



438
HISTOLOGY TEAM
KING SAUD UNIVERSITY



Histology of the Eye

- ▣ **Editing file**
- ▣ **Important**
- ▣ **Doctor notes / Extra**



Objectives:

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:

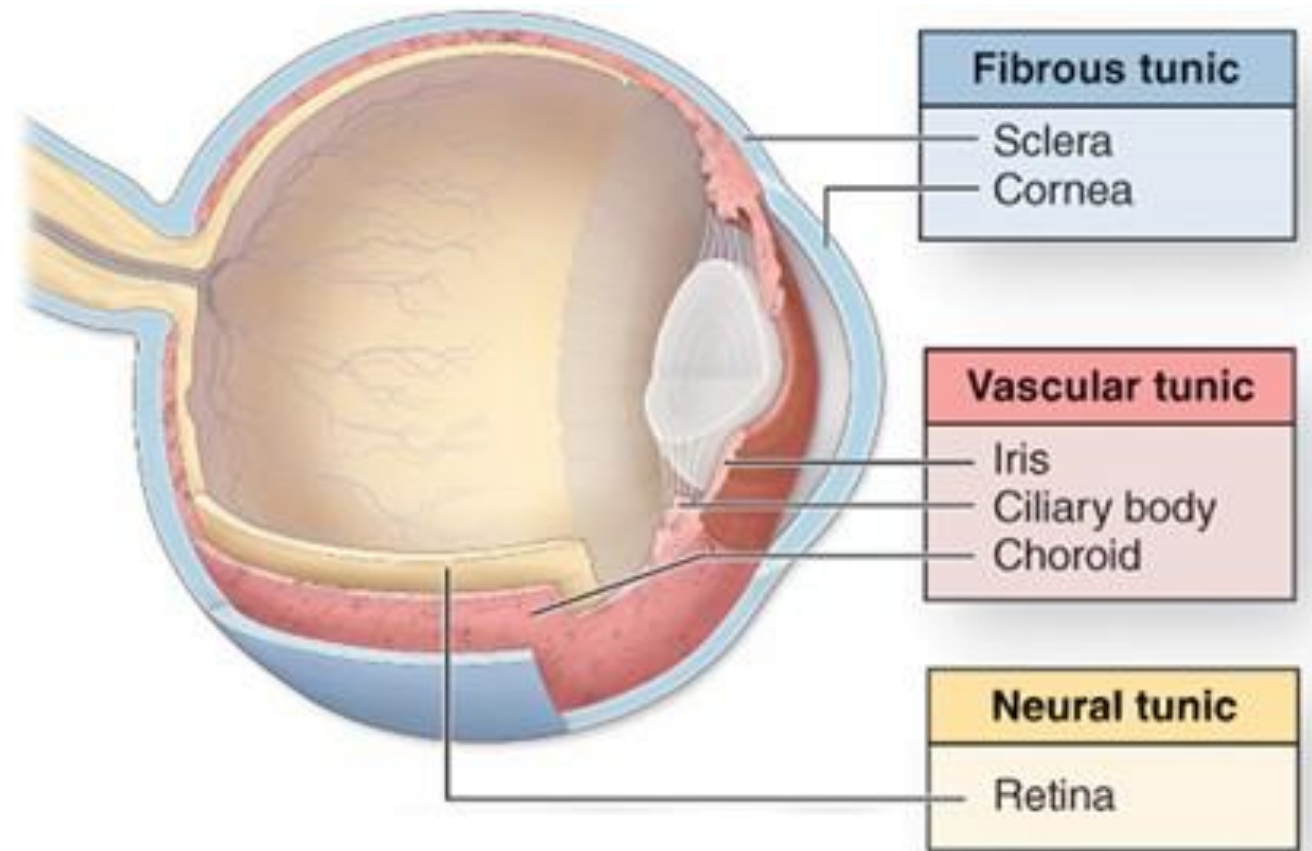
Cornea.
Sclera.

2- Vascular tunic: highly vascular + pigmented

Choroid.
Ciliary body.
Iris.

