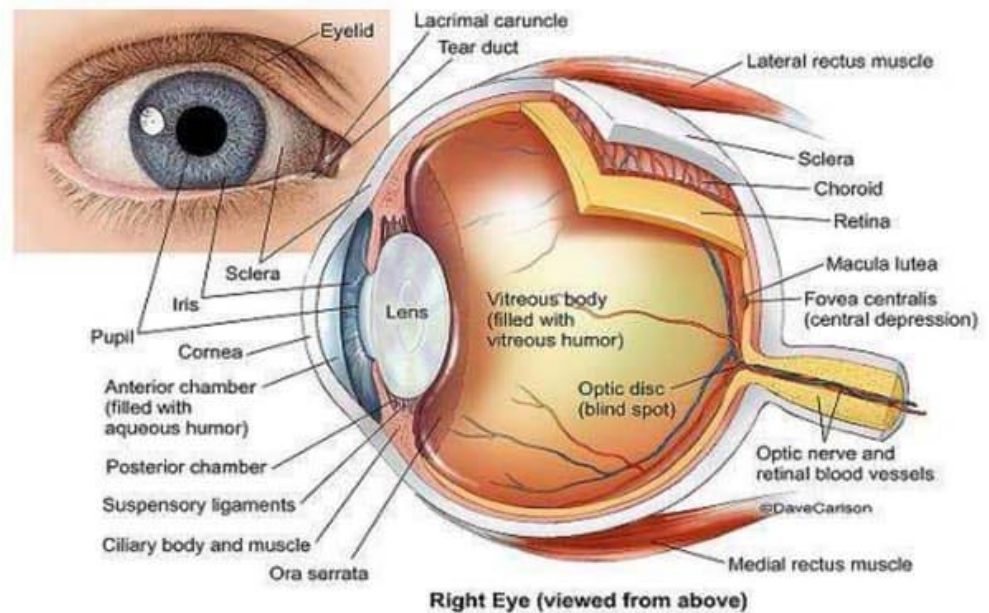


EYE ANATOMY AND PHYSIOLOGY

Asst. Lec. Safa Jalil Al-Yassiri

*Visual system
Department of occupational Therapy
Techniques*



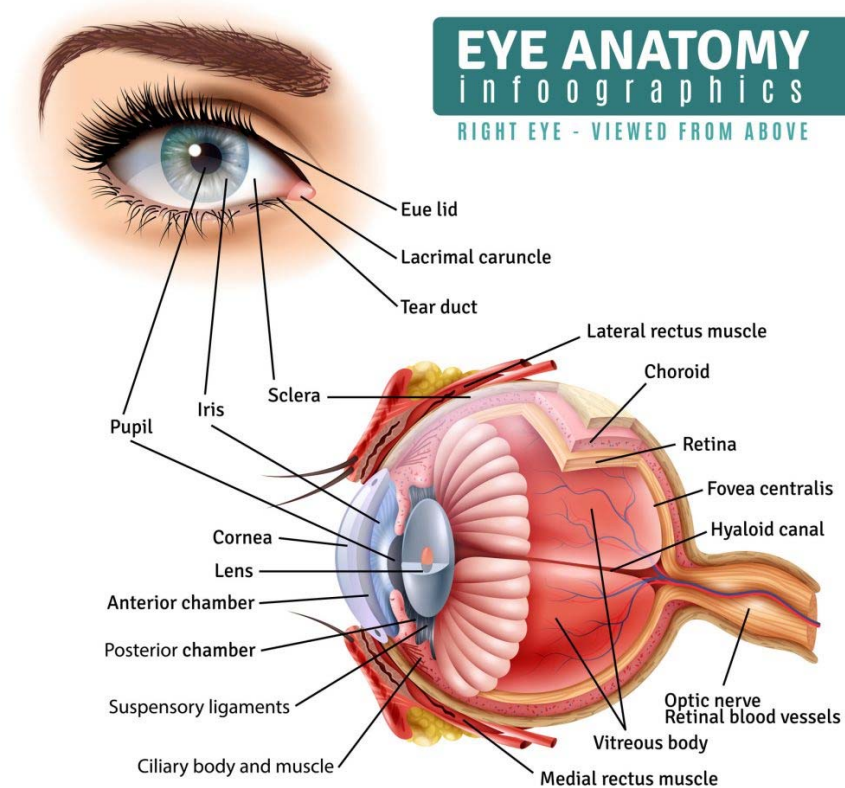
Vision: the act of seeing, is extremely important to human survival because it allows us to view potentially dangerous objects in our surroundings. More than half the sensory receptors in the human body are located in the eyes, and a large part of the cerebral cortex is devoted to processing visual information.

