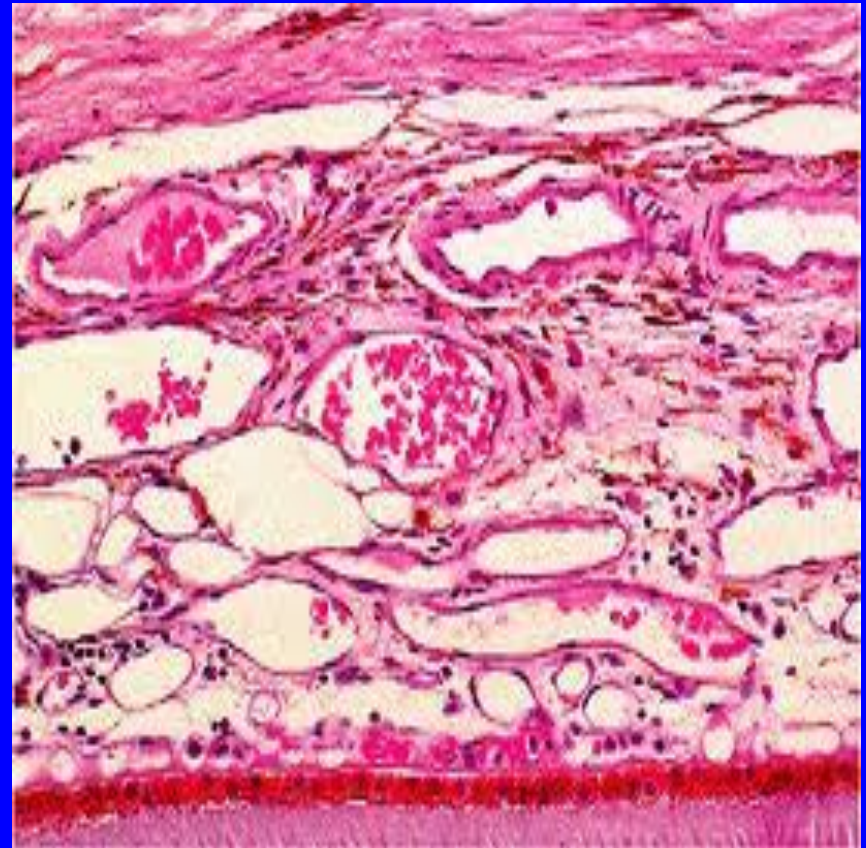
# SCLERA

- It covers the posterior 5/6 of the fibrous tunic.
- **Sclera Proper:** consists of interlacing bundles of type I collagen (dense collagenous C.T., irregular type).
- Melanocytes are located in the deeper regions.



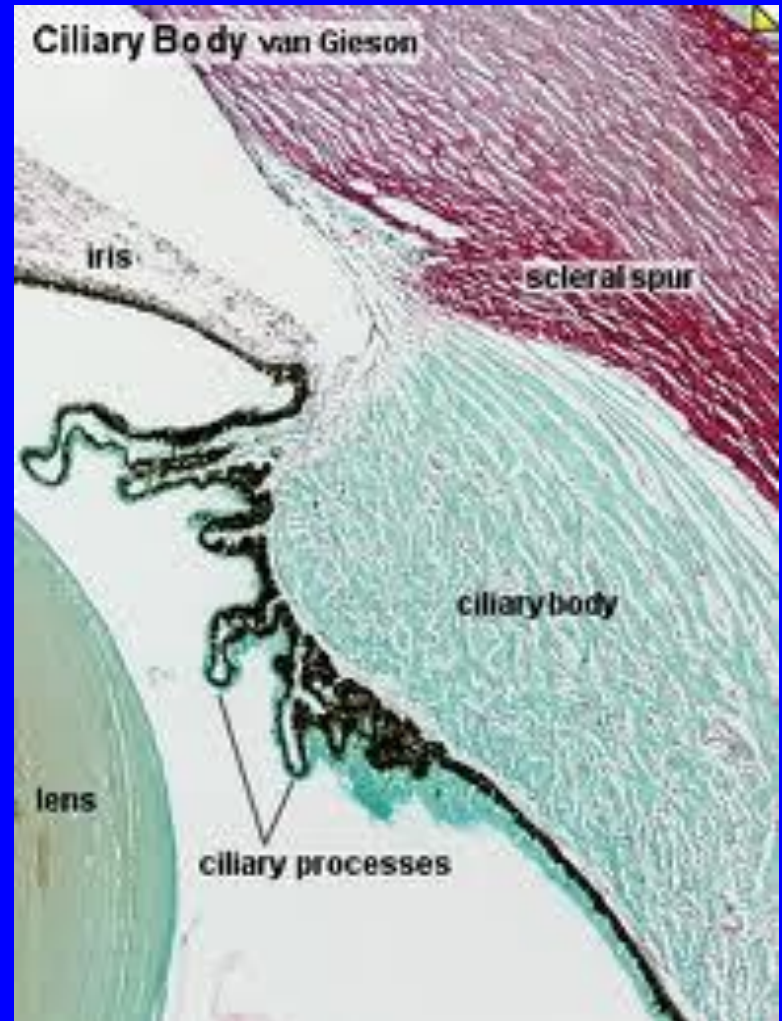
# CHOROID

- It is the vascular, pigmented posterior portion of the middle vascular tunic.
- **Structure:**  
It is composed mainly of loose C.T. with melanocytes. It is separated from the retina by its Bruch's membrane.



