## Motivational Corner:

"It does not matter how slowly you go as long as you do not stop."

For better understanding, please check the summary that is in the last slide before starting to study the lecture.
Good luck.




# Objectives:

By the end of this lecture, the student should be able to describe:

1- The general structure of the eye.
2- The microscopic structure of:
Cornea.
Retina.

## 2-

# Histology of the eye.

Extra notes: Gray
**Important notes: Red**

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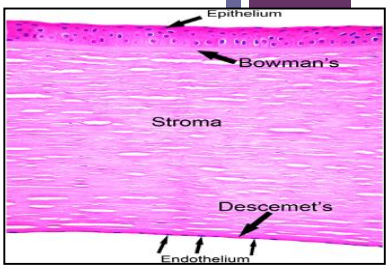
# Fibrous Tunic

## 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

**- 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.

### 4. Descemet's membrane

- It is a thick basement membrane.

### 5. Corneal endothelium.

It is s 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:**

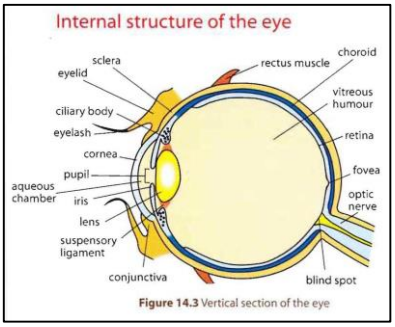


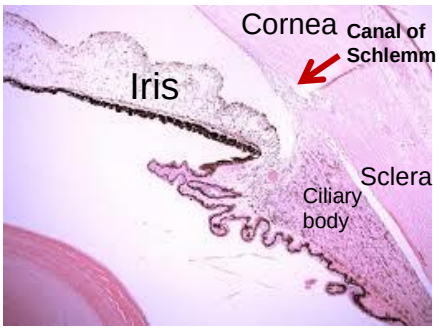
Figure 14.3 Vertical section of the eye

### Canal of Schlemm:

It drains the aqueous humor into the venous system.

### Trabecular meshwork:

Endothelium-lined spaces.
It leads to canal of Schlemm

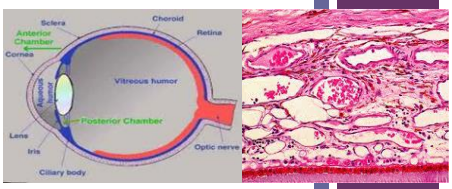



## Sclera

- 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:

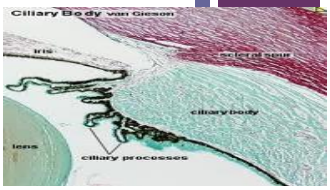



It is the vascular, pigmented posterior portion of the middle vascular tunic.

**Structure:**

It is composed mainly of loose C.T. with melanocytes. It is separated from the retina by its Bruch's membrane

## Ciliary body:

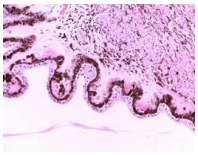



It is the anterior continuation of the choroid. It surrounds the lens.

**Structure:**

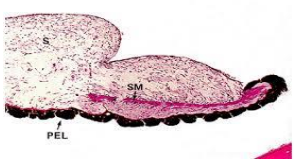
- It is formed of loose vascular and pigmented C.T. that contains 3 bundles of smooth muscle cells (ciliary muscle).
- Its inner surface is lined by pars ciliaris retinae ( 2 rows of columnar cells; outer pigmented and inner non- pigmented layers) .
- Its inner surface is highly folded forming the **ciliary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

## Iris:




**5 layers**

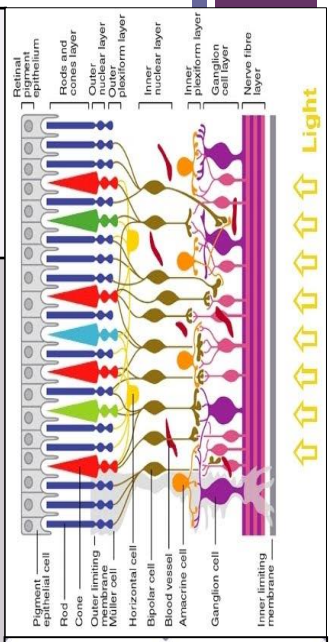
- **Anterior border layer:**
  - Incomplete layer of fibroblasts and melanocytes
- **Stroma:**
  - Poorly vascularized C.T. with fibroblasts and melanocytes.
- **Vessel layer:**
  - Well-vascularized loose C.T.
  - Centrally, it contains circularly arranged smooth muscle fibers (sphincter pupillae muscle).
- **Dilator pupillae muscle layer:**
  - Contains radially arranged myoepithelial cells.
- **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

