

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

— IN THE NAME OF ALLAH —



# THE EYE

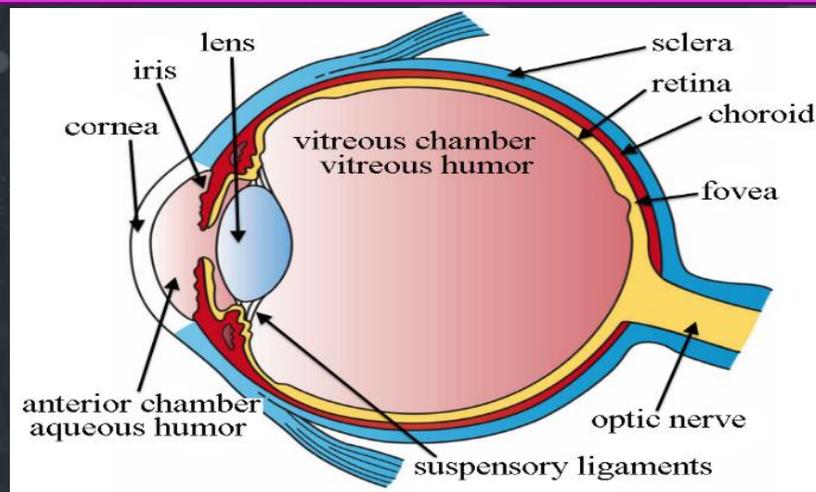
Dr. Dalia Eita

## Definition:

The eyes are photosensitive organs that provide us with the sense of sight.

## Site:

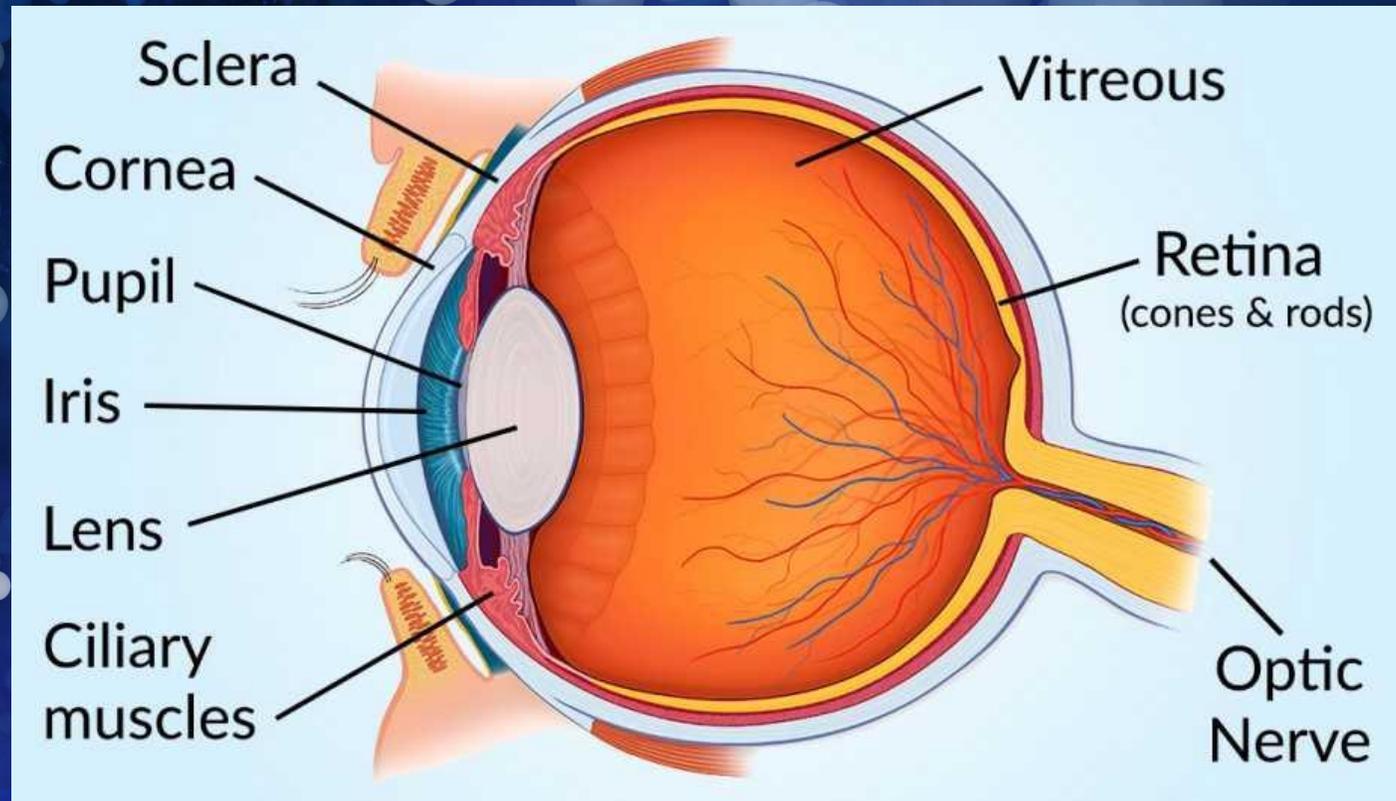
- The eyes are located in a protective bony structure of the skull, the orbit.
- The wall of the eyeball consists of 3 coats (layers):
  - 1- Outer fibrous layer : cornea and sclera.
  - 2- Middle vascular or uveal layer : choroid, ciliary body and iris.
  - 3- Inner nervous layer : retina.



# 1-THE OUTER FIBROUS COAT

**Cornea**

**Sclera**



# The Cornea

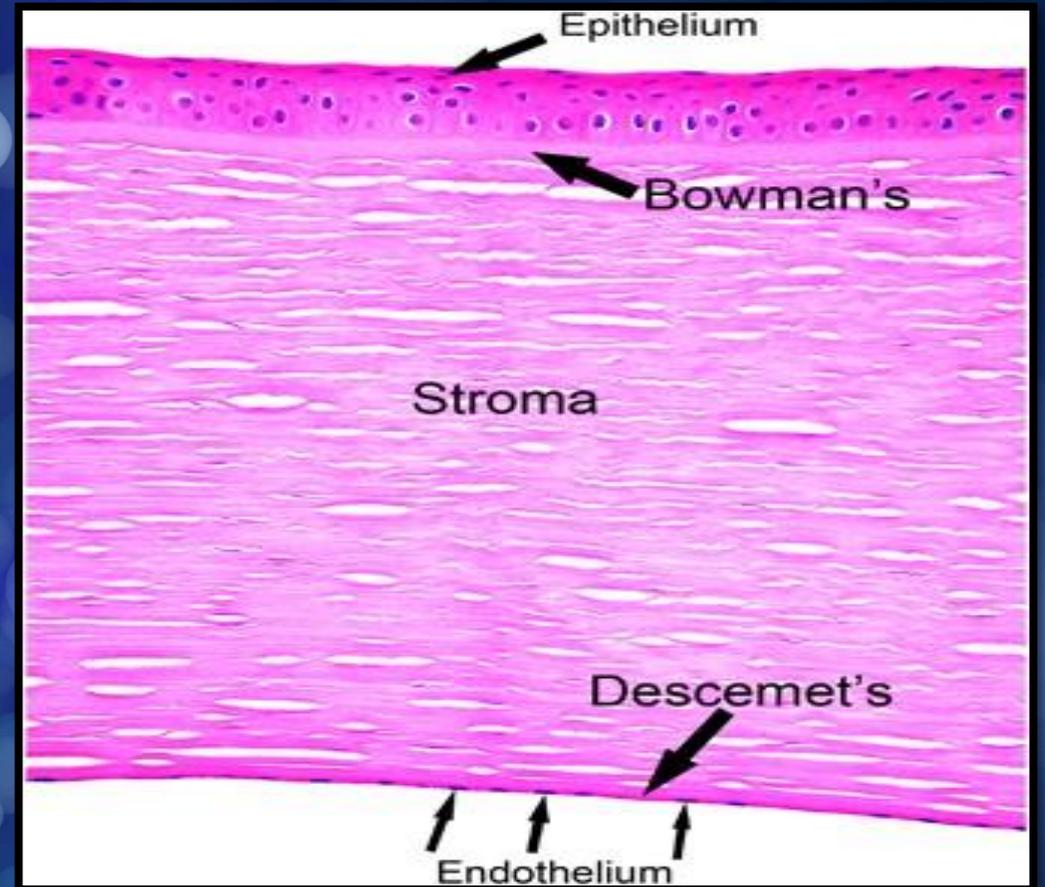
## Definition:

It is the anterior 1/6 of the outer fibrous coat. It is colourless, non vascular and transparent.

## L.M:

A transverse section shows that it consists of 5 layers from outside inwards:

1. *Epithelium*
2. *Bowman's membrane*
3. *Substantia propria*
4. *Descemet's membrane*
5. *Descemet's endothelium*

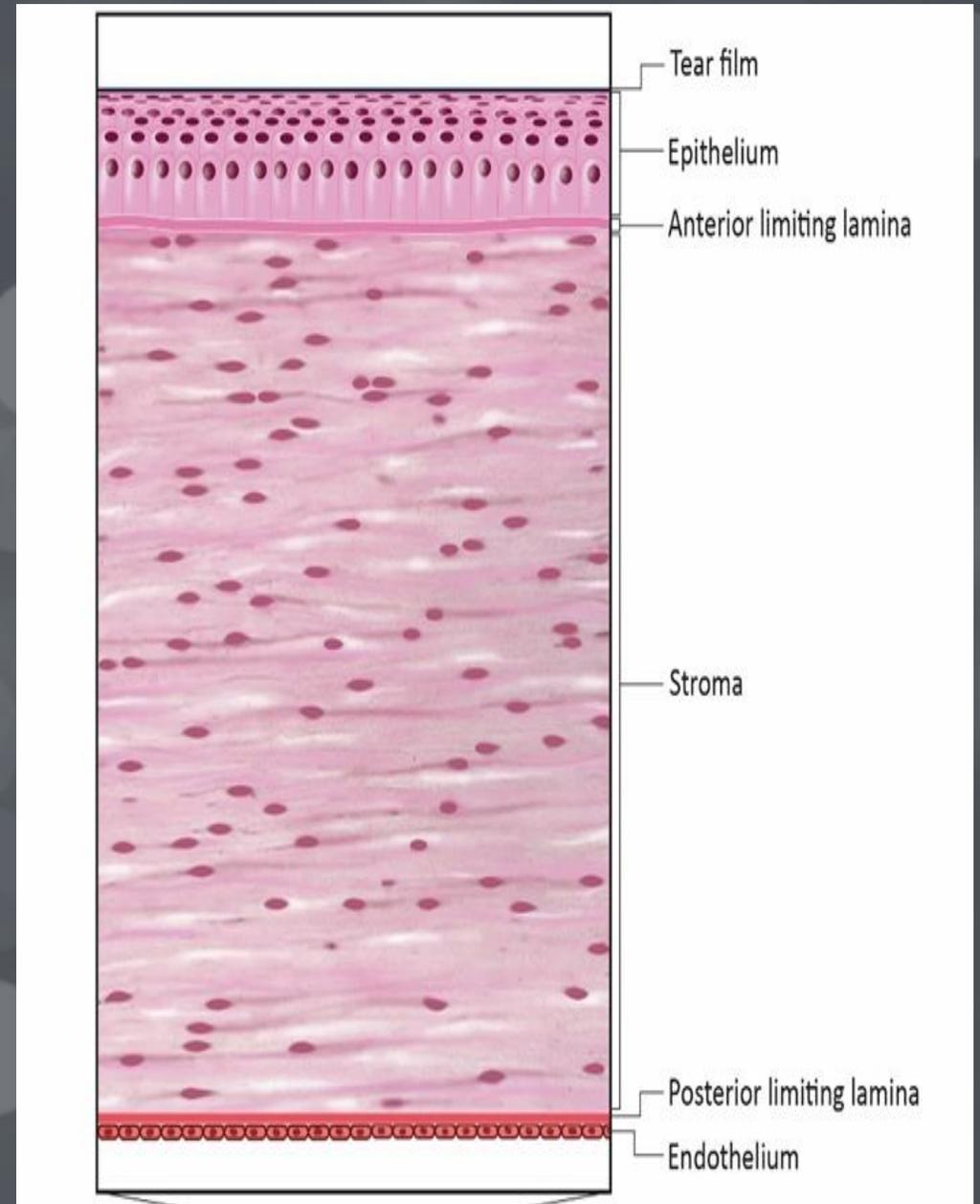


**1) Epithelium:** it is a thin layer of stratified squamous non keratinized epithelium formed of 5-6 layers of cells:

**a) The basal layer:** a single layer of cubical cells lying on a straight basement membrane.

**b) The intermediate layers:** are 3-4 layers of polyhedral cells with numerous free nerve ending in between.

**c) The top layer:** squamous cells provided with microvilli which retain a film of tears, a protective layer of lipid and glycoprotein, which keeps the cornea wet all the time.