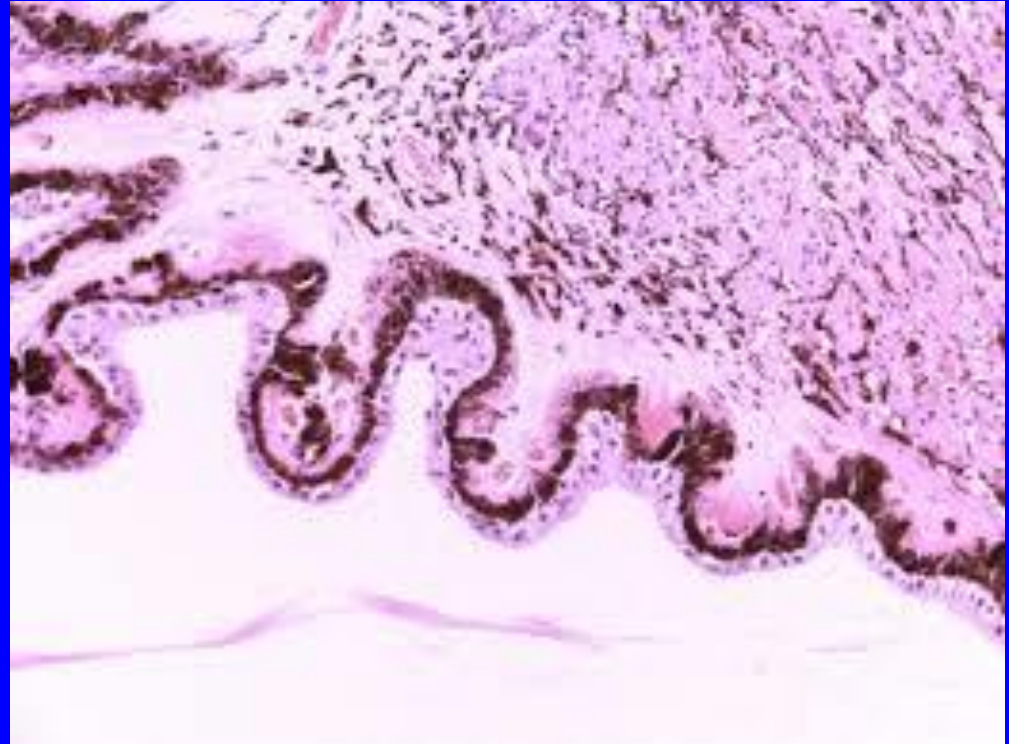
# CILIARY BODY

- It is the anterior continuation of the choroid. It surrounds the lens.
- **Structure:**
  - It is formed of loose vascular and pigmented C.T. that contains 3 bundles of smooth muscle cells (ciliary muscle).
  - Its inner surface is lined by pars ciliaris retinae ( 2 rows of columnar cells; outer pigmented and inner non- pigmented layers) .
  - Its inner surface is highly folded forming the ciliary processes.



# CILIARY PROCESSES

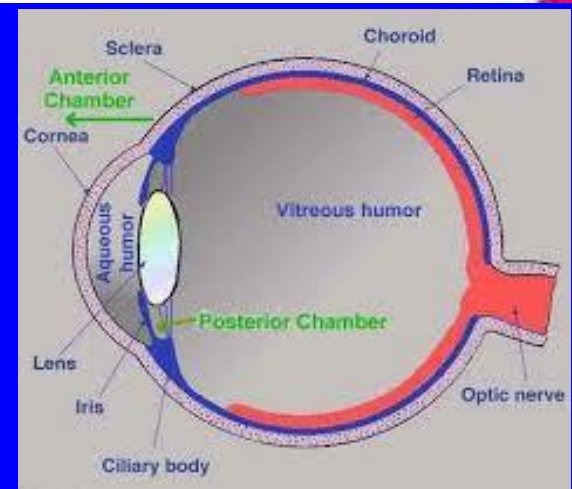
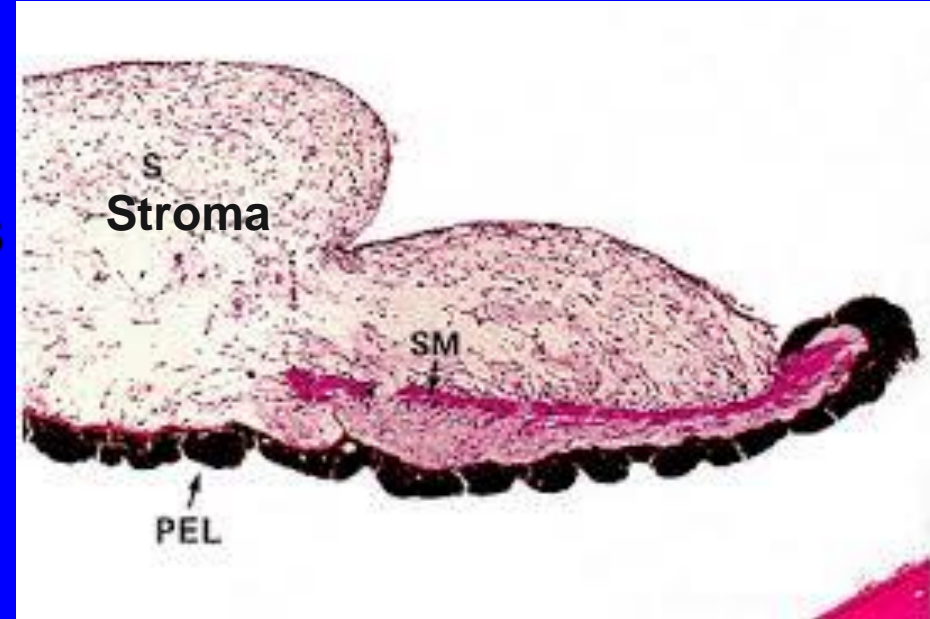
- Processes project from the inner surface of the anterior 1/3 of the ciliary body towards the lens.
- Are covered by pars ciliaris retinae (2 rows of columnar cells).
- They give attachment to the lens suspensory ligaments (zonule fibers).



