Histology of the Eye

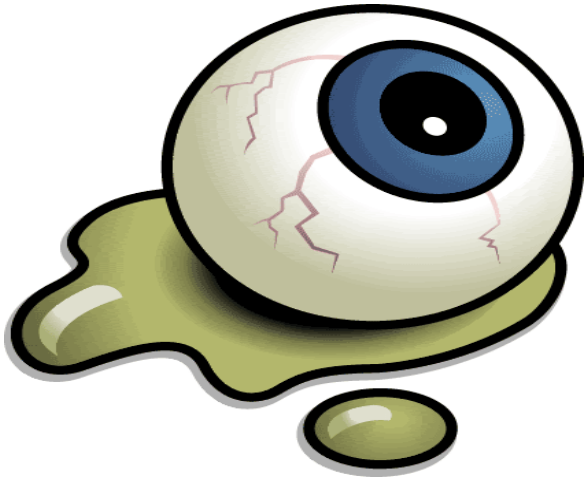
CNS Block

OBJECTIVES:

1- General structure of the eye.

2-The microscopic structure of:

- Cornea
- Retina



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For any correction, suggestion or any useful information do not hesitate to contact us: **Histology434@gmail.com**

Eye Bulb

Fibrous tunic:

- Cornea
- Sclera

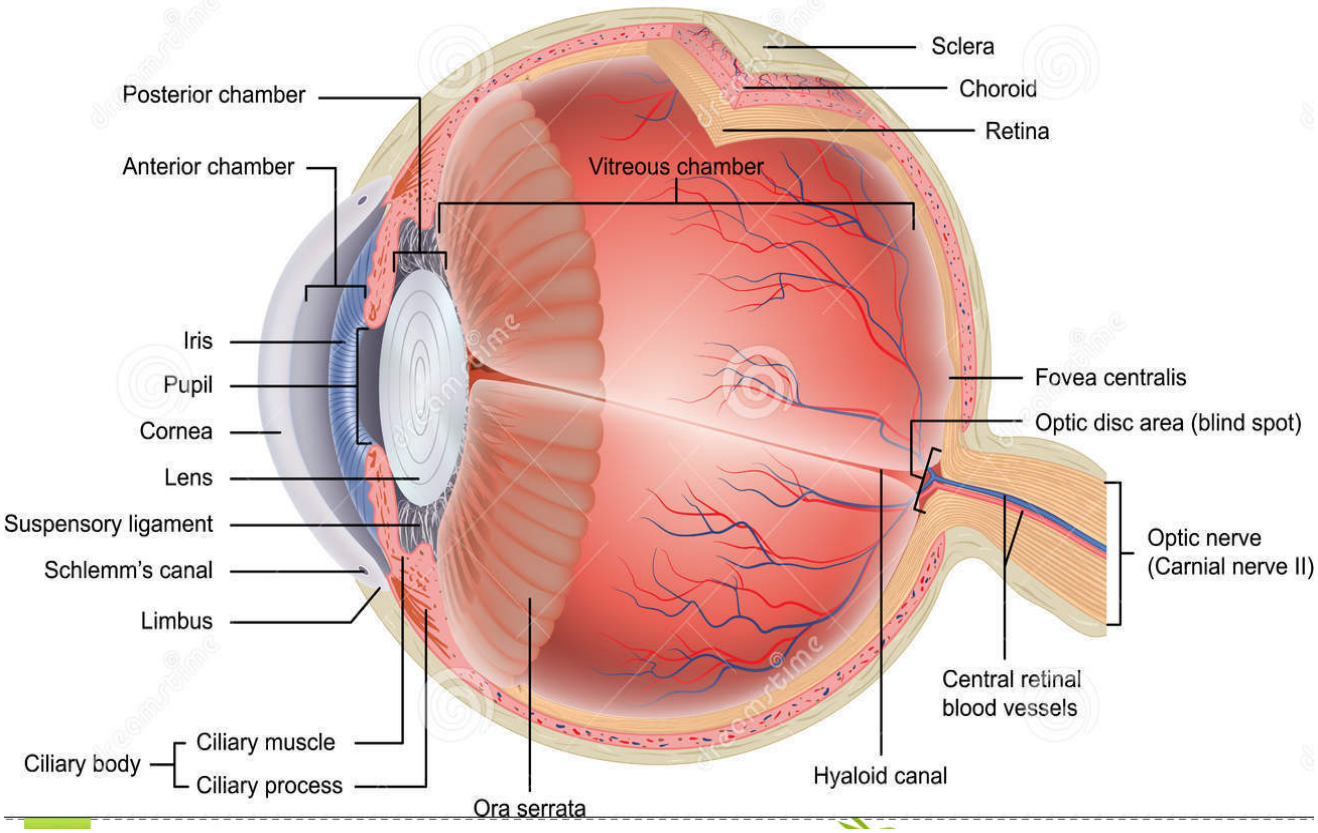
Vascular tunic: (pigmented)

