



# LECTURE 2: HISTOLOGY OF THE EYE

## ❑ 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

NOTE: If there is a purple ( \* ) next to a word, you will find it in the extra note on PAGE 7

# YE BULB

three coats (3 Tunics)

## Fibrous tunic:

- Cornea.
- Sclera.

## Vascular tunic

- Choroid.
- Ciliary body.
- Iris.

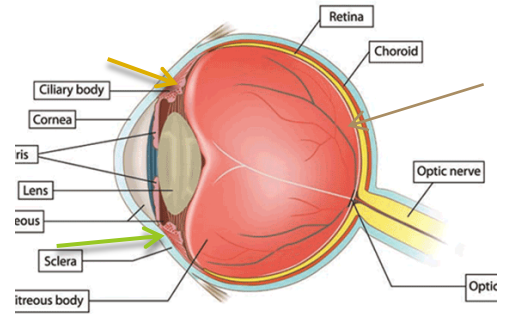
## Neural tunic

- 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

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

### 2-bowman's membrane

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

### 3-Stroma.

the thickest layer (about 90%).

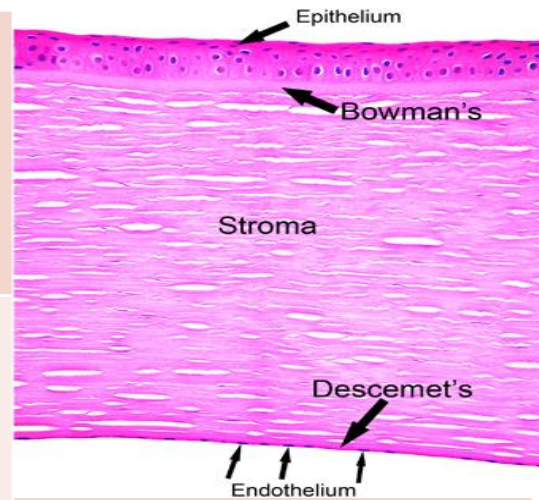
- Composed of parallel lamellae of **dense collagenous C.T.**

### 4-Descemet's membrane

- Thick basement membrane

### 5-Corneal endothelium.

- **simple squamous epithelium.**



- *Each lamella:* Composed mainly of parallel **type I collagen** fibers with long **fibroblasts.**

\*Formed by: Corneal Endothelium. (the layer under it)

### ❖ **Function:**

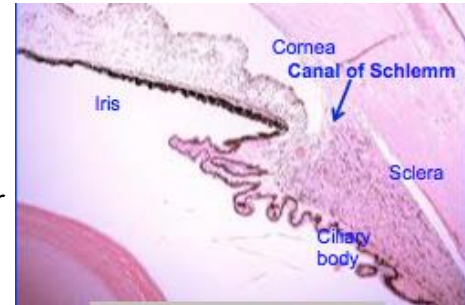
- Keeping the stroma relatively dehydrated (sod pump → water

# 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.

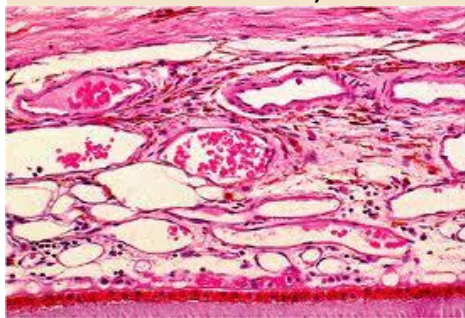


### CHOROID

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



### 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).
- inner surface (pars ciliaris):  
(2 rows of columnar cells: outer pigmented & inner non-pigmented)
- Its inner surface is

### CILIARY PROCESSES

-Processes project from the inner surface of the anterior 1/3 of the ciliary body towards the lens.