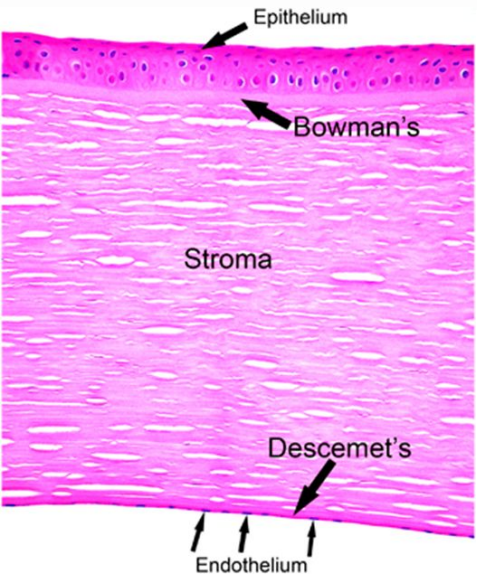
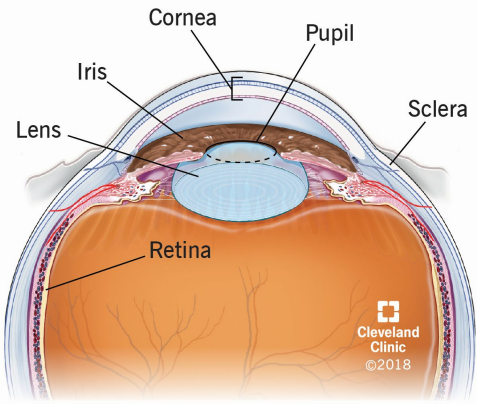
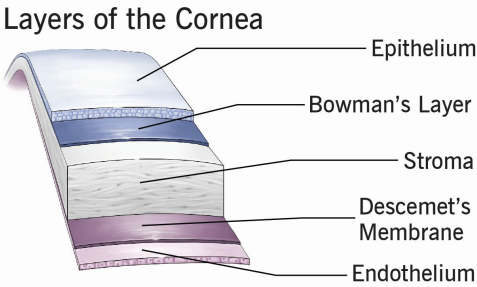
3- Neural tunic: formation of image

Retina.