## **2) Bowman's membrane:**

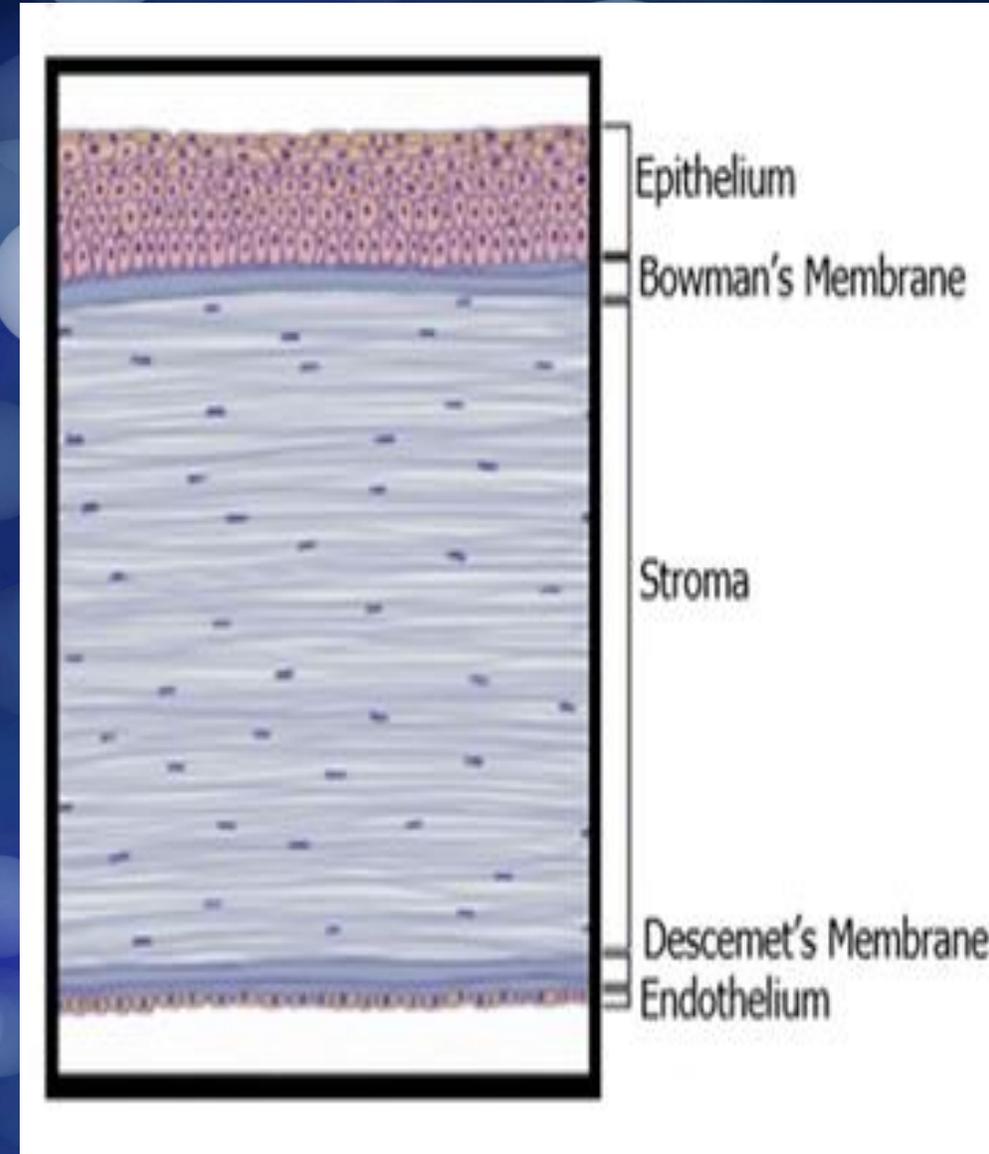
**LM:** it is a transparent homogenous a cellular layer.

### **Function:**

**It acts as a protective barrier against trauma and bacterial invasion. Once destroyed, it is not regenerated and healing from the underlying C.T. always leaves a scar causing corneal opacity.**

## **3) Substantia propria**

- It comprises about 90% of the thickness of the cornea**
- It is formed of about 20-25 regular lamellae of type I collagen bundles separated from each other by flattened fibroblasts (corneal corpuscles).**



#### **4- Descemet's membrane:**

**It is a homogenous, non cellular membrane formed of fine collagenous filaments and basement membrane materials. It is thinner than the Bowman's membrane.**

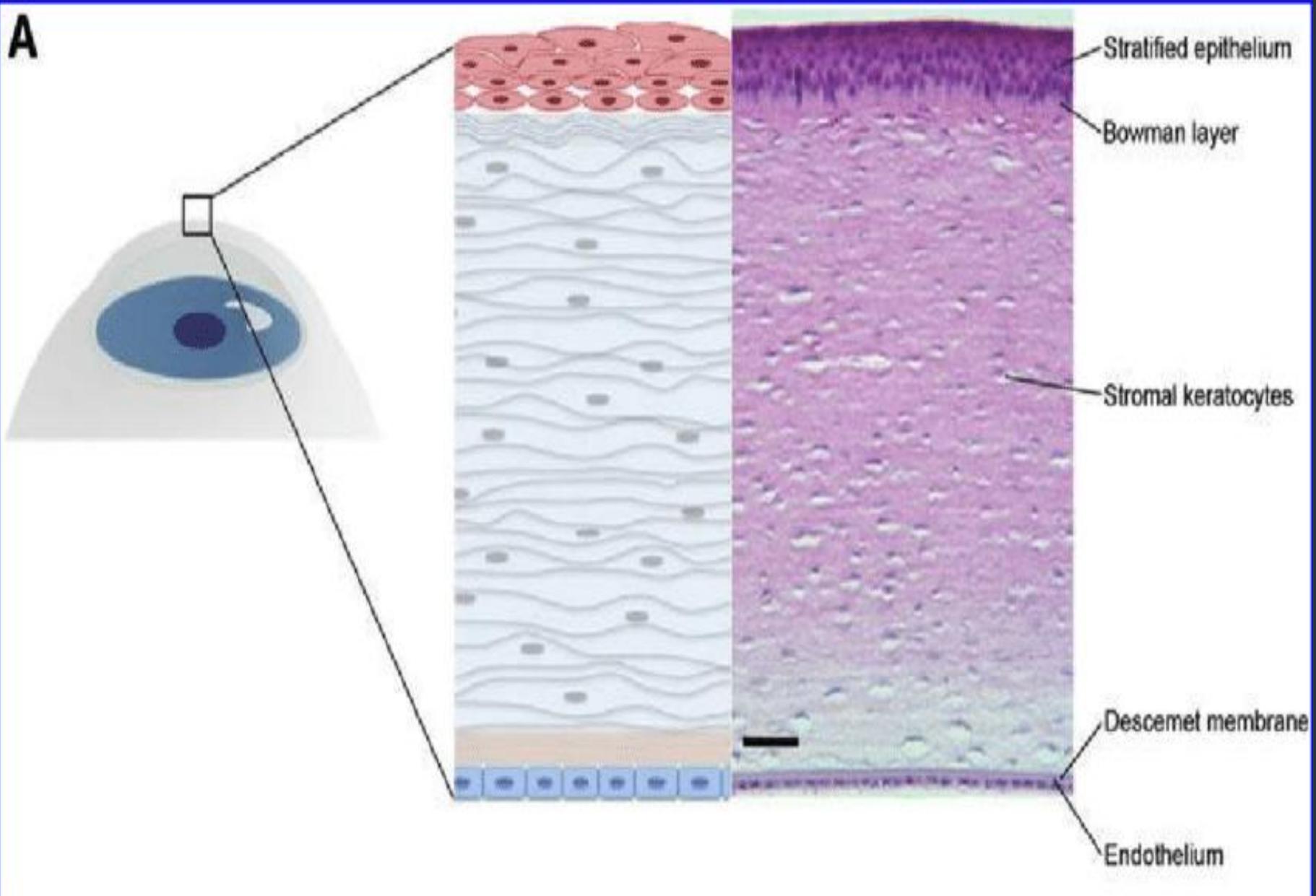
#### **5- Descemet's endothelium:**

**It is a simple squamous epithelium covering the posterior surface of the cornea facing the anterior chamber. This layer is responsible for the synthesis and maintenance of Descemet's membrane.**

#### **Causes of corneal transparency:**

- 1- The continuous evaporation of water from its surface.**
- 2- The absence of blood vessels.**
- 3- The cells, fibers and matrix have the same refractive indices.**
- 4- The regular arrangement of the fibers and cells of the substantia propria.**
- 5- The regular arrangement of the cells of the covering epithelium.**

**A**



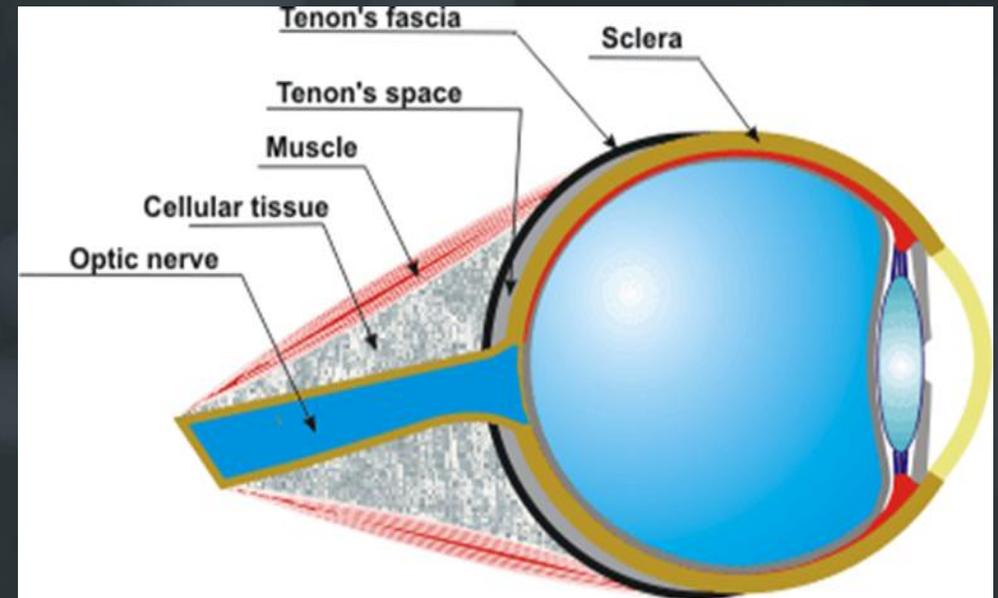
# The Sclera

## Definition:

**It is the white opaque posterior 5/6 of the eye.**

## **The sclera is opaque because:**

- 1- The refractive indices of all its elements is not equal.**
- 2- The irregular arrangement of its C.T. fibers.**
- 3- The presence of great amount of water.**

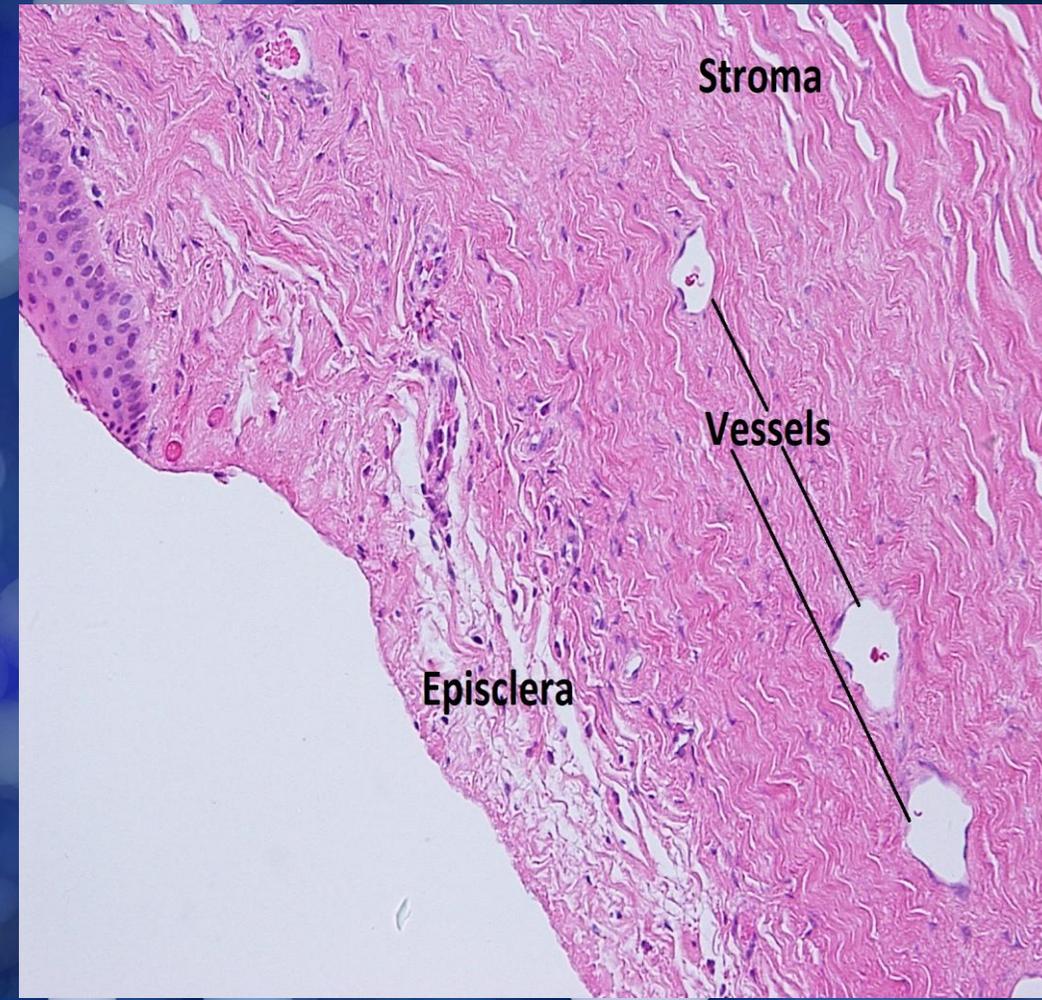


**L.M.:**

**a) Its external surface which gives attachment to the tendons of the eye muscles “The episclera”. Surrounded by a dense layer of C.T. called tenon’s capsule (Fascia) between this capsule and the sclera is “Tenon’s space”**

