**Name: Etuk Esther Emmanuel**

**Matric no.: 17/mhs01/124**

**Department: Medicine and Surgery**

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**Course Title:** Histology of Special Senses and Neurohistology
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**Question**
**1.** Write an essay on 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 infection penetration

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

**Answer**

**THE HISTOLOGICAL IMPORTANCE OF EYE IN RELATION TO THEIR CELLULAR FUNCTIONS**

 The eye is a complex highly developed photosensitive organ responsible for light reception. Each eye is located in a protective bony chamber in the skull, the orbit. The eyeball is slightly flattened anteroposteriorly, with the anterior 1/6th of the sphere (the cornea) being more convex. Histologically, the eye consists of three concentric layers: External (fibrous) layer: the tunica fibrosa, Middle (vascular) layer: the tunica vascoulosa and Internal (nervous) layer: the retina.

 The external layer (tunica fibrosa) is subdivided into sclera and cornea. The Cornea is a transparent layer and covers the anterior one-sixth of the eye. Sclera covers the posterior five-sixths of the eye. The junction between the cornea and the sclera is called limbus.

 The **sclera** is the part of the eye commonly known as the “white of the eye or, in older literature, as the tunica albuginea oculi.” It forms the supporting wall of the eyeball, and is continuous with the clear cornea. The sclera is covered by the conjunctiva, a clear mucus membrane that helps lubricate the eye. It is thickest in the area surrounding the optic nerve. The sclera is made up of three divisions: the **episclera**, loose connective tissue, has rich blood supply, immediately beneath the conjunctiva; **sclera stroma proper**, contains bundles of type I collagen fibers intermingled with fibroblasts, melanocytes, elastic fibers, protoglycans and glycoproteins. Variability in the collagen fibers diameter, interlacing in the bundles of collagen, and relative deficiency in the dense white tissue that gives the area its color; and the **lamina fusca**, the innermost zone made up of elastic fibers. The sclera is opaque due to the irregularity of the Type I collagen fibers. The sclera provides an opaque protective coat for the intraocular tissues and a stable support during variations in internal pressure and eye movements, which would otherwise perturb the visual process through distortion of the retina and the lens/iris diaphragm, maintaining the shape of the globe. This stability, which is vital for clear vision is made possible by the organization and viscoelastic properties of scleral connective tissue. It also provides attachment for the extraocular muscles.

 The Cornea is the most anterior part of the eye, a highly transparent convex structure divide into 5 layers, these include: Anterior Epithelium (Pavement Epithelium), Anterior limiting (Bowman’s) membrane, The Corneal stroma (Substantia Propria), Posterior limiting (Descemet’s) membrane and The Posterior epithelium (Corneal Endothelium).

 

 **Histology of Cornea**

 Anterior Epithelium (Pavement Epithelium) is stratified squamous epithelium (non keratinized) consisting of 5-6 cell layers. The basal layer regenerates other cells (corneal epithelial turnover occurs each 7 days) and mitotic figures are seen especially at the periphery. The surface cells have microvilli protruding into the tear film. The epithelium has a very rich sensory nerve supply. It provides barrier function and a smooth surface for the tear film.
 Anterior limiting (Bowman's) membrane is the very thick (8-12 μm) basement membrane of the epithelium, consisting of randomly running collagen fibers, it is responsible for corneal strength. It is composed of type 1 collagen fibers, laminin, and several other heparan sulfate proteoglycans. This layer is tough, and keeps the cornea from swelling forward which means when the cornea swells, it must do so backwards into the anterior chamber.
The Corneal stroma (Substantia Propria) is about 60 layers of parallel highly organized collagen bundles crossing at right angles to each other. The uniform orthogonal array of these collagen fibrils contributes to the corneal transperacy. Fibroblast-like cells (keratocytes) have flattened cytoplasmic extensions (like butterfly wings) between collagen fibrills, with proteoglycan-rich extracellular substance. Lymphoid cells are seen in the stroma. The cornea stroma provides the majority of the cornea. Injuries at this level can scar.

 Posterior limiting (Descemet’s) membrane is thick homogenous layer composed of fine interwoven collagen fibers organized in a 3D network. This layer is important for the health of endothelial cells. One of the leading needs for cornea transplant is from a dystrophy of Descemet’s layer called Fuch’s dystrophy.