The visual system includes both the eyes and the brain

The adult eyeball measures about 2.5 cm (1 in.) in diameter. Of its total surface area, only the anterior one-sixth is exposed; the remainder is recessed and protected by the orbit, into which it fits.

Anatomically, the wall of the eyeball consists of three layers:

- (1) fibrous tunic.
- (2) vascular tunic.
- (3) retina (inner tunic).

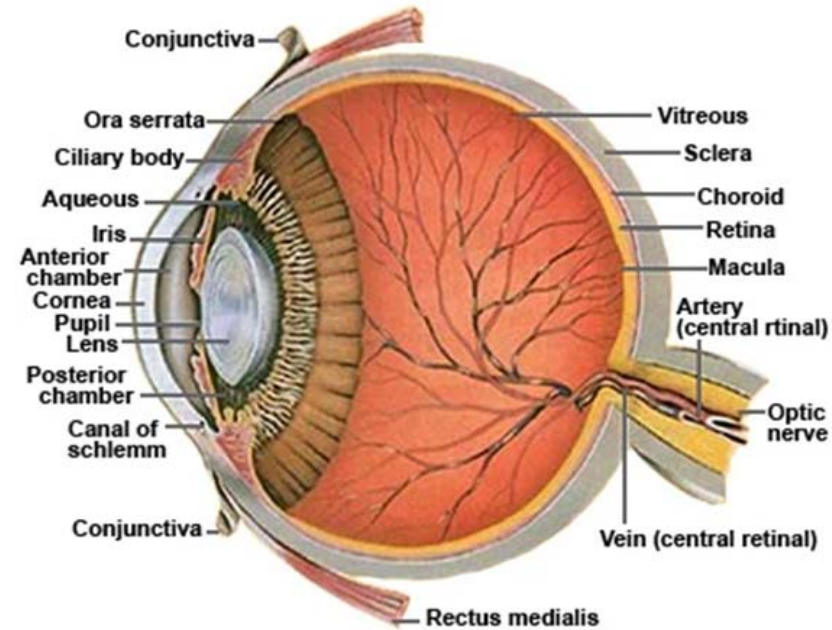


Fibrous Tunic: The fibrous tunic is the superficial layer of the eyeball and consists of the anterior cornea and posterior sclera.