# IRIS

It is formed of 5 layers:

- 1- Anterior border layer:  
Incomplete layer of fibroblasts and melanocytes.
- 2- Stroma:  
Poorly vascularized C.T. with fibroblasts and melanocytes.
- 3- Vessel layer:  
Well-vascularized loose C.T.  
Centrally, it contains circularly arranged smooth muscle fibers (sphincter pupillae muscle).



# IRIS

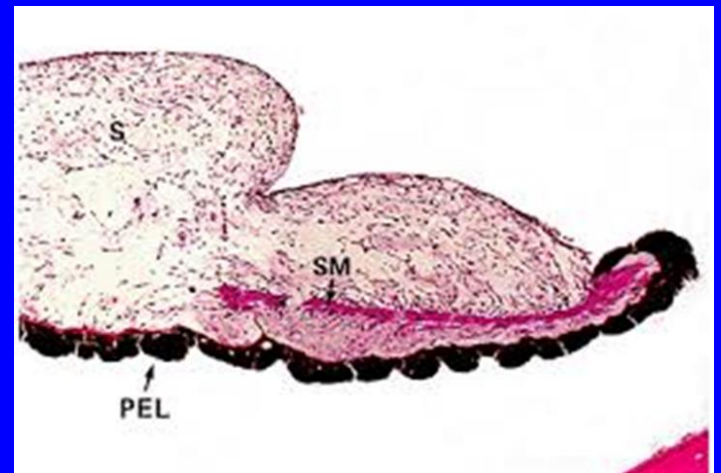
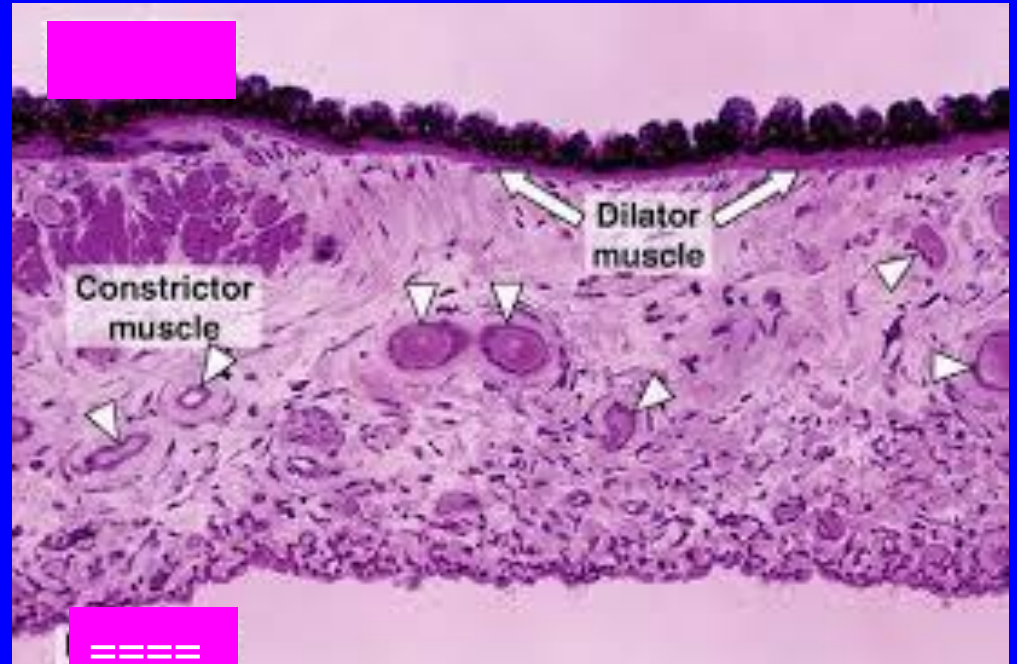
- 4- Dilator pupillae muscle layer:

Contains radially arranged myoepithelial cells.