 The Posterior epithelium (Corneal Endothelium) is a simple squamous epithelium, with the cells showing the features of active transport and protein synthesis. Cells in this region do not regenerate and have pumps that maintain fluid balance and prevent swelling of the stroma. When corneal endothelial cells are lost, neighboring cells stretch to attempt to compensate these losses.

 The corneoscleral junction (The Limbus) is the highly vascularized transitional zone between the cornea and sclera. In the stromal layer of the limbus, there is the scleral venous sinus or Schlemmm's canal, an irregular endothelium-lined space that communicate with the anterior chamber of the eye via many tiny openings at the iridocornealangle. Schlemm's canal is connected to the venous system and act to drain the aqueous humor to it. The cornea is avascular, it is nourished by diffusion from vessels in the limbus and the aqueous humor.

 Middle (vascular) layer also called The Tunica Vasculosa consists of three parts: choroid, ciliary body and iris. The choroid is a highly vascularized thin layer, with a loose connective tissue between its blood vessels which supplies nourishment to structures of the eye. It lines the posterior 3/4s of sclera (approximately to the level of ora serrata). The choroid is rich in connective tissue cells, collagen, elastic fibers and melanocytes (that give the choroid its dark colour). The outer layer of choroid beneath the sclera is the suprachoroidal lamina. The inner layer (the choriocapillary lamina) is richer in small blood vessels and has a major role in the nutrition of the retina, from which it is separated by the hyalin Bruch's membrane. This membrane consists of three layers: elastic fibers network in the middle and collagen layers on each side. Bruch's membrane is covered externally by basement membrane of choriocapillary vessels and internally by basement membrane of the pigmented epithelium of 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.

 Ciliary body consists of loose connective tissue rich in blood vessels, elastic fibers and melanocytes. The ciliary body is divided into the ciliary muscles and ciliary processes. Ciliary muscles is made up of two bundles of smooth muscle fibers divided into thick inner circular & thin outer longitudinal layers, the ciliary muscles are important in visual accommodation. Ciliary processes is about 75 ridge-like or finger-like projections from the ciliary body, eachconsists of a loose connective tissue core rich in fenestrated capillaries and covered by 2 layers ofepithelium. Ciliary processes serve two functions: it gives attachment to the fibers of suspensary ligament of the lens (that extend from the basement membrane of the pigmented epithelium to the capsule of the lens) and secrete the aqueous humor (by the non-pigmented epithelium) into the posterior chamber.

 The Iris is the anterior part of the uveal tract (the coloured part of the eye), a disc-like structure attached to the ciliary body peripherally and having a rounded aperture (the pupil) centrally. It has three layers which include: Anterior Iridial border (anterior surface of the iris), Iris Stroma (stroma iridis) and posterior surface of the iris. Anterior Iridial border ( anterior surface of the iris) is not covered by epithelium, but formed by a discontinuous layer of fibroblasts and melanocytes, with interdigitating processes giving an irregular, rough grooved appearance. The anterior layer (adjacent to the stroma) consists of less pigmented myoepithelial cells that have radially arranged processes forming the dilator pupillae muscle (innervated sympathetically). The Iris Stroma (stroma iridis) is a loose connective tissue with an anterior zone poorly vascularized, rich in fibroblasts, melanocytes and a highly vascularized posterior zone. Around the pupil, the stroma contains circularly-arranged smooth muscle fibers innervated parasympathetically, the sphincter pupillae muscle. Posterior surface of the iris is a smooth surface covered by the same two epithelial layers covering the ciliary body. The posterior layer (facing the posterior chamber) cells are heavily pigmented, preventing light from entering the eye except via the pupil. Posterior pigmented epithelium and melanocytes in the stroma of the iris are responsible for the eye colour. People with few melanocytes have blue eyes, people with more melanocytes and collagen in the iris stroma have darker eyes. People with albinism lack pigment in their cells, they have pink eyes from the visible blood vessels of the iris.