**b) Its middle part formed of irregular white dense C.T.**

**c) Its inner most layer (the lamina fusca) (faces the choroid): a thin layer of loose CT rich in melanocytes, fibroblast and elastic fibers.**

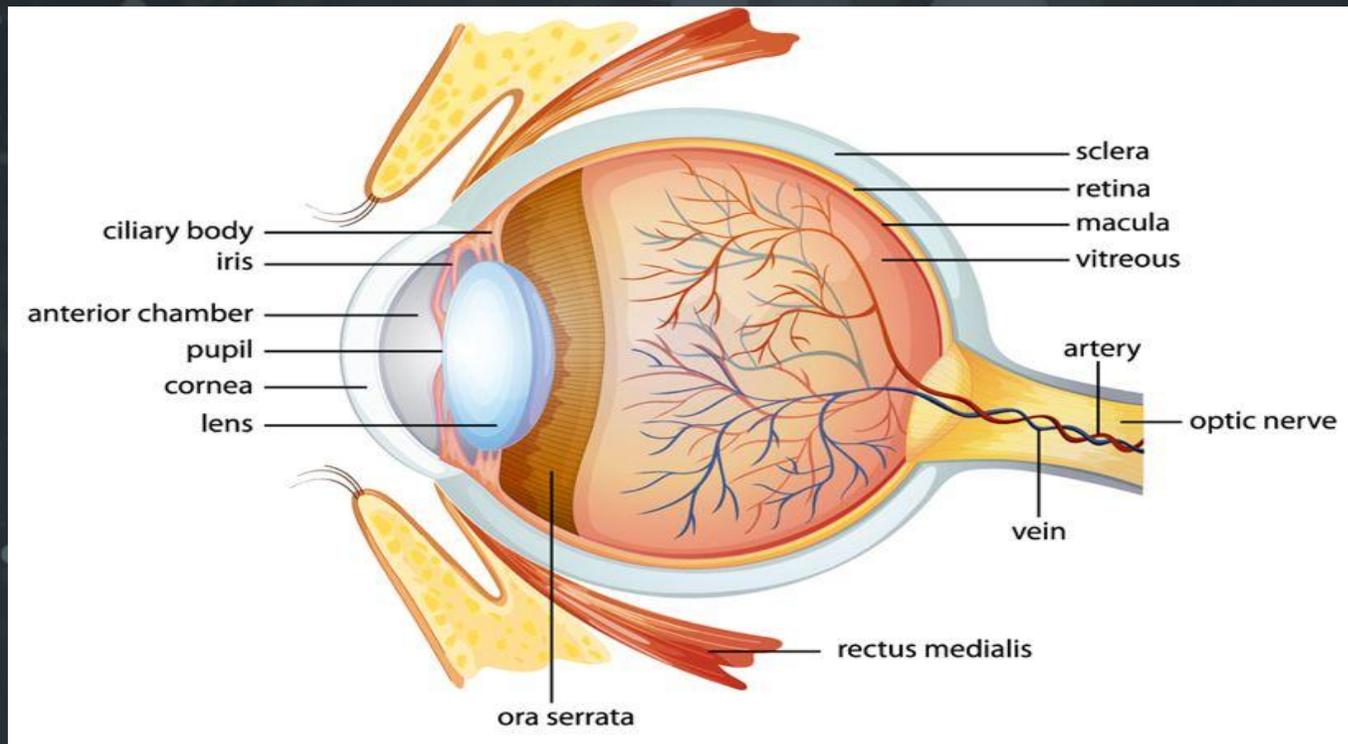


# THE MIDDLE VASCULAR COAT

**Choroid**

**Ciliary body**

**Iris**



# Choroid

## Definition:

**Pigmented vascular C.T. layer lies between the retina and the sclera and covers the posterior half of the eye.**

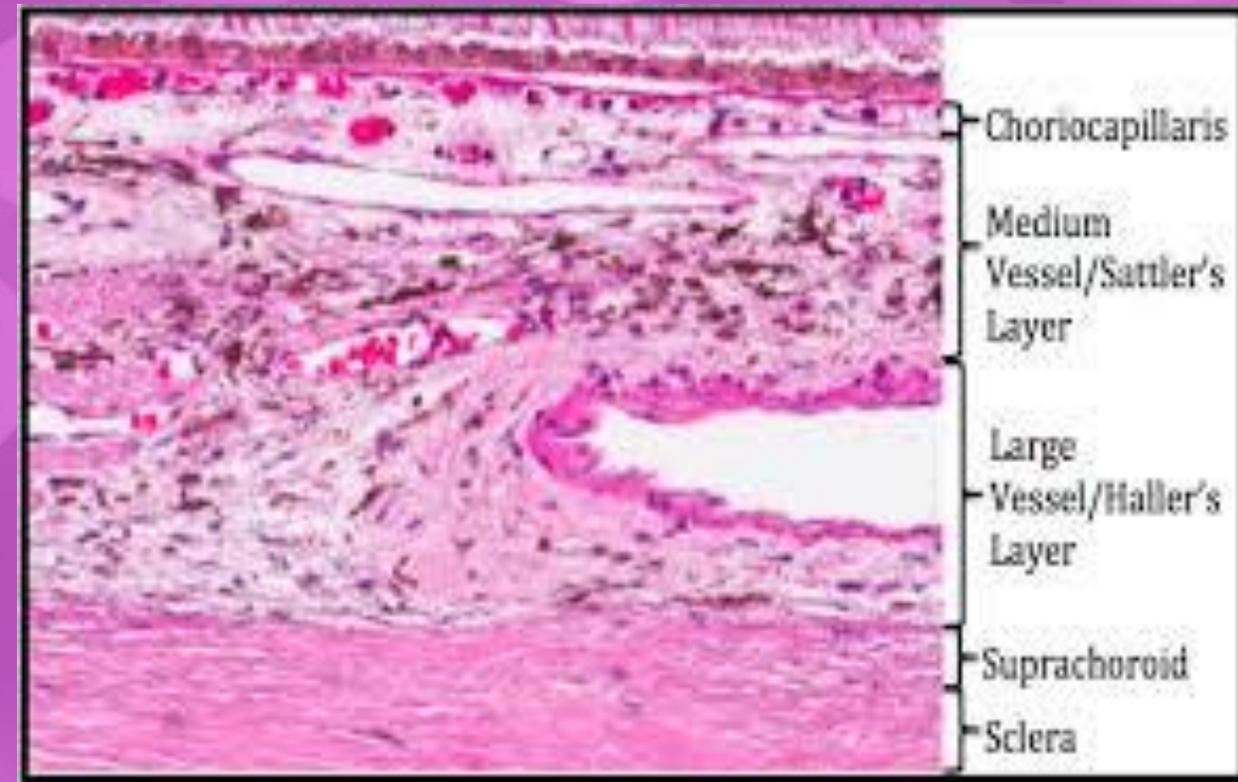
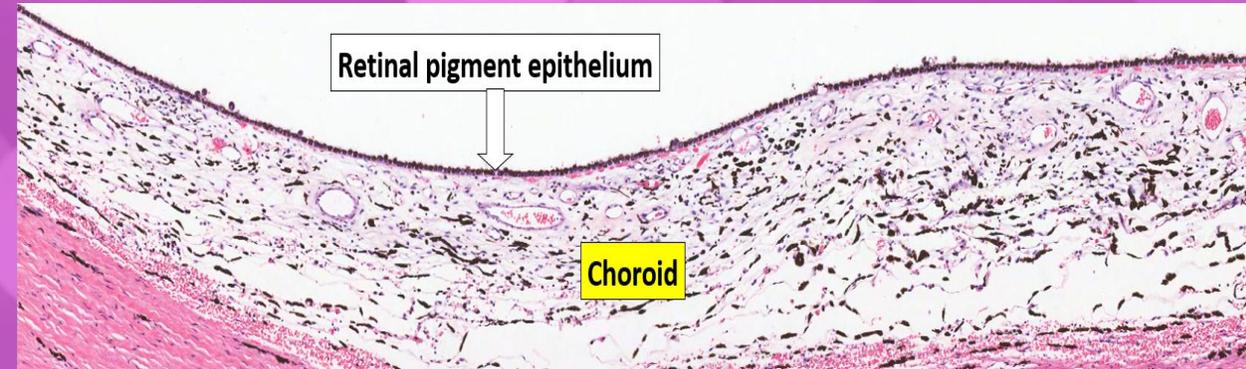
**LM.: It is made up of 4 layers:**

### **1. Epichoroid or suprachoroid.**

**It is the most outer layer. It consists of a loose C.T. layer rich in melanocytes fibroblast, macrophages, nerve fibers and ganglion cells.**

### **2. The vessel layer:**

**A highly vascular C.T. rich in elastic fibers and pigment cells.**



### **3. The choriocapillaries:**

It is formed of a single layer of fenestrated blood capillaries.

### **4. Bruch's membrane:** formed of 5 layers by E.M.

- The central layer is composed of a network of elastic fibers which is lined on its two surfaces with layers of collagen fibers its outer most and inner most collagen layers are covered by basal lamina .

### **Function:**

- 1. The choriocapillary layer has an important function in the nutrition of the retina.**
- 2. It supports the retina and absorbs excess light.**
- 3. Bruch's membrane plays an important role in limiting access of inappropriate macromolecules from the fenestrated capillaries to the retina.**

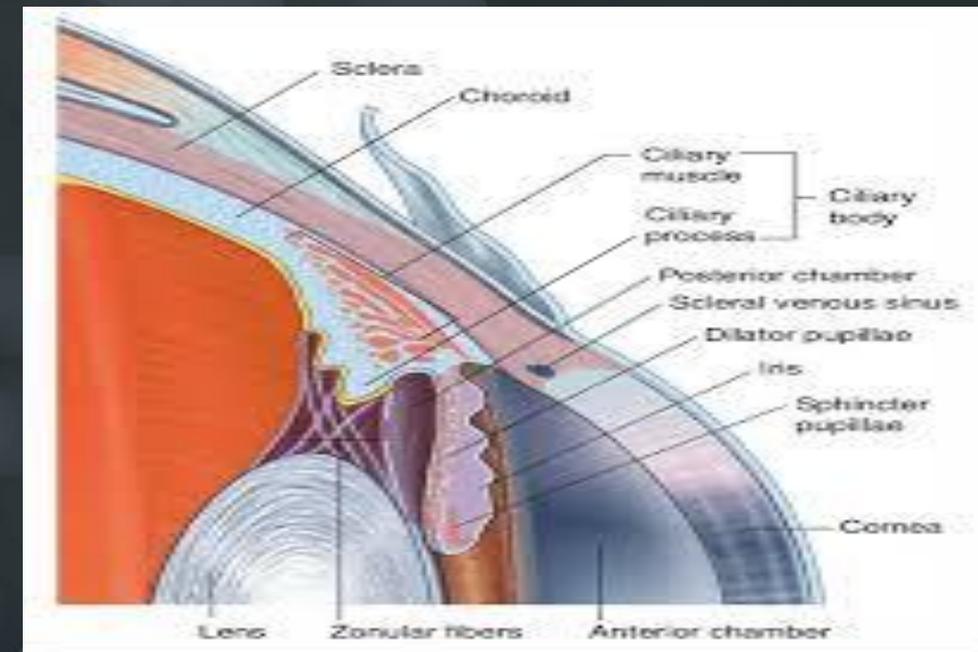
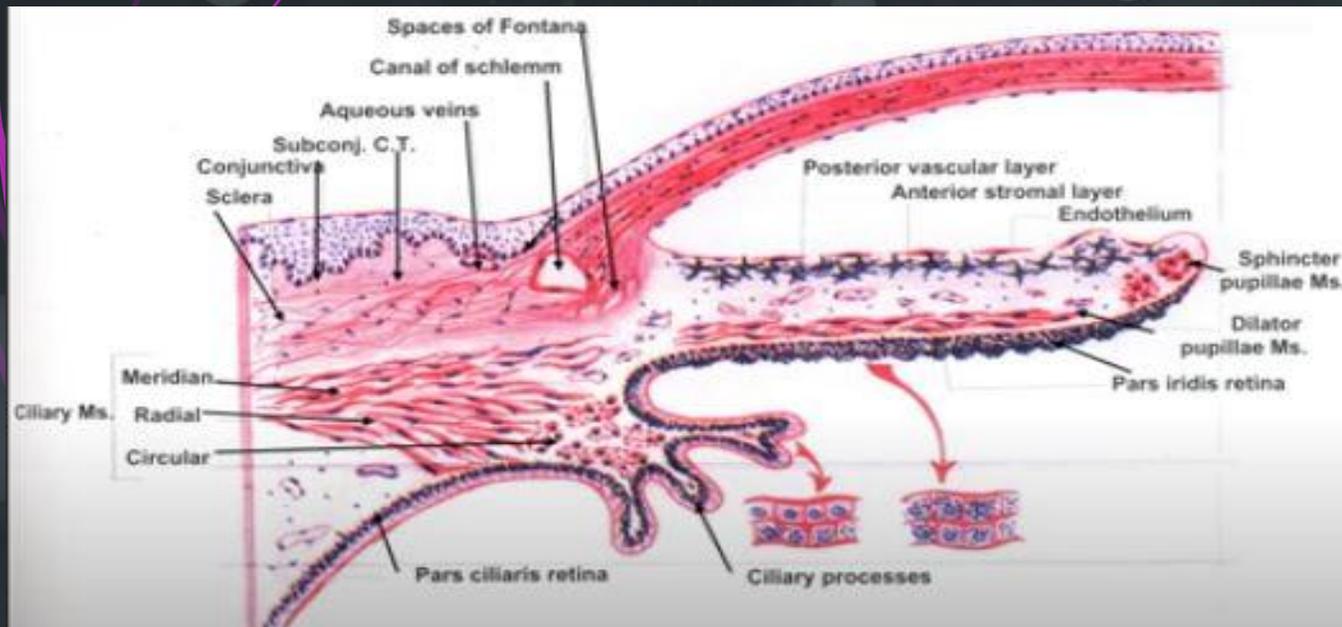
# Ciliary body

## Definition:

- It is the thickened anterior part of the choroid.