- 5- Posterior surface layer (pigmented epithelium layer):

It is composed of 2 rows of **pigmented** epithelial cells (pars iridis retinae).

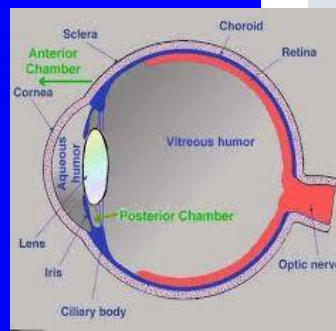
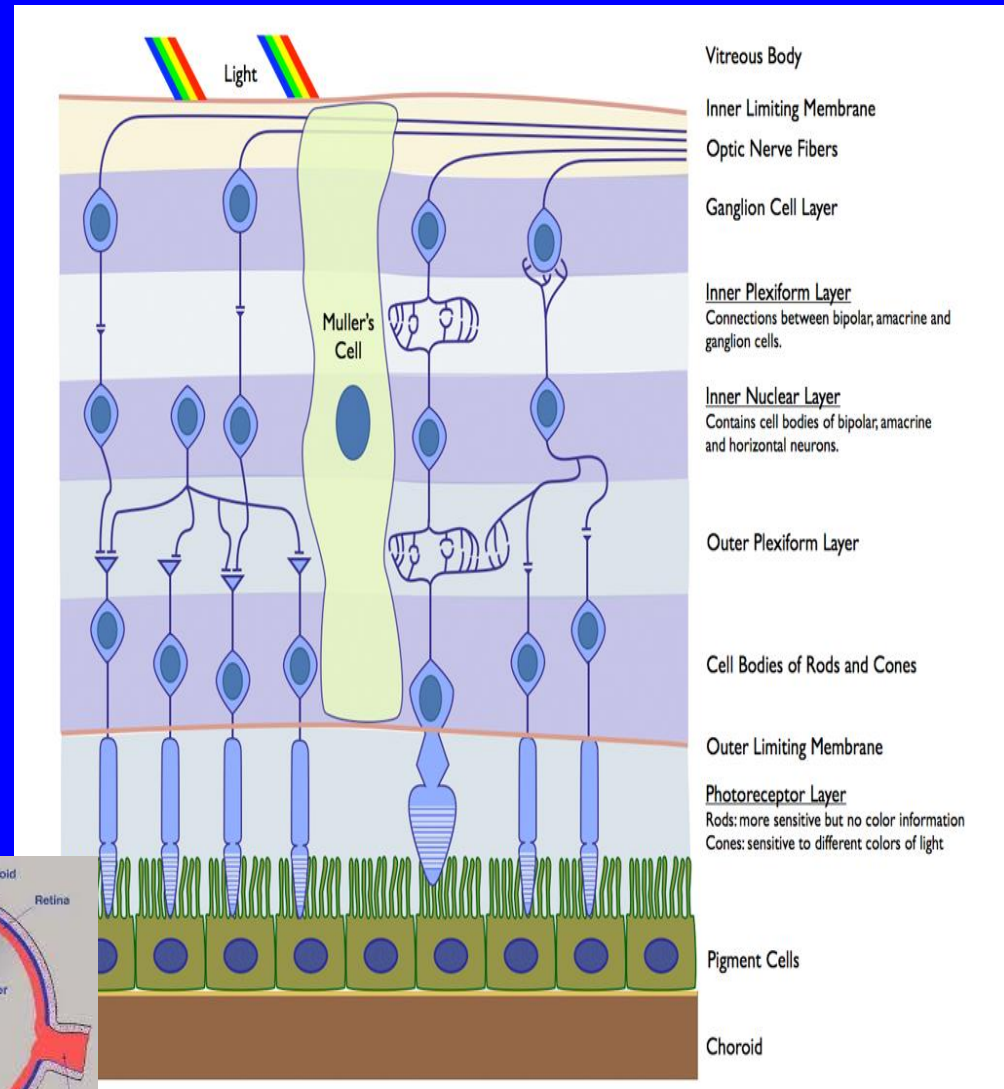
They are the continuation of pars ciliaris retinae.