 Internal (nervous) layer includes Lens, retina and Viterous body. The lens is a biconvex transparent structure with great elasticity (that decreases with age) that separates the aqueous and vitreous chambers. The lens has three components: lens capsule, subcapsular epithelium and lens fibers. Lens capsule is a thick homogenous refractile external layer that represents the basement membrane of the lens epithelium. Subcapsular epithelium is simple cuboidal or columnar cells lining the anterior half of lens capsule. Cells at the lens periphery divide to give new lens fibers. Lens fibers are extremely elongated highly differentiated epithelial cells that fill the lens. They originate from the subcapsular epithelium and lose their nuclei and organelles to become very long, thin, flattened structures filled with proteins (crystallins). New lens cells differentiate from the lens epithelium and are incorporated peripherally, pushing older lens cells towards the middle. The suspensory ligament stretches between the lens and the ciliary body, keeping tension on the lens and enabling it to focus on the distant objects.

 The Vitreous Body is a transparent gelatinous medium filling the vitreous space between the lens and retina. It consists of water (99%) with hyaluronate and small amounts of collagen. Vitreous body is surrounded by the vitreous membrane, made by type IV collagen. The only cells in the vitreous body are few macrophages and a small number of hyaluronate- producing cells (hyalocytes) near the membrane.

 The retina is the innermost of the three tunics of the eye and is responsible for photoreception. The retina consists of millions of cells packed together in a tightly knit network spread over the surface of the back of the eye. These cells can be divided into a three basic cell types, photoreceptor cells, neuronal cells, and supporting (glial) cells.

 Photoreceptor cells are the retinal rods and cones. Each human retina contains approximately 120 million rods and 6 million cone photoreceptors. The rods are approximately 95% of the photoreceptors cells in the retina, and they specialize in registering low-light levels, thus helping to create a black and white vision- known as scotopic vision. Rods are concentrated in the outer retina and their density increases as one moves outward towards the periphery of the retina, with there being zero rods in the central fovea. Rods have a slow speed of response, and their spatial acuity and contrast sensitivity are also very low, directly contrasting the rapid, high spatial acuity, and high contrast sensitivity of cones. Also, rods cannot function during the daytime as they are "photo-bleached" and need 20 minutes to recover, and only after 40 minutes after sunset or immersion into darkness can all the rods come online and help with creating scotopic vision. More rods converge onto a single retinal ganglion cell (RGC). Rods have a higher sensitivity to single photons of light. The configuration of rods into the retinal system allows them to use their unique sensitivity to photons and integrate the photon signal for longer by converging multiple rods onto a single retinal ganglion cell (RGC) and thus reducing background noise. Rod cells use glutamate as their neurotransmitter and synapse onto second-order bipolar cells at the outer plexiform layer.

 Cones are comprising of only 5% of the total number of retinal photoreceptors. Unlike rods, cones are less sensitive to photons in general but are better at responding to one of three specific (colors) wavelengths of light. Cone cells specialize in detecting either red light (64%), green light (32%), or blue light (2%) and concentrate primarily in the central area of the retina referred to as the macula- which also contains fovea. Cone cells help the brain process photopic vision, which involves color vision at varying light levels, which humans use in a majority of our day-to-day interactions. The high density of cones in the fovea enables the brain to differentiate between two points and in general cones allow for great spatial acuity even though rods are more sensitive to photons. Cone cells can adapt to light rapidly and do not become saturated under constant light. After photobleaching, cones can recover their membrane current within 20 milliseconds. Cone cells release glutamate onto second-order bipolar cells located in the outer plexiform layer.

 There is a third class of photoreceptors within the retina (in addition to the rods and cones). These are the much rarer intrinsically photosensitive retinal ganglion cells, which are stimulated by light even when all rods and cones are blocked. The photosensitive ganglion cells contain the pigment melanopsin. Alteration in this pigment by light is involved in non – image-forming responses to light, such as synchronization of circadian rhythms to the light-dark cycle, contributing to regulation of pupil size and influencing release of melatonin from the pineal gland.