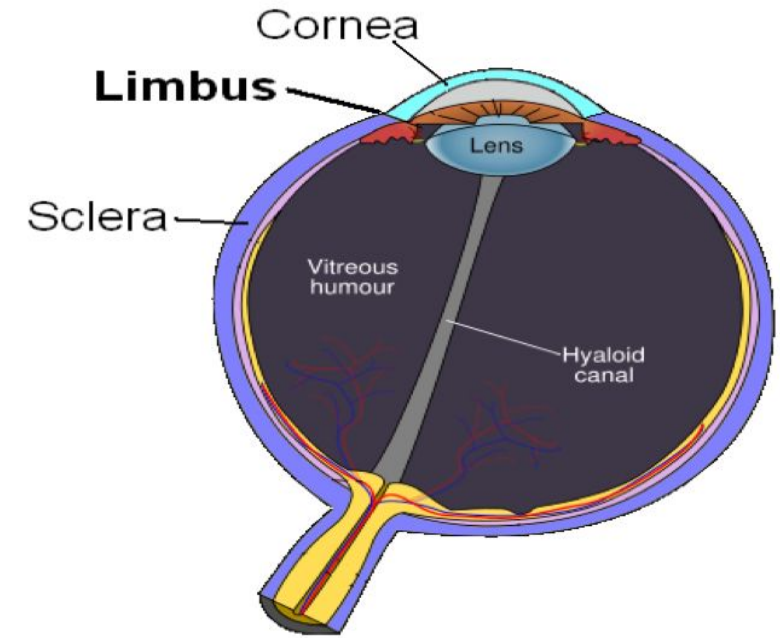
▣ Fibrous tunic: **Cornea**

Definition	It is the transparent, avascular and highly innervated anterior portion of the fibrous coat.	
Layers of cornea	Corneal epithelium	<ul style="list-style-type: none"> - Non-keratinized Stratified squamous epithelium. - Contains numerous free nerve endings. Pain receptors
	Bowman's membrane	- It is homogenous non-cellular layer containing type I collagen fibrils.
	Stroma	<ul style="list-style-type: none"> - It is the thickest layer (about 90%). - It is composed of parallel lamellae of dense collagenous C.T. Regular arrangement to make it transparent - Each lamella is composed mainly of parallel type I collagen fibers with long fibroblasts.
	Descemet's membrane	It is a thick basement membrane.
	Corneal endothelium	<p>It is simple squamous epithelium.</p> <p>Functions: dehydration aids in transparency</p> <ol style="list-style-type: none"> 1- Formation of Descemet's membrane. 2- Keeping the stroma relatively dehydrated (sod. pump → water withdrawal from the stroma).



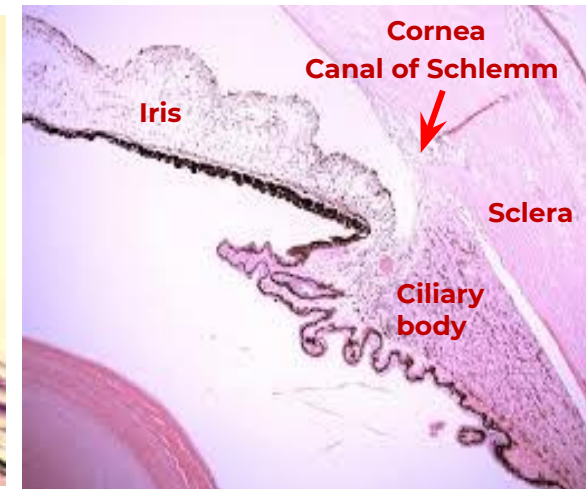
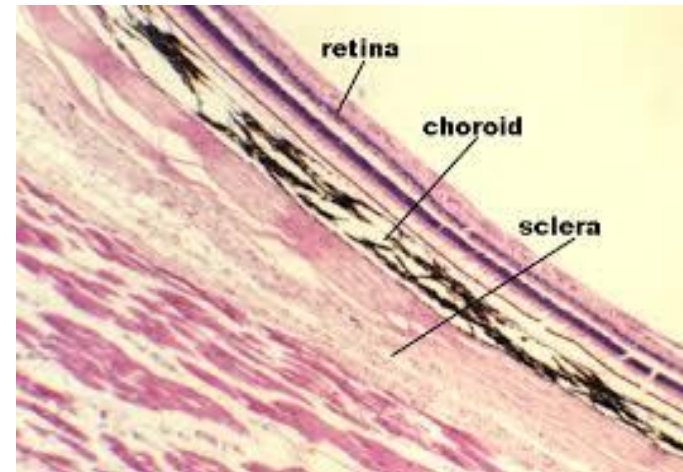
▣ Fibrous tunic: **Limbus (corneo scleral junction)**

- It is the transition region between the cornea and sclera.
- It is about 1.5 mm width.
- It is highly vascular. Provide nutrition to the cornea
- **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.



▣ Fibrous tunic: **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.



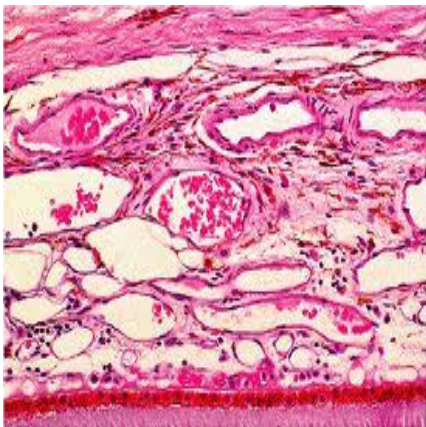
Vascular tunic

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.

