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**DEPARTMENT: MEDICINE & SURGERY**

**COURSE CODE: ANA 305(HISTOLOGY OF SPECIAL SENSES AND NEUROHISTOLOGY)**

- 1) Write an essay on the histological importance of eye in relation to their cellular functions.
- 2) Corona virus can penetrate the body through eye and implicate the immune system, briefly discuss the layers of retina for information penetration.

**Answers**

**1)** The eye has both external and internal structures. The external structures of the eye include the eyelashes, lids, muscles, accessory glands and conjunctiva.

The internal structures of the eye consist of three layers of tissue arranged concentrically:

- 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

**External structures of the eye**

1. *Conjunctiva*

- The conjunctiva lines the inner part of the eyelids.
- The tarsal plate lies beneath the conjunctiva & contains meibomian glands, which secrete an oily substance to decrease the evaporation of the tear film.

2. *Tear film*: It consists of aqueous, mucus, and oily secretions.

3. *Accessory glands*: Apocrine glands of Moll, meibomian glands, lacrimal glands.

4. *Muscles*: Orbicularis oculi, levator palpebrae superioris, superior tarsal muscle

5. *Eyelid*: It is likewise known as the cover of the eye, a mobile layer made up of skin and also muscular tissue and also covers the eyeball.

**Internal structures of the eye**: they're organized in the 3 layers as follows:

**(A) Outermost Layer: Sclera and Cornea:**

1. *The sclera (white of the eye)*

- The sclera is dense connective tissue made of mainly type 1 collagen fibres oriented in different directions.
- The four layers of sclera from external to internal are: episclera, stroma, lamina fusca, endothelium.

2. *Cornea (transparent front layer of the eye)*

- Consists of type 1 collagen fibres oriented in a uniform parallel direction to maintain transparency.
- Consists of 5 layers: epithelium (non-keratinized, stratified squamous epithelium), Bowman's layer, stroma (also called substantia propria), Descemet's membrane, corneal endothelium.

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

1. *Iris:*

- Consists of (a) stromal layer with pigmented, fibrovascular tissue and (b) 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.

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 fibres 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 the nourishment to the structure 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 chambers*

- 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.
2. *Vitreous*: a jelly-like space made up 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.

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

**2)** Between the vitreous body and the choroid the retina can usually be seen to consist of 9 neural layers and a pigmented layer. Following the path of light these are:

- The inner limiting layer(**ILL**)
- The nerve fiber layer(**NFL**), containing the ganglionic cell axons that converge at the optic disc and form the optic nerve.
- The ganglionic layer(**GL**),containing cell bodies of the ganglion cells and thicker near the retina's center than its periphery.
- The inner plexiform layer(**IPL**),containing fibers and synapses of the ganglion cells and the bipolar neurons of the next layer.
- The inner nuclear layer(**INL**),with the cell bodies of several types of bipolar neurons which begin to integrate signals from the rod and cone cells.
- The outer plexiform layer(**OPL**),containing fibers and synapses of the bipolar neurons and rod and cone cells.
- The outer nuclear layer(**ONL**),with the cell bodies and nuclei of the photosensitive rod and cone cells.
- The outer limiting layer(**OLL**),a line formed by junctional complexes holding the rod and cone cells to the intervening Muller cells.
- The rod and cone layer(**RCL**),which contains the outer segments of these cells where the photoreceptors are located.
- The non-neural pigmented layer(**PL**),which has several supportive functions important for the function & maintenance of the neural retina.