 Neural cells (nerve cells) include bipolar cells, ganglion cells, horizontal cells, and amacrine cells. Bipolar cells are second-order long-projection neurons, named after their axons 180-degree orientation, that receive visual inputs from photoreceptors (rods and cones) and projects their axons onto retinal ganglion cells. Bipolar cells are contained entirely within the retina, connecting the photoreceptors to the ganglion cells. These are vertically oriented (perpendicular to the retinal surface). Bipolar cells form circuits with other photoreceptors that provide the basic elementary blocks of vision such as chromatic composition, polarity, contrast, and temporal profile of incoming visual stimuli. Bipolar cells link the inner and outer layers of the retina by forming a synaptic connection with rods and cones in the inner plexiform layer (IPL) of the retina. Therefore, bipolar cells receive glutamatergic inputs from rods and cones, and GABAergic inputs from horizontal cells, and in turn, bipolar cells provide glutamatergic excitatory input to retinal ganglion cells and amacrine cells. This form of parallel information processing allows highly pre-processed excitatory inputs to become the elementary building blocks of vision.

 Retinal ganglion cells (RGC) are the retina's main output neuron, but also a third class of photoreceptors that are also photosensitive and help transmit both image-forming and non-image forming information that functions in the physiological processes of the circadian rhythm, modulation of melatonin release, and regulation of pupil size. 1 to 2% of all RGCs are intrinsically photosensitive, like their cone and rod counterparts, by their selective expression of the G-protein peptide neuromodulator called melanopsin. Retinal ganglion cells receive both excitatory and inhibitory inputs from two types of intermediate neurons which are amacrine cells and bipolar cells. RGCs and amacrine cells form a functional subunit of on-off centers that allow for the brain to interpret a small dot moving at a distance. Retinal ganglion cells send axonal projections that converge in the optic disc and pass through the lamina cribrosa unmyelinated, to not interfere with incoming light.

 Amacrine cells are intermediate neurons that release the inhibitory neurotransmitter GABA or glycine. However, given their unique gap junction physiology, they can be both inhibitory or excitatory. Amacrine cells serve as the ultimate utility cell of the retina. The diversity among amacrine cells allows them to form dedicated functional microcircuits that allow the retina to detect different shades and movements of light in particular directions. Stratification of amacrine cell output can be either pre-synaptic or post-synaptic and in conjunction with gap junctions, which allows for amacrine cells to be both inhibitory or excitatory despite releasing only inhibitory neurotransmitters. Amacrine cells also have a paracrine function, with some varieties releasing dopamine.

 Horizontal cells are involved in modulating information transfer between bipolar cells and photoreceptors and are involved with helping eyes adjust to both bright light and low light conditions. Horizontal cells are GABAergic interneurons that provide inhibitory inputs to bipolar cells as well as inhibitory feedback to both rods and cones. Horizontal cells form contacts in the outer plexiform layer that convey polarity, spectral sensitivity, speed, and structure the spatial receptive field. Horizontal cells amplify signals from ON-OFF centers by providing lateral inhibitory GABAergic inputs to the surrounding bipolar cells encircling the ON-center or OFF-center bipolar cells. By antagonizing the surrounding bipolar cells, horizontal cells help support contrast enhancement via binary signaling and providing two-point differentiation. Horizontal cells play a key role in sheathing bipolar cells, invaginating contacts with dendrites of ON cone bipolar cells and have basal contacts with OFF cone bipolar cells.

 Supporting (glial) cells are interspersed between and among the axons of the ganglion cells within the retina and optic nerve. These supporting cells of the retina include Muller cells, astrocytes, and microglial cells. Muller cells are the principal glial cells of the retina, form a supporting matrix radially across the thickness of the retina and also form the inner and outer limiting membranes of the retina. Astrocyte cell bodies and processes are almost entirely restricted to the nerve fiber layer of the retina. Microglial cells are of mesodermal origin. Unlike the Muller cells and astrocytes, they are not neuroglial.



**Histology of the Retina Showing the Cells**

 The eye also consists of accessory structures such as conjunctiva, eyelids and lacrimal apparatus. The conjunctiva is a thin, transparent mucous membrane that extends from the corneoscleral limbus located on the peripheral margin of the cornea across the sclera (bulbar conjunctiva) and covers the internal surface of the eyelids (palpebral conjunctiva). It consists of a stratified columnar epithelium containing numerous goblet cells and rests on a lamina propria composed of loose connective tissue. The goblet cell secretion is a component of the tears that bathe the eye. The tarsal plate lies beneath the conjunctiva and contains meibomian glands, which secrete an oily substance to decrease the evaporation of the tear film.