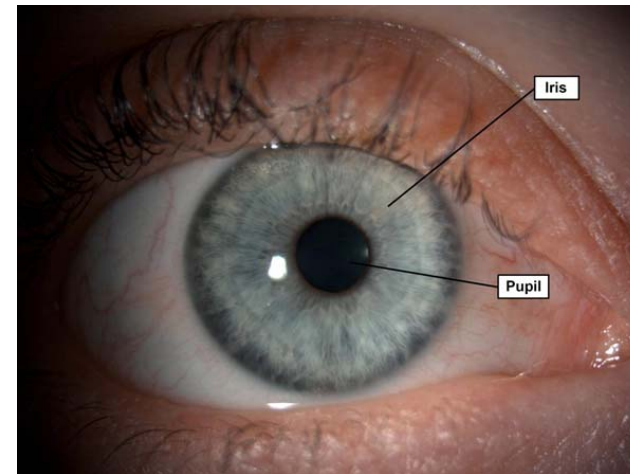
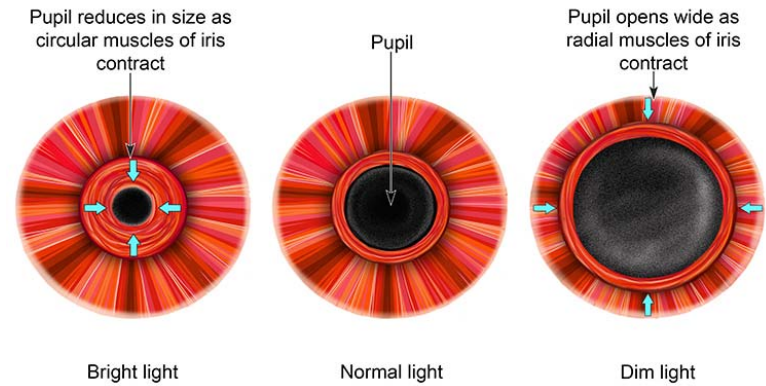
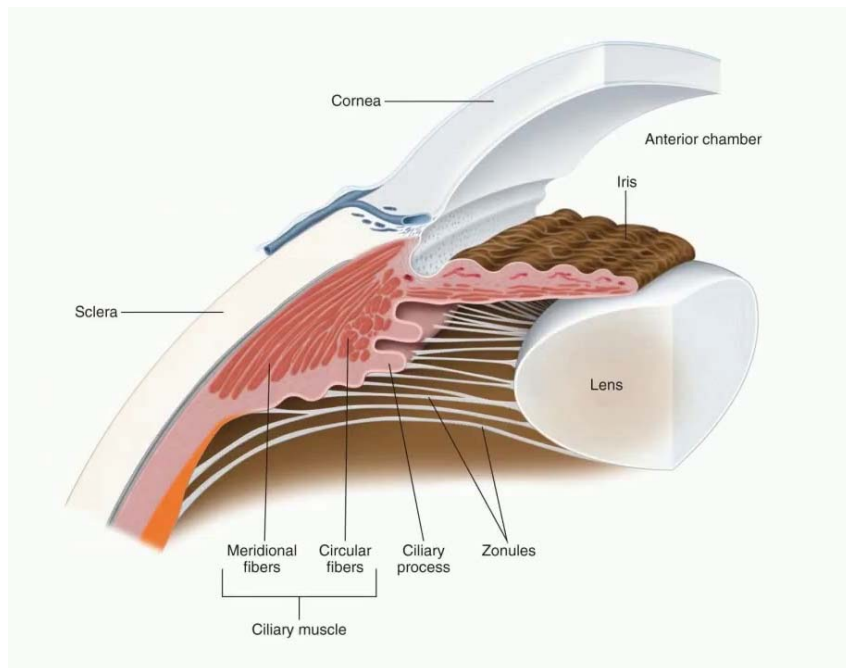
- **The cornea:** is the transparent anterior part helps focus light onto the retina.
- **The sclera:** an opaque posterior portion, the “white” of the eye covers the entire eyeball except the cornea; it gives shape to the eyeball, makes it more rigid, protects its inner parts, and serves as a site of attachment for the extrinsic eye muscles. Peripherally, the cornea is continuous with the sclera at the sclera-corneal junction

Vascular Tunic: The vascular tunic or uvea is the middle layer of the eyeball. It is composed of three parts: **choroid, ciliary body and iris** .

