**NAME: BASSEY MARVELLOUS**

**MAT.NO: 17/MHS01/081**

**COURSE: ANA 305**

**COURSE TITLE: NEUROHISTOLOGY**

# **Question 1: Write an essay on the histological importance of the eye in relation to their cellular functions.**

The eyes are housed in the bony orbits, they are photosensitive organs responsible for vision. Each eye has

1. Three tunics: Tunica fibrosa (outer layer), Tunica vasculosa (middle layer) and retina
2. The eye possesses intrinsic muscles that adjust the aperture of the Iris and alters the lens diameter, permitting accommodation for close vision
3. It possesses extrinsic muscles attached to the external aspect of the Orb (eyeball) which moves the eyes in a coordinated manner to perceive the desired visual fields
4. The eyeball is covered by the upper and lower eyelids. The Orb is moistened by lacrimal fluid (tears) secreted by lacrimal gland

## TUNICA FIBROSA

This layer is composed of the Sclera and Cornea. The sclera is an opaque, relatively avascular fibrous connective tissue layer that covers the posterior five sixths of the eyeball. The cornea is a transparent highly innervated avascular anterior one-sixth of the tunica. It joins with the sclera at the Limbus. The cornea consist of five layers

1. **CORNEAL EPITHELIUM:** A non-keratinising stratified squamous epithelium having no papillae of connective tissue. It lines the anterior surface of the cornea and possesses microvilli in its superficial layer (the microvilli traps moisture, preventing dehydration of the cornea
2. **BOWMAN’S MEMBRANE:** Is a homogeneous noncellular layer that provides form, stability and strength
3. **CORNEAL STROMA:** The corneal stroma is the thickest layer. It is composed of many layers of Type 1 collagen fibres flying parallel to each other. The collagen fibers are also embedded in a ground substance composed of Chondroitin sulphate and keratin sulphate
4. **DESCEMET MEMBRANE:** Is a thick (5-10 um) basal lamina separating the stroma from the endothelium lining the cornea
5. **CORNEAL ENDOTHELIUM:** Lines the posterior aspect of the cornea. It is a simple squamous epithelium with cells that exhibit numerous pinocytic vesicles. It resorbs fluid from the stroma, thus contributing in the transparency of the cornea.

## TUNICA VENULOSA

Is composed of three parts of the Uvae

1. **CHOROID:** It is a highly pigmented layer on the posterior wall of the orb. Its loose connective tissues contain melanocytes. It possesses a deep choriocapillary layer and bruch membrane (basement membrane)
2. **CILIARY BODY:** It is a wedge shaped extension of the choroid. It is lined in its inner surface area by two epithelial layers. An outer pigmented columnar epithelium and an inner nonpigmented simple columnar epithelium. Its ciliary processesses have a connective tissue core containing FENESTRATED CAPILARIES and are covered by the two epithelial layers. Ciliary muscles are attatched to the sclera and ciliary body in a manner that its contractions stretch the ciliary body and release tension on the suspensory ligament and lens. The ciliary muscle is innervated by PARASYMPATHETIC FIBERS of the oculomotor nerve (CN III)
3. **IRIS:** consists of a stromal layer with pigmented fibrovascular tissue and pigmented epithelial cells beneath the stroma. The SPHINCTER PUPILLAE and dilator pupillae muscles connect to the stroma. The pigmented layer blocks rays of light and ensures that light must move through the pupil to reach the retina. The angle formed by the cornea and iris contains connective tissues with endothelial cells called the TRABECULAR MESHWORK which drains aqueous humor in the anterior chamber into the venous canal of SCHLEMM.

## Innermost layer: Lens, Vitreous, Retina":

**1. LENS:** separates the aqueous and vitreous chambers.

* Consists of an outer capsule, a middle layer called cortex, and an inner
* 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:** The retina is the innermost Tunicae of the eye and is responsible for photoreception. It has a shallow depression in its posterior wall that contains only cones, this avascular region is called the FOVEA CENTRALIS whose central region, the MACULA, exhibits the greatest visual activity. The retina has 10 distinct layers, which will be discussed later.

## EXTERNAL STRUCTURE

* **CONJUCTIVA:** The conjunctiva lines the inner part of the eyelids. The tarsal plate lies beneath the conjunctiva meibomian glands which secretes any oily substance, to decrease evaporation of film
* **TEAR FILM:** The tear film consist of aqueous, mucus and oily secretions
* **ACESSORY GLANDS:** Apocrine glands of moll, meibomian glands, lacrimal glands.
* **MUSCLES:** Orbitucularis oculi, levator palpebrea, superioris, superior tarsal muscles.
* **EYELID:** The eyelids arelined internally by conjunctiva and externally by skin that is elastic and covers a supportive framework of tarsal plates. The eyelids contains highly modified sebaceous glands (meibomian glands), smaller modified sebaceous glands (gland of zeis), and sweat glands (glands of moll).

## FUNCTIONS

* The layers of the eye perform distinct functions which coalesce to create a unified, perceptual experience. The essential role of the external eye structures is to protect the delicate tissue of the internal eye. The eyelid prevents foreign bodies from entering the inner eye and helps refresh and distribute the tear film by blinking. Eyelashes are finely sensitive to touch and warn the eye of possible debris and particles that may cause injury.
* Internal parts of the eye have primarily structural and visual functions. The cornea serves a protective role and is responsible for two-thirds of the refractive properties of the eye. The remaining one-third of refraction is performed by the lens, which is functionally adjustable through the action of the zonular fibers and ciliary muscles. At the end of the visual process, as rays of light bend through the cornea and lens, photon energy is converted to neurochemical action potentials by cells of the retina, which then send these impulses to the brain, via the optic nerve.
* The uvea of the eye is a crucial mediator of nutrition and gas exchange, as blood vessels course through the ciliary body and iris, while the choriocapillaris in the posterior eye help support the retina. This abundant blood supply is implicated in uveitis, as inflammatory mediators enter the eye through this vascular network.

# **Question 2: Corona virus can penetrate the body through the eye and implicate the immune system, briefly discus the layers of the retina for information penetration.**

* RETINA: This is the nervous tissue of the eye where photons of light convert to neurochemical energy via action potentials

Moreover, the retina itself is divided into various layers as follows:

* **“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 of photo receptor layer"**: 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.