- Choroid
- Ciliary body
- Iris

Neural tunic:

- Retina

Eye is a protrusion from the brain



Cornea

- It is the transparent, avascular and highly innervated anterior portion of the fibrous coat. Formed of 5 Layers:

Corneal epithelium

- Non-keratinized Stratified (more than one layer) squamous epithelium.
- Contains numerous free nerve endings.

Bowman's membrane

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

Stroma:

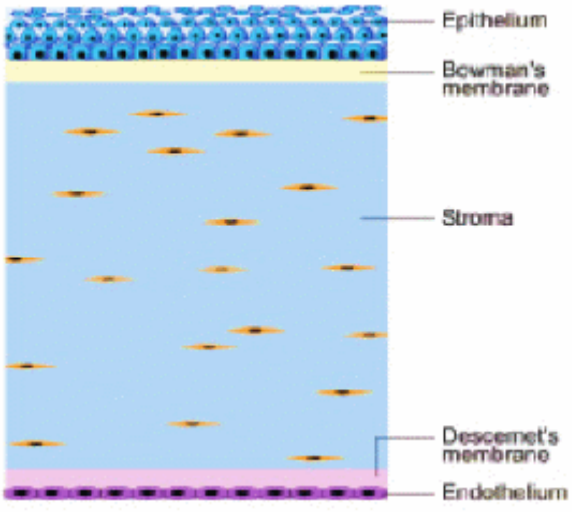
- It is the thickest layer (about 90%).
- It is composed of parallel lamellae of dense collagenous C.T.
- Each lamella is composed mainly of parallel type I collagen fibers with long fibroblasts.

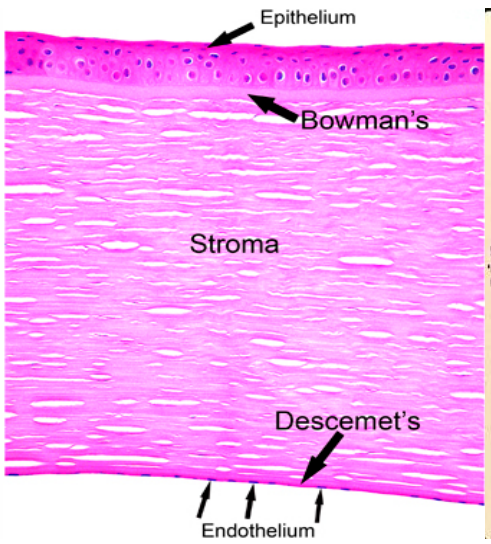
Descemet's membrane:

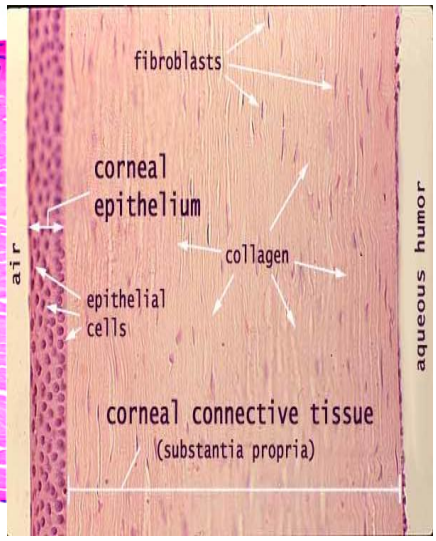
- It is a thick basement membrane.