- **Choroid:** which is the posterior portion of the vascular tunic, lines most of the internal surface of the sclera. Its numerous blood vessels provide nutrients to the posterior surface of the retina.
- **Ciliary body:** consists of **ciliary processes** (a group of sixty to eighty folds arranged radially) and **ciliary muscle**. Main function is secretes aqueous humor and alters shape of lens for near or far vision.
- **Iris:** the colored portion of the eyeball, is shaped like a flattened donut. It is suspended between the cornea and the lens and is attached at its outer margin to the ciliary processes. It consists of melanocytes and circular and radial smooth muscle fibers. The amount of melanin in the iris determines the eye color. The eyes appear brown to black when the iris contains a large amount of melanin, blue when its melanin concentration is very low, and green when its melanin concentration is moderate. A principal function of the iris is to regulate the amount of light entering the eyeball through the pupil.

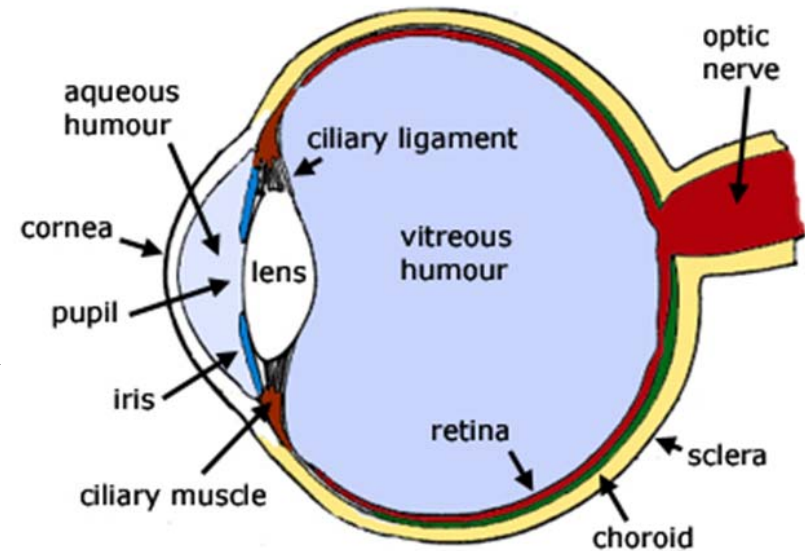


When bright light stimulates the eye, parasympathetic fibers of the oculomotor (III) nerve stimulate the circular muscles or sphincter pupillae of the iris to contract, causing a decrease in the size of the pupil (constriction). In dim light, sympathetic neurons stimulate the radial muscles or dilator pupillae of the iris to contract, causing an increase in the pupil's size (dilation).



Retina inner (tunic):

- The third and inner layer of the eyeball, the retina, lines the posterior three-quarters of the eyeball and is the beginning of the visual pathway, its function receives light and converts it into receptor potentials and nerve impulses. Output to brain via axons of ganglion cells, which form optic (II) nerve.
- The retina consists of a pigmented layer and a neural layer.
- ❖ **The pigmented layer** is a sheet of melanin-containing epithelial cells, helps to absorb stray light rays.
- ❖ **The neural (sensory) layer** of the retina is a multilayered outgrowth of the brain that processes visual data extensively before sending nerve impulses into axons that form the optic nerve. Three distinct layers of retinal neurons the photoreceptor cell layer (the layer of rods and cones), the bipolar cell layer, and the ganglion cell layer.