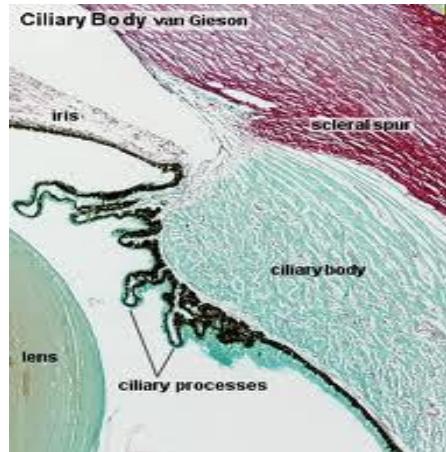


Ciliary body

It is the anterior continuation of the choroid. It surrounds the lens.

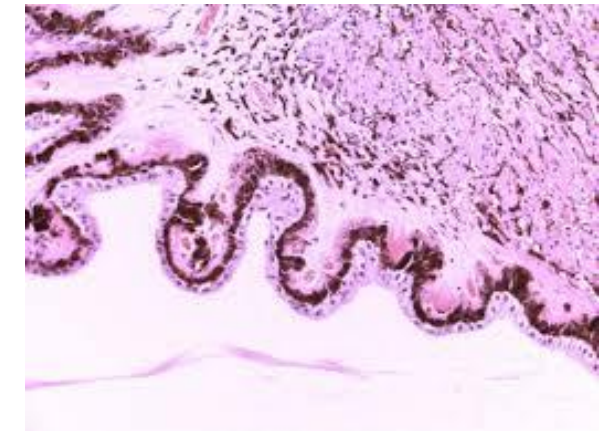
Structure:

- 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

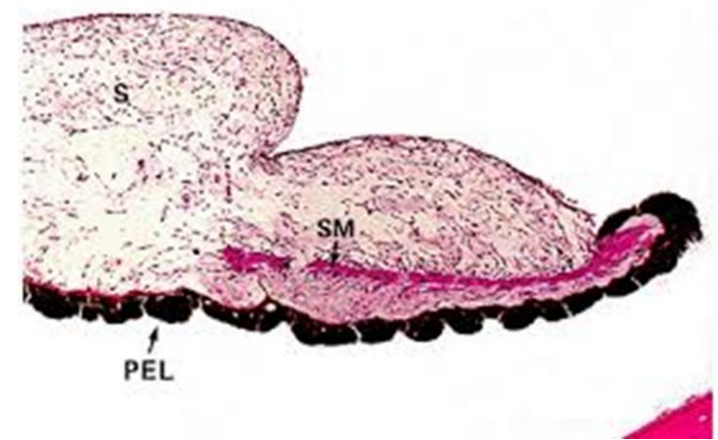
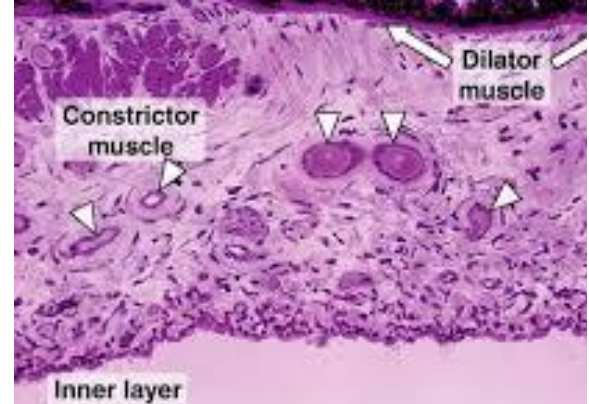
- Processes project from the inner surface of the anterior 1/3 of the ciliary body towards the lens.
- Are covered by pars ciliaris retinae (2 rows of columnar cells).
- They give attachment to the lens suspensory ligaments (zonule fibers).