Corneal endothelium:

- It is s simple squamous epithelium.
- **Function:**
- Formation of Descemet's membrane.
- Keeping the stroma relatively dehydrated (sod. pump → water withdrawal from the stroma).



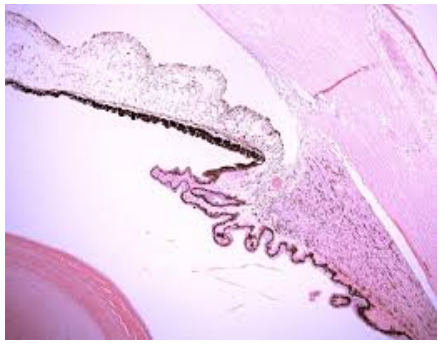




Sclera

- 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, they are esponsible for formation and secretion of melanin

LIMBUS (CORNEO SCLERAL JUNCTION)



- It is the transition region between the cornea and sclera, is about 1.5 mm width. It is highly vascular.
- It contains:

1. **Trabecular meshwork**:Endothelium-lined space. It leads to canal of Schlemm.
2. **Canal of Schlemm:**
It drains the aqueous humor into the venous system.

Choroid

- It is the **vascular**, pigmented posterior portion of the middle vascular tunic.
- **Structure:** composed mainly of loose C.T. with melanocytes.

It is separated from the retina by its Bruch's membrane.

- Anterior part of the choroid is dilated (closer to the lens)

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) .

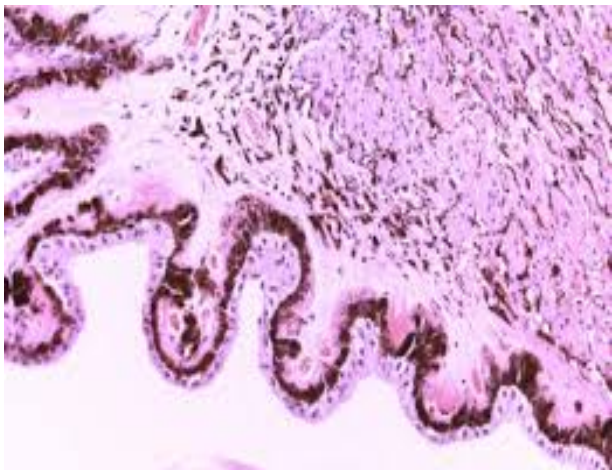
✓Its inner surface is highly folded forming the ciliary processes.

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).