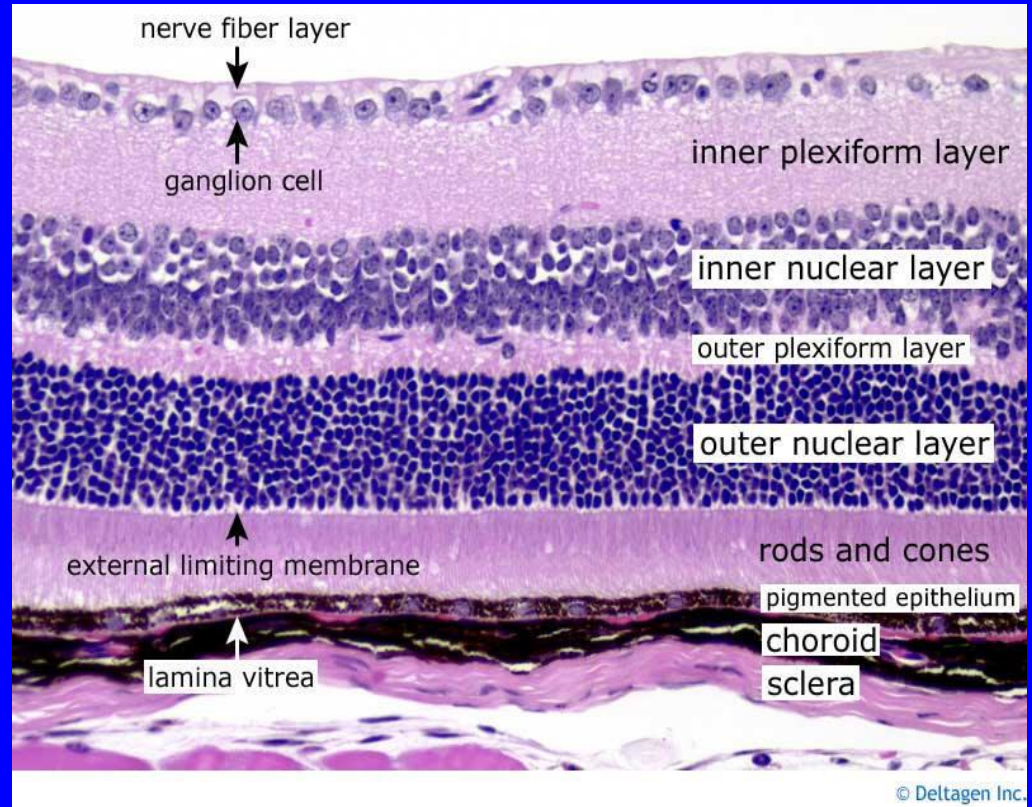
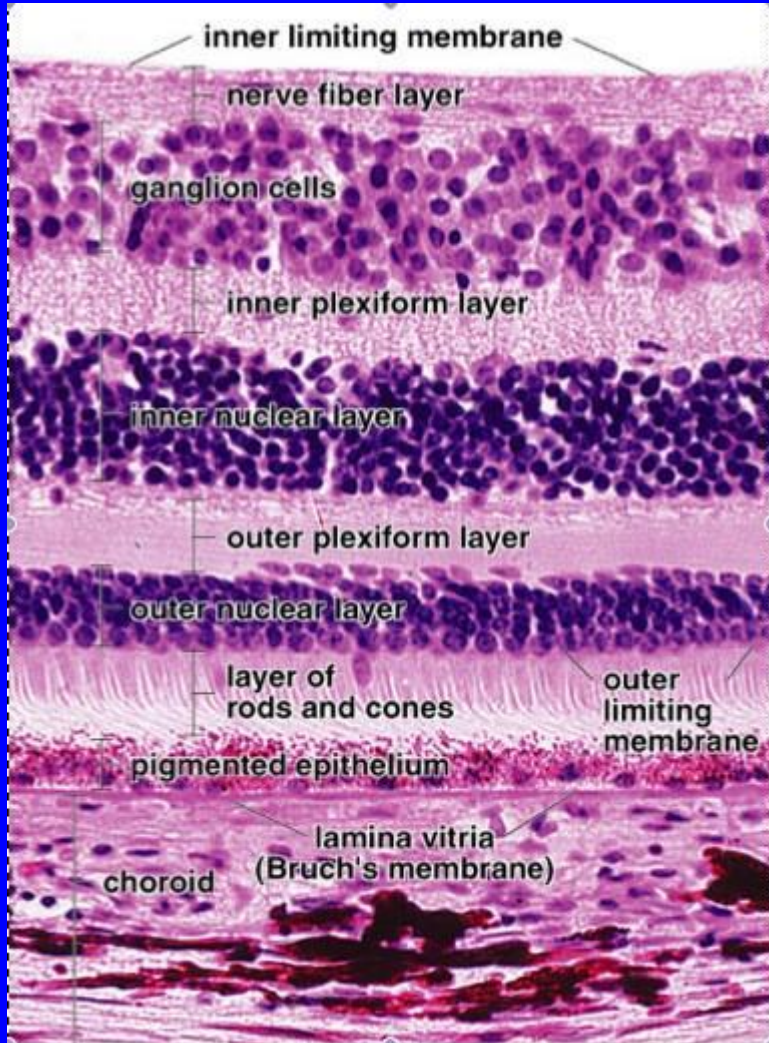
# RETINA

It is composed of **10 distinct layers** (from outside to inside):

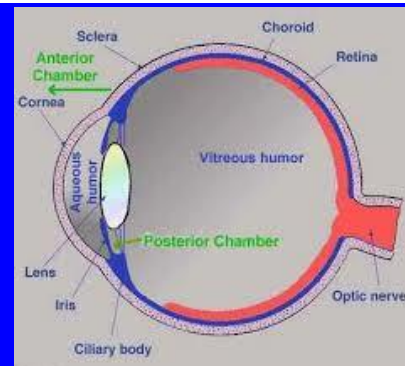
- 1- Pigmented epithelium.
- 2- Rods and cones layer.
- 3- Outer limiting membrane.
- 4- Outer nuclear layer.
- 5- Outer plexiform layer.
- 6- Inner nuclear layer.
- 7- Inner plexiform layer.
- 8- Ganglion cell layer.
- 9- Optic nerve fiber layer.
- 10- Inner limiting layer.