■ Vascular tunic: **Iris**

It is formed of 5 layers:

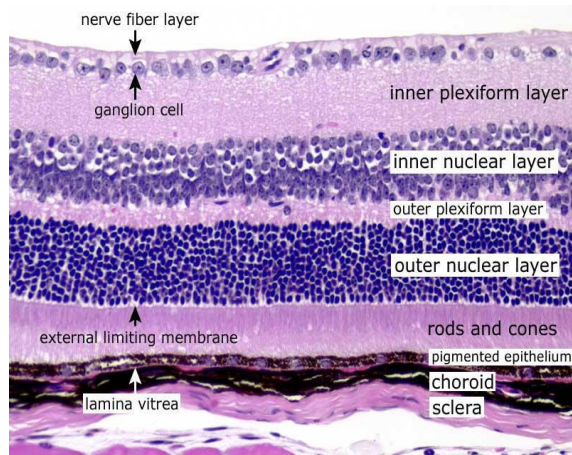
1- Anterior border layer	Incomplete layer of fibroblasts and melanocytes.
2- Stroma	Poorly vascularized C.T. with fibroblasts and melanocytes . Pigments are responsible for the eye color
3- Vessel layer	Well-vascularized loose C.T. Centrally, it contains circularly arranged smooth muscle fibers (sphincter pupillae muscle).
4- Dilator pupillae muscle layer	Contains radially arranged myoepithelial cells.
5- Posterior surface layer	It is composed of 2 rows of pigmented epithelial cells (pars iridis retinae). They are the continuation of pars ciliaris retinae.



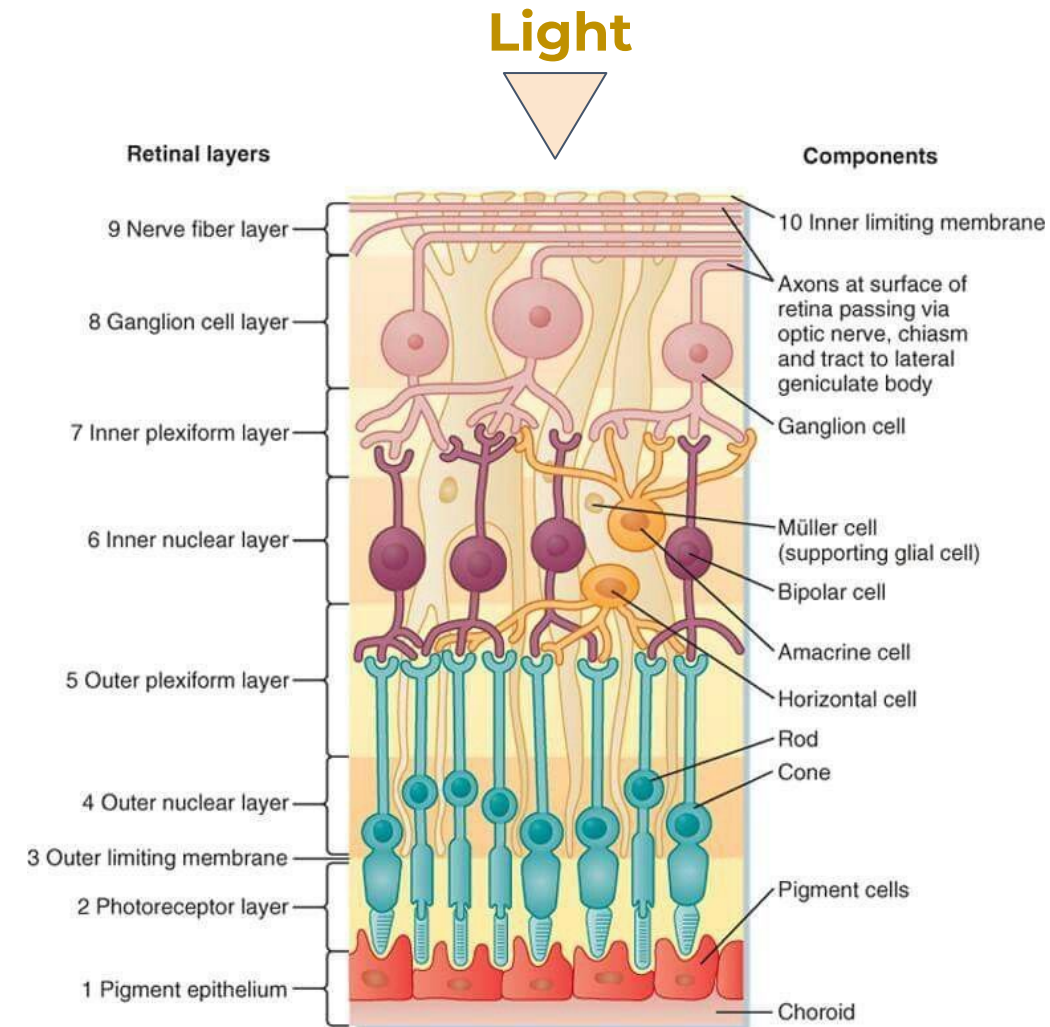
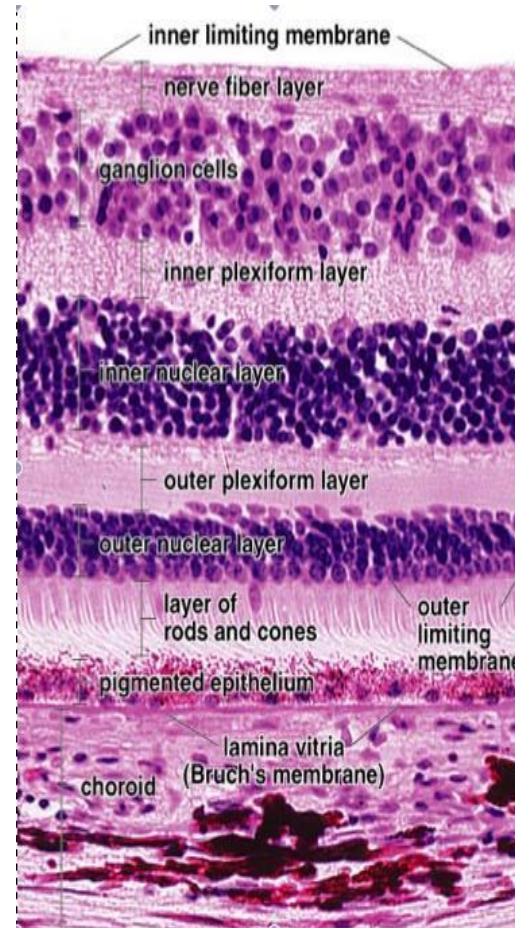
■ Neural tunic: **Retina**