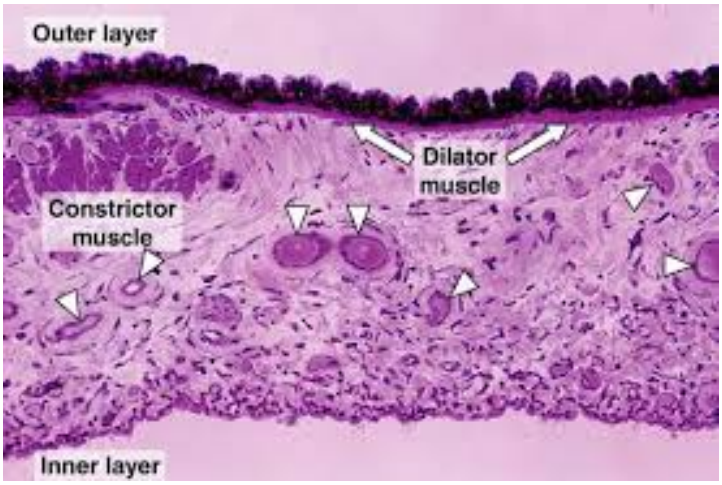
Iris

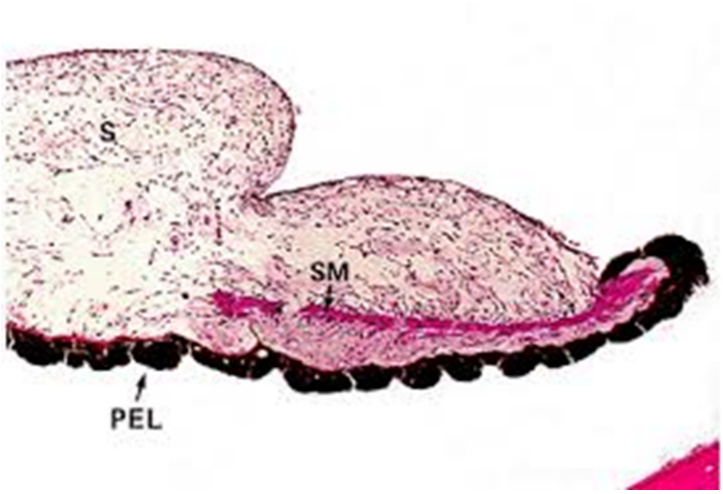
It is formed of 5 layers:

- **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).
- **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.

Iris gives the eye its color **not** the cornea
Vessel layer is more vascularized than stroma
'Pars' means area
Iris separates the anterior chamber from the posterior chamber





