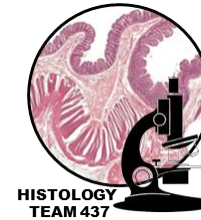




Histology of the eye



Red: important.

Black: in male | female slides.

Gray: notes | extra.

Editing file



➤ OBJECTIVES

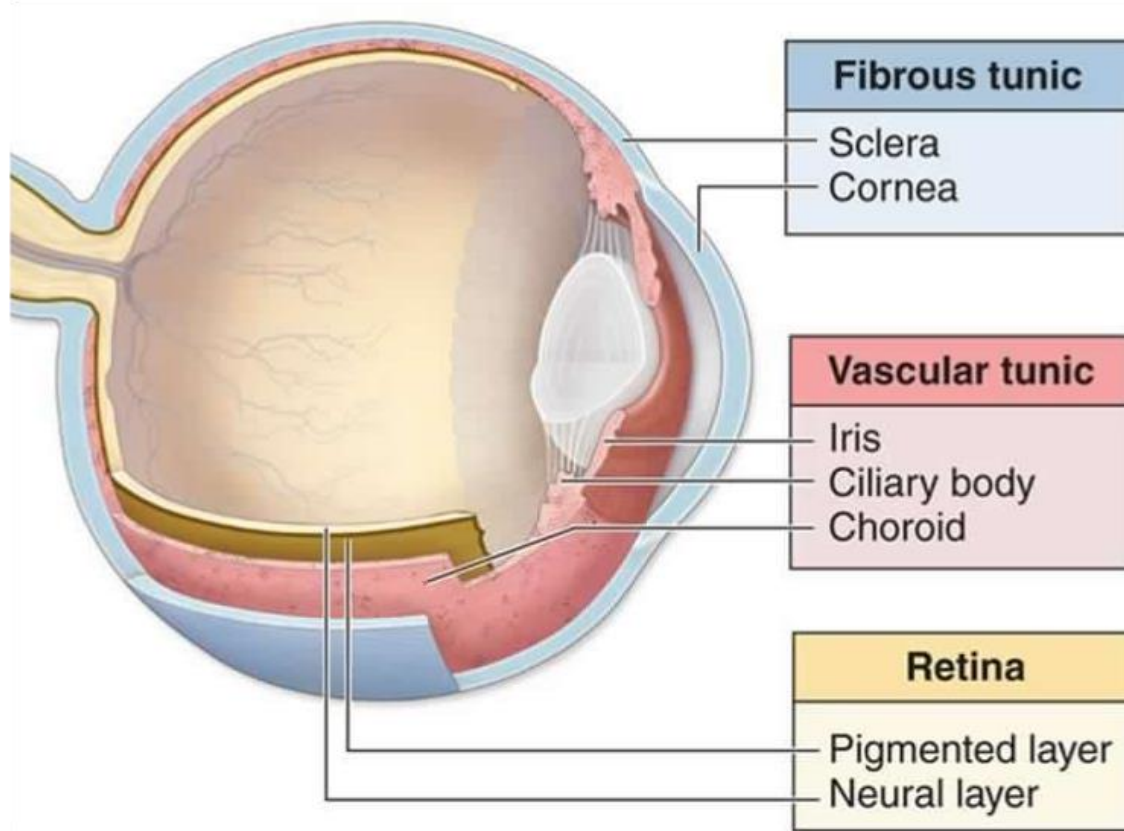
By the end of this lecture, the student should be able to describe:

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

★ According to Dr. Ali the questions of the exam will only be from the three topics mentioned above.

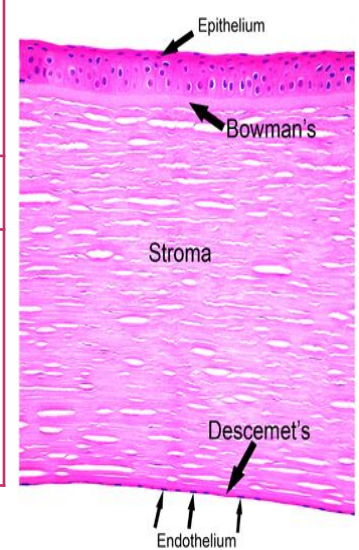
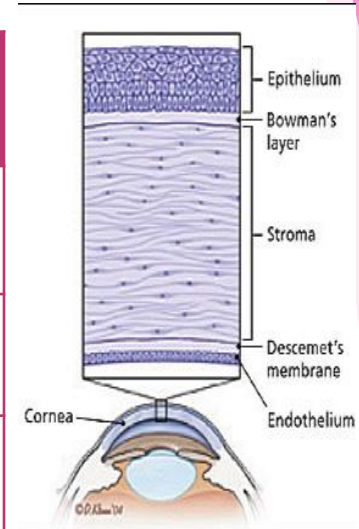
★ Eye Bulb

