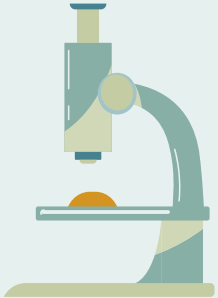
MED439
KING SAUD UNIVERSITY

Revised & Approved
Abdullah Alsubaihi
Rania Almutiri

جامعة الملك سعود
King Saud University
1957



Histology of the eye

Histology Team
439

Color index:
- Slides
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- Doctors notes
- Extra

Editing file

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

Helpful video for better understanding

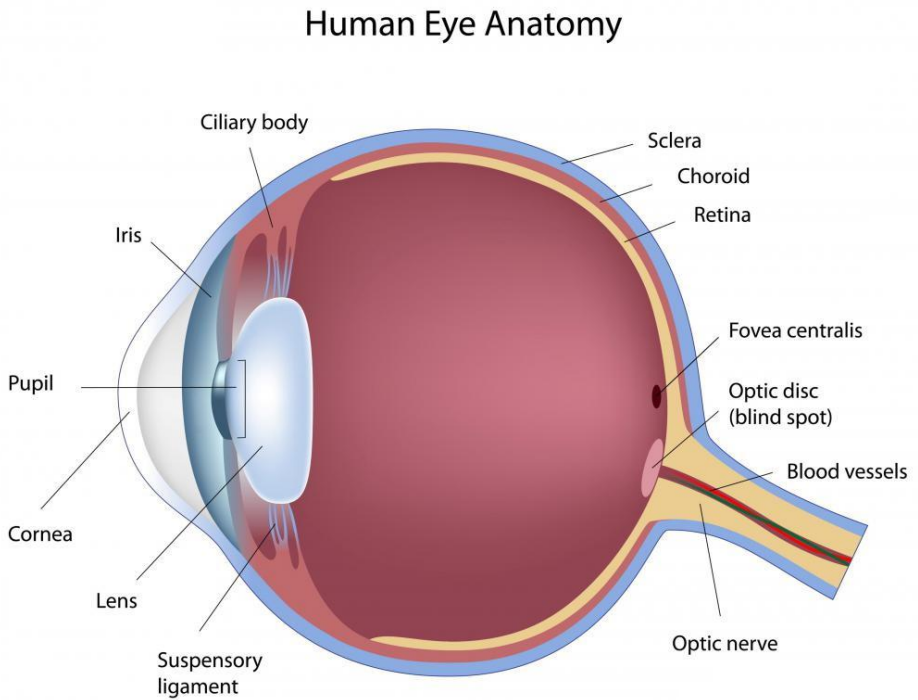
Eye Bulb

Has Three coats (3 Tunics):

1) **Fibrous tunic:**
   a) Cornea
   b) Sclera

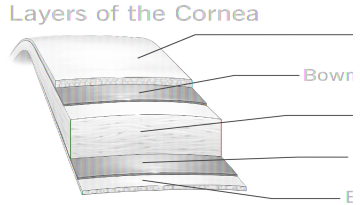
2) **Vascular tunic**
   a) Choroid
   b) Ciliary body
   c) Iris

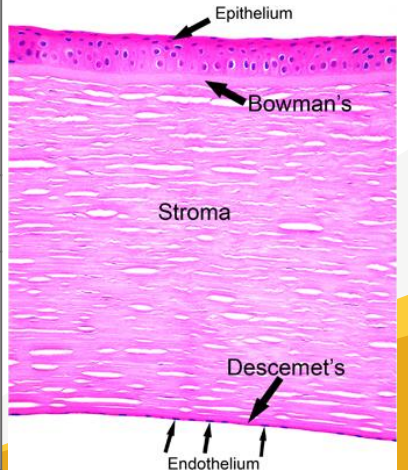
3) **Neural tunic**
   a) Retina



Cornea

Definition	It is the transparent, avascular 'so we can see ' and highly innervated anterior portion of the fibrous coat. And It has 5 Layers:
1) Corneal epithelium	• Non-keratinized Stratified squamous epithelium. 'keratin is thick will prevent the clear vision ' • Contains numerous free nerve endings. 'that why you feel uncomfortable whenever there's something in your eye'
2) Bowman's membrane	• It is homogenous non-cellular layer containing type I collagen fibrils 'fibers collection. • Any injury in this layer will lead to corneal opacity which cause blindness
3) Stroma (substantial prober)	• 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 (Corneal corpuscles). 'if its irregular = disrupt the arrangements of the fibers and prevent the clear vision '
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).