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

1. Pigmented epithelium. (outermost)
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. (innermost)



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Layers Of Retina

1- Pigmented Epithelium:	2- Rods and cones layer	3- Outer limiting membrane	4- Outer nuclear layer
<ul style="list-style-type: none"> • Cuboidal to columnar cells (single layer). • Apical microvilli. (to increase surface area) • Abundance of melanin granules. <p>Functions:</p> <ol style="list-style-type: none"> 1. Absorb light. 2. Phagocytosis of membranous discs from tips of rods. 3. Esterification (Activation) of Vitamin A (in SER). 	<p>Are photoreceptor cells. Each has:</p> <p>1. Dendrite formed of:</p> <ul style="list-style-type: none"> • Outer segment: contains membranous discs containing rhodopsin (in rods) and iodopsin (in cones). • Connecting Stalk: with modified cilium. • Inner segment <p>2. Cell body.</p> <p>3. Axon: synapses with dendrite of bipolar neuron of inner nuclear layer.</p> <p>Functions:</p> <ol style="list-style-type: none"> 1. Rods are receptors for dim light (low intensity light). 2. Cones are receptors for bright light and color vision (red, green & blue). 	<p>A region of zonulae adherents junctions between Muller cells and the photoreceptors</p>	<p>Contains nuclei of the rods & cones.</p>