3 Coats (tunics)	components
1-Fibrous tunic (Outer most layer)	<ul style="list-style-type: none"> • Cornea • Sclera
2- Vascular tunic (Middle layer)	<ul style="list-style-type: none"> • Choroid • Ciliary body • Iris
3- Neural tunic (Inner layer)	<ul style="list-style-type: none"> • Retina



★ Cornea

Layers of Cornea	DEFINITION:	It is the transparent, <u>avascular</u> and highly innervated anterior portion of the fibrous coat.
	Corneal epithelium (anterior layer)	- <u>Non-keratinized</u> Stratified 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 (posterior layer)	It is <u>simple squamous epithelium</u> . Functions: 1- Formation of Descemet's membrane. 2- Keeping the stroma relatively dehydrated (sod. pump → water withdrawal from the stroma).



- Bowman's membrane is the basement membrane for corneal epithelium

★ ➤ 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.
- gives nutrients to cornea.

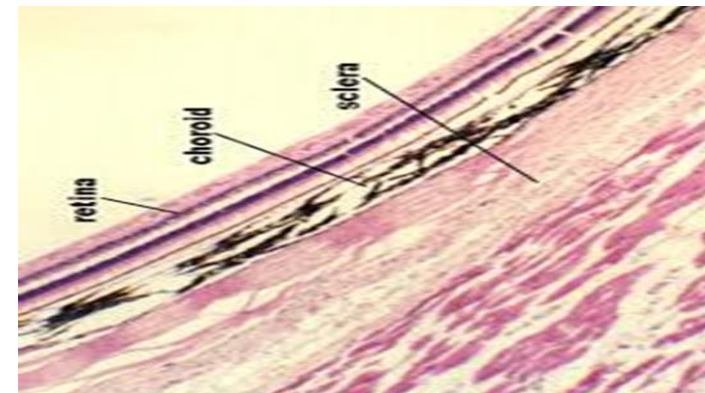
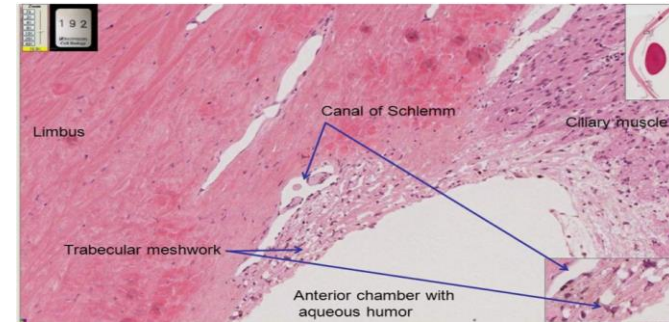
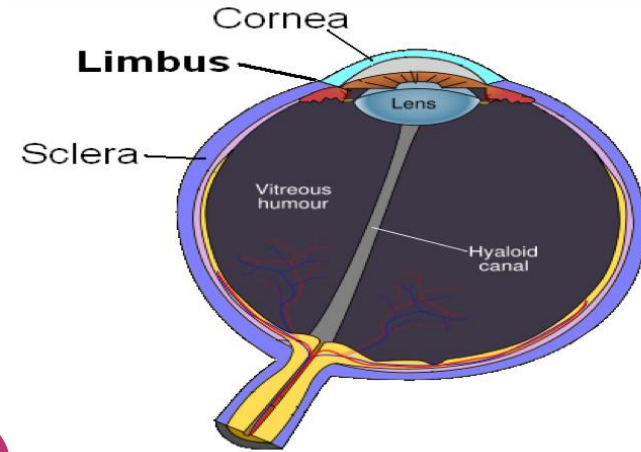
It contains:

Trabecular meshwork:

- Endothelium-lined spaces.
- It **leads to canal of Schlemm**.

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.

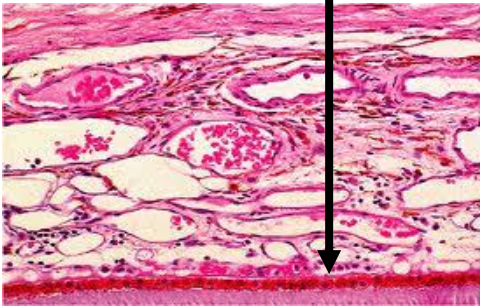


➤ Choroid

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.