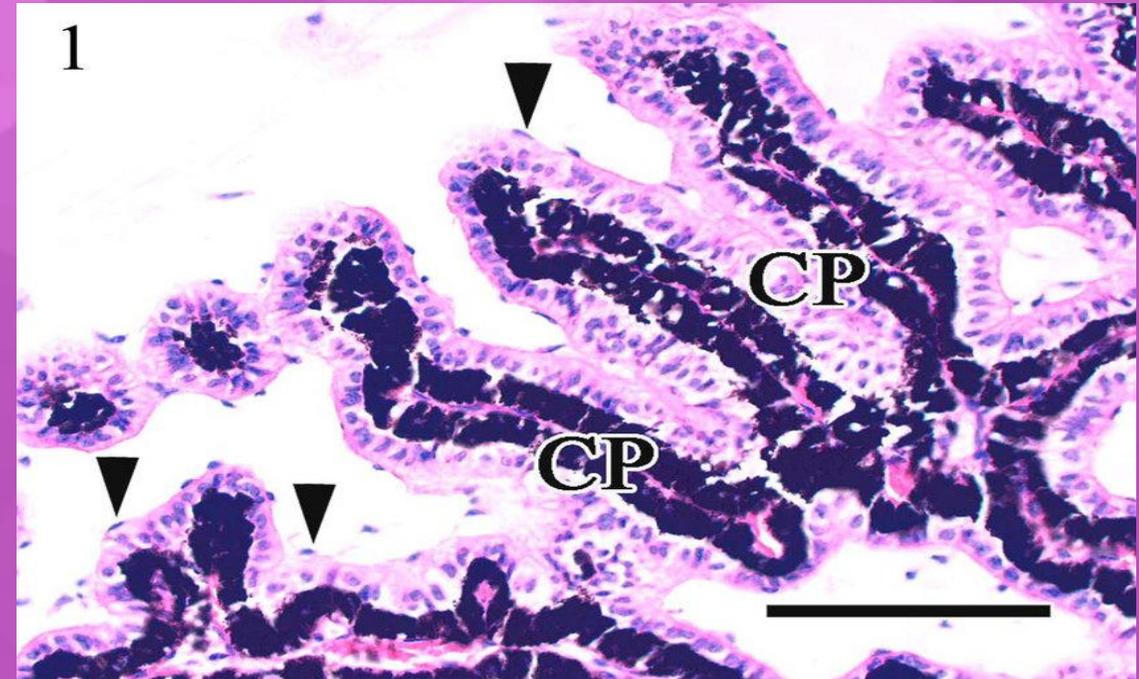
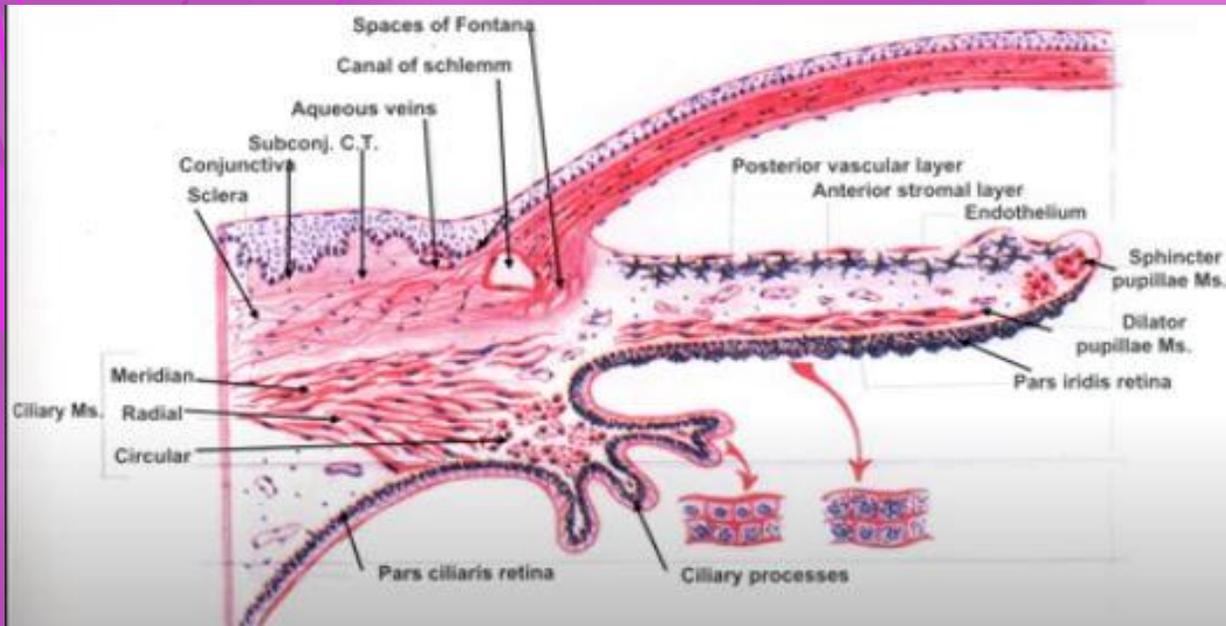
## Histological Structure:

- made of loose C.T. rich in blood vessels and melanocytes in which the ciliary muscles (smooth muscles fibers) are embedded.



## Ciliary Processes:

- Irregular processes arising from the medial side of the ciliary body extending toward the lens.
- Formed of loose C.T. core contains fenestrated capillaries covered by the ciliary epithelium.
- **ciliary epithelium** is formed of 2 layers of cubical cells the inner is nonpigmented while the outer layer is pigmented rich in melanin pigment.



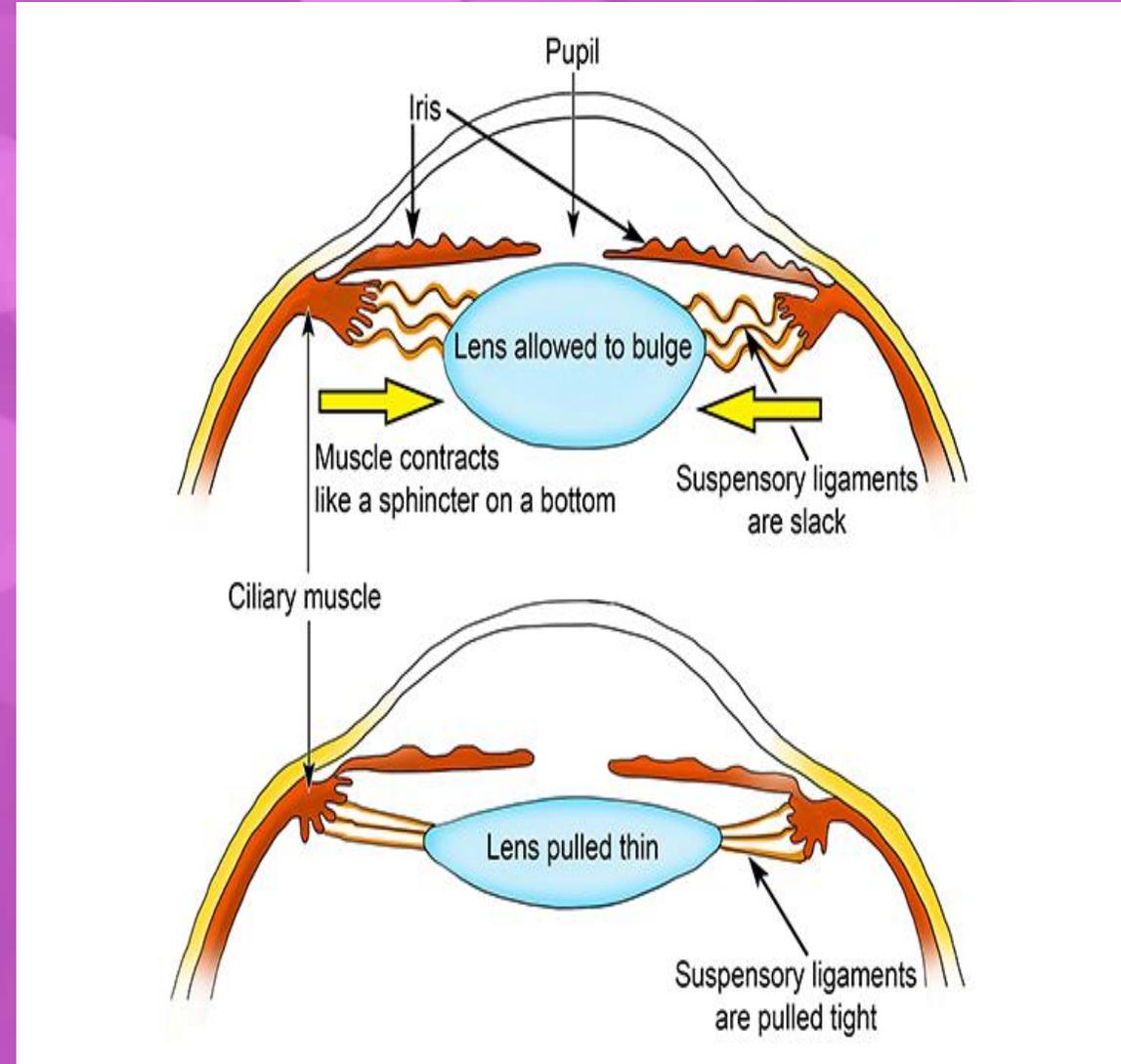
## Function:

1. Formation of the aqueous humor by the ciliary processes.

2. The ciliary body are responsible for the processes of accommodation of the lens to near and far objects as the ciliary muscles are attached to the suspensory ligament of the lens.

- Contraction of the ciliary muscle fibers pulls the lens becomes more convex so change the focus for near vision.

- Relaxation of these muscle fibers cause flattening of the lens & focusing on distant vision.



# Iris

## Definition:

The iris is a disk shaped coloured diaphragm with a central adjustable aperture named the pupil.

## Site:

The iris is present between the anterior and posterior chambers of the eye.

## Function:

1. Changes the pupillary size.
2. Shares in the formation of aqueous humor.
3. Gives the color of the eye.



## Histological structure:

1- The anterior surface is lined with a discontinuous layer of fibroblasts, melanocytes and collagen.

2- The stroma of the iris contains loose C.T. that differentiates into 2 layers:

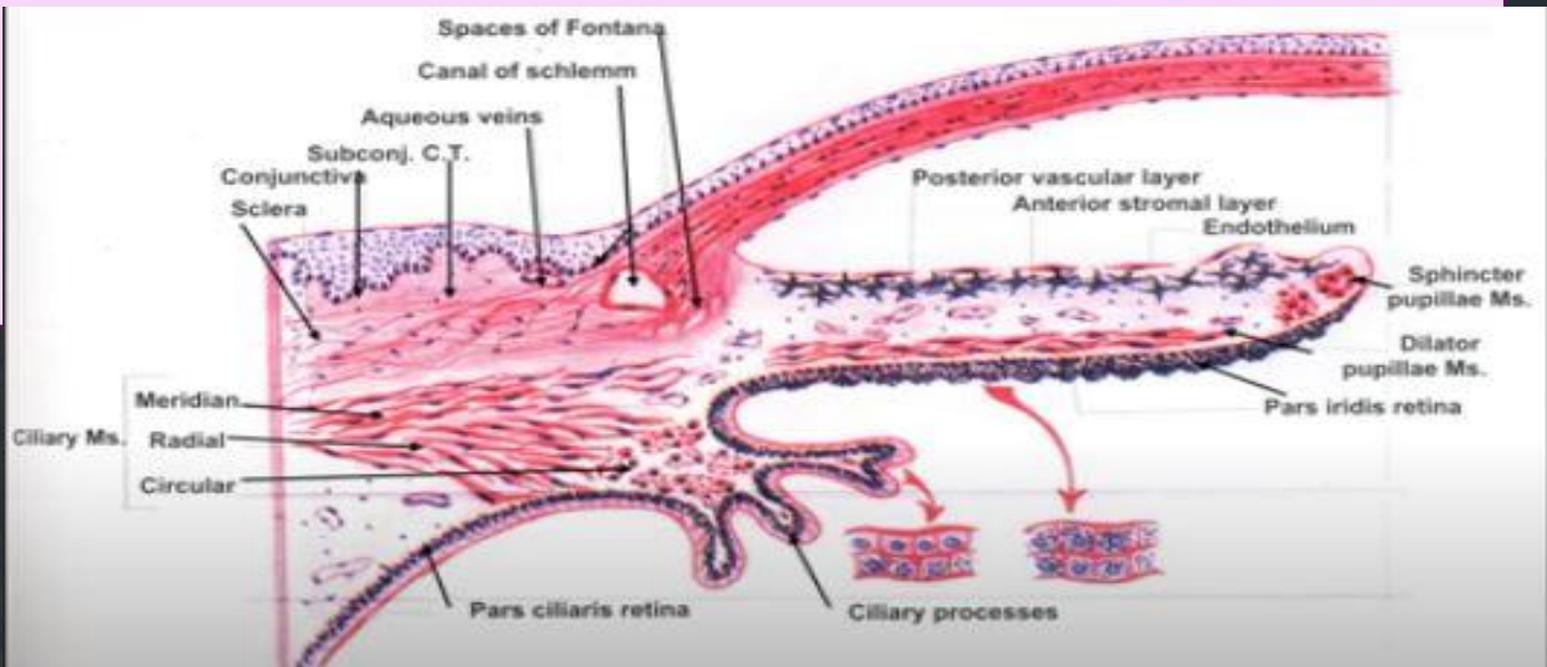
a- **Anterior stromal layer** more pigmented but less vascular.