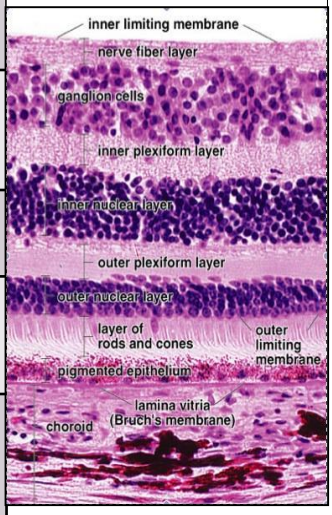
# Neural Tunic

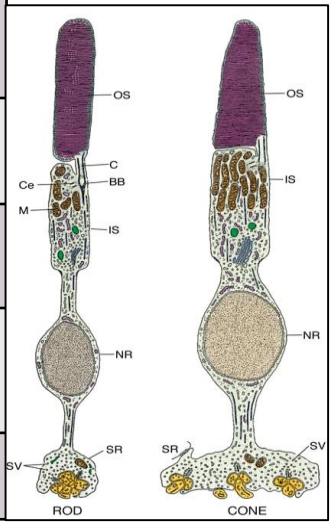
## Retina

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

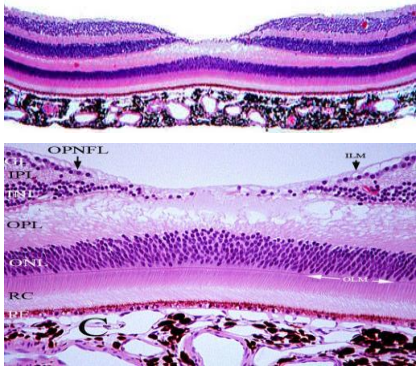
| | |
|---|---|
| 1- Pigmented epithelium | - **Cuboidal** to columnar cells (single layer).<br>- **Apical** microvilli.<br>- Abundance of **melanin granules**.<br>- **Functions:**<br>• Absorb light.<br>• Phagocytosis of membranous discs from tips of rods.<br>• Esterification of Vitamin A (in SER). |
| 2- Rods and cones layer | - Are photoreceptor cells.<br>- Each has:<br>1. **Dendrite** formed of:<br>• **Outer segment (OS):** contains membranous discs containing rhodopsin (in rods) and iodopsin (in cones).<br>• **Connecting Stalk:** with modified cilium.<br>• **Inner segment (IS).**<br>2. **Cell body.**<br>3. **Axon:** synapses with dendrite of bipolar neuron of inner nuclear layer.<br>- Functions:<br>• **Rods** are receptors for **dim** light ( low intensity light).<br>• **Cones** are receptors for **bright** light and color vision (red, green & blue). |
| 3- Outer limiting membrane. | A region of **zonulae adherents junctions** between **Muller cells** and the **photoreceptors**. |
| 4- Outer nuclear layer | Contains **nuclei** of the **rods** & **cones**. |
| 5- Outer plexiform layer | Contains **axodendritic synapses** between the **photoreceptor cells** and **dendrites** of bipolar and horizontal cells. |
| 6- Inner nuclear layer | Contains the **nuclei** of:<br>• **Bipolar** neurons.<br>• **Horizontal** neurons.<br>• **Amacrine** neurons (**unipolar** neurons):<br>• **Neuroglial** cells (**Muller** cells) that extend between the vitreous body and the inner segments of rods and cones. |
| 7- Inner plexiform layer | Contains **axodendritic** synapses between axons of bipolar neurons and dendrites of ganglion cells and amacrine cells. |
| 8- Ganglion cell layer | Contains **cell bodies** of large **multipolar** neurons of the **ganglion** cells. |
| 9- Optic nerve fiber layer | Contains **unmyelinated** axons of the ganglion cells.<br>N.B. These axons become **myelinated** as the nerve **pierces** the sclera. |
| 10- Inner limiting layer | It is formed by the **basal laminae** of the **Muller** cells. |