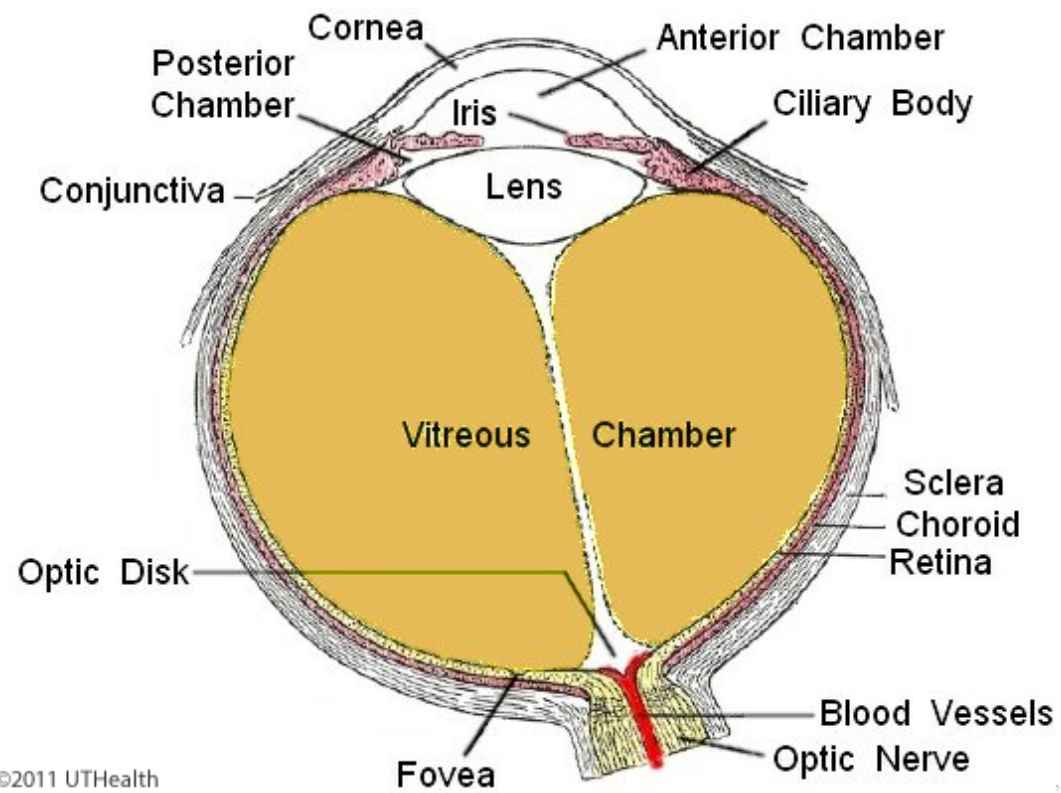


Lens: behind the pupil and iris, within the cavity of the eyeball, the lens helps focus images on the retina to facilitate clear vision.

Interior of the eyeball:

the lens divides the interior of the eyeball into two cavities:

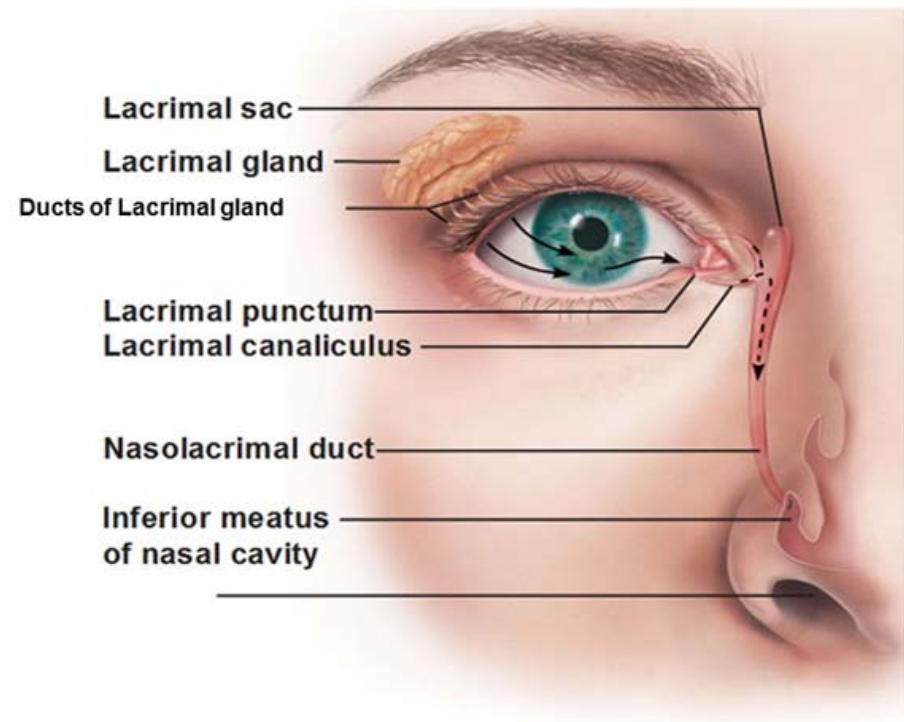
- **The anterior cavity:** the space anterior to the lens consists of two chambers, both chambers of the anterior cavity are filled with aqueous humor that helps maintain shape of eyeball and supplies oxygen and nutrients to lens and cornea.
- **The vitreous chamber:** which lies between the lens and the retina. Within the vitreous chamber is the vitreous body, a transparent jellylike substance that holds the retina flush against the choroid, giving the retina an even surface for the reception of clear images or helps maintain shape of eyeball and keeps retina attached to choroid.