Layers Of Retina

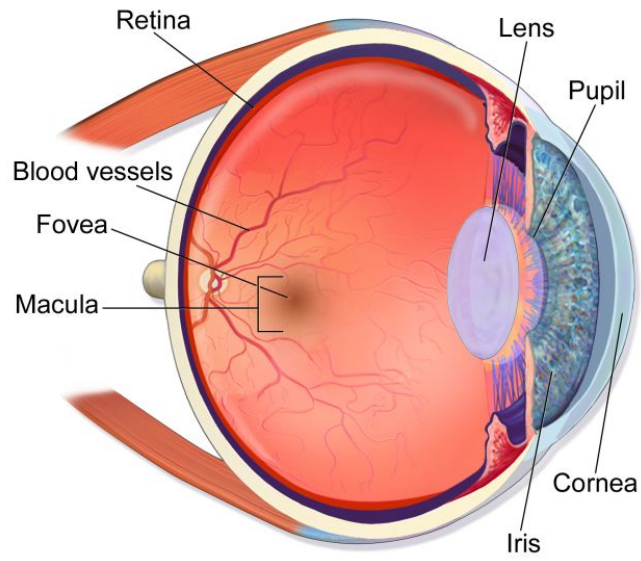
5- Outer plexiform layer:	6- Inner nuclear layer:	7- Inner plexiform layer:	8- Ganglion cell layer:	9- Optic nerve fiber layer:	10- The inner limiting membrane:
<p>Contains axodendritic synapses between the photoreceptor cells and dendrites of bipolar and horizontal cells.</p>	<p>Contains the nuclei of:</p> <ol style="list-style-type: none"> 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. 	<p>Contains axodendritic synapses between axons of bipolar neurons and dendrites of ganglion cells and amacrine cells.</p>	<p>Contains cell bodies of large multipolar neurons of the ganglion cells.</p>	<p>Contains unmyelinated axons of the ganglion cells.</p> <p>N.B. These axons become myelinated as the nerve pierces the sclera.</p>	<p>It is formed by the basal laminae of the Muller cells.</p>

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.



Eye Anatomy

Types of cells in the retina:

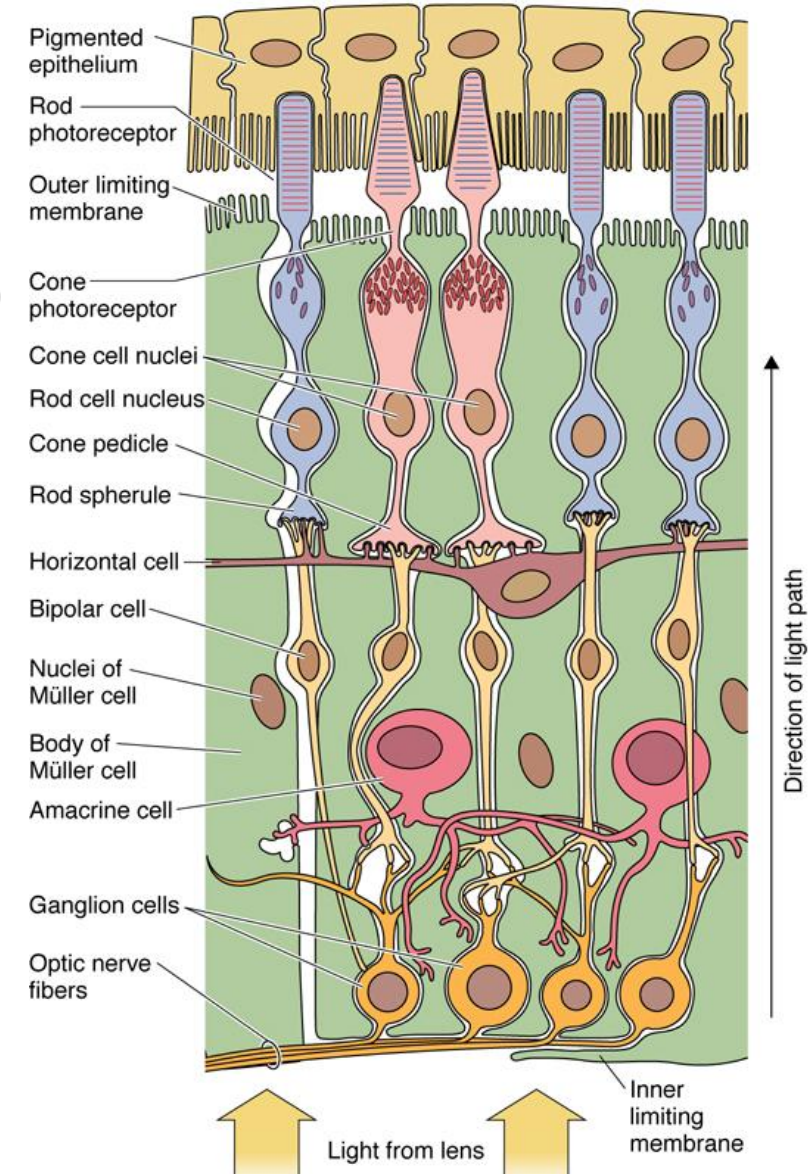
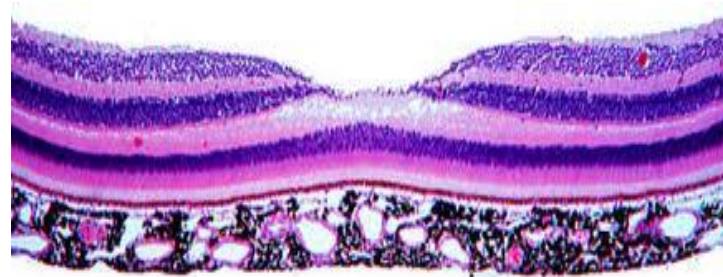
1- Pigmented epithelium.