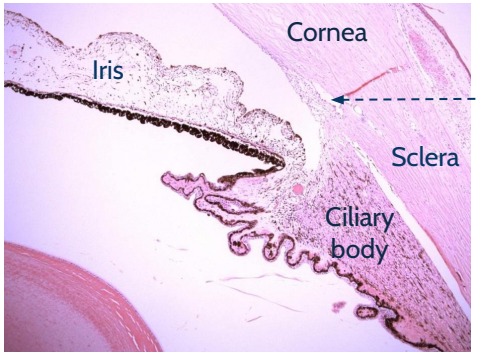


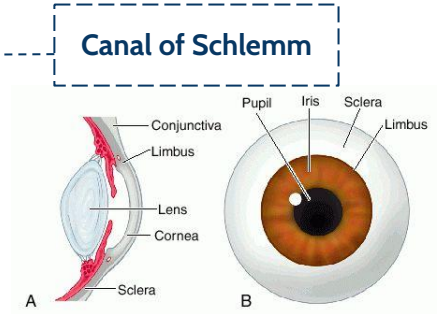
Limbus (corneo scleral junction)

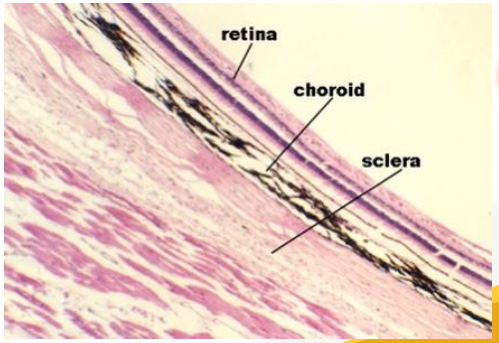
- It is the transition region between the cornea and sclera
- It is about 1.5 mm width
- It is **highly vascular**
- **Blockage of limbus will lead to glaucoma**
- It contains:
  1. **Trabecular meshwork**:
     - Endothelium-lined spaces.
     - It leads to canal of Schlemm.
  2. **Canal of Schlemm**:
     - It drains the aqueous humor into the venous system.

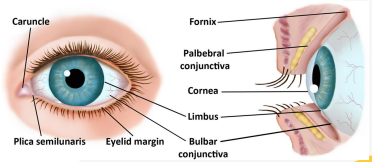
Sclera

- 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.







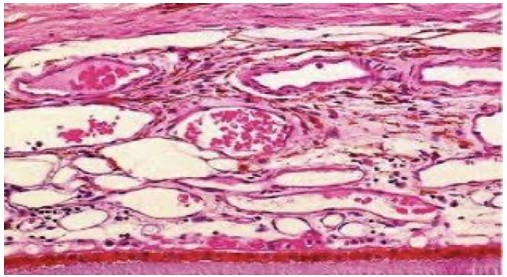


Choroid

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 Bruch's membrane.



Ciliary body

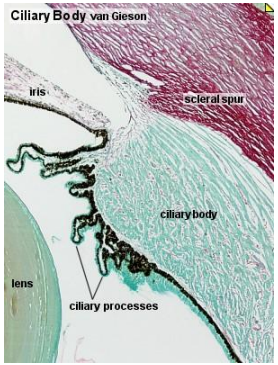
It is the anterior continuation of the choroid. It surrounds the lens.

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).