Accessory Structures of the Eye

The lacrimal apparatus

- The lacrimal apparatus is a group of structures that produces and drains lacrimal fluid or tears in a process called lacrimation.
- The lacrimal glands, each about the size and shape of an almond, secrete lacrimal fluid, which drains into 6–12 excretory lacrimal ducts that empty tears onto the surface of the conjunctiva of the upper lid.
- From here the tears pass medially over the anterior surface of the eyeball to enter two small openings called lacrimal puncta.
- Tears then pass into two ducts, the superior and inferior lacrimal canaliculi, which lead into the lacrimal sac (within the lacrimal fossa) and then into the nasolacrimal duct.
- This duct carries the lacrimal fluid into the nasal cavity.



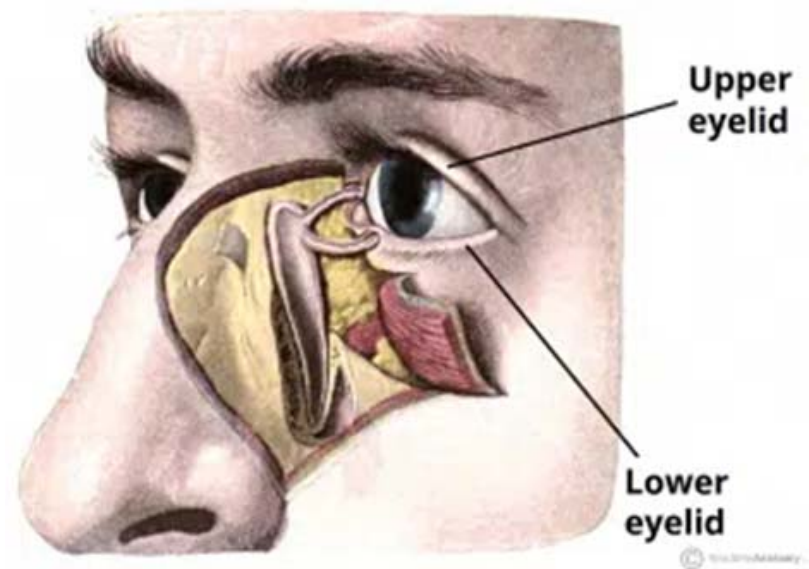
Eyelids:

The upper and lower eyelids, or palpebrae , shade the eyes during sleep, protect the eyes from excessive light and foreign objects, and spread lubricating secretions over the eyeballs. The upper eyelid is more movable than the lower and contains in its superior region the levator palpebrae superioris muscle.

Eyelashes and Eyebrows:

The eyelashes: which project from the border of each eyelid. Sebaceous glands at the base of the hair follicles of the eyelashes, called sebaceous ciliary glands, release a lubricating fluid into the follicles. Infection of these glands, usually by bacteria, causes a painful, pus-filled swelling called a sty.