Retina

1- Pigmented epithelium

2- Rods & Cones later

3- Outer limiting membrane

4- Outer nuclear layer

5- Outer plexiform layer

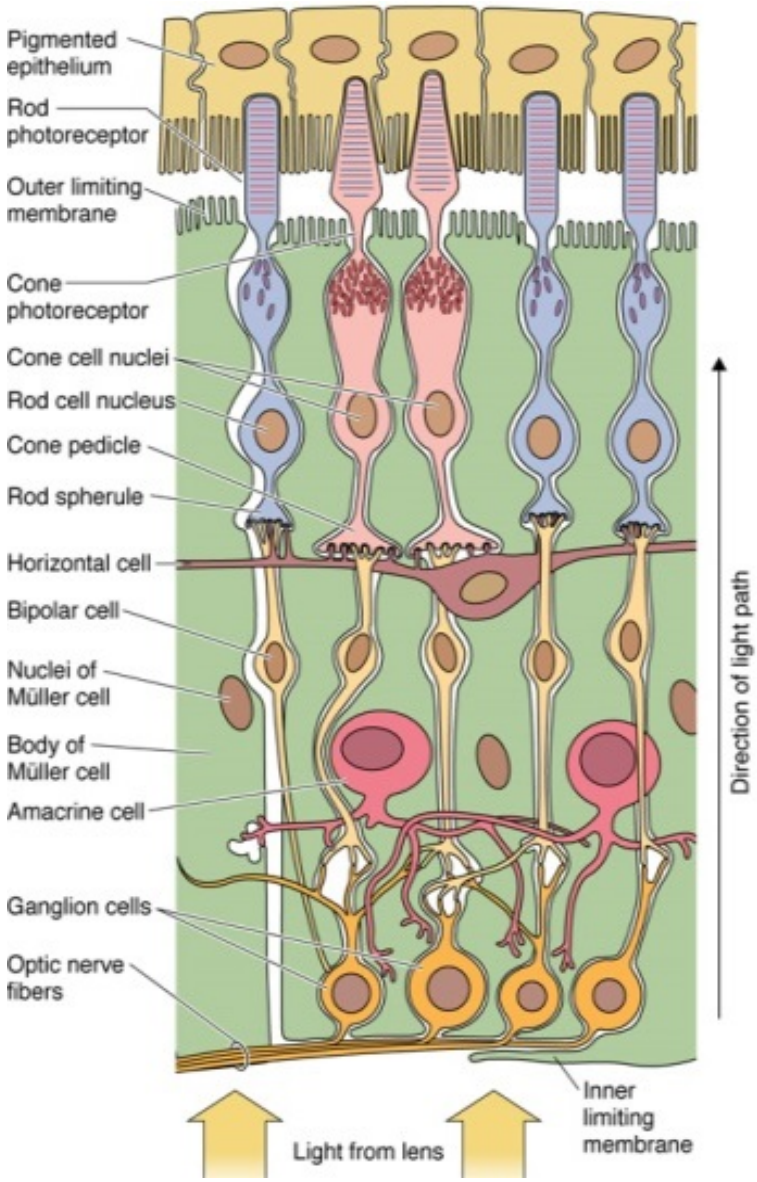
6- Inner nuclear layer

7- Inner plexiform layer

8- Ganglion cell layer

9- Optic nerve fiber layer

10- Inner limiting layer



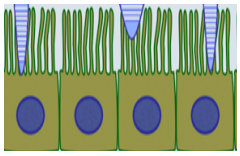
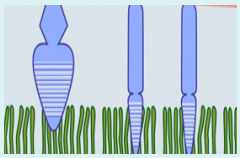
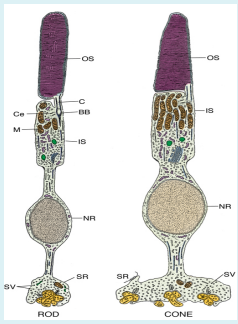
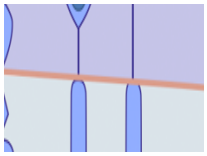
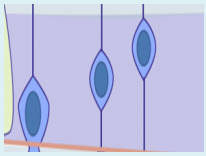
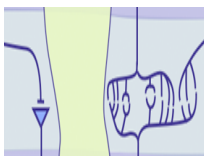
Types of cells in the Retina

Pigmented epithelium

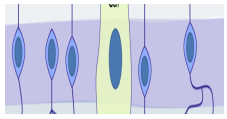
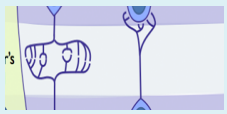
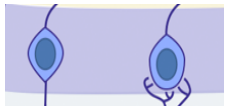
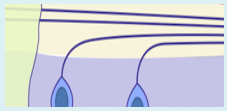
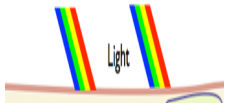
Nerve Cells
- Photoreceptor cells (rods & cones)
- Bipolar neurons.
- Ganglion cells.
- Association neurons:
  - i. Horizontal cells.
  - ii. Amacrine cells.

Neuroglial cells (supporting cells):
- Muller's cells.
- Astrocytes

Retina Cont.

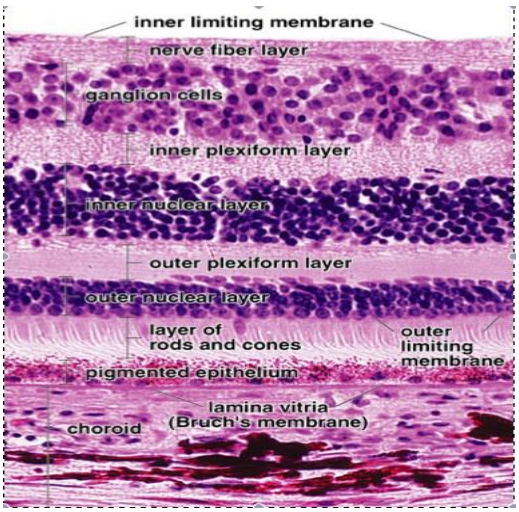
Pigmented Epithelium	-Cuboidal to Columnar cells "single layer" - Apical Microvili - Abundence of Melanin granules	1. Absorb light 2. Phagocytosis of membranous discs from tips of rods 3. Estrificationof Vitamin A in Smooth endoplasmic reticuum	
RODS AND CONES LAYER	**Photoreceptor cells**, each has: **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. Dendrites of the bipolar neurons synapse with the axon of rods and cones	- Rods are receptors for dim light (low intensity light). - Cones are receptors for bright light and color vision (red, green & blue). Rods and cones layer only contains the Dendrites	 
Outer limiting membrane	A region of zonulae adherents junctions between Muller cells and the photoreceptors.		
Outer nuclear layer	Contains nuclei of the rods and cones.		
Outer plexiform layer	Contains axodendritic synapses between the photoreceptor cells and dendrites of bipolar horizontal cells.		