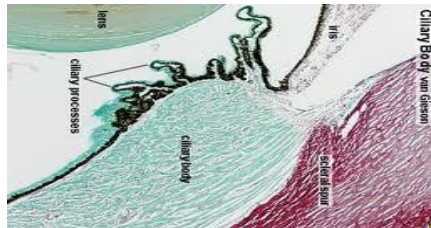


➤ Ciliary Body

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.



Histology team 437 | Neuropsychiatry block | Lecture two

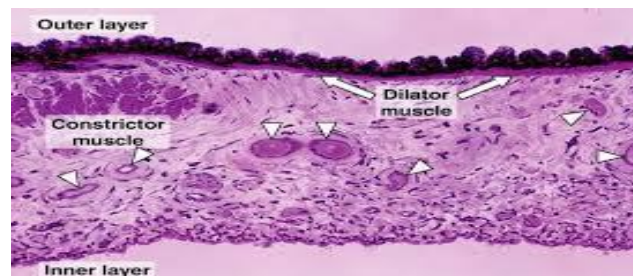
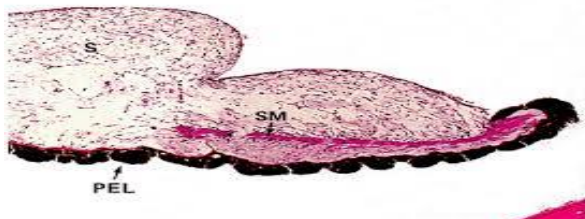
➤ Ciliary Processes

- Smooth muscles
- 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).
- ciliary process is what controls curvature of the lens but it is not directly attached to it.



➤ Iris

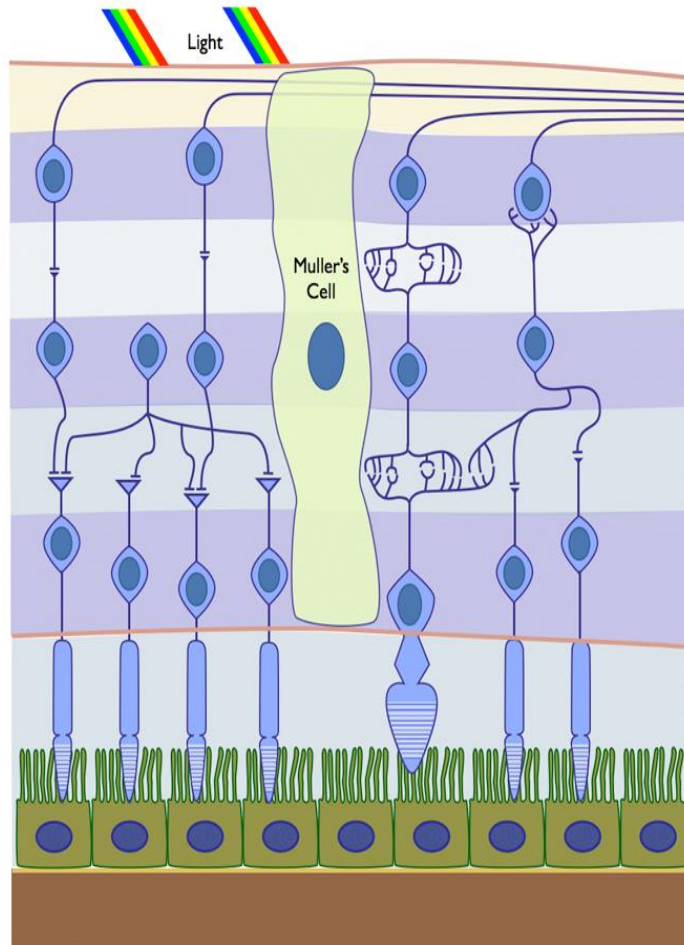
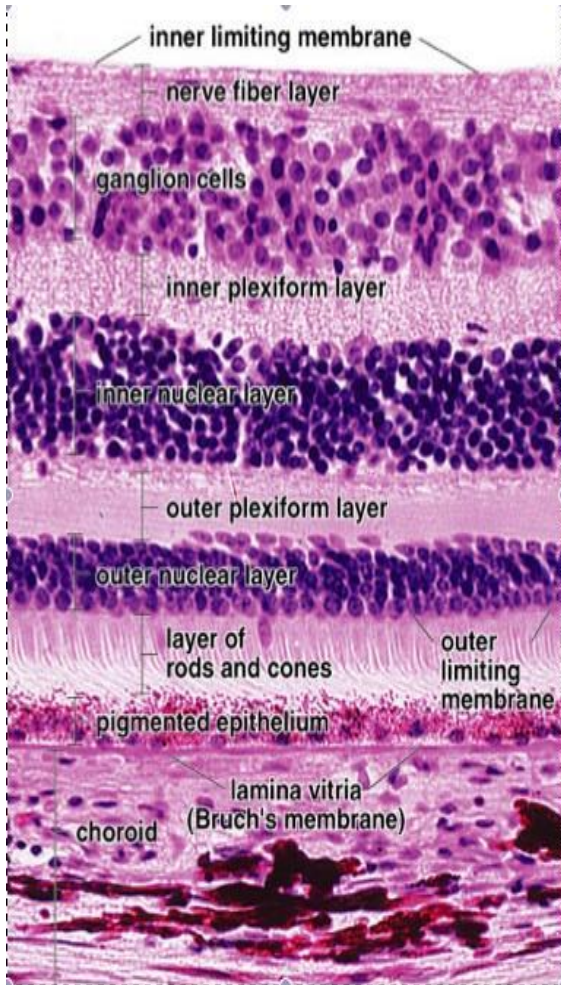
It is formed of 5 layers:	1- Anterior border layer	Incomplete layer of <u>fibroblasts</u> and <u>melanocytes</u> . Most of it are cones sells
	2- Stroma	Poorly vascularized C.T. with fibroblasts and melanocytes.
	3- Vessel layer More prominent layer	Well-vascularized loose C.T. Centrally, it contains circularly arranged smooth muscle fibers (sphincter pupillae muscle).
	4- Dilator pupillae muscle layer Arranged in sunrays shape	Contains radially arranged myoepithelial cells. So the iris constricts and dilates the pupil.
	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.