# Retina cont.

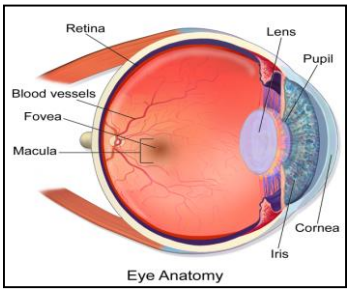


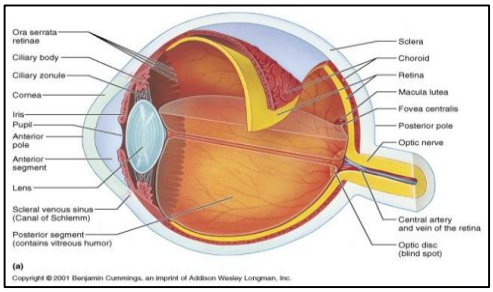

## Fovea centralis:

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

## Types of cells in the retina:

- 1- Pigmented epithelium.
- 2- Nerve cells:
  - Photoreceptor cells (rods & cones)
  - Bipolar neurons.
  - Ganglion cells.
  - Association neurons:
    - i. Horizontal cells.
    - ii. 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:

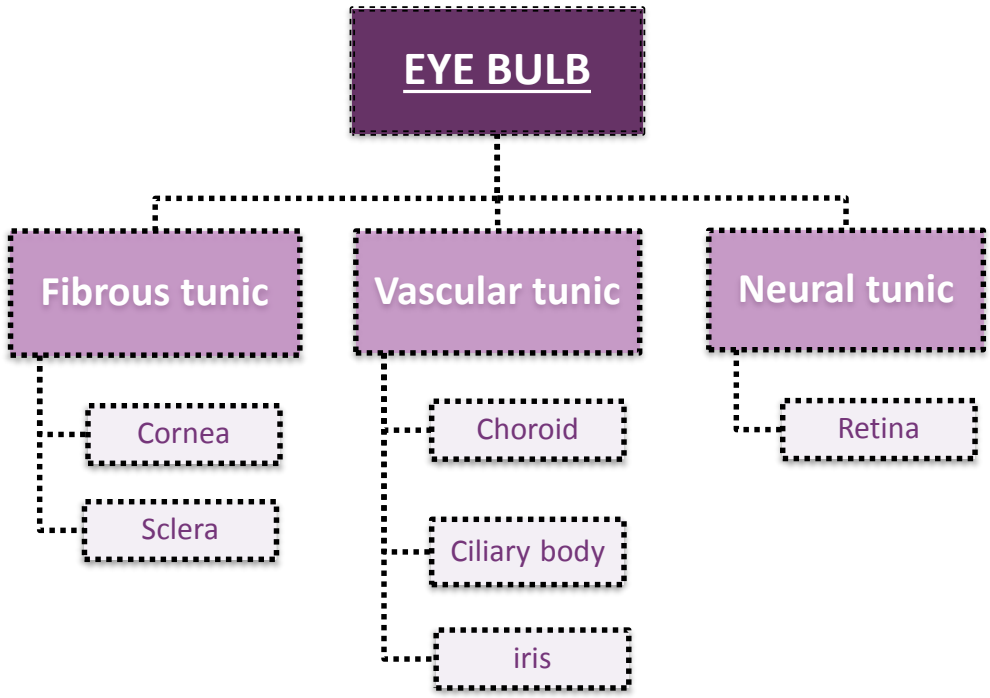
1- Epithelium:

Stratified columnar epithelium with numerous goblet cells.

2- Lamina propria:

Loose C.T.

# Summary




## MCQs

1) What are neurons in the retina?
a. Unipolar
b. Pseudounipolar
c. d. Multipolar
d.Both a and b
e. Bipolar

2) Each lamella of Stroma is composed of which type of coallagen?
a.Type2collagen
b.Type1collagen
c.Type3collagen
d. Type4collgen.
e.Type A collagen

3) Which layer forms the majority of the cornea?
a. Epithelium
b. Endothelium
c. Descemet's membrane
d. Bowman's membrane
e. Substantia propria

4) Which structure is transparent?
a. Cornea
b. Ciliary body
c. Iris
d. Ora serrata
e. Choroid

5) What is the space anterior to the iris?
a. Posterior chamber
b. Anterior chamber
c. Vitreal cavity
d. Both a and b
e. All of a, b, and c

6) Melanocytes of sclera proper are located in the deeper regions?
a.True
b.false

**Thanks you for checking our work, Good luck.**
**-Team histology.**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