#### **Structure:**

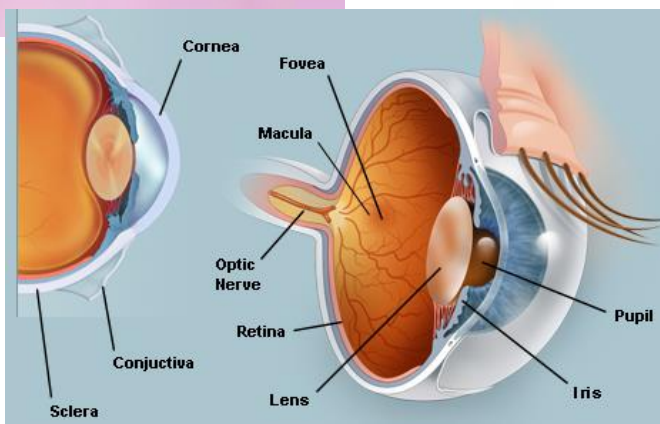
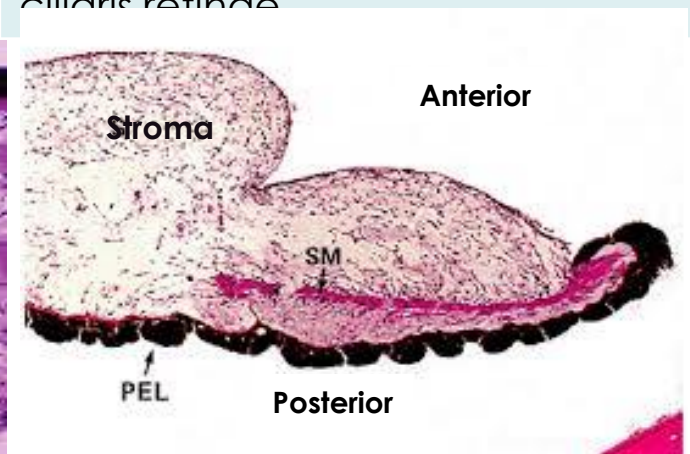
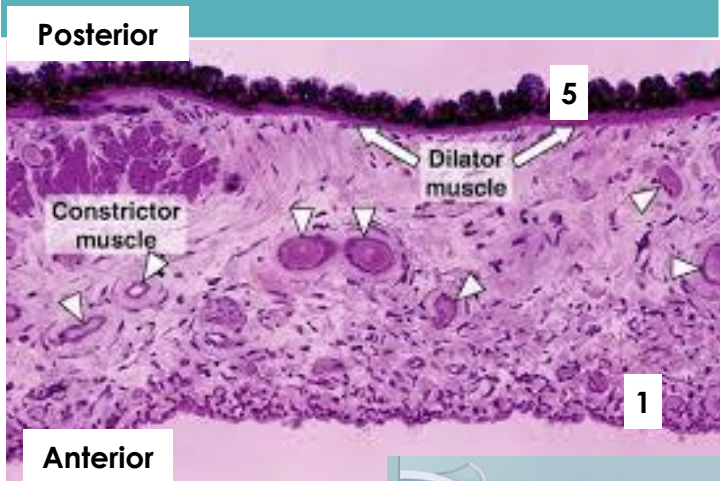
- Are covered by pars ciliaris retinae (2 rows of columnar cells) and **attach to lens**



# IRIS

It is formed of **5 layers** (colored part)

<p><b>1) Anterior border layer</b></p>	<p>Incomplete layer of:</p> <ul style="list-style-type: none"> <li>• fibroblasts</li> <li>• melanocytes.</li> </ul>
<p><b>2) Stroma</b></p>	<p><b>Poorly vascularized C.T</b> with:</p> <ul style="list-style-type: none"> <li>• fibroblasts</li> <li>• melanocytes.</li> </ul>
<p><b>3) Vessel layer</b></p>	<p><b>Well-vascularized loose C.T.</b> Centrally, it contains circularly arranged <u>smooth muscle fibers</u> (sphincter pupillae muscle).</p>
<p><b>4) Dilator pupillae muscle layer</b></p>	<p>Contains radially arranged myoepithelial cells.</p>
<p><b>5) Posterior surface layer</b> (<i>pigmented epithelium layer</i>)</p>	<p>It is composed of two rows of <u>pigmented epithelial cells</u> (pars iridis retinae) They are the continuation of pars ciliaris retinae</p>