2- Nerve cells:

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

3- Neuroglial cells:

- Müller'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).

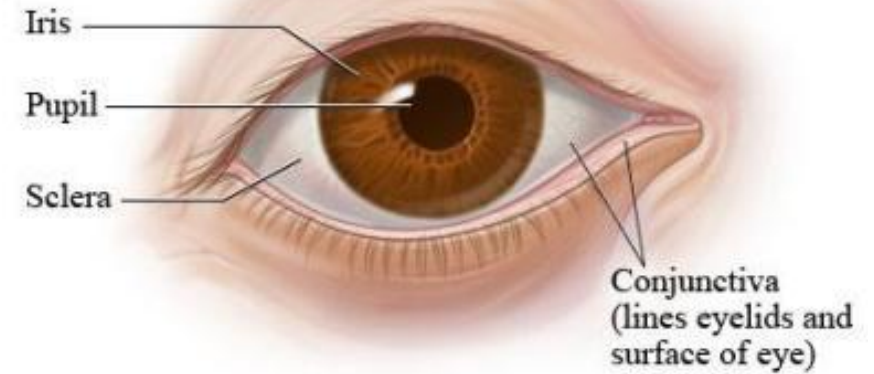
L/M:

1- Epithelium:

Stratified columnar epithelium with numerous **goblet cells** (they secrete mucins on the surface of the eye).

2- Lamina propria:

Loose C.T.



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Quiz

1, which one of the following keep the stroma dehydrated in cornea :

- A. corneal epithelium
- B. stroma of cornea
- C. bowman membrane
- D. corneal endothelium

2. Which of the following neuroglial cells are found in the retina?

- A. Cones
- B. Rods
- C. Muller's cells
- D. Ganglion cells

3. what type of cell bodies are located in ganglion cell layer of the retina :

- A. bipolar
- B. multipolar
- C. unipolar
- D. pseudo multipolar

4. which one of the following is poorly vascularized layer

- A. stroma of the iris
- B. stroma of the cornea
- C. limbus
- D. vessel layer of the iris

5. from where the ciliary processes project :

- A. from inner surface of the anterior $\frac{1}{3}$ of ciliary body
- B. from outer surface of the anterior $\frac{1}{3}$ of ciliary body
- C. from inner surface of the posterior $\frac{1}{3}$ of ciliary body
- D. from outer surface of the posterior $\frac{1}{3}$ of ciliary body

6. dense collagenous CT irregular type found in :

- A. stroma of the cornea
- B. sclera proper
- C. choroid
- D. vessel layer of the iris

Special thanks for

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- Sarah alflaij