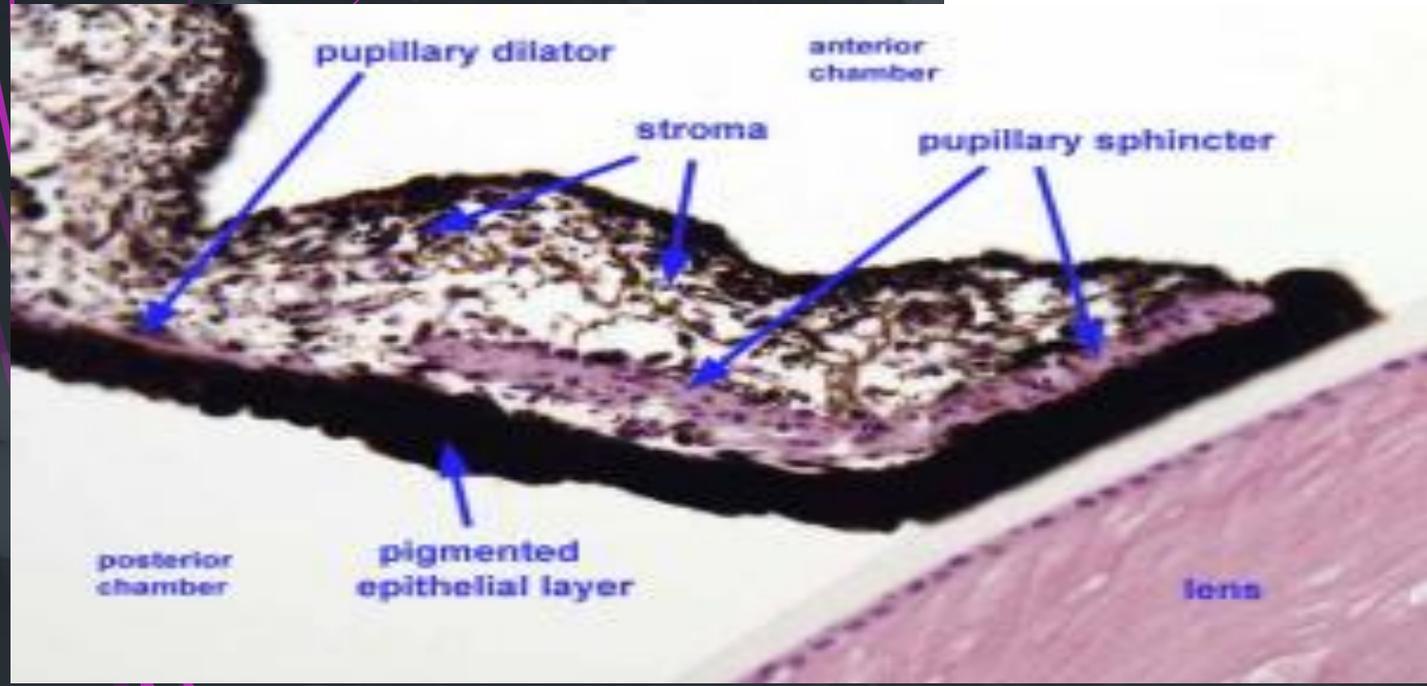
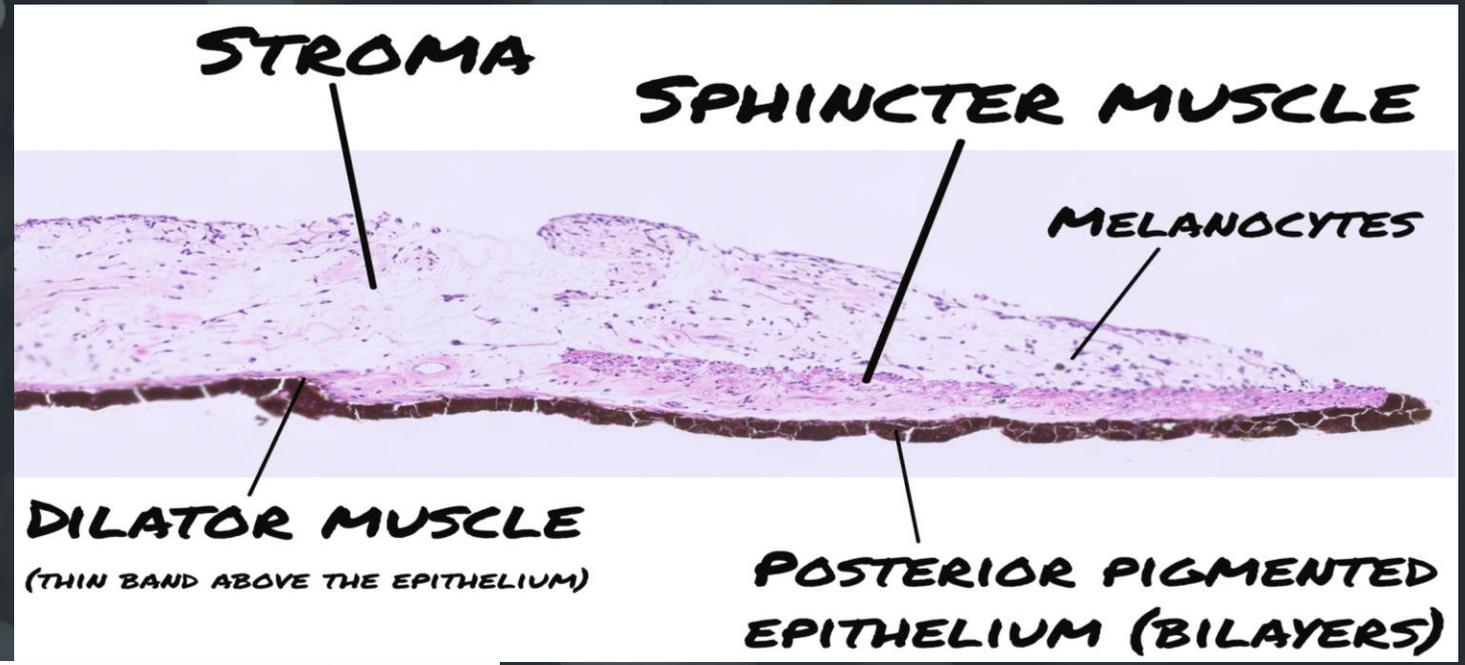
b- **Posterior vessel layer** is more vascular and contains the muscles of the iris:

- The dilator pupillae muscles, which are myoepithelial cells, radially arranged lie near the back of the iris they dilate the pupil.
- The constrictor pupillae muscle is a circular band of smooth muscle fibers that is situated at the pupillary margin of the iris they constrict the pupil.

3- The posterior surface

is covered by two layers of heavily pigmented cuboidal epithelial cells “pars iridis retina”.





# THE REFRACTIVE MEDIA OF THE EYE

**Cornea**

**Aqueous  
humor**

**Lens**

**Vitreous  
body**

## The aqueous humor

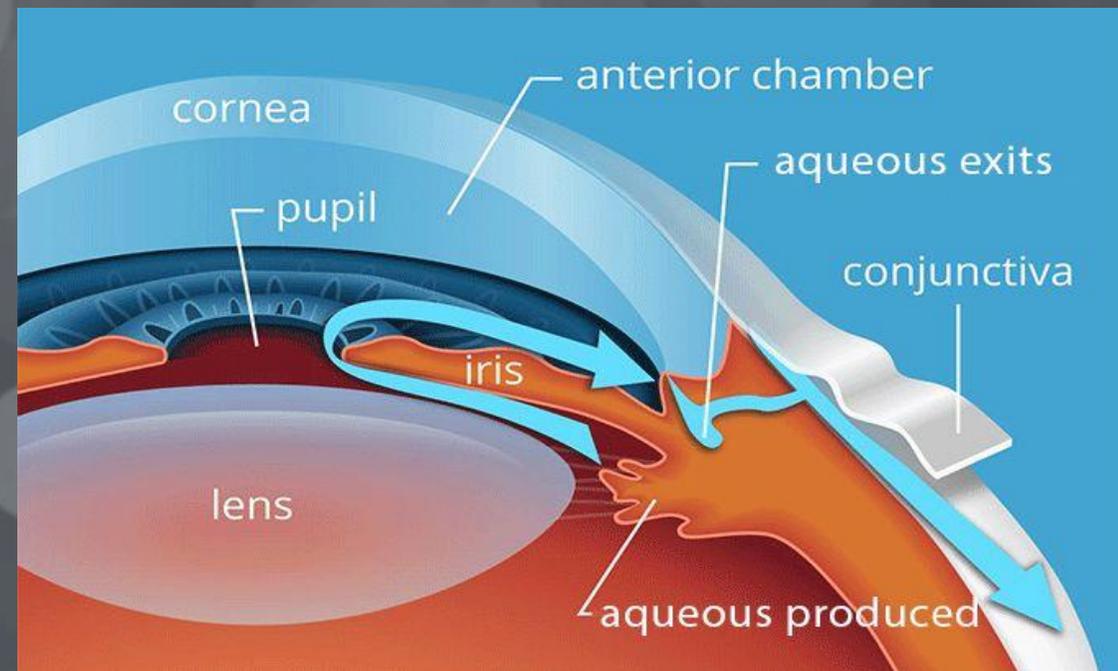
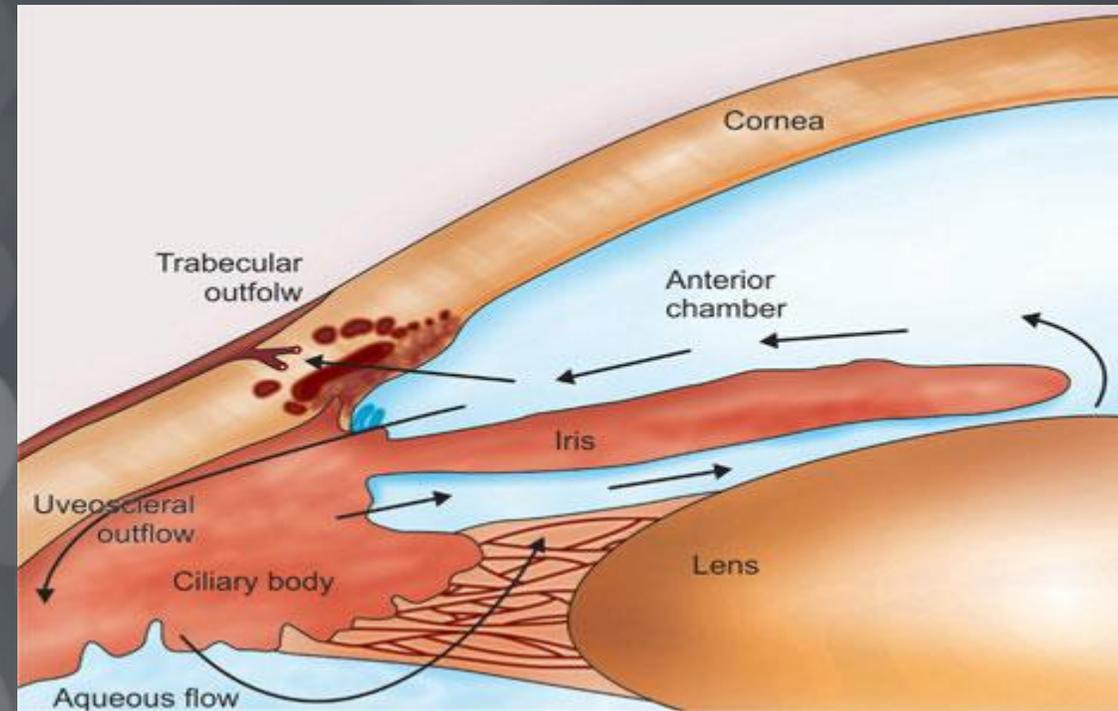
It is a watery fluid similar to plasma.