# RETINA

It is formed of 10 distinct layers

From Inside to Outside

1) Inner limiting\* layer

2) Optic nerve fiber layer

3) Ganglion cell layer

4) Inner plexiform\* layer

5) Inner nuclear layer

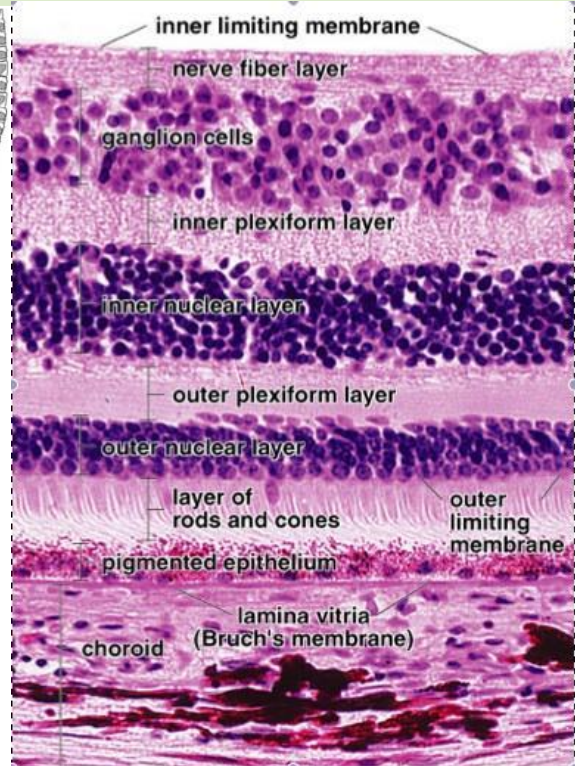
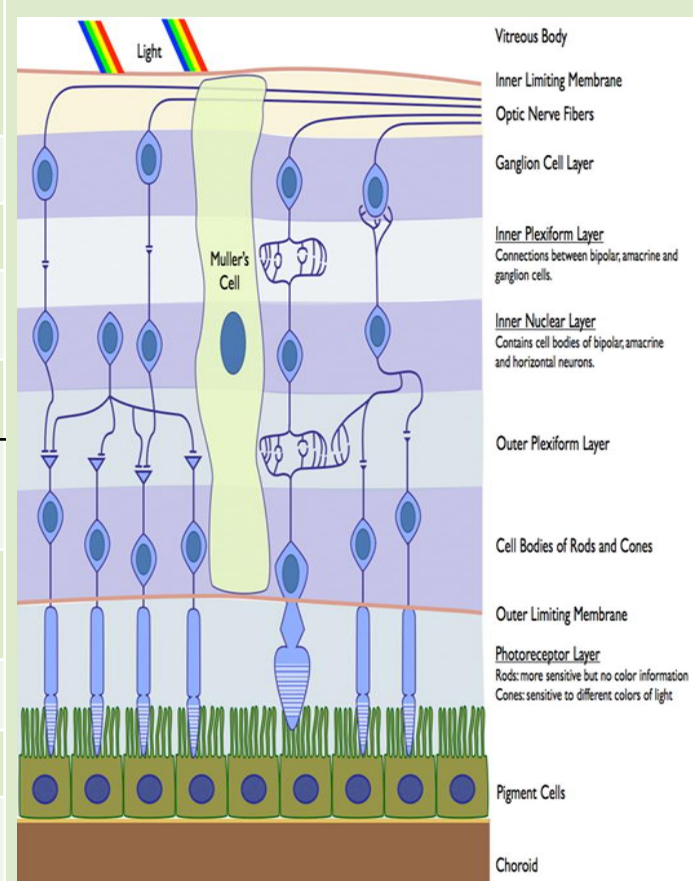
6) Outer plexiform\* layer

7) Outer nuclear layer

8) Outer limiting\* membrane

9) Rods and cones layer

10) Pigmented epithelium



Types of cells in the retina:

1. **Pigmented epithelium**

2. **Nerve cells:**

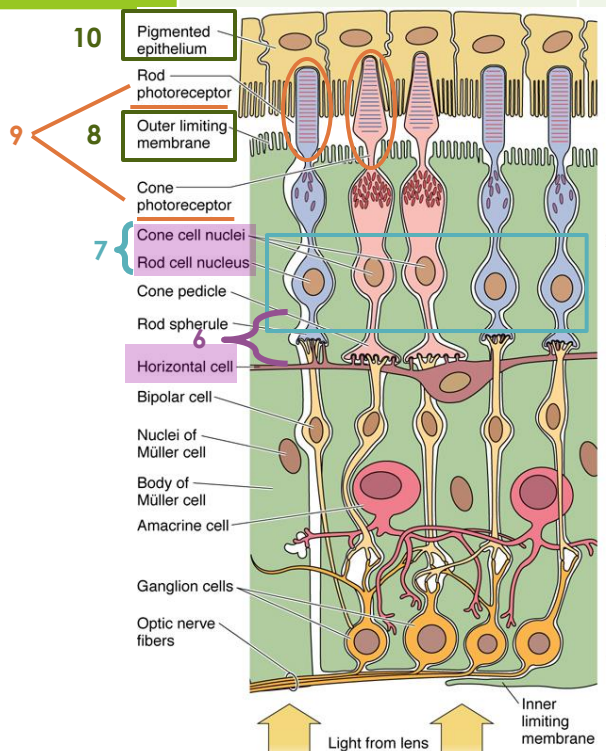
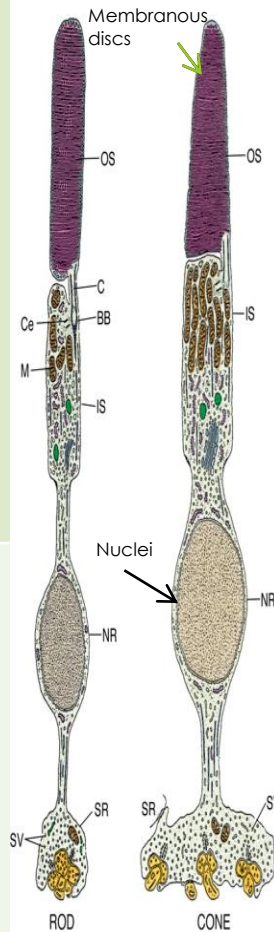
- Photoreceptor cells (rods and cones)
- Bipolar neurons
- Ganglion cells

3. **Neuroglial cells:**

- Muller's cells
- Astrocytes

# RETINA (Cont.) [from outside to inside]

Layer	10) Pigmented epithelium	9) Rods and cones layer (photoreceptor cells)
Cells/ Architecture	<ul style="list-style-type: none"> <li>Cuboidal to columnar cells (single layer)</li> <li>Apical microvilli</li> <li>Abundance of melanin granules</li> </ul>	<ol style="list-style-type: none"> <li><b>Dendrites</b> formed of:               <ul style="list-style-type: none"> <li>Outer segment (OS): contains membranous discs containing rhodopsin (in rods) and iodopsin (in cones).</li> <li>Connecting Stalk: with modified cilium.</li> <li>Inner segment (IS).</li> </ul> </li> <li><b>Cell body</b></li> <li><b>Axon:</b> synapses with dendrites of bipolar neurons of inner nuclear layer.</li> </ol>
Function	<ol style="list-style-type: none"> <li>Absorb light</li> <li>Phagocytosis of membranous discs from tips of rods</li> <li>Esterification of vitamin A (in SER).</li> </ol>	<ul style="list-style-type: none"> <li><b>Rods</b> are receptors for dim light (low intensity light)</li> <li><b>Cones</b> are receptors for bright light and color vision (Red, Green, Blue)</li> </ul>



<p><b>8) Outer limiting membrane</b></p>	<p>A region of zonulae adherents junctions between Muller cells and the photoreceptors.</p>
<p><b>7) Outer nuclear layer:</b></p>	<p>Contains nuclei of the rods &amp; cones</p>
<p><b>6) Outer plexiform layer:</b></p>	<p>Contains axodendritic synapses between the photoreceptor cells and dendrites of bipolar and horizontal cells.</p>

# RETINA (Cont.) [from outside to inside]

## 5) Inner nuclear layer:

Contains the nuclei of:

- Bipolar neurons.**
- Horizontal neurons\***
- Amacrine neurons** (unipolar neurons)
- Neuroglial cells "Muller cells"** that extend between the vitreous body and the inner segments of rods and cones.