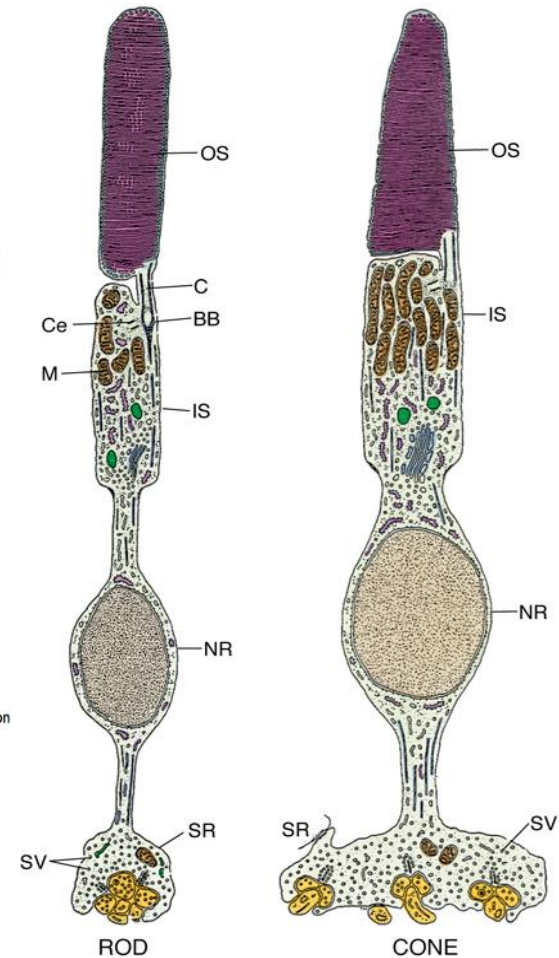
★ RETINA

Layers	Features	Function
1-Pigmented epithelium (outside)	<ul style="list-style-type: none"> • <u>Cuboidal to columnar cells</u> (single layer). Short column • Apical microvilli. • Abundance of melanin granules. 	<ul style="list-style-type: none"> • Absorb light. • Phagocytosis of membranous discs from tips of rods. • Esterification of Vitamin A (in SER).
2-Rods and cones layer	<ul style="list-style-type: none"> • Are photoreceptor cells. • Each has: <ol style="list-style-type: none"> 1. Dendrite formed of: <ul style="list-style-type: none"> - 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. 	<ul style="list-style-type: none"> • Rods are receptors for dim light (low intensity light). • Cones are receptors for bright light and color vision (red, green & blue).
3-Outer limiting membrane	A region of <u>zonulae adherents junctions</u> between Muller cells and the photoreceptors.	
4-Outer nuclear layer	Contains nuclei of the rods & cones.	
5-Outer plexiform layer	Contains <u>axodendritic synapses</u> between the <u>photoreceptor cells</u> and <u>dendrites of bipolar and horizontal cells.</u>	
6-Inner nuclear layer	Contains the nuclei of: <ol style="list-style-type: none"> 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. 	
7-Inner plexiform layer	Contains axodendritic synapses between <u>axons of bipolar neurons</u> and <u>dendrites of ganglion cells and amacrine cells.</u>	
8-Ganglion cell layer	Contains cell bodies of large multipolar neurons of the ganglion cells.	
9-Optic nerve fiber layer	Contains <u>unmyelinated</u> axons of the <u>ganglion</u> cells. N.B. These axons become myelinated as the nerve pierces the sclera.	
10-The inner limiting membrane	It is formed by the basal laminae of the Muller cells.	

