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COURSE: NEUROHISTOLOGY

QUESTIONS

1. Write an essay in 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. HISTOLOGICAL IMPORTANCE OF EYE IN RELATION TO THEIR CELLULAR FUNCTIONS

The layers of the eye perform distinct functions which coalesce to create a unified, perceptual experience. They include:

1. The essential role of the external eye structures is to protect the delicate tissue of the internal eye.
2. The eyelid prevents foreign bodies from entering the inner eye and helps refresh and distribute the tear film by blinking.
3. Eyelashes are finely sensitive to touch and warn the eye of possible debris and particles that may cause injury.
4. Internal parts of the eye have primarily structural and visual functions.
5. The cornea serves a protective role and is responsible for two thirds of the refractive properties of the eye.
6. The remaining one third of refraction is performed by lens, which is functionally adjustable through the action of the zonular fibers and ciliary muscles
7. 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 those impulses to the brain, via the optic nerve.
8. The Uvea of the eye is a crucial mediator of nutrition and gas exchange, as blood vessels course through the ciliary bodily and iris, while choriocapillaries in the posterior eye help support the retina.

This abundant supply is implicated in the uveitis,as inflammatory mediators enter the eye through this vascular network.

2). LAYERS OF RETINA FOR INFORMATION PENETRATION

The retina develops as an outgrowth from the brain(diencephalon). The retina is approximately 0.5 mm thick and lines the back of the eye.The proximal part of the diverticulum remains narrow and is called the optic stalk, it later becomes the optic nerve. The optic nerve contains the ganglion cell axons running to the brain and, additionally, incoming blood vessels that open into the retina to vascularize the retinal layers and neurons. The distal part of the diverticulum forms a rounded hollow structure called the optic vesicles. This vessicle is invaginated by the developing lens(and other surrounding tissues) so that it gets converted into a two layered optic cup. At first, each layer of the cup is made up of a a single layer of cells.

The outer layer persists as a single layered epithelium ghat becomes pigmented. It forms the pigment cell layer of the retina. Over the greater part of the optic cup the cells of the inner layer multiply to form several layers of cells that become the nervous layer of the retina. In this anterior part, both layers of the optic cup remain single layered. These two layers like:

1. The inner surface of the ciliary body forming the ciliary part of the retina
2. The posterior surface of the iris forming the iridial part of the retina

Opposite the posterior pole of the eyeball the retina shows a central region about 6mm in diameter. This region is responsible for sharp vision. In the centre of the macula lutea. In the centre of the macula lutes is a small depression that is called the fovea centralis. .The floor of the centralis is often called the foveola.. This is the area of clearest vision.

Beginning from the external surface the following layers can be made out.

1. PIGMENT CELL LAYER

This consists of a single layer of cells containing pigment. Processes from pigment cells extend into the next layer.

1. LAYERS OF RODS AND CONES

Light must, therefore, travel through the thickness of the retina before striking and activating the rods and cones. The cones respond best to bright light(photopic vision), they are responsible for sharp vision and for the discrimination of Colour. Rods can respond to poor light(scotopic vision) and specially to movement across the field of vision.

1. EXTERNAL NUCLEAR LAYER

They are composed of the cell bodies of the rods and cones is about the same thickness in central and peripheral retina. However in the peripheral the rod cell bodies outnumber the cone cell bodies while the reverse is true for central retina. In central retina, the cones have oblique axons displacing their cell bodies from their synaptic pedicles in the external plexiform layer. These oblique axons with accompanying Muller cell processes form a pale-staining fibrous-looking area known as the Henle fibre layer. The latter layer is absent in peripheral retina.

1. EXTERNAL PLEXIFORM LAYER

The first area of neuropil is the external plexiform layer where connections between rod and cones, and vertically running bipolar cells and horizontally oriented horizontal cells occur.It consists only of nerve fibers that form a plexus.

1. INTERNAL NUCLEAR LAYER

The inner nuclear layer (INL) is thicker in the central area of the retina compared with peripheral retina, due to a greater density of cone-connecting second-order neurons (cone bipolar cells) and smaller-field and more closely-spaced horizontal cells and amacrine cells concerned with the cone pathways . As we shall see later, cone-connected circuits of neurons are less convergent in that fewer cones impinge on second order neurons, than rods do in rod-connected pathways.

1. INTERNAL PLEXIFORM LAYER

It consists of synapsing nerve fibers. The axons of bipolar cells synapse with dendrites of ganglion cells and both these processes synapse with processes of amacrine cells.

1. LAYER OF GANGLION CELLS

It contains the cell bodies of ganglion cells. Each ganglion cell gives off an axon that forms a fiber of the optic nerve

1. LAYER OF OPTIC NERVE FIBRES

It is made up of axons of ganglion cells. The fibers converge on the optic disc where they pass through foramina of the lamina cribrosa to enter the optic nerve.