## 4) Inner plexiform layer:

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

## 3) Ganglion layer:

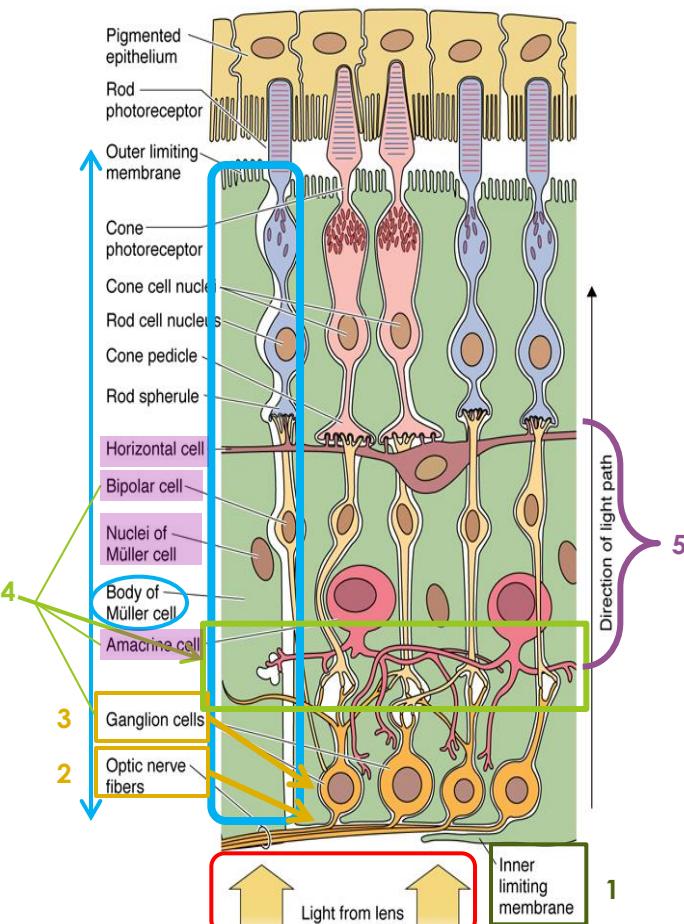
Contains cell bodies of large multipolar neurons of the ganglion cells.

## 2) Optic nerve fiber layer:

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

## 1) Inner limiting membrane:

It's formed by the basal laminae of the Muller cells.



## NOTES:

- \*Aqueous humor is water like / vitreous humor is jelly like.
- \*The cornea is transparent to allow the passage of light.
- \*Corneal Epithelium is stratified for protection.
- \* "Meshwork" = fibers are very narrow and delicate.
- \*Limiting membranes = have to do with Muller Cells
- \*The Plexiform Layers are the places where synapse happens
- \*The horizontal cell separates the 2 plexiform layers.
- \*The conjunctiva doesn't cover cornea. Only inner eyelids and sclera.



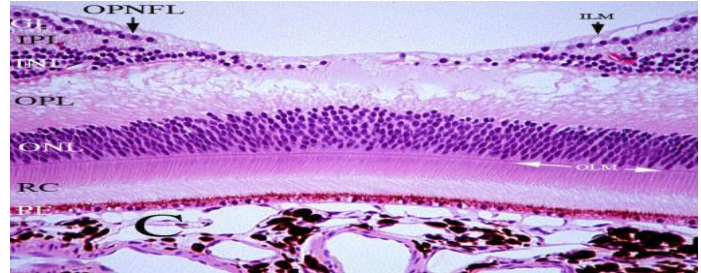
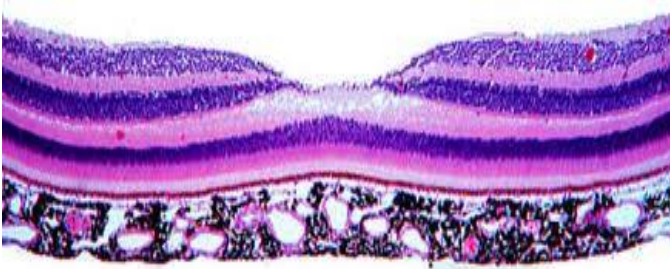
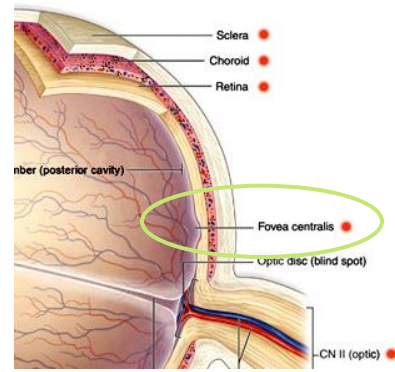
# RETINA (Cont.):

