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**DEPARTMENT: MEDICINE AND SURGERY**

**COURSE: HISTOLOGY**

1. **HISTOLOGICAL IMPORTANCE OF THE EYE IN RELATION TO THEIR CELLULAR FUNCTION**

The eyes can be viewed broadly as a series of overlapping tissues, and it is a complex and highly developed photosensitive organ that permits an accurate analysis of the form, light, intensity and color reflected from objects.

The eye is composed of two group of structures;

* External structures; which includes; eye lashes, eyelids, muscles, accessory glands and conjunctiva.
* Internal structures; which is composed of 3 concentric layers;
1. An external layer: which consists of the sclera and cornea.
2. A middle layer, also called vascular layer; which consists of the choroid, ciliary body and iris.
3. An inner layer of nerve tissue, the retina, which consists of an outer pigment epithelium and an inner retina proper.

EXTERNAL STRUCTURES OF THE EYE

* The eyelids: It is a mobile layer made up of skin and muscular tissue, whose main function is to cover the eye ball.
* Muscles: they include;
* Levator palpebrae superioris: it elevates the upper eyelid; it is a skeletal muscle under voluntary control.
* Orbicularis oculi: it contains both palpebra and orbital parts, it acts to close the eyelids.
* Superior and inferior tasal: the superior and inferior tasal plates are dense fibrous plates that gives support and form to the eyelids.
* Accessory glands; they include;
* Apocrine glands of moll: it is a modified apocrine sweat gland that is found on the margin of the eyelid, next to the base of the eyelash. This gland empty into the adjacent eyelash and it secrets sebum that keep the lashes supple.
* Meibomian glands: also called tarsal glands, they are located along the rims of the eyelids inside the tarsal plate. They produce meibum, an oily substance that prevents evaporation of the eye’s tear film. Meibum prevents tears spilling onto the cheek, trapping the tears between the oiled edge and the eyeball, and making the closed eyelid air tight. There are about 50 glands on the upper eyelid and 25 on the lower eyelid.
* Lacrimal gland: they are paired, almond-shaped exocrine glands, one for each eye that secrete the aqueous layer of tear film. They are situated in the upper lateral region of each orbit, in the lacrimal fossa of the orbit formed by the frontal bone. The lacrimal gland produces tears which then flow into canals that connect to the lacrimal sac. From the sac, the tears drain through the lacrimal duct into the nose.
* Conjunctiva: the conjunctiva is a tissue that lines the inside of the eyelids and covers the sclera (the white of the eye). It is composed of unkeratinized stratified squamous epithelium with goblet cells, and stratified columnar epithelium. It is highly vascularized, with many micro vessels easily accessible for imaging studied. The conjunctiva helps lubricate the eye by producing mucus and tears, although a smaller volume than the lacrimal gland. It also contributes to immune surveillance that helps to prevent entrance of microbes into the eye.

INTERNAL STRUCTURES

External layer

* Sclera (white of the eye): it consists of tough, dense connective tissue made up mainly of type I collagen fiber bundles intersecting in various directions. The lack of parallel orientation of collagen fiber give the sclera its white appearance as opposed to the transparent nature of the cornea. The collagen of the sclera is continuous with the cornea. From the outer to the innermost, the four layers of the sclera are; episcleral, stroma, lamina fusca and endothelium. The sclera along with the intraocular pressure (IOP) of the eye, maintains the shape of the eye ball. The tough fibrous nature of the sclera also protects the eye from serious damage. The sclera also provides a sturdy attachment for the extraocular muscles that controls the movement of the eyes.
* Cornea: it is colorless and transparent. The cornea epithelium is nonkeratinized stratified squamous. The cornea has five layers; epithelium, bowman’s layer, the stroma, Descemet’s membrane and the endothelium. In the basal part of the epithelium, are numerous mitotic figures that are responsible for the cornea’s regenerative capacity.

Middle layer

* Choroid: it is a thin, variably pigmented, vascular tissue forming the posterior uvea. It joins the ciliary body anteriorly and lies between the retina and sclera posteriorly. The choroid is extremely vascular, with its capillaries arranged in a single layer on the inner surface to nourish the outer retina layers. The choroid has three layers, (from inner to outer); choriocapillaris, stroma and lamina fusca.
* Ciliary body: it is the part of the eye that includes the ciliary muscles, which controls the shape of the lens, and ciliary epithelium, which produce the aqueous humor, is produced in the non-pigmented portion of the ciliary body. The ciliary body joins the ora serrata of the choroid to the roots of the iris. The ciliary body has three function;
1. Accommodation
2. Aqueous humor production and resorption
3. Maintenance of the zonules for the purpose of anchoring the lens in place
* Iris: it is a thin annular structure in the eye, responsible for controlling the diameter and size of the pupil, and thus the amount of light reaching the retina. The iris consists of two layers; the front pigmented fibrovascular layer known as a stroma and the pigmented epithelial cells beneath the stroma. The iris is divided into two main regions;
1. The pupillary zone which is the inner region whose edge forms the boundary of the pupil.
2. The ciliary zone is the rest of the iris that extends to its origin at the ciliary body.

Inner layer

* Retina: it is the innermost, light-sensitive layer of tissue of the eye. The retina serves a function analogue to that of the film or image sensor in a camera. It is a nervous tissue of the eye where photons of light convert to neurochemical energy via action potential. The retina has two main cells; rod and cines, and they are bipolar neuronal cells.

**LAYERS OF THE RETINA**

* Choroid: this is made up of layers of blood vessels that supply oxygen and nutrients to the retina
* Retinal pigment epithelium: this is a single layer of cells that provides essential nutrition and waste removal for the photoreceptor cells.
* Photoreceptors: this is where the rod and cones are located that convert light into electrical signals. Rod helps with night and peripheral vision. Cones are more concentrated in the macula (central part of retina) and proved central and color vision. Death of rods can cause vision loss called retinitis pigmentosa
* Horizontal cells: these cells are connected with the photoreceptors that surround the bipolar connected photoreceptors and help integrate and regulate the input from the multiple photoreceptor cells, increasing visual acuity.
* Bipolar cells: the dependence of each layer of the retina on each other is exemplified here. These cells take the electrical information from the photoreceptor cells and pass it along to other retina cells.
* Ganglion cells: these cells extend to form an optic nerve that conveys information to the brain and take the electrical information from the bipolar cells and process it to determine shape, contrast and color. Glaucoma vision loss results from high intraocular pressure that affects the optic nerve, interrupting the signals to the brain.