# RETINA (Cont.)



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# RETINA (Cont.)

- **Pigmented Epithelium:**

- Cuboidal to columnar cells (single layer).
- Apical microvilli.
- Abundance of melanin granules.

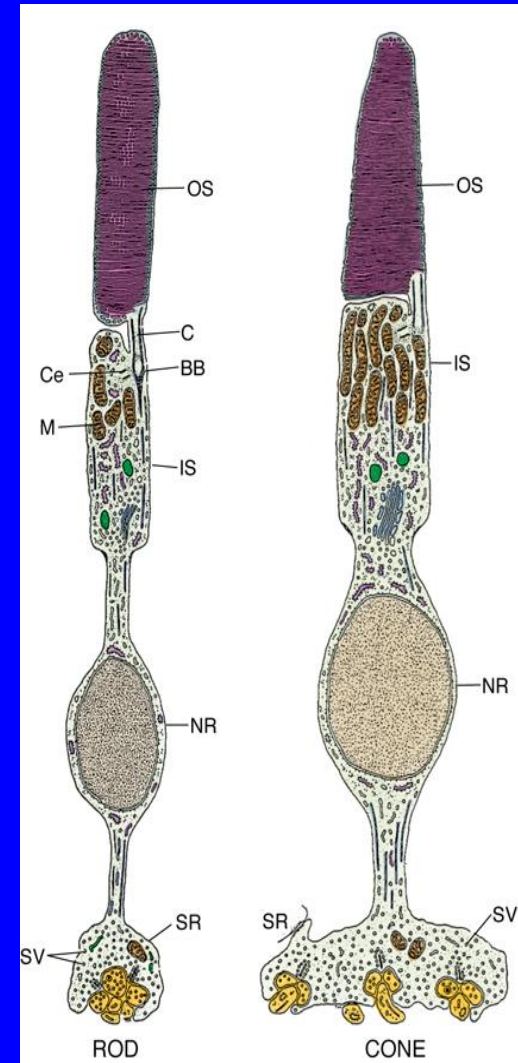
- **Functions:**

- 1- Absorb light.
- 2- Phagocytosis of membranous discs from tips of rods.
- 3- Esterification of Vitamin A (in SER).

# RODS AND CONES LAYER (Cont.)

- Are photoreceptor cells.
- Each has:
  1. Dendrite formed of:
    - Outer segment (OS): contains membranous discs containing rhodopsin (in rods) and iodopsin (in cones).
    - Connecting Stalk: with modified cilium.
    - Inner segment (IS).
  2. Cell body.
  3. Axon: synapses with dendrite of bipolar neuron of inner nuclear layer.
- **Functions:**

Rods are receptors for dim light ( low intensity light).  
Cones are receptors for bright light and color vision (red, green & blue).



# RETINA (Cont.)

## ■ Outer limiting membrane:

- A region of zonulae adherents junctions between Muller cells and the photoreceptors.

## ■ Outer nuclear layer:

- Contains nuclei of the rods & cones.

## ■ Outer plexiform layer:

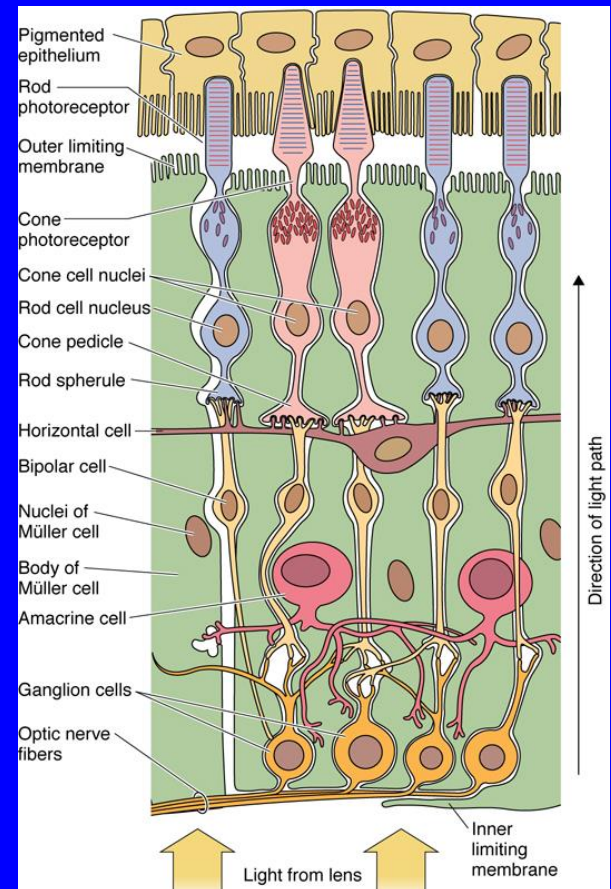
- Contains axodendritic synapses between the photoreceptor cells and dendrites of bipolar and horizontal cells.