 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. Each eyelid consists of the following layers; Skin is thin, elastic skin with eyelashes at its free margin. Loose C.T containing two muscles: orbicularis oculi and levator palpebri superioris. Tarsal plate is tough plate of dense connective tissue that contains the meibomian glands and Conjunctiva. The eyelid contains four types of glands: Meibomian glands (long sebaceous glands in the tarsal plate. They don't communicate with the hair follicles of eyelashes and produce an oily layer on the surface of the tear film preventing its rapid evaporation), Glands of Zeis(smaller modified sebaceous glands connected to the hair follicles) Glands of Moll (spiral sweat glands that open in the hair follicles of the eyelashes) and Acessory lacrimal glands of Krause and of Wolfring.

 The Lacrimal apparatus includes lacrimal gland, lacrimal canaliculi, lacrimal sac and nasolacrimal duct. Lacrimal gland is the tear secreting gland, located in the antero-supero-lateral part of the orbit. It consists of several lobes with several ducts that open in the superior conjunctival fornix. The lacrimal gland is tubuloalveolar gland composed of serous columnar cells rich in secretory granules. The secretory portion is surrounded by myoepithelial cells. Tear film moisturizes the front of the eye and is drained by Lacrimal canaliculi, that begin at two lacrimal puncta (tiny openings at the medial end of the free margin of each eyelid), run medially about 8mm then unite forming one canaliculus (all lined with stratified squamous epithelium) before opening into Lacrimal sac, which passes tears to the nasal cavity via the Nasolacrimal duct.

 The cells of the eyes work together, to ensure that the eye can produce vision. The cells of the sclera include type I collagen fibers, fibroblasts, melanocytes, elastic fibers, protoglycans and glycoproteins. They provide a protective coat for the intraocular tissues and a stable support during variations in internal pressure and eye movements. It also helps to maintain the shape of globe. The cells of the cornea include the non keratinized stratified squamous epithelial cells, microvilli, type I collagen fibers, lymphoid cells, keratocytes, simple squamous epithelial cells, endothelial cells, laminin and several other heparin sulfate protoglycans that provide corneal strength, provides barrier function and a smooth surface for the tear film. The cells of the choroid include the loose connective tissue cells, collagen fibers, blood vessels, elastic fibers and melanocytes. It helps to supply nourishments to the structures of the eye. The cells of the Iris help to give the eye colour, and these are the fibroblasts, melanocytes, pigmented myoepithelial cells e.t.c. The cells of the retina include the rods, cones, bipolar cells, ganglion cells, horizontal cells, amacrine cells, muller cells, astrocytes and microglial cells and they are responsible for photoreception. The cells of the accessory structures such as the goblet cell, meibomian glands, lacrimal gland cells and connective tissue cells help in the production of tears which protects the eye by flushing out dusts and infections from the eye.

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

**Answer**

The layers of retina are divided into ten, namely:

**1.** **Retinal pigment epithelium (RPE):** The RPE is a single layer of cuboidal cells rest on Bruch’s membrane of the choroid layer. The pigment cells are tallest in the fovea and adjacent regions, which accounts for the darker color of this region. Adjacent RPE cells are connected by a junctional complex consisting of gap junctions and elaborate zonulae occludentes and adherentes. This junctional complex is the site of the blood–retina barrier. The pigment cells have cylindrical sheaths on their apical surface that are associated with, but do not directly contact, the tip of the photoreceptor processes of the adjacent rod and cone cells. Complex cytoplasmic processes project for a short distance between the photoreceptor cells of the rods and cones. Numerous elongated melanin granules, unlike those found elsewhere in the eye, are present in many of these processes. The Retinal pigment epithelium serves several important functions, including the following:

**1.** It absorbs light passing through the neural retina to prevent reflection and resultant glare.

**2.** It isolates the retinal cells from blood-borne substances. It serves as a major component of the blood–retina barrier via tight junctions between Retinal pigment epithelium cells.

**3.** It participates in restoring photosensitivity to visual pigments that were dissociated in response to light. The metabolic apparatus for visual pigment re-synthesis is present in the RPE cells.