### Formation:

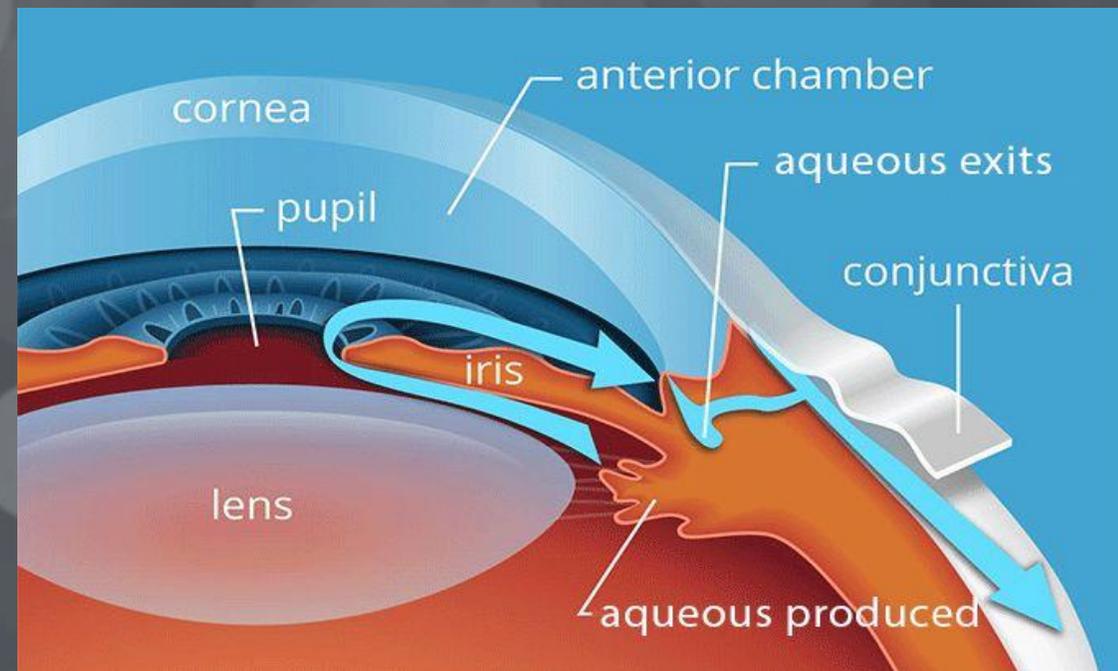
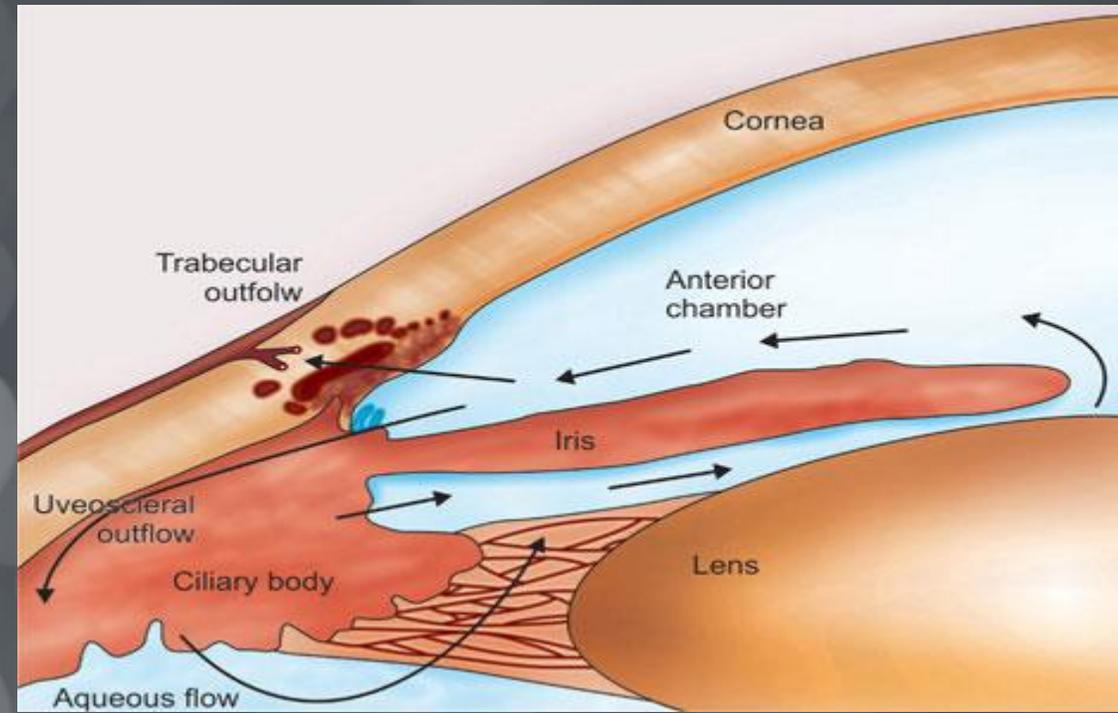
It is produced mainly by the ciliary processes and partly by the posterior surface of the iris.

### Circulation and absorption:

The fluid passes from the posterior chamber to the anterior chamber through the pupil, then to the spaces of Fontana → to the canal of schlemm → absorbed through small channels across the sclera to → aqueous veins in the subconjunctival tissue → venous circulation.



**N.B.: If there is an obstruction to the drainage and the secretion continues, intraocular pressure rises. This condition is called glaucoma and may result in damage to the eye and blindness if left untreated.**



# The Lens

## **Definition:**

**elastic, transparent biconvex structure of epithelial origin.**

## **Position:**

**It is situated in the posterior chamber behind the pupil and in front of the vitreous body. It is encircled by the suspensory ligament and ciliary processes.**

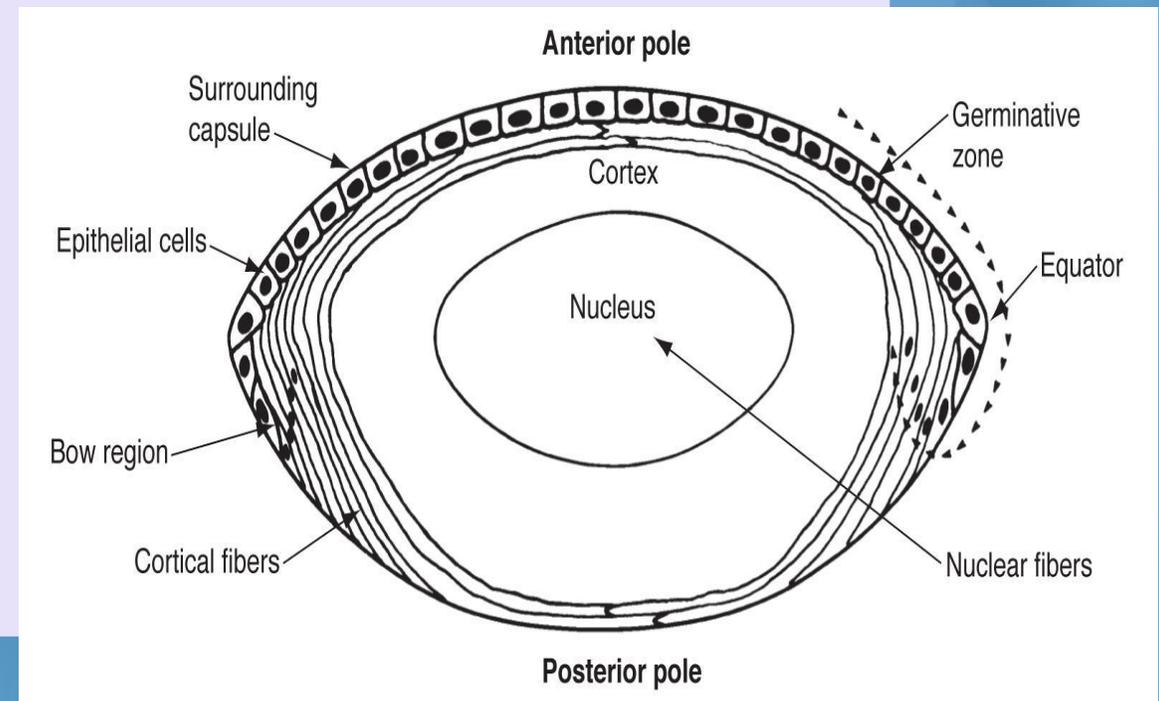
## **Histological structure:**

### **a) Lens capsule**

### **b) Lens epithelium:**

- **It consists of cuboidal cells.**
- **At the equator these cells are high columnar.**

### **c) Lens fibers**



## **Function:**

*The lens is important for accommodation → contraction and relaxation of the ciliary muscles can change the curvature of the lens. Thus the image of near and far objects can be focused on the retina.*

## **N.B.:**

- ***Presbyopia:*** Is a normal aging process occurring after age of 40 in which the ability of the lens to change its curvature is lost, It can be corrected by wearing glasses with convex lenses.
- ***In persons exposed to excessive amount of **ultraviolet radiation** and in **diabetic patient** especially elderly individuals. Their lens become gray and opaque leading to impairment of vision a condition called **“cataract”**. Surgical removal of the clouded lens and replace it by a clear artificial one must be done to restores vision.***

## **The vitreous body (Vitreous Humor):**

### **Definition:**

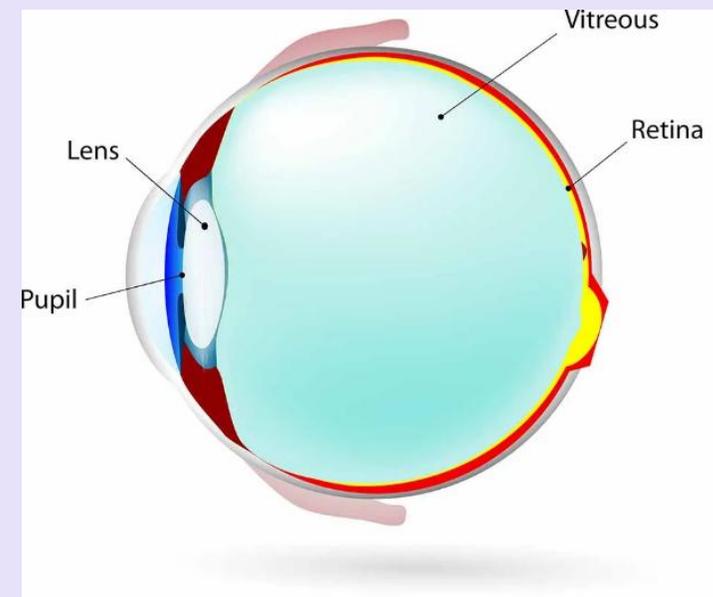
**Transparent jelly-like amorphous substances harder in the periphery and softer in the center.**

