

Vision

Accessory Structures of the Eye

Lacrimal Apparatus

- group of structures that produce and drains lacrimal fluid or tears
- lacrimal gland**- secrete lacrimal fluid into 6-12 excretory **lacrimal ducts** that empty tears onto the surface of the conjunctiva of the upper lid.
- tears pass medially over the anterior surface of the eyeball to enter two openings called the **lacrimal puncta**, then to the **lacrimal canals**, which lead into the **lacrimal sac** and then into the **nasolacrimal duct**.

Lacrimal Apparatus

Anatomy of the Eyeball

- about 1" diameter and only 1/6 exposed
- Consist of three layers
- fibrous tunic- the superficial coat of the eyeball
- vascular tunic- the middle layer
- retina- the inner layer

Fibrous Tunic

- the superficial coat (outer layer) of the eyeball
- is avascular and consist of
- anterior cornea
- posterior sclera

Fibrous Tunic: Cornea

Fibrous Tunic: Cornea

- Because of its curvature, most of the bending of the light rays (refraction) occurs at the cornea.
- Outer surface consist of nonkeratinized st. sq. epi.
- Middle coat consist of collagen fibers and fibroblast
- Inner surface is simple squamous epithelium

Fibrous Tunic: Sclera

- the white of the eye
- a layer of dense c.t., mostly collagen fibers and fibroblast
- covers the entire eyeball except the cornea
- gives the eyeball shape, makes it more rigid, and protects its inner parts
- scleral venous sinus (canal of Schlemm)- an opening located at the junction of the sclera and cornea that drains fluid (aqueous humor).

Vascular Tunic (Uvea)

- Inner layer of the eyeball
- Has three layers
- choroid
- ciliary body
- iris

Vascular Tunic: Choroid

- highly vascularized
- is the posterior portion of the vascular tunic that lines most of the internal surface of the sclera

Vascular Tunic: Ciliary Body

- choroid becomes the **ciliary body** toward the anterior portion of the vascular tunic
- extends from the **ora serrata** (the jagged anterior margin of the retina) to the point just posterior to the junction of the sclera and cornea

Vascular Tunic: Ciliary Body

- consist of the
 - ciliary processes**- protrusions or folds on the internal surface of the ciliary body
 - contain blood vessels and secrete aqueous humor
 - zonular fibers** (suspensory ligaments- extends from the ciliary processes to the to the lens
 - ciliary muscle**- circular band of smooth muscle that contracts and relaxes the alter the shape of the lens to adapt it for near or far vision

Iris

Vascular Tunic: Iris

- flat donut shaped colored portion of the eyeball
- suspended between the cornea and the lens
- consist of circular and radial smooth muscle fibers
- functions to regulate the amount of eye entering the pupil (the hole in the center of the iris)

Vascular Tunic: Iris

- Bright light causes the stimulation of the parasympathetic neurons causing contraction of the **circular fibers (sphincter pupillae)** resulting in pupillary constriction
- Dim light stimulates sympathetic neurons, causing contraction of the **radial muscles (dilator pupillae)**, increasing pupil size (dilation)

Retina

- third inner coat of the eyeball
- lines the posterior $\frac{3}{4}$ of the eyeball
- the only surface in the body where blood vessels can be viewed directly

Retina

- Optic disc**- the site where the optic nerve and retinal artery and vein enter and exit the eye

–**central retinal artery**- branch of the **ophthalmic artery**

- branches of the central retinal artery fan out to nourish the anterior surface of the retina

Retina: Optic Disc

Retina

Consist of pigmented layer and neural layer

Retina: Pigmented Layer

- a sheet of melanin-containing epithelial cells** located between the choroid and neural part

•**Melanin** in the choroid and in the pigmented layer **absorbs stray light** rays, which prevents reflection and scattering of light within the eyeball, **allowing for sharp images**

Retina: Neural Layer

•three layers of retinal neurons

–photoreceptor layer

–bipolar cell layer

–ganglion cell layer

•layers are separated by the outer (plexiform) and inner (plexiform) synaptic zones

Retina: Photoreceptors

•two types

–Rods- approx. 120 million, low light threshold, good for dim light, no color, shades of gray

–Cones- approx. 6 million, higher light threshold, color vision, difficult seeing in dim light, most vision experience mediated by cones, the loss causes visual legal blindness

Retina

•**macula lutea**- exact center of posterior retina (visual axis of the eye)

•**central fovea**- small depression in the center of the macula lutea that contains only cones

Lens

•behind the pupil and iris

•composed of a proteins arranged in onion skin rows called **crystallins**

•focuses light on the retina

Lens

•divides the internal eye in to

–**anterior chamber**- contains watery fluid called **aqueous humor** that nourishes the lens and cornea

–**Posterior chamber**

Anterior Cavity

•divided into two cavities: **anterior chamber and posterior chamber**

•contains watery fluid called **aqueous humor** that nourishes the lens and cornea

•**circulates** between the ciliary body capillaries and scleral venous sinus (canal of Schlemm)

•**intraocular pressure**- provided by aqueous humor and vitreous body

–**maintains the shape** of the eyeball and **prevents** the eyeball from **collapsing**.

Posterior Cavity

•**posterior chamber**- contains **vitreous body**, a jelly-like substance that **contributes to intraocular pressure** that **hold the retina flush against the choroid** so that the retina has an even surface for the reception of clear images

•unlike the aqueous humor, it **does not undergo constant replacement**

•contains **phagocytic cells** that remove debris

•**hyaloid canal**- a narrow channel that was occupied by the hyaloid artery in the fetus

Lens: Function Image Formation

•Involves

- the refraction or bending of light by the lens and cornea.
- 75% by cornea
- 25% by the lens
- accommodation- the change in the shape of the lens thereby varying refraction .
- constriction or narrowing of the pupil by the constriction and dilation of the iris according to the amount of light available.

The Normal Eye

Emmetropia

Myopia (nearsightedness)

Hyperopia (farsightedness)

Astigmatism

Presbyopia (old age vision)

Cataract

Convergence

Photoreceptors & Photopigments

- Rods and cones are named for the different appearance of each's outer segment.
- photopigments are integral proteins in the plasma membrane of the outer segment
- the outer segment are sloughed off and renewed very rapid pace
- sloughed off tips are phagocytized by pigment epithelial cells

Photoreceptors & Photopigments

Other Cells of the Retina

•Bipolar cells-

- bipolar cells synapse with rods and cones and ganglion cells.
- beginning of signal **convergence**- grouping of input signals

•Ganglion cells- largest neurons of the retina

–axons form the optic nerve

- some cells absorb light and are **involved with light intensity and the control of pupillary diameter**

•Horizontal and amacrine cell- involved in enhancing perception of contrast, the edges of objects, and changes in light intensity

- light causes a change in the retinal molecule which disassociates from opsin (bleaching) resulting in activation of opsin.

Deactivation of cGMP Closes Na⁺ Channels

Chalazion

Hordeolum (Sty)