## ■ Inner nuclear layer:

- Contains the nuclei of:

- 1- Bipolar neurons.
- 2- Horizontal neurons.
- 3- Amacrine neurons (unipolar neurons):
- 4- Neuroglial cells (Muller cells) that extend

between the vitreous body and the inner segments of rods and cones.



# RETINA (Cont.)

- **Inner plexiform layer:**

Contains axodendritic synapses between axons of bipolar neurons and dendrites of ganglion cells and amacrine cells.

- **Ganglion cell layer:**

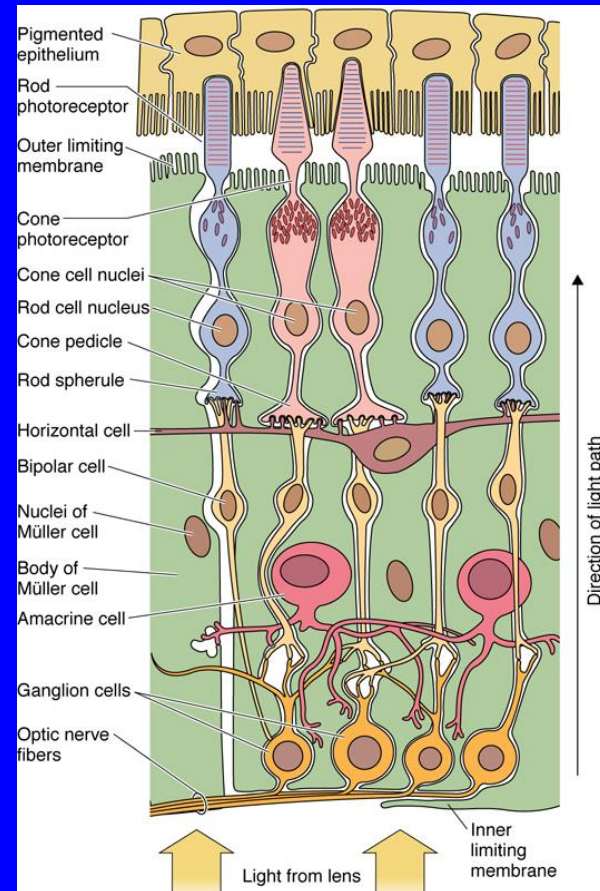
Contains cell bodies of large multipolar neurons of the ganglion cells.

- **Optic nerve fiber layer:**

Contains unmyelinated axons of the ganglion cells.  
N.B. These axons become myelinated as the nerve pierces the sclera.

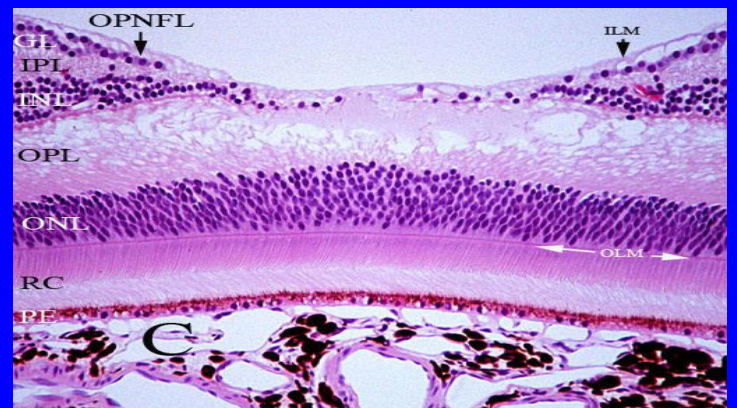
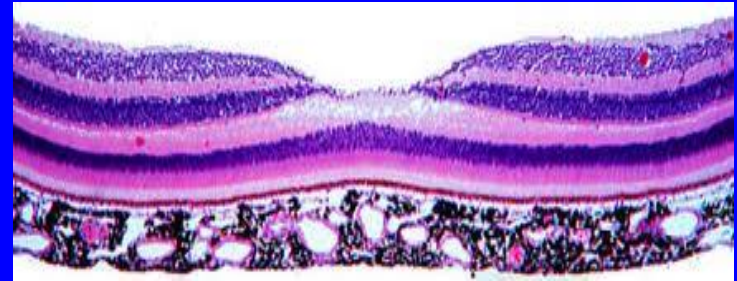
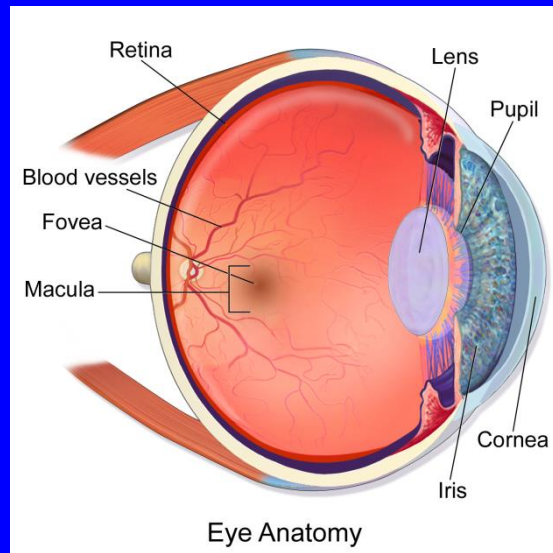
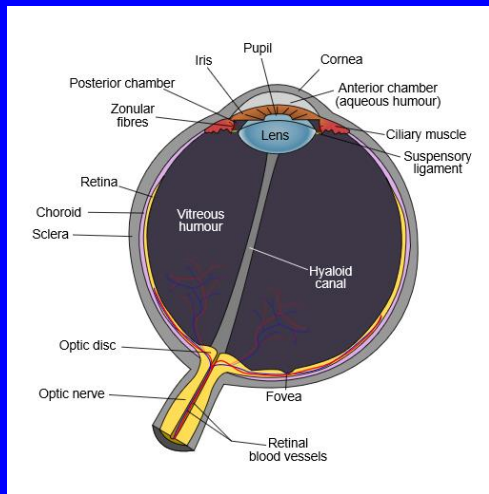
- **The inner limiting membrane:**

