**Histological importance of the eye**

 Broadly, from an anatomical perspective, the eye can be viewed as a series of overlapping layers. The eye comprises two components fused into one; hence, it does not possess a perfect spherical shape. It is classified based on two aspects, namely external and internal components.

**Internal component**

The wall of the **eye** is composed of **three layers**, each of which has one or more very important components:

* The sclera and cornea make up the exterior layers.
* The uvea is the vascular layer in the middle, subdivided into the iris, ciliary body, and choroid.
* The retina constitutes the innermost layer and is made up of nervous tissue.

**(A)- *"Exterior Layer: Sclera and Cornea":***

1. *The sclera*:

* The sclera is dense connective tissue made of mainly type 1 collagen fibers, oriented in different directions, it is the white part of the eye. The lack of parallel orientation of collagen fibers gives the sclera its white appearance, as opposed to the transparent nature of the cornea. However, the collagen of the sclera and cornea are continuous.
* The four layers of the sclera from external to internal are episclera, stroma, lamina fusca, endothelium.
* The episclera is the external surface of the sclera. It is connected to the Tenon capsule by thin collagen fibers. At the corneoscleral junction, also known as the limbus, the Tenon capsule contacts stroma of the conjunctiva.

2. *Cornea :*

* Consists of type I collagen fibers oriented in a uniform parallel direction to maintain transparency
* Consists of five layers: epithelium (non-keratinized, stratified squamous epithelium), Bowman layer, stroma (also called substantia propria), Descemet’s membrane, corneal endothelium.
* Corneal epithelium: fast growing, regenerating multicellular layer which interacts directly with the tear film.
* Bowman layer: This is a layer of subepithelial basement membrane protecting the underlying stroma. It is composed of type 1 collagen, laminin, and several other heparan sulfate proteoglycans.
* Stroma: The largest layer of the cornea, the stroma has collagen fibers arranged in a regular pattern. Keratocytes maintain the integrity of this layer. The function of this layer is to maintain transparency, which occurs by the regular arrangement, and lattice structure of the fibrils, whereby scatter from individual fibrils gets canceled by destructive interference, and the spacing of less than 200 nm allows for transparency.
* Descemet’s membrane: an acellular layer made of type IV collagen that serves as a modified basement membrane of the corneal endothelium
* Corneal endothelium: a one cell thick layer made of either simple squamous or cuboidal cells. Cells in this region do not regenerate and have pumps that maintain fluid balance and prevent swelling of the stroma.

**(B)- "Middle Layer: Uvea (Iris, Ciliary Body, Choroid)":**

*1. Iris:*

* Consists of (1) stromal layer with pigmented, fibrovascular tissue and (2) pigmented epithelial cells beneath the stroma
* The sphincter pupillae and dilator pupillae muscles connect to the stroma
* The pigmented layer of cells blocks rays of light and ensures that light must move through the pupil to reach the retina
* The angle formed by the iris and cornea contains connective tissue with endothelial channels called the trabecular meshwork, which drains aqueous humor in the anterior chamber into the venous canal of Schlemm. From here, fluid drains into episcleral veins.

*2. Ciliary Body:*  The tissue that divides the posterior chamber and vitreous body

* Consists of the ciliary muscle and the ciliary epithelium
* The ciliary muscle, via the lens zonules, controls the structure of the lens, which is vital for accommodation. Zonules are connective tissue fibers that connect the ciliary muscle and lens.
* The ciliary epithelium produces aqueous humor which fills the anterior compartment of the eye.

*3. Choroid:*

* Consists of a dense network of blood vessels supplying nourishment to structures of the eye, housed in loose connective tissue.
* The choriocapillary layer is located in the innermost part of the choroid and supplies the retina
* The Bruch membrane is an extracellular matrix layer situated between the retina and choroid and has significance in age-related macular degeneration, where an accumulation of lipid deposits prevent diffusion of nutrients to the retina.

**(C)-“ Innermost layer: Lens, Vitreous, Retina”:**

1. Lens: separates the aqueous and vitreous chamber

* Consists of an outer capsule, a middle layer called cortex, and an inner layer called the nucleus.
* The capsule is the basement membrane of the lens epithelium which lies below
* New lens cells differentiate from the lens epithelium and are incorporated peripherally, pushing older lens cells towards the middle.

2. Vitreous: a jelly-like space made of type II collagen separating the retina and the lens

3. Retina: nervous tissue of the eye where photons of light convert to neurochemical energy via action potentials.

Corona virus and the eye

Our eyes may play an important role in the spread and prevention of the new corona virus outbreak seen throughout the world, eye doctors and health experts say.To cut your personal risk of contracting the new corona virus, avoid touching your eyes, nose and mouth with unwashed hands. It is the mucous membranes (membranes that line various cavities in the body) that are most susceptible to transmission of the virus.

The relationship between the transmission of the corona virus and your eyes is complicated.It’s thought that corona virus spreads from person to person mainly through airborne “respiratory droplets” produced when someone coughs or sneezes, much like the flu virus spreads, the CDC says. These droplets can land in the mouths or noses of people who are nearby, and possibly be inhaled into the lungs. These droplets also can be spread to your eyes when you touch your face and then your eyes with unwashed hands.

The retina itself is divided into various layers as follow:

Retinal pigment epithelium: made of cuboidal cells containing melanin which absorbs light. These cells also establish a blood-retina barrier through tight junctions.

 "Rod and cone cells": the layer of cells with photoreceptors and glial cells. Rods are located peripherally and are more sensitive to light and motion than cones. Cones have higher visual acuity and specificity for color vision.

* *"Outer limiting membrane"*: a layer of Muller cells and rod/cone junctions which serves to separate the photosensitive regions of the retina from the areas that transmit the electrical signals.
* *"Outer nuclear layer"*: This layer consists of nuclei of rod and cone cells.
* *"Outer plexiform layer"*: This layer contains synaptic processes of rod and cone cells.
* *"Inner nuclear layer':* This layer contains the cell body of glial, amacrine, bipolar, and horizontal cells
* *"Inner plexiform layer"*: This layer relays information from cells of the inner nuclear layer. Thus, this layer has axons of amacrine, bipolar, and glial cells and dendrites of retinal ganglion cells.
* *"Ganglion cell layer"*: This layer contains nuclei of retinal ganglion cells.
* *"Nerve fiber layer"*: This layer contains axons of retinal ganglion cells and the astroglia which support them. Collectively, these axons constitute the optic nerve.
* *"Internal limiting membrane"*: A thin layer of Muller glial cells and basement membrane which demarcates the vitreous anteriorly from the retina posteriorly.

. A foreign object in the eye is something that enters the eye from outside the body. It can be anything that does not naturally belong there, from a particle of dust to a metal shard to the corona virus. When a foreign object enters the eye, it will most likely affect the cornea or the conjunctiva. The cornea is a clear dome that covers the front surface of the eye. It serves as a protective covering for the front of the eye. Light enters the eye through the cornea. It also helps focus light on the retina at the back of the eye. The conjunctiva is the thin mucous membrane that covers the sclera, or the white of the eye. The conjunctiva runs to the edge of the cornea. It also covers the moist area under the eyelids. When a foreign object enters the eye it can lead to injuries, these injuries usually are minor. However, some types of foreign objects can cause infection or damage your vision and one of it is the corona virus but it’s not an object it’s a virus. Corona virus may cause pink eye , but it’s rare .If you see someone with pink eye, don’t panic. It doesn’t mean that person is infected with coronavirus. But health officials believe viral pink eye, or conjunctivitis, develops in about 1% to 3% of people with corona virus. The virus can spread by touching discharge from an infected person’s eyes.