Retina Cont.

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.	
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. Ganglion nerve cells are large nodular cells	
Optic nerve fiber layer	Contains unmyelinated axons of the ganglion cells. N.B. These axons become myelinated as the nerve pierces the sclera. Axons of bipolar neurons form the optic nerve	
Inner limiting membrane	It is formed by the basal laminae of the Muller cells. **Nuclei** of Muller cells are in the inner nuclear layer	

Fovea Centralis

It lies in the center of macula lutea.
Cones are highly concentrated in the fovea.
It is responsible for visual acuity.
Has no rods
Lutea: white spot



Conjuctiva

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)

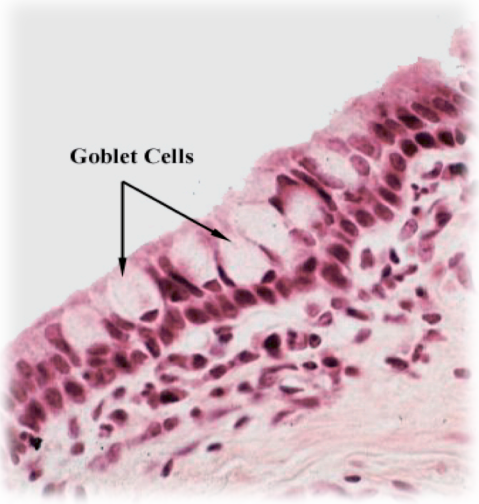
L/M

Lamina propria

Loose connective tissue

Epithelium

Stratified columnar epithelium with numerous goblet cells



Summary

Fibrous Tunic

Cornea

Its transparent, avascular and highly innervated anterior portion of fibrous coat

5 Distinct layers:

1- Corneal Epithelium	- Contains numerous free nerve endings
2- Bowman's Membrane	- Its homogenous non-cellular layer containing type I collagen fibrils
3- Stroma	- It is the thickest layer (90%)
4- Descemet's Membrane	- It is a thick basement membrane
5- Corneal Endothelium	- It is a simple squamous epithelium

Sclera

It covers the posterior 5/6 of the fibrous tunic

Sclera Proper:

- Consist of interlacing bundles of type I collagen

Lumbus (Corneo Scleral Junction)

- It is the transition region between the cornea and sclera

Vascular Tunic

Choroid

- It is vascular, pigmented, posterior portion of the middle vascular tunic
- It is separated from the retina by its Brunch's membrane

Ciliary Body

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

Iris

Formed of 5 layers:

1- Anterior border layer
2- Stroma
3- Vessel layer
4- Dilator pupillae muscle layer
5- Posterior surface layer

Neural Tunic

Retina

Composed of 10 distinct layers:	Type of cells:
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	1- Pigmented epithelium 2- Nerve cells: - Photoreceptors cells (rods & cons) - Bipolar neurons - Ganglion cells - Association cells * Horizontal cells * Amacrine cells 3- Neuroglial cells: - Muller's cells - Astrocytes

MCQs

1) The Choroid ciliary body is conceded of which one of the eye bulb tunics?

A. Vascular tunic.
B. Neural tunic.
C. Fibrous tunic.

2) A transparent avascular and highly innervated anterior portion of fibrous coat?

A. Retina.
B. Sclera.
C. Cornea.

3) The Bowman's membrane is composed of which type of collagen?

A. Type 1 collagen.
B. Type 2 collagen.
C. Type 3 collagen..

4) Which of the cornea's layers are responsible of keeping the stroma relatively dehydrated?

A. Descemet's membrane.
B. Corneal epithelium.
C. Corneal endothelium.

Answers:

1) A
2) C
3) A
4) C

SAQs

5) What does the limbus contain?

Trabecular meshwork and a Canal of schlemm.

6) The structure that is responsible about the phagocytosis of membranous discs from the tips of rods?

Retina.

7) It lies in the center of macula lutea and it is responsible for visual acuity?

Fovea centralis

Thank you for checking our work