It is formed by the basal laminae of the Muller cells.



# RETINA (Cont.)

- **Fovea centralis:**
- It lies in the center of macula lutea.
- Cones are highly concentrated in the fovea.
- It is responsible for visual acuity.



# RETINA (Cont.)

## ■ Types of cells in the retina:

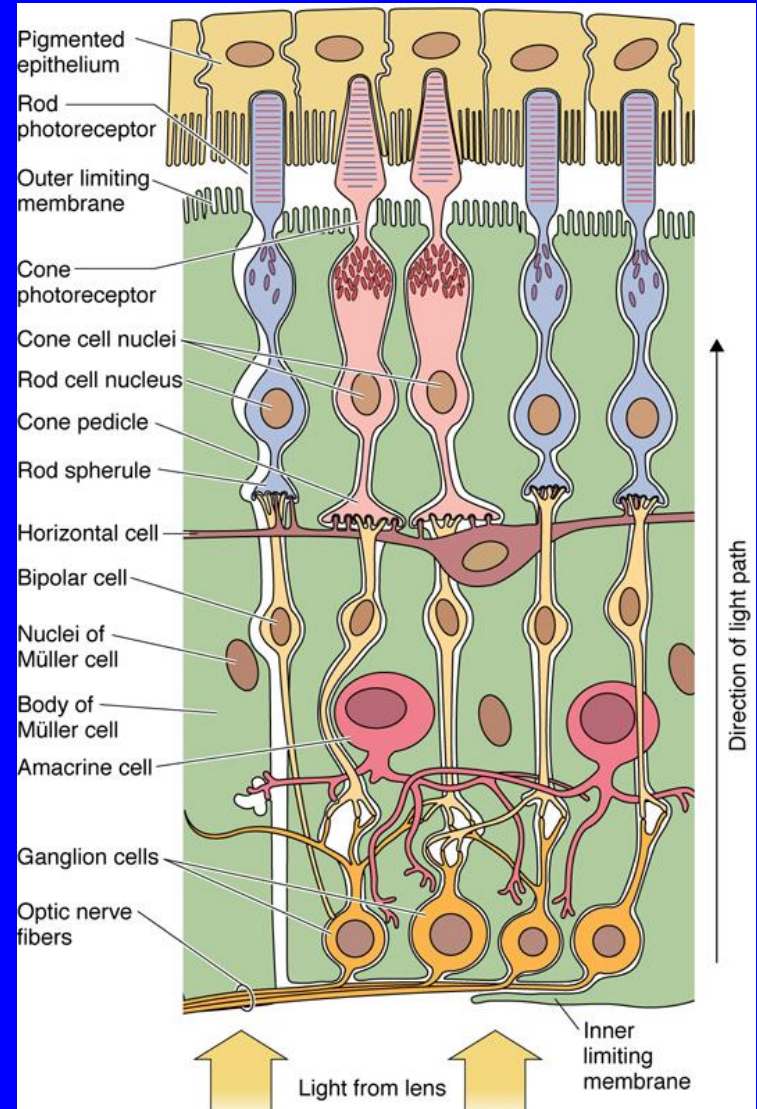
1- Pigmented epithelium.

2- Nerve cells:

- Photoreceptor cells (rods & cones)
- Bipolar neurons.
- Ganglion cells.
- Association neurons:
  - Horizontal cells.
  - Amacrine cells.

3- Neuroglial cells:

- Muller's cells.
- Astrocytes.



# CONJUNCTIVA

- It is the transparent mucous membrane lining the inner surfaces of the eyelids (**palpebral conjunctiva**) and reflecting onto the sclera of the anterior surface of the eye (**bulbar conjunctiva**).
- **L/M:**
- **1- Epithelium:**  
Stratified columnar epithelium with numerous goblet cells.
- **2- Lamina propria:**  
Loose C.T.



GOOD

LUCK