**4.** It phagocytoses and disposes membranous discs from the rods and cones of the retinal photoreceptor cells.

**2. Photoreceptor layer**: contains the outer and inner segments of photoreceptor cells. The rods and cones are the outer segments of photoreceptor cells whose nuclei form the outer nuclear layer of the retina. The retina contains approximately 120 million rods and 7 million cones.

Functionally, the rods are more sensitive to light and are the receptors used during periods of low light intensity (e.g., at dusk or at night). The rod pigments have a maximum absorption at 496nm of visual spectrum, and the image provided is one composed of gray tones (a “black and white picture”). In contrast, the cones contains a different visual pigment molecule that is activated by the absorption of light at the blue (420 nm), green (531 nm), and red (588 nm) ranges in the color spectrum. Cones provide a visual image composed of color by mixing the appropriate proportion of red, green, and blue light. Each rod and cone photoreceptor consists of three parts:

**A.** The outer segment of the photoreceptor is roughly cylindrical or conical (hence, the descriptive name rod or cone). This portion of the photoreceptor is intimately related to microvilli projecting from the adjacent pigment epithelial cells.

**B.** The connecting stalk contains a cilium composed of nine peripheral microtubule doublets extending from a basal body. The connecting stalk appears as the constricted region of the cell that joins the inner to the outer segment.

**C.** The inner segment is divided into an outer ellipsoid and an inner myloid portion. This segment contains a typical complement of organelles associated with a cell that actively synthesize proteins. The outer segment is the site of photosensitivity, and the inner segment contains the metabolic machinery that supports the activity of the photoreceptor cells.

**3. Outer limiting membrane:** the apical boundary of Müller’s cells. The outer limiting membrane (external limiting membrane) is the layer that separates the inner segment portions of the photoreceptors from their cell nuclei. The rod and cone layer (bacillary layer) contains the inner and outer segments of the rod and cone photoreceptors cells.

**4. Outer nuclear layer:** contains the cell bodies (nuclei) of 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.

**5. Outer plexiform layer:** contains the processes of retinal rods and cones and processes of thehorizontal, amacrine, and bipolar cells that connect to them. 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.

**6. Inner nuclear layer:** contains the nuclei of horizontal, amacrine, bipolar, and Müller’s cells.

**7. Inner plexiform layer:** contains the processes of horizontal, amacrine, bipolar, and ganglioncells that connect to each other. The inner plexiform layer contains the synapses between dendrites of ganglion cells and amacrine cells and the axons of bipolar cells. 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.

**8. Ganglion cell layer:** contains the cell bodies (nuclei) of ganglion cellsand displaced amacrine cells. As a rule of thumb, smaller ganglion cells dendrites arborize in the inner plexiform layer while larger ganglion cells dendrites arborize in other layers.

**9. Optic nerve fibers layer:** contains ganglion cells processes that lead from the retina to the brain.

**10. Inner limiting membrane:** composed of the basal lamina of Müller’s cells. The inner limiting membrane is the boundary between the retina and the vitreous body. It is formed by astrocytes and the footplates of Muller cells together with a basal lamina. The nerve fiber layer is the layer of optic nerve fibers consisting of ganglion cell axon fibers, which course towards the optic nerve head. The ganglion cells layer contains the nuclei of 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.



**The Layers of Retina**

 The corona virus is released as particles into the surrounding environment by infected persons. The corona virus ridden particles are inhaled by others and come in contact with cells lining the throat and larynx. The virus can also penetrate through the eyes by making contact with the external part of the eye (the sclera). The cells in these parts of the body have large numbers of receptors known as Ace-2 receptors on their surfaces. Cell receptors play a key role in passing chemicals into cells and in triggering signals between cells. The virus has a surface protein that is primed to lock on that receptor and slip its RNA into the cell. Once inside, that RNA inserts itself into the cell’s own replication machinery and makes multiple copies of the virus. These will eventually burst out of the cells, and the infection spreads in the other part of the eye. The host body immune system will then respond by generating antibody against the virus (antigen). Antibodies generated by the body’s immune system eventually targets the virus and in most cases halts its progress if the individual’s immune system is strong or its progress will continue to form a more serious disease if the person’s immune system is weak.