**OPUTE RUTH ADAEZE**

**17/MHS01/270**

**NEURO HISTOLOGY**

**QUESTION 1**

The eye is a complex and highly developed photosensitive organ that analyses the form, intensity, and colour of light reflected from objects, providing the sense of sight. Broadly, from an anatomical perspective, the eye can be viewed as a series of overlapping layers of tissue.

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.

**The Internal Structures of the Eye**

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

**1.Outermost Layer**

* ***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 fibres. At the corneoscleral junction, also known as the limbus, the Tenon capsule contacts stroma of the conjunctiva.

*THE HISTOLOGICAL IMPORTANCE OF THE SCLERA*

The dense fibrous connective tissue of the sclera, as well as the collagen fibres connecting the layers of the sclera together allows the sclera to give protection to the delicate structures in the eye and give form and shape to the eye.

* ***The Cornea***

Consists of type I collagen fibers oriented in a uniform parallel direction to maintain transparency. The cornea consists of five layers.

1. An external stratified squamous epithelium,
2. An anterior limiting membrane (Bowman's membrane, the basement membrane of the stratified epithelium),
3. The stroma,
4. A posterior limiting membrane (Descemet's membrane, the basement membrane of the endothelium), and
5. An inner simple squamous endothelium.

*THE HISTOLOGICAL IMPORTANCE OF THE CORNEA*

The corneas external stratified epithelium provides a smooth optical surface as an internal part of tear film cornea interface contributing to refractive power of the eye. The arrangement, structure and shape of the collagen present in the stroma layer helps in producing the corneas light conducting transparency which futher increases the refracting power of the cornea.

The inner simple squamous epithelium maintains corneal clarity by removing fluid from the corneal stroma, therefore maintaining a perfect balance between fluid being moved into the cornea and fluid being pumped out.

**2. Middle Layer**

* ***The Iris***

Consists of 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 anterior surface of the iris, exposed to the anterior chamber, is not covered by epithelium, but consists of an irregular, discontinuous layer of fibroblasts and melanocytes, densely packed and with interdigitating processes. Deeper in the iris the stroma is more typical loose connective tissue with microvasculature. The underlying epithelial layer is composed of myoepithelial cells which are also at least partially pigmented. 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.

*THE HISTOLOGICAL FUNCTION OF THE IRIS*

The smooth muscles of the iris sphincter pupillae and dilator pupillae (which have fibres that are elongated, tapering, and non striated cells, each of which is enclosed by a thin basal lamina and a fine network of reticular fibers ) are responsible for the contraction of the iris thus controlling the size of the pupil and the amount of light entering.

* ***Ciliary Body***

It is the tissue that divides the posterior chamber and vitreous body. It consists of the ciliary muscle and the ciliary epithelium. 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.

*THE HISTOLOGICAL IMPORTANCE OF THE CILIARY BODY*

The ciliary epithelium produces the aqueous humour which helps in supplying nutrients to the eye and maintain intraocular pressure.

The ciliary smooth muscle (which have fibres that are elongated, tapering, and non striated cells, each of which is enclosed by a thin basal lamina and a fine network of reticular fibers ) is in a ring form and is ressponibke for accommodation of the eye

* ***Choroid***

The choroid is the vascular portion of the eye. 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.

*THE HISTOLOGICAL IMPORTANCE OF THE CHOROID*

The dense network of blood vessels in this layer of the eye helps in supplying nutrients and oxygen. Some important structures in the eye like the anterior part of the optic nerve are dependent on choroidal blood supply.

**3. Innermost layer**

* Lens

It 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.

*THE HISTOLOGICAL IMPORTANCE OF THE LENS*

The capsule in the lens acts as the basement memebrane and helps in changing the shape of the lens therefore changing the focal distance of the eye in order to create clear images at various distances.

* **Vitreous Body**

The virteous body is a jelly-like space made of type II collagen separating the retina and the lens. It also consists of hylauronic acid

*THE HISTOLOGICAL IMPORTANCE OF THE VITREOUS BODY*

The vitreous helps the eye to hold its spherical shape.

* **Retina**

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

1. [Inner limiting membrane](https://en.wikipedia.org/wiki/Inner_limiting_membrane) – basement membrane elaborated by [Müller cells](https://en.wikipedia.org/wiki/Muller_glia).
2. [Nerve fibre layer](https://en.wikipedia.org/wiki/Nerve_fiber_layer) – axons of the [ganglion cell](https://en.wikipedia.org/wiki/Retinal_ganglion_cell) bodies (note that a thin layer of Müller cell footplates exists between this layer and the inner limiting membrane).
3. [Ganglion cell layer](https://en.wikipedia.org/wiki/Ganglion_cell_layer) – contains nuclei of ganglion cells, the axons of which become the optic nerve fibres, and some displaced [amacrine cells](https://en.wikipedia.org/wiki/Retina_amacrine_cell).
4. [Inner plexiform layer](https://en.wikipedia.org/wiki/Inner_plexiform_layer) – contains the synapse between the [bipolar cell](https://en.wikipedia.org/wiki/Retina_bipolar_cell) axons and the dendrites of the [ganglion](https://en.wikipedia.org/wiki/Retinal_ganglion_cell) and amacrine cells
5. [Inner nuclear layer](https://en.wikipedia.org/wiki/Inner_nuclear_layer) – contains the nuclei and surrounding cell bodies (perikarya) of the [amacrine cells](https://en.wikipedia.org/wiki/Amacrine_cells), [bipolar cells](https://en.wikipedia.org/wiki/Retina_bipolar_cell), and [horizontal cells](https://en.wikipedia.org/wiki/Retina_horizontal_cell)
6. [Outer plexiform layer](https://en.wikipedia.org/wiki/Outer_plexiform_layer) – projections of rods and cones ending in the rod spherule and cone pedicle, respectively. These make synapses with dendrites of bipolar cells and horizontal cells. In the [macular](https://en.wikipedia.org/wiki/Macula) region, this is known as the Fiber layer of [Henle](https://en.wikipedia.org/wiki/Friedrich_Gustav_Jakob_Henle).
7. [Outer nuclear layer](https://en.wikipedia.org/wiki/Outer_nuclear_layer) – cell bodies of rods and cones.
8. [External limiting membrane](https://en.wikipedia.org/wiki/External_limiting_membrane) – layer that separates the inner segment portions of the photoreceptors from their cell nuclei.
9. Inner segment / outer segment layer – inner segments and outer segments of rods and cones. The outer segments contain a highly specialized light-sensing apparatus.
10. [Retinal pigment epithelium](https://en.wikipedia.org/wiki/Retinal_pigment_epithelium) – single layer of cuboidal epithelial cells (with extrusions not shown in diagram). This layer is closest to the choroid, and provides nourishment and supportive functions to the neural retina, The black pigment melanin in the pigment layer prevents light reflection throughout the globe of the eyeball; this is extremely important for clear vision.

*THE HISTOLOGICAL IMPORTANCE OF THE RETINA*

The cells of the retinal pigmented epithelium absorb light passing through the retina to prevent its reflection and then conert this light through other cells to neuro signals

**CLINICAL SIGNIFICANCE**

CORNEA: The shape or curvature of the cornea can be changed surgically to improve certain visual abnormalities involving the ability to focus.

LENS: Advancing age reduces the elasticity of the lens, making accommodation for near objects difficult. This is a normal process, which can be corrected by wearing glasses with convex lenses (reading glasses).

When areas of the lens become opaque or cloudy and vision is impaired, the condition is termed cataract

RETINA: Head trauma or other conditions can cause the pigmented epithelium layer and the photoreceptor layer to separate due to the fact they are not properly attached to eachother. Prompt surgery can quickly correct this.

**QUESTION 2**

The retina is a thin layer of tissue that lines the back of the eye on the inside. It is located near the optic nerve. The purpose of the retina is to receive light that the lens has focused, convert the light into neural signals, and send these signals on to the brain for visual recognition. The 10 layers for information penetration are;

1. [Inner limiting membrane](https://en.wikipedia.org/wiki/Inner_limiting_membrane) – basement membrane elaborated by [Müller cells](https://en.wikipedia.org/wiki/Muller_glia).
2. [Nerve fibre layer](https://en.wikipedia.org/wiki/Nerve_fiber_layer) – axons of the [ganglion cell](https://en.wikipedia.org/wiki/Retinal_ganglion_cell) bodies (note that a thin layer of Müller cell footplates exists between this layer and the inner limiting membrane).
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**CLINICAL SIGNIFICANCE**

The pigmented epithelium and the photoreceptor layer of the retina, derived from the two layers of the optic cup, are not firmly joined to one another. Head trauma or other conditions can cause the two layers to separate with an intervening space. In such regions of detached retina the photoreceptor cells no longer have access to metabolic support from the pigmented layer and choroid and will eventually die. Prompt repositioning of the retina and reattaching it with laser surgery is an effective treatment