

NAME; HARRISON FORTUNE

MATRIC NO.; 17/MHS01/140

COURSE CODE; ANA 305

1. Write an essay on the histological importance of eye in relation to their cellular functions?

THE EYE!!!

The human eyes are the organs of vision in human body and hence termed as photoreceptors. The paired eyes in man are located inside bony sockets of skull called orbits. An eye is almost a spherical ball, guarded by two eye lids: upper eye lid and lower eye lid which can move frequently. These eye lids are bordered by hairs forming eye-lashes. In man the third eye lid is vestigial and lies at the corner of the eye and is known as plica semilunaris. On the margins of eye lids are small meibomian glands which secrete an oily substance for lubricating the eye lids and for holding a thin film of tears underneath. Below the outer corner of the upper eye lid are lacrimal or tear glands to produce tears that keep the eye ball (conjunctivae) moist. The tear flows across the front of the eye and excess of tears at the time of emotion are drained into the small lacrimal sac at the inner margin from where they are then discharged by means of nasolacrimal duct into the nasal passage ways.

These muscles are attached in the bony sockets at one end and the other end of these muscles is attached to the outer coat of the eye ball. These muscles together are responsible for the movement of the eye ball from side to side and up and down, thus controlling the direction of vision. The eye ball is formed of three coats, an outer fibrous (sclera and cornea), middle vascular (iris, choroid and ciliary body) and inner retina.

Sclerotic

It is the outermost layer of the eye ball and is formed of a tough layer of modified fibrous connective tissue. On the front side it is transparent and non-

vascular and known as cornea. Over the cornea another transparent but vascular membrane called conjunctiva is present which is an extension of the skin of the eyelid. The sclerotic layer gives shape to the eye ball, protects the eye and provides surface for attachment of six extrinsic muscles.

The Cornea

It is optically transparent and the anterior most 1/6th external tunic, which is comprised of three cellular layers and two noncellular layers the outermost layer is the corneal epithelium: which is a stratified, non-keratinized epithelium that is continuous with the conjunctival epithelium overlying the adjacent sclera. Bowman's membrane: it is the basement membrane of the corneal epithelium. This is a layer of subepithelial basement membrane protecting the underlying stroma. It is composed of type 1 collagen, laminin, and several other heparan sulfate proteoglycans. The corneal stroma: the largest layer of the cornea, the stroma has collagen fibers and keratocytes maintaining the integrity of the layer. The function of this layer is to maintain transparency, which occurs by the regular arrangement, and lattice structure of the fibrils. Descemet's membrane: it is an acellular layer made of type iv collagen that serves as a modified basement membrane of the corneal endothelium. The corneal endothelium: it is a simple squamous epithelium facing the anterior chamber of the eye. Transparency of the cornea requires precise control of the hydration of the stroma and it is cells of the corneal endothelium that perform this function. Unlike the corneal epithelium, corneal endothelial cells have very limited proliferative potential, so severe damage to this epithelium can only be repaired by transplantation.

Iris

The iris controls the amount of light that enters through the pupil and ensures that light must move through the pupil to reach the retina by dividing the cavity of the eye ball into a small, anterior aqueous chamber and a large, posterior vitreous chamber. It maintains intraocular pressure, acts as a refractive medium, supplies nutrition to lens and drains away metabolic wastes.

Ciliary body

The ciliary body functions primarily to control the shape of the lens and produce aqueous humor. Just behind the iris, the surface of the ciliary body is thrown into folds known as ciliary processes. The innermost cells facing the "lumen" of the eyeball are non-pigmented and are ultimately continuous with the

ganglion cell layer of the neural retina, however these cells are obviously not neural.

Choroid

It is the middle layer lying below the sclerotic. The choroid is made of loose but highly vascular connective tissue having dark brown pigment. In nocturnal mammals this layer contains a silvery connective tissue (tapetum) for reflecting light causing the eye to shine at night. In front the choroid thickens as a circular ciliary body. It contains blood vessels, glands and ciliary muscles. In front of the ciliary body, the choroid separates from the sclerotic and passes inwards as iris which possesses a circular aperture in the centre called pupil. The muscles of iris can alter the size of the pupil. Behind the iris is a transparent biconvex lens, which is attached to the ciliary body by suspensory ligaments.

Vitreous humour

Vitreous humour is a jelly like material and almost has same composition as aqueous humour. However, it contains less glucose but higher concentration of pyruvic acid and lactic acid. A lymphatic vessel is found in the vitreous chamber passing from the lens to the blind spot and is known as hyaloid canal.