## FOVEA CENTRALIS

**Location:** In the center of **macula lutea**

**Components:** Highly concentrated with **CONES**

**Function:** It is responsible for **visual acuity**



## CONJUNCTIVA

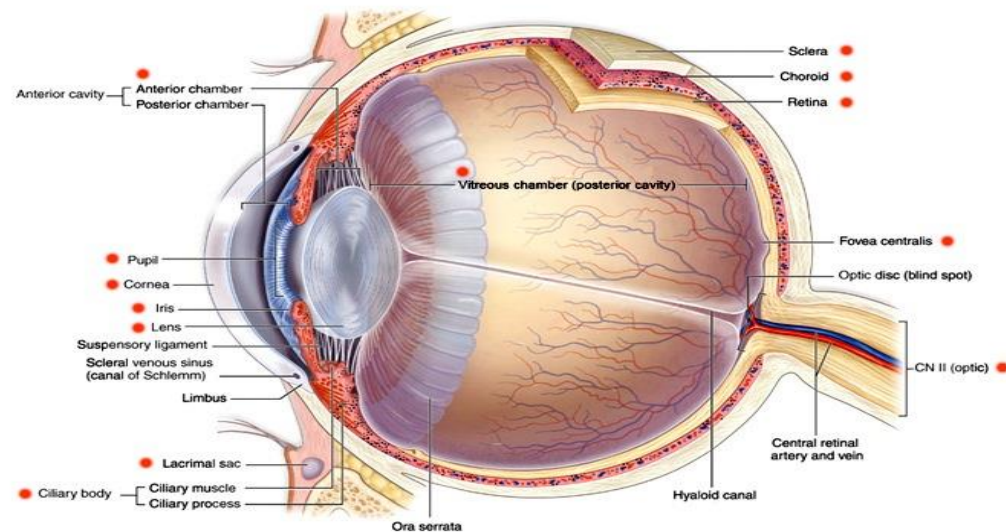
It's the **transparent mucous membrane** lining the inner surface of the eyelids (palpebral conjunctiva) and reflecting onto the sclera of the anterior surface of the eye (bulbar conjunctiva).

### 1- Epithelium:

- Stratified columnar epithelium
- numerous goblet cells.

### 2- Lamina propria:

- Loose C.T.





# MCQs

**Q1- A layer of the Cornea that contains type 1 collagen fibrils:**

- a) Corneal layer
- b) Bowman's layer
- c) Stroma layer

**Q2- The Stroma is:**

- a) The thickest layer of Cornea
- b) Non-keratinized
- c) Lined by Simple Squamous Epithelium

**Q3- The formation of Descemet's membrane is the function of:**

- a) Corneal Epithelium
- b) Corneal Endothelium
- c) Stroma

**Q4- Melanocytes are located in:**

- a) Iris
- b) Sclera
- c) Choroid
- d) All of the above

**Q5- Which of the following are cells found in the Retina?**

- a) Squamous cells
- b) Goblet cells
- c) Pigmented Epithelium

**Q6- The Retina is responsible for the esterification of:**

- a) Vitamin A
- b) Vitamin C
- c) Vitamin B

**Q7- The transparent mucous membrane lining the inner surface of the eye is:**

- a) Iris
- b) Conjunctiva
- c) Eye Bulb

**Q8- The Limbus (Corneoscleral junction) is about:**

- a) 1.5 mm in length
- b) 1.5 mm in width
- c) 1.5 cm in width

**Q9- The Choroid is separated from Retina by:**

- a) Bowman's Membrane
- b) Brunch's Membrane
- c) Descemet's Membrane

**Q10- The inner surface of the Ciliary Body is lined by:**

- a) Two rows of Columnar cells (outer pigmented & inner non-pigmented)
- b) One row of pigmented Columnar cells
- c) Two rows of Columnar cells (inner pigmented & outer non-pigmented)