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17/MHS01/017
NEURO HISTOLOGY ASSIGNMENT
300L

QUESTIONS:

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

1. The eyes are highly developed photosensitive organs for analysing the form, intensity, and colour of light reflected from objects and providing the sense of sight. Each eye is composed of three concentric tunics/layers.

1. Fibrous layer: A tough external, consisting of the SCLERA and the transparent CORNEA.

- **SCLERA**: The sclera consists mainly of dense connective tissue, with flat bundles of type 1 collagen.

Functions:-

- Supports eye shape.
- Protects delicate internal structures
- Extrinsic eye muscle attachment site.

- **CORNEA**: The cornea is composed of two layers of epithelium with organised connective tissue in between. The cornea is transparent and completely avascular, a section of the cornea shows five distinct layers.

- An external stratified squamous epithelium
- An anterior limiting membrane
- The thick stroma
- A posterior limiting membrane
- An inner simple squamous epithelium

Functions:-

- Protects anterior surface of the eye
- Refracts (bends) incoming light

MEDICAL APPLICATION

The shape of the cornea can be changed surgically to improve certain visual abnormalities involving the ability to focus. In the common ophthalmologic procedure, laser-

assisted in situ keratomileusis (LASIK) surgery, the corneal epithelium is displaced as a flap and the stroma reshaped by an excimer laser which vaporizes collagen and keratinocytes in a highly controlled manner with no damage to adjacent cells or ECM. After reshaping the stroma, the epithelial flap is repositioned and a relatively rapid regenerative response re-establishes normal corneal physiology. LASIK surgery is used to correct myopia, hyperopia, or astigmatism. Corneal grafts between unrelated individuals can usually be accomplished successfully without immune rejection due in part to this tissue's lack of both a vascular supply and lymphatic drainage and to local immune tolerance produced by ocular antigen-presenting cells and immune-modulatory factors in aqueous humor.

2. Vascular layer: Known as UVEA. A middle layer that includes the CHOROID, CILIARY BODY and IRIS.

- **CHOROID**: Consists of loose, well-vascularized connective tissue and contains numerous melanocytes. The choroid is composed of Areolar connective tissue; highly vascularized.

Functions:

- Supplies nourishment to retina
- Pigment absorbs extraneous light

- **CILIARY BODY**: It is composed of ciliary smooth muscle and ciliary processes covered with a secretory epithelium.

Functions:

- Hold suspensory ligaments that attach to the lens and change lens shape for far and near vision.

-Epithelium secretes aqueous humor.

3. **THE RETINA (internal layer):** This is an inner sensory layer that communicates with the cerebrum through the posterior optic nerve. The retina has two structures the **PIGMENTED LAYER** and the **NEURAL LAYER**.

- **PIGMENTED LAYER:** This layer is composed of the pigmented epithelial cells.

FUNCTION:

- Absorbs extraneous light
- Provides vitamin A for photoreceptor cells

- **NEURAL LAYER:** This layer is composed photoreceptors, bipolar neurons, ganglion cells, and supporting Muller cells.

Functions:

- Detects incoming light rays; light rays are converted to nerve signals and transmitted to the brain.

2. LAYERS OF RETINA FOR INFORMATION PENETRATION

The retina can be divided into nine layers, and this layers can be found in the neural retina. True to its embryonic origin, the neural retina functions as an outpost of the CNS with glia and several interconnected neuronal subtypes in well-organized strata.

They include:

CATEGORY 1: Three major layers that contain the nuclei of the interconnected neurons.

1. **Outer nuclear layer (ONL):** This is near the pigmented epithelium. Contains cell bodies of photoreceptors. These cells receive O₂ and nutrients by diffusion from the choroidocapillary lamina of the choroid.
2. **Inner nuclear layer (INL):** Contains the nuclei of various neurons, notably the bipolar cells, amacrine cells, and horizontal cells, all of which make specific connections with other neurons and integrate signals from rods and cones over a wide area of the retina.
3. **Ganglionic layer (GL):** Near the vitreous the GL has neurons (ganglion cells) with much longer axons. These axons make up the NFL
4. **Nerve fiber layer (NFL):** The axons of the ganglion cells make up the NFL and converge to form the optic nerve which leaves the eye and passes to the brain. The GL is thickest near the central, macular region of the retina, but it thins peripherally to only one layer of cells.

CATEGORY 2: Between the three layers with cell nuclei are two fibrous or “plexiform” regions containing only axons and dendrites connected by synapses.

5. **Outer plexiform layer (OPL):** Includes axons of the photoreceptors and dendrites of association neurons in the INL.
6. **Inner plexiform layer (IPL):** Consists of axons and dendrites connecting neurons of the INL with the ganglion cells.

The rod and cone cells, named for the shape of their outer segments, are polarized neurons with their photosensitive portions aligned in the retina's

7. **Rod and cone layer (RCL):** and their axons in the OPL.
8. **Outer limiting layer (OLL):** This is a poorly stained but well-defined series of adherent junctions (zonula adherents) between the photoreceptors and Muller cells.
9. **Inner limiting membrane (ILM):** Consists of terminal expansions of Muller cell processes that cover the collagenous membrane of the vitreous body and form the inner surface of the retina.

All these layers of the retina can be seen by routine light microscopy. Light must pass through all the layers of the neural retina before reaching the layer of rods and cones. Branches of the central retinal artery and vein run mainly within the nerve fiber and GLs, surrounded by perivascular feet of Muller cells and astrocytes which are located there. In some retina regions capillaries extend as deeply as the INL. A few scattered microglial cells occur throughout the neural retina.

MEDICAL APPLICATION

The pigmented epithelium and the photoreceptor layer of the retina, derived from the two layers of the optic cup, are not firmly joined to each other. 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.