### **Composition:**

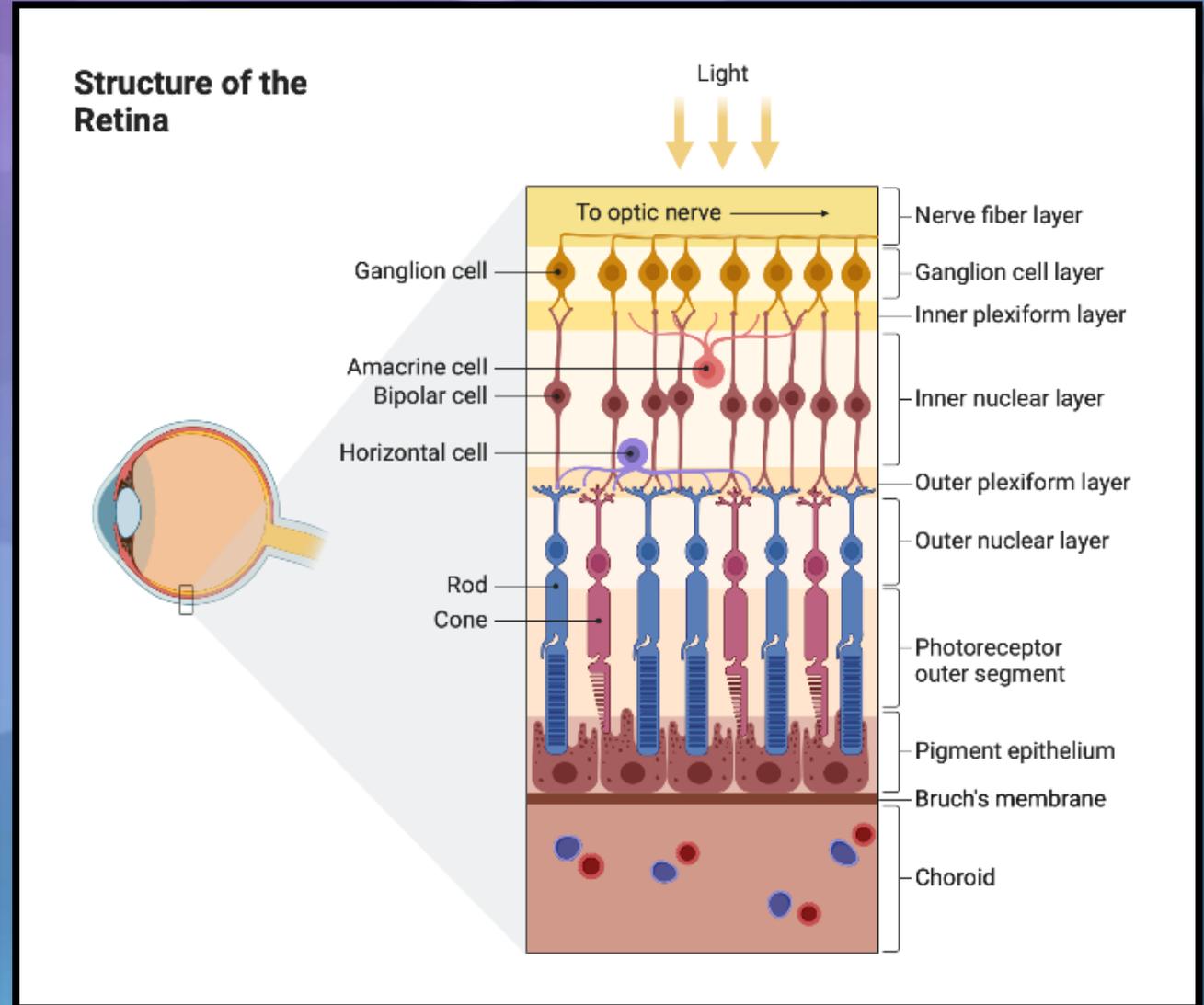
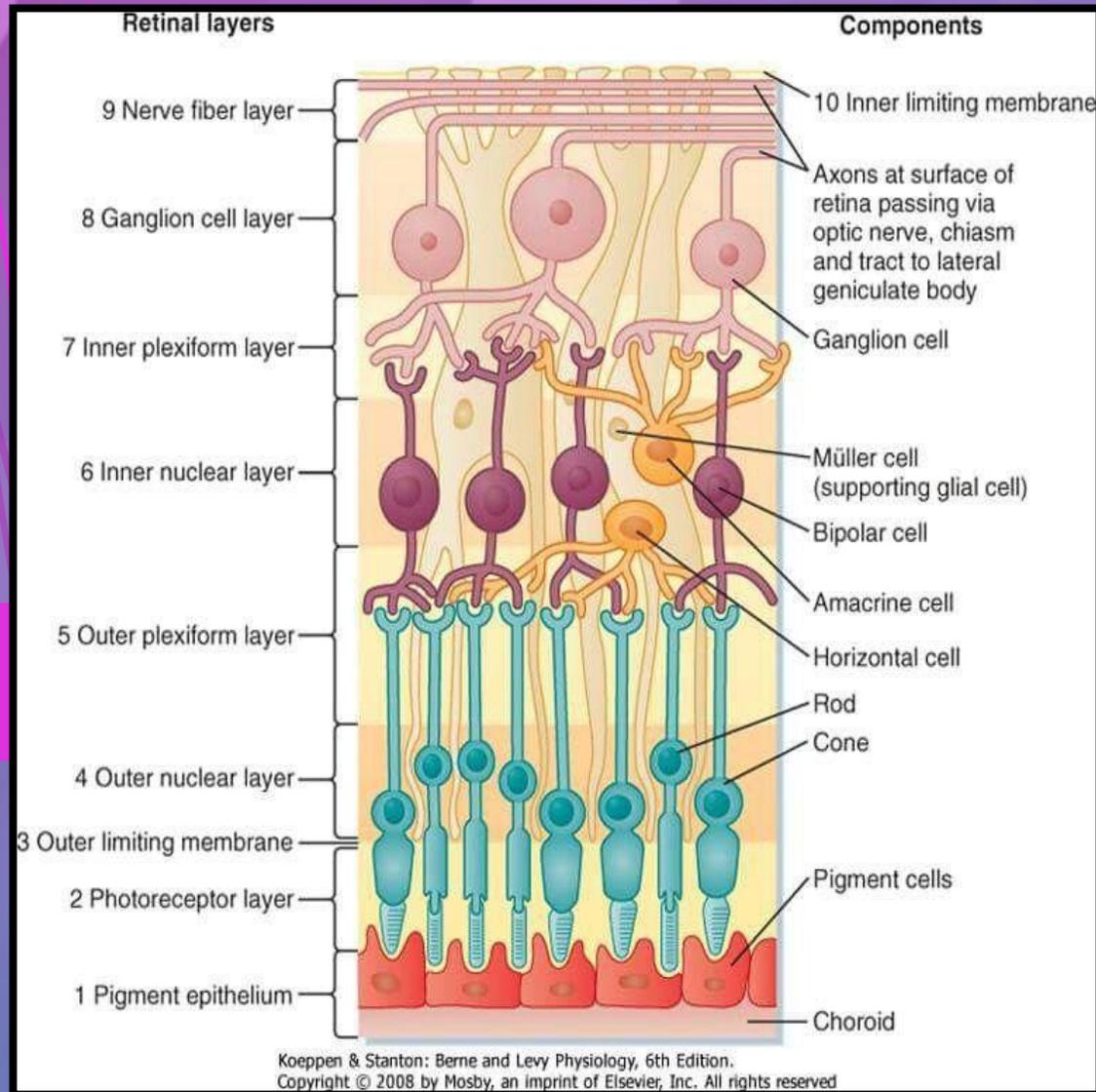
- **Consists of about 99% water.**
- **A small amount of type II collagen fibrils.**
- **Hyaluronic acid.**

### **Function:**

- 1. Transmits light.***
- 2. It helps to hold the lens in its place.***
- 3. Prevents retinal detachment.***



# THE INNER NERVOUS COAT (RETINA)



# THE INNER NERVOUS COAT (RETINA)

## A- The pigmented epithelium:

Consists of high cubical cells with rounded nuclei. The cytoplasm contains melanin granules

## B- The neural part of the retina: The retinal layers are 9 layers:

### 1- The rods and cones layer:

- It contains the dendritic processes of the rods & cones.
- These processes are photoreceptors

	<b>Rods</b>	<b>Cones</b>
<b>(A) Number:</b>	120 millions	6-7 millions
<b>(B) Function:</b>	– Adapted to function in dim light	– Adapted to function in bright light.
<b>(C) Site:</b>	Not present at the fovea centralis	The only receptors found in the fovea centralis.

**2- The outer limiting membrane: (dark line)**

**3- The outer nuclear layer:**

**Contains the cell bodies of rod and cone cells (the 1st order neurons).**

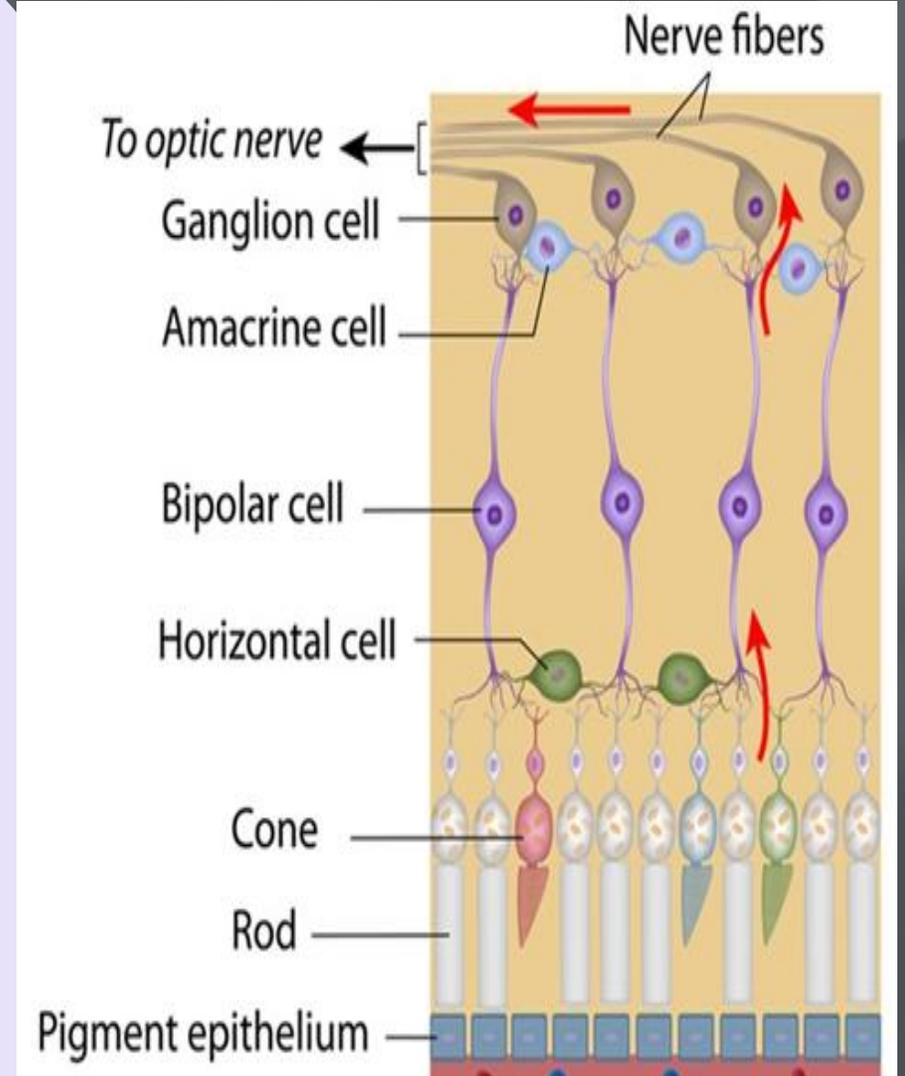
**4- Outer plexiform (reticular) layer:**

**It contains the synapses between the axons (synaptic processes) of rod and cone cells and the dendrites of the bipolar and the horizontal cells.**

**5- The inner nuclear layer:**

**It contains the cell bodies of:**

- a. The bipolar cells (the 2nd order neurons)**
- b. Horizontal cells**
- c. Amacrine cells**
- d. Muller Cells**



**6- The inner plexiform (reticular layer):**

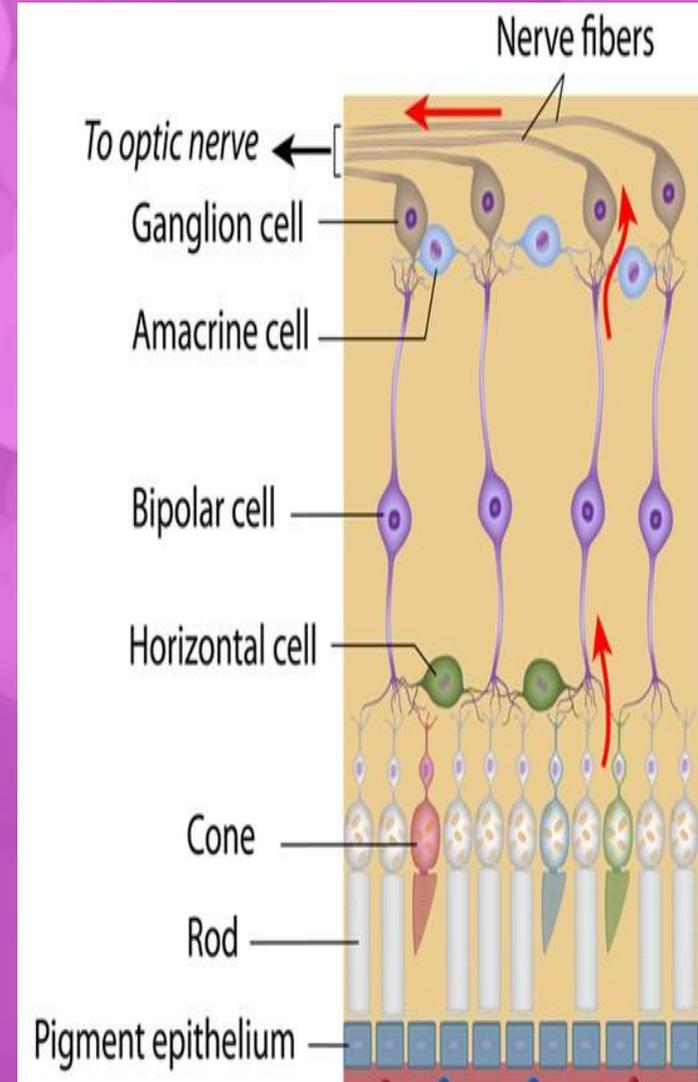
**It contains the synapse between the axon of the bipolar nerve cells and the dendrites of ganglion cells, It contains the synapses of amacrine cells.**

