NAME: ONYEMA GIDEON TOCHUKWU

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COLLEGE: COLLEGE OF MEDICINE AND HEALTH SCIENCES

DEPARTMENT: MEDICINE AND SURGERY

COURSE: NEUROHISTOLOGY AND ANATOMY OF THE SPECIAL SENSES.

 **ASSIGNMENT**

1. Write an essay on the histological importance of the eye in relations to their cellular function.
2. Corona virus can penetrate the body through the eye and implicate the immune system. Briefly discuss the layers of the retina for information penetration.
3. **HISTOLOGY OF THE EYE**

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.

All of these layers can further subdivide and undergo histological classification.[

**STRUCTURES OF THE EYE**

**External Structures of the Eye:**

1**. Conjunctiva**

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

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

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

4. **Muscles:**Orbicularis oculi, levatorpalpebraesuperioris, superior tarsal muscle.

5. **Eyelid:** The eyelid, 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:**

 The innermost structures of the eye are organized in the three layers as follows

1. **Outermost Layer: Sclera and Cornea**

 ***The sclera***

* The sclera is dense connective tissue made of mainly type 1 collagen fibers, oriented in different directions. 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.

**(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 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
* 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

1. **THE LAYERS OF THE RETINA**

The pathway through which information passes through the retina to enter into the eyes is through the layers of the retina. There are **ten different layers** of the retina which are made up of six major cell types.

1. Rods
2. Cones
3. Retinal Ganglion cells
4. Bipolar cells
5. Horizontal cells
6. Amacrine cells

The various layers of the retina arranged from the outermost to the innermost is the pathway through which information penetration occurs. They are;

* 1. **Retinal pigment epithelium**

The retina is supported by the retinal pigment epithelium (RPE), which has many functions including vitamin A metabolism, maintenance of the blood-retina barrier, phagocytosis of photoreceptor outer segments, production of mucopolysaccharide matrix surrounding the outer segments of the retina, and active transport of materials into and out of the RPE.

* 1. **Rod and cone cells ( The photoreceptor 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.

* 1. **External limiting membrane**

This layer contains the bases of the rod and cone photoreceptors cell bodies. The ELM forms a barrier between the subretinal space, into which the inner and outer segments of rods and cones project to be in close association with the pigment epithelial layer behind the retina, and the neural retina proper.

* 1. **Outer nuclear layer**

This layer contains the rod and cone granules that sense photon, extensions from the rrororodrod, and cone cell bodies.

* 1. **Outer plexiform layer**

This layer of the retina contains a neuronal synapse of between rods and cones with the footplate of horizontal cells. Capillaries are also found to be primarily running through the outer plexiform layer.

* 1. **Inner nuclear layer**

This layer of the retina contains the cell bodies of bipolar cells, horizontal cells, and amacrine cells.

* 1. **Inner plexiform layer**

The inner plexiform layer is an area comprised of a dense reticulum of fibrils formed by interlaced dendrites of Retinal Ganglion Cells and cells of the inner nuclear layer.

* 1. **Ganglion cell layer**

This layer contains the retinal ganglion cells (RGCs) and displaced amacrine cells. As a rule of thumb, smaller RGCs dendrites arborize in the inner plexiform layer while larger RGCs dendrites arborize in other layers.

* 1. **Nerve fiber layer (NFL)**

The nerve fiber layer is the second innermost layer of the retina from the vitreous. Patients with retinitis pigmentosa may have a measurable degree of RNFL thinning as determined by OCT.

* 1. **Inner limiting membrane**

The ILM is the retina's inner surface bordering the vitreous humor and thereby forming a diffusion barrier between the neural retina and vitreous humor. The ILM contains laterally contacting Muller cell synaptic boutons and other basement membrane parts.