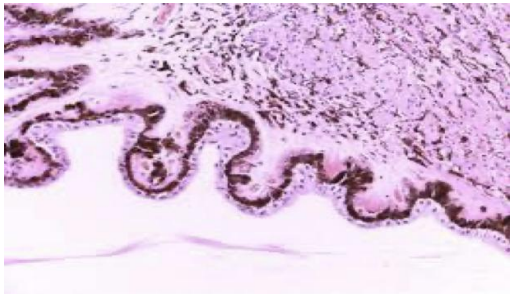
- Its inner surface is highly folded forming the ciliary processes.



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)

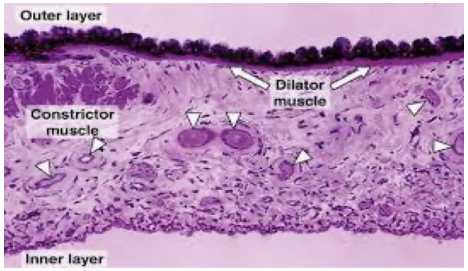
All attached to the lens to control the lens by ciliary muscle

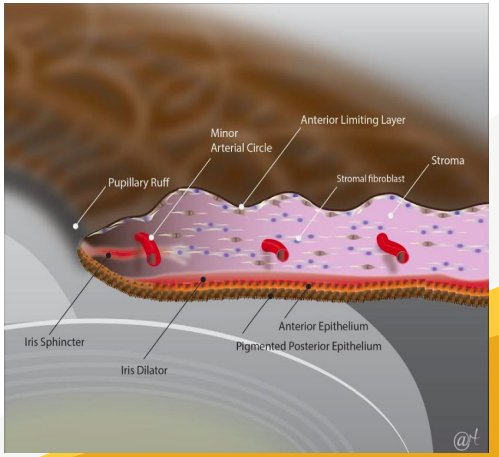


Iris

Iris is the colored part that gives the eye its color.
It is formed of 5 layers :

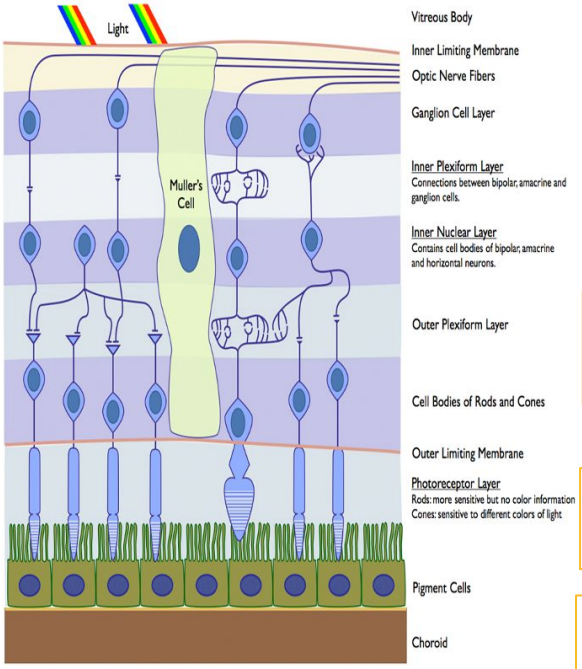
Layers	Features
Anterior border layer	Incomplete layer of fibroblasts and melanocytes.
Stroma	Poorly vascularized C.T. with fibroblasts and melanocytes. "eye color"
Vessel layer	Well-vascularized loose C.T. Centrally, it contains **circularly** arranged smooth muscle fibers (sphincter pupillae muscle). 'control the diameter of the lens in response to the light '
Dilator pupillae muscle layer	Contains **radially** arranged myoepithelial cells. the iris constricts and dilates the pupil.
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.





Layers Of Retina (important)

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



Inner side

"side face the light "

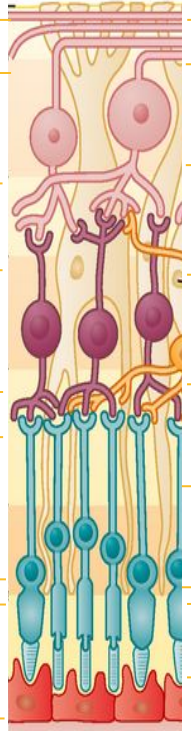
9- Optic nerve fiber layer.

7- Inner plexiform layer.

5- Outer plexiform layer.

3-Outer limiting membrane.

1-Pigmented Epithelium



10- Inner limiting layer.

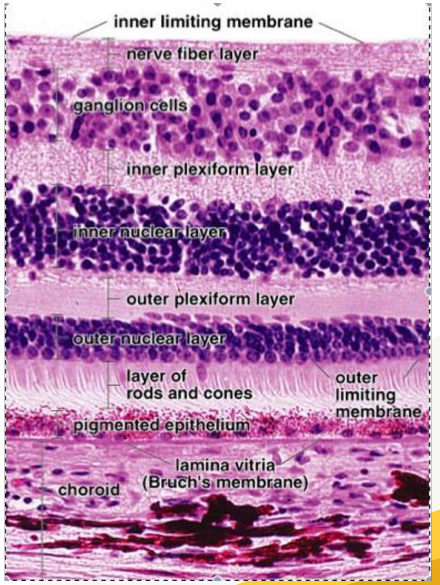
8- Ganglion cell layer.

6- Inner nuclear layer.

4- Outer nuclear layer.

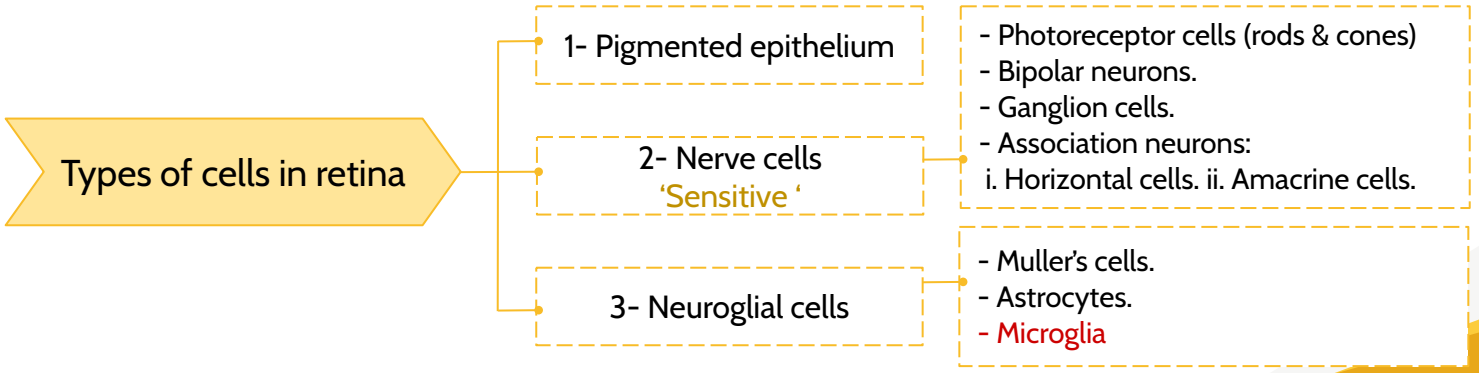
2-Rods and cones layer.

outer side



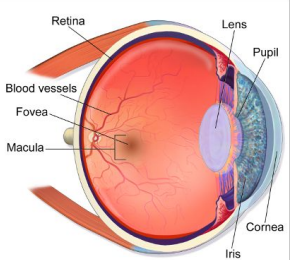
RETINA		
Layers	**Features**	**Function**
Pigmented Epithelium	• Cuboidal to columnar cells (single layer). • Apical microvilli. • Abundance of melanin granules. 'for protection'	• Absorb light. • Phagocytosis of membranous discs from tips of rods. • Esterification of Vitamin A (in SER) For accuracy of vision
Rods and cons layer **(They are photoreceptor cells)**	Contain: • **Dendrite formed of:** 1. Outer segment (OS): contains membranous discs containing rhodopsin (in rods) and iodopsin (in cones). 2. Connecting Stalk: with modified cilium. 3. Inner segment (IS). • **Cell body** • **Axon**: synapses with dendrite of bipolar neuron of inner nuclear layer.	• Rods are receptors for dim light (low intensity light). • Cones are receptors for bright light and color vision (red, green & blue).
Outer limiting membrane	• A region of zonulae adherents junctions between Muller cells and the photoreceptors.	-
Outer nuclear layer	• Contains nuclei of the rods & cones.	-
Outer plexiform layer	• Contains axodendritic synapses between the photoreceptor cells and dendrites of bipolar and horizontal cells.	-

Layers	Features
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.
Optic nerve fiber layer	• Contains unmyelinated axons of the ganglion cells. N.B. These axons become myelinated as the nerve pierces the sclera.
The inner limiting membrane	• It is formed by the basal laminae of the Muller cells

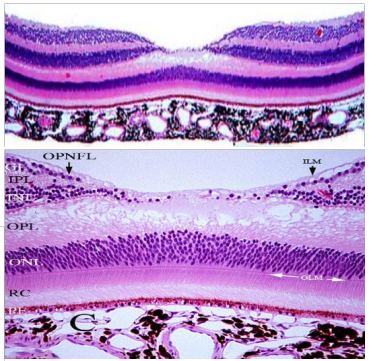


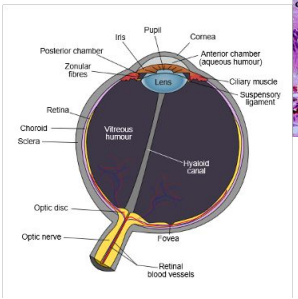
Fovea centralis

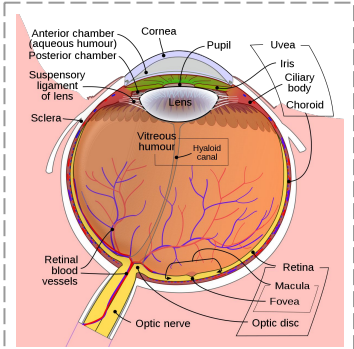
- It lies in the center of macula lutea.
- Cones are highly concentrated in the fovea.
- It is responsible for visual acuity.



Eye Anatomy







Additional photo for further understanding

▶ Conjunctiva (Never cover the retina)

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).

When you try to touch the sclera, actually you will touch the conjunctiva

L/M:

1- Epithelium: Stratified columnar epithelium with numerous goblet cells.

2- Lamina propria: Loose C.T.

MCQs

Q1) Which of the following sites contain the highest concentration of cones?
A- Optic disc
B- Fovea centralis
C- Conjunctiva
D- All of the above

Q2) Esterification of Vitamin A is function of?
A- Retina
B- Sclera
C- Limbus
D- Cornea

Q3) What is the thickest layer of cornea?
A- Stroma
B- Corneal epithelium
C- Bowman's membrane
D- Corneal endothelium

Q4) Describe the position of the limbus:
A- Transition region between the cornea & choroid
B- Transition region between the cornea & lens
C- Transition region between the cornea & sclera
D- Transition region between the cornea & retina

Q5) Which of the following contain nuclei of the rods & cons?
A- Pigmented epithelium
B- Inner nuclear layer
C- Outer limiting membrane
D- Outer nuclear layer

Q6) What type of collagen is found in Bowman's membrane?
A- Type I
B- Type II
C- Type III
D- None of the above

Q1: B
Q2: A
Q3: A
Q4: C
Q5: D
Q6: A

Team leaders

Mariam Alruhaimi

Mohamed Albabtain

Team members

Abdullah Alburikan

Fayez AlTabbaa

Mohammad Benhjji

Nawaf Alshahrani

Yazeed Alomar

Afnan AlMohsen

Joud Alarifi

Maha Alqahtani

Nourah Alklaib

Rania Almutairi

Sumo Abdulrahman

Histology439team@gmail.com

Member

Organizer

Note taker

Reviser