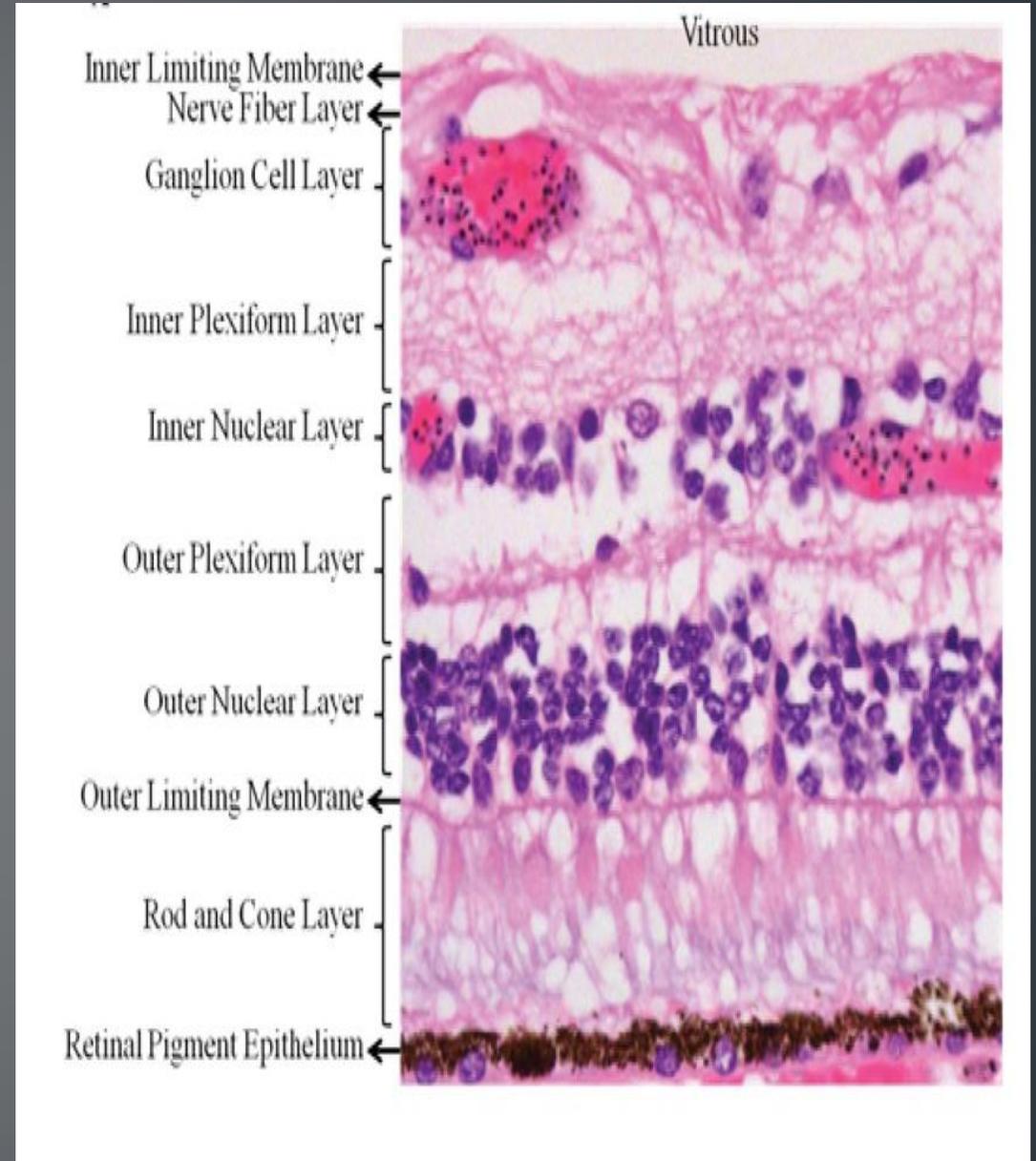
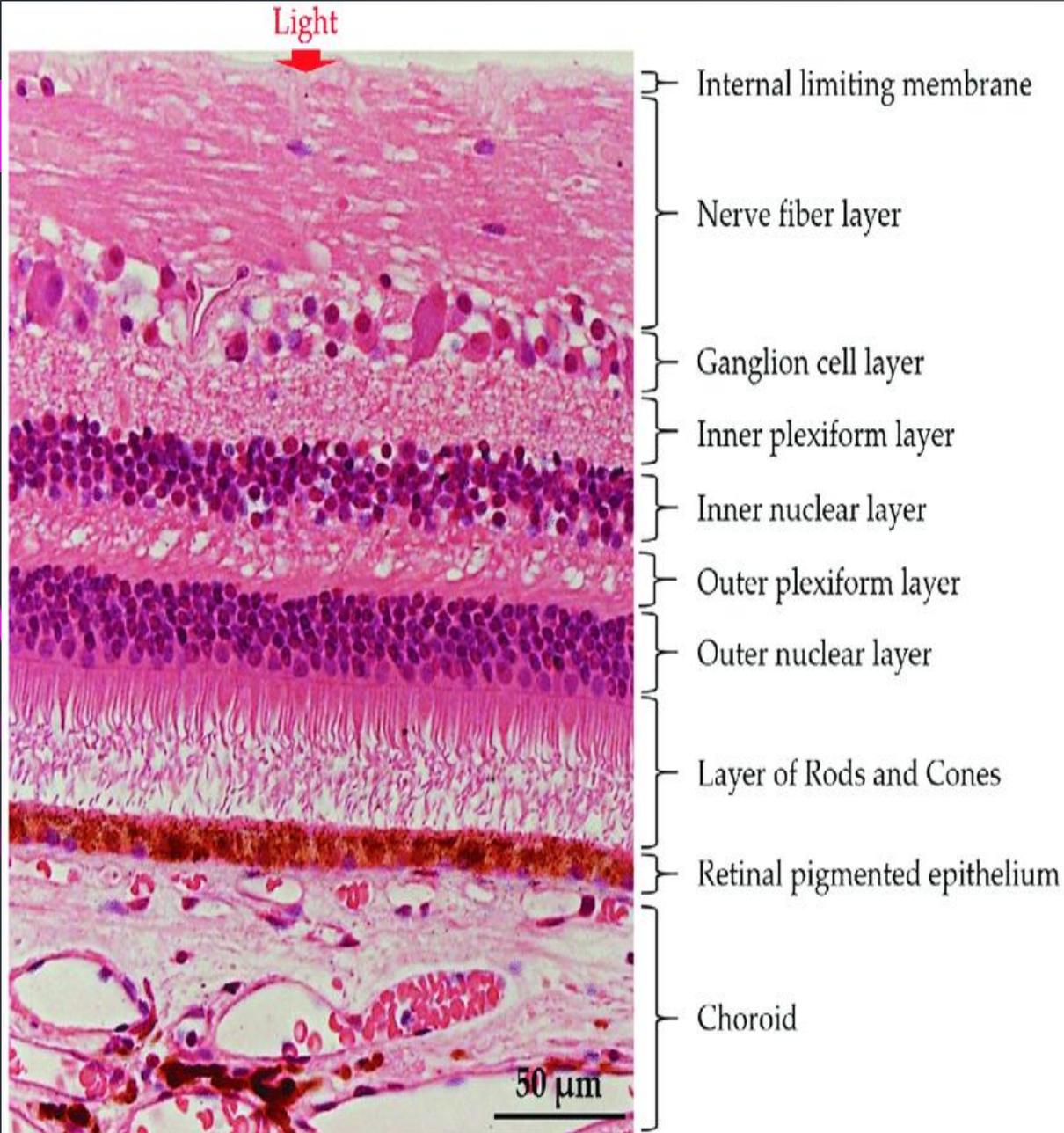
**7- The ganglion cell layer (the 3rd order neuron):**

- It contains the ganglion cells, their dendrites synapse with the axons of the bipolar nerve cells. Their axons form the fibers of the optic nerve.**

**8- The nerve fiber layer: It contains the axons of the ganglion cells which pass at right angle to form the optic nerve which is not covered by myelin sheath except after traversing the sclera.**

**9- The inner limiting membrane: (dark line)**



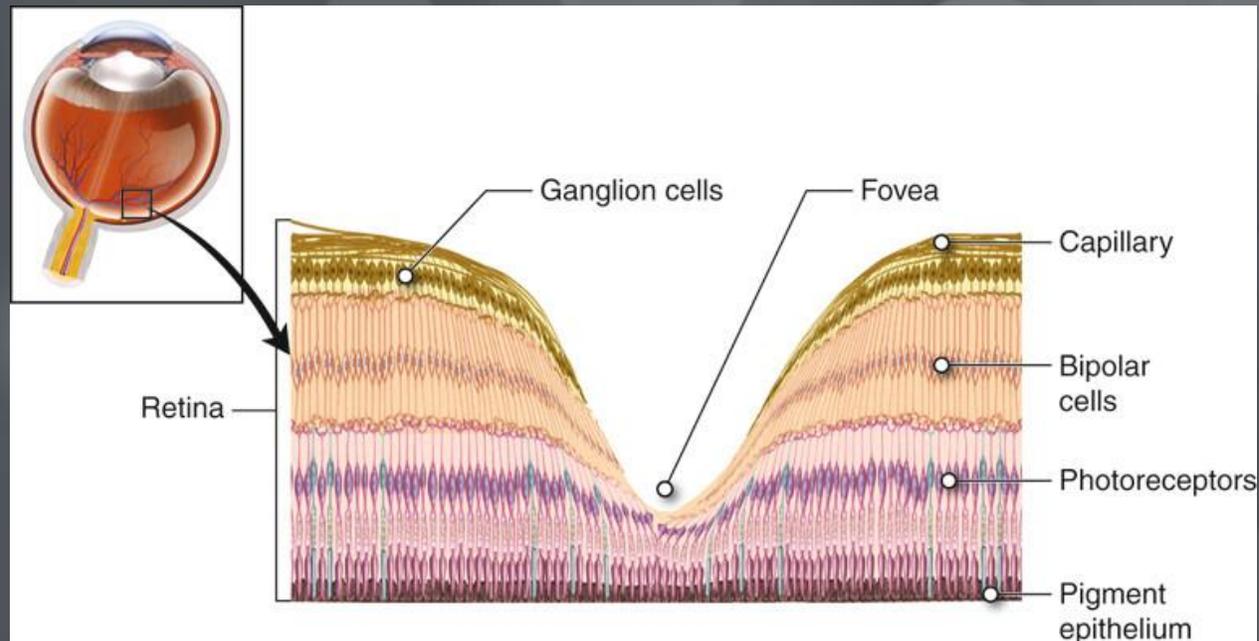


# Fovea Centralis

**Definition:** it is an area of the retina that provides the highest visual acuity.

**Site:** it lies in the bottom of a depression in the retina named the macula lutea (yellow spot).

**Type of receptors present:** cone cells only.



# THE ACCESSORY STRUCTURES OF THE EYE

## (1) The Conjunctiva

**Site:** It covers the anterior portion of the eye up to the cornea. It also lines the internal surface of the eyelids.

### Parts:

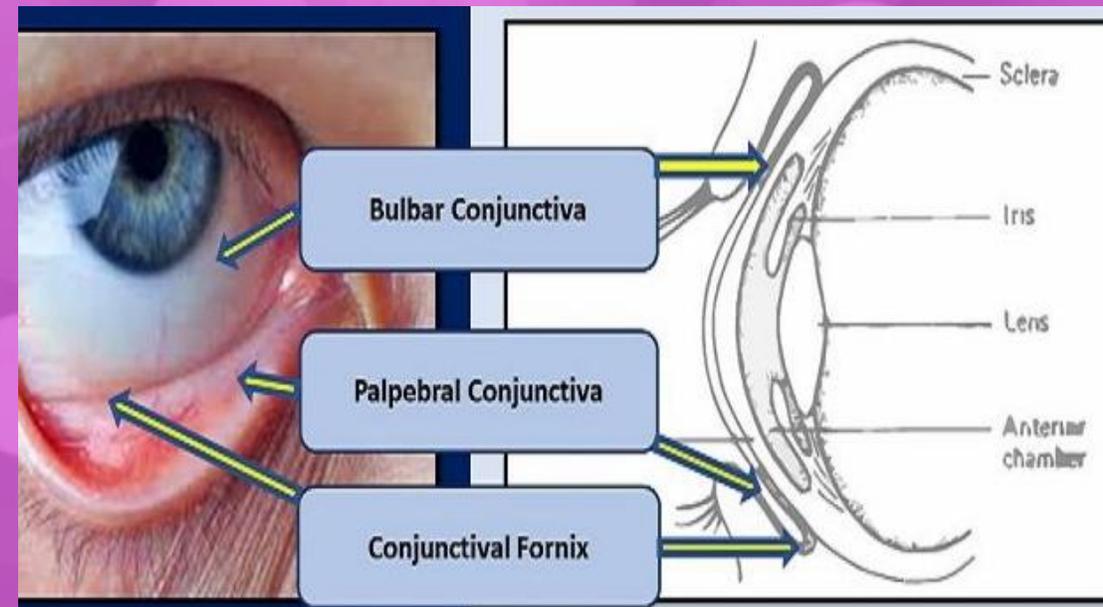
- 1- Bulbar conjunctiva which covers the anterior part of the sclera.
- 2- Palpebral conjunctiva which lines the skin of the eyelid from its inside.
- 3- Fornix of conjunctiva: at junction between part (1) & (2).

### Histological structure:

#### 1- Epithelium:

- a- At the fornix: stratified columnar with few goblet cells.
- b- At the bulbar part stratified squamous.
- c- At the palpebral part: stratified squamous

#### 2- Corium: loose connective tissue



## (2) The Eyelids

### Histological structure:

A perpendicular section shows the following layers from front backwards:

1-Skin

2-Skeletal muscles: bundles of the orbicularis oculi.

3-The tarsus

4-Palpebral Conjunctiva

5-The Eye lashes



## The three types of glands in lid are:

**a) The meibomian glands:** are sebaceous glands in the tarsal plate.

- **“Chalazion”** is a swelling as a result of the infection of the meibomian glands.

**b) Gland of Moll:** are modified sweat glands.

**c) Gland of Zeis:** Are modified sebaceous glands which are present at the roots of the hair follicles of the eye lashes.

- **“A sty”** is produced as a result of infection of either the gland of moll or the gland of Zeis.





*Thank you*

*Dr. Dalila Eita*