17/MHS01/101

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1.

Layers of the eye

The wall of the eye consists of 3 layers:

An outer, fibrous corneoscleral coat, including the sclera and the cornea

The uvea: a middle vascular layer including the choroid, the ciliary body and iris

The inner retina, including the outer pigment epithelium, the inner neural retina, and the epithelium of the ciliary body and iris.

The internal cavity of the eye is filled with the vitreous body, a transparent gel that supports the shape of the eye.

The corneoscleral coat

The cornea covers the anterior one sixth of the eye, and is continuous with the fibrous sclera posteriorly.

It consists of 5 layers:

The outer layer of stratified squamous, non keratinizing corneal epithelium

Bowman’s membrane, upon which the corneal epithelium sits

The corneal stroma (substantia propria) forming most of the thickness of the cornea

Descemet’s membrane, the basil lamina of the corneal endothelium

The inner layer of cuboidal cells called the corneal endothelium

The sclera consists of dense, irregular connective tissue, making it opaque.

Bowman’s membrane ends at the junction of the cornea and the sclera, called the limbus, which contains the canal of Schlemm that drains aqueous humour from the eye into veins of the sclera, preventing the build up of intraocular pressure.

The Uvea

This consists mainly of the choroid, which has a dark brown colour due to many venous plexuses and capillaries, as well as melanin pigment, which helps to reduce glare within the eye.

Just posterior to the corneoscleral junction, the ciliary body extends inwards to form a ring-like thickening, with ciliary processes on its anterior third, from which the suspensory ligament of the lens (zonular ligament) arises.

The ciliary body continues posteriorly until it merges with the retina at the ora serrata.

The layers of the ciliary body include a stroma and an epithelium, with the stroma divided into 2 layers:

The outer ciliary muscle, which alters the shape of the lens in accommodation.

An inner vascular region extending into the ciliary process

The epithlium of the ciliary body is double layered, derived from the layers of the optic cup (the retinal epithelium), and thus the deeper layer is pigmented (like the retinal pigment epithelium)

The superficial, non-pigmented epithelial layer secretes aqueous humour, which passes into the anterior chamber of the eye before draining laterally to the angle formed between the cornea and iris, finding its way to the canal of Schlemm.

The iris extends over the anterior surface of the lens from the anterior border of the ciliary body, and consists of 5 layers, from anterior to posterior:

A discontinuous layer of fibroblasts and melanocytes

The avascular anterior stromal sheet (lamella)

A vascular layer of loose connective tissue forming the bulk of the iris

The posterior membrane, containing the circular sphincter pupillae and radial dilator pupillae muscles

A double layer of pigmented epithelium.

The Retina

The retina consists of:

The inner, neural retina, containing photoreceptor cells, with a 10 layered structure.

The outer retinal pigment epithelium (RPE) that sits on the choroid, consisting of cuboidal melanin-containing cells.

Layers of the retina, from the outside inwards

Retinal Pigment Epithelium

Melanin containing cells

Layer of rods and cones

Inner and outer segments of photoreceptor cells

External (Outer) limiting membrane

Apical boundary of Müller’s cells

Outer nuclear layer

Cell bodies of rods and cones

Outer plexiform layer

1st synaptic layer, between photoreceptors and horizontal, amacrine and bipolar cells

Inner nuclear layer

Cell bodies of horizontal, amacrine, bipolar and Müller’s cells

Inner plexiform layer

2nd synaptic layer, between horizontal, amacrine and bipolar cells and ganglion cells

Ganglion cell layer

Cell bodies of ganglion cells

Layer of optic nerve fibres

Processes of ganglion cells travelling to the brain

Internal (Inner) limiting membrane

Composed of the basal lamina of Müller’s cells

The neural retina meets the optic nerve at the optic disc (or optic papilla), which is devoid of photoreceptor cells, forming a blind spot in the visual field.

The fovea, lateral to the optic disc, is the area of greatest visual acuity, and is surrounded by a yellow pigmented zone called the fovea lutea.

Chambers of the eye

There are 3 chambers of the eye:

The anterior chamber, between the cornea and the iris

The posterior chamber, between the posterior surface of the iris and the anterior surface of the lens

The vitreous space, between the posterior surface of the lens and the neural retina.

The conjunctiva

This is a thin, transparent mucous membrane extending from the lateral margin of the cornea, across the sclera, and covering the internal surface of the eyelids.

It is composed of a stratified squamous columnar epithelium, containing many goblet cells, that rests on a lamina propria of loose connective tissue.

The Lens

The lens is a transparent, avascular, biconvex structure that is suspended by the suspensory ligament of the lens, and has 3 components:

The lens capsule, produced by anterior lens cells

A subcapsular epithelium, a cuboidal layer of cells that is only present on the anterior surface of the lens

Lens fibres, derived from the subcapsular epithelial cells, which lose their nuclei and organelles to become filled with proteins called crystallins.

2. The retina at the back of the eye is essential for all vision. Each layer of cells in this tissue serves a specific purpose. As we prepare for Age-Related Macular Degeneration Awareness Month in February, a closer look at the layers of the retina and their function.

Layers of the Retina

Choroid – This is made up of a layer of blood vessels that supply oxygen and nutrients to the retina. Defect in the CHM gene can cause choroideremia, leaky blood vessels can expand in the retina causing wet age-related macular degeneration (AMD) and diabetic retinopathy.

Retinal pigment epithelium – This is a single layer of cells that provide essential nutrition and waste removal for the photoreceptor cells. Accumulation of waste can lead to AMD and Stargardt disease.

Photorecptors – This is where the rods and cones are located that convert light into electrical signals. Rods help you with night and peripheral vision. Cones are more concentrated in the macula (the central part of the retina) and proved central and color vision. Death of the rods can cause vision loss called retinitis pigmentosa, while AMD is the loss of central vision.

Horizontal cells – These cells are connect to the photoreceptors that surround the bipolar connected photoreceptor cells and help the help integrate and regulate the input from multiple photoreceptor cells, increasing your 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 retinal 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 shapes, contrast and color. Glaucoma vision loss results from high intraocular pressure that affects the optic nerve, interrupting the signals to the brain.