➤ Layers Of Retina



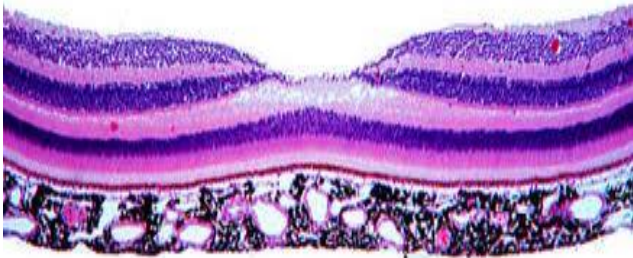
- Vitreous Body
- Inner Limiting Membrane
- Optic Nerve Fibers
- Ganglion Cell Layer
- Inner Plexiform Layer
Connections between bipolar, amacrine and ganglion cells.
- Inner Nuclear Layer
Contains cell bodies of bipolar, amacrine and horizontal neurons.
- Outer Plexiform Layer
- Cell Bodies of Rods and Cones
- Outer Limiting Membrane
- Photoreceptor Layer
Rods: more sensitive but no color information
Cones: sensitive to different colors of light
- Pigment Cells
- Choroid



★ Retina

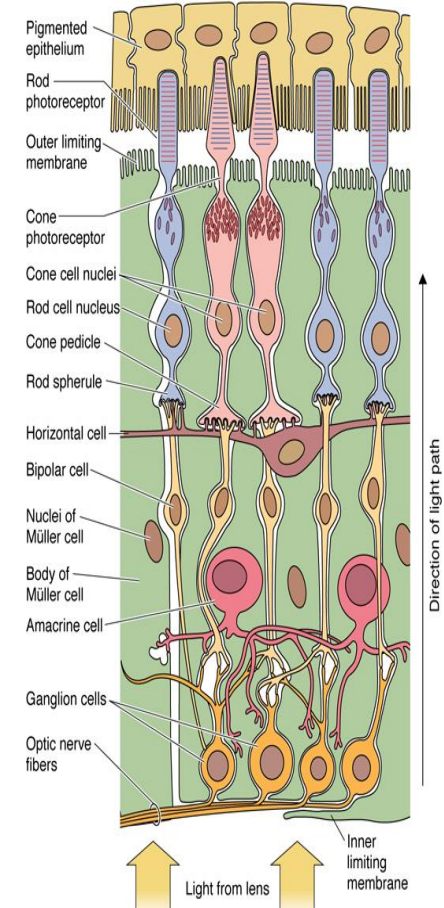
Fovea centralis

- It lies **in the center of macula lutea.**
- **Cones** are highly concentrated in the fovea.
- It is **responsible for visual acuity.**
- Important for sharp vision (like reading)
- Highly affected by hyperglycemia.



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.



➤ **QUESTIONS:**

Q1: Canal of schlemm is found in which of the following ?

- A) Retina B) sclera C) limbus D) Choroid

Q2: Which of the following sites contain the **highest concentration of cones**?

- A) Optic disk B) Fovea centralis C) Conjunctiva D) All above

Q3: What type of collagen is found in **Bowman's membrane**?

- A) Type 1 B) Type 2 C) Type 3 D) Type 4

Q4: What is the thickest layer of **cornean**?

- A) Bowman's membrane B) Descemet's membrane C) Stroma D) Corneal endothelium

Q5: Which structure drains the aqueous humor into the **venous system**?

- A) Optic disk B) Fovea centralis C) Conjunctiva D) Canal of schlemm

D - 5
C - 4
A - 3
B - 2
C - 1



Team members :

Ebtesam Almutairi
Marwah Alkhalil
Rinad Alghoraiby

Tareq Allhaidan
Abdulmalik Alharbi
Fahad Alnuhabi

Team leaders :

Khalid Fayez Alshehri
Rawan Mohammad Alharbi



[Twitter.com/Histology437](https://twitter.com/Histology437)



HistologyTeam437@gmail.com