Retina:

It is 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 retinal pigment epithelium: made of cuboidal cells containing melanin which absorbs light. These cells also establish a blood-retina barrier through tight junctions.

Internal parts of the eye have primarily structural and visual functions.

The cornea serves a protective role and is responsible for two-thirds of the refractive properties of the eye. The remaining one-third of refraction is performed by the lens, which is functionally adjustable through the action of the zonular fibers and ciliary muscles. 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 these impulses to the brain, via the optic nerve

Clinical significance

- Astigmatism: this abnormality of vision is due to the irregularities in the shape of the lens and cornea. The lens shows different curvatures in different regions of the eye. So the light rays are not brought into sharp focus on the retina. This defect is corrected by the cylindrical lens.
- Myopia or short-sightedness: people having this eye defect can see near objects clearly but not distant objects. In this case the lens of the eye is too convex and the rays of light are focused at a point in front of the retina instead of upon it. This defect is corrected by the use of concave lenses
- Presbyopia or old-age sight: it is due to the loss of flexibility of the lens in the old age. The person feels difficulty in focussing on near objects. This defect occurs at any time after the age of 35. It is corrected by the use of convex lens.
- Chalazion: a sterile lump often in the upper eyelid caused by obstruction of the meibomian oil glands.
- Conjunctivitis: inflammation of the transparent conjunctiva that may be caused by bacterial or viral infections, allergies, or exposure to certain chemicals.

2. Corona virus can penetrate the body through eye and implicate the immune system , briefly discuss the layers of retina for information penetration.

Retina is a nervous tissue of the eye where photons of light convert to neurochemical energy via action potentials. Retina tunic includes; an outer pigmented epithelium and an inner neural retina proper. The photosensitive inner layer of the retina communicates with the cerebrum through the optic nerve on the eye's posterior side; its anterior edge is called the ora serrata. Moreover, the retina itself is divided into various layers as follows Retinal pigment epithelium: made of cuboidal cells containing melanin which absorbs light.

Anatomic layers of the retina

Each of the microscopic layers of the retina has a name and contains various structures. Beginning with the innermost layer (closest to the vitreous) and proceeding outwards towards the choroid and sclera, these layers are as follows:

- **"Internal limiting membrane"**: A thin layer of Muller glial cells and basement membrane which demarcates the vitreous anteriorly from the retina posteriorly.
- **"Nerve fiber layer"**: The nerve fiber layer is the layer of optic nerve fibers consisting of ganglion cell axon fibers, which course towards the optic nerve head. This layer contains axons of retinal ganglion cells and the astroglia which support them.
- **"Ganglion cell layer"**: The ganglion cells layer contains the nuclei of retinal ganglion cells, the axons of which become the optic nerve fibers for messages. There are also some displaced amacrine cells within this layer. Additionally, this layer also contains the non-rod and non-cone photoreceptors, the photosensitive ganglion cells, which are important for reflexive responses to bright daylight.
- **"Inner plexiform layer"**: This layer relays information from cells of the inner nuclear layer. Thus, this layer has axons of amacrine, bipolar, and glial cells and dendrites of retinal ganglion cells.
- **"Inner nuclear layer"**: The inner nuclear layer contains the nuclei of horizontal, bipolar and amacrine cells. The inner nuclear layer is thicker in the central area of the retina compared with peripheral retina because of a greater density of cone-connecting second-order neurons (cone bipolar cells) and smaller and more closely spaced horizontal cells and amacrine cells concerned with the cone pathways. There are also nuclei of the supporting Muller cells.
- **"Outer plexiform layer"**: the outer plexiform layer contains the rod and cone axons (projections of rods and cones ending in the rod spherule and cone pedicle), horizontal cell dendrites, and bipolar cells

dendrites. Synapses among these structures occur within this layer. In the macular region, this layer is termed the fiber layer of Henle. The outer plexiform layer is also known as the outer synaptic layer.

- ***"Outer nuclear layer"*** the outer nuclear layer consists of the cell bodies of the retinal rods and cones. In the peripheral retina, the rod cell bodies outnumber the cone cell bodies, whereas the reverse is true for the central retina.
- ***"Outer limiting membrane"***: A layer of Muller cells and rod/cone junctions which serves to separate the photosensitive regions of the retina from the areas that transmit the electrical signals.
- ***Rod and cone cell layer***: the rod and cone cell layer (RCL), which contains the outer segments of these cells where the photoreceptors are located.
- ***Pigmented layer***: the pigmented layer (PL) which is not sensory, but has several supportive functions important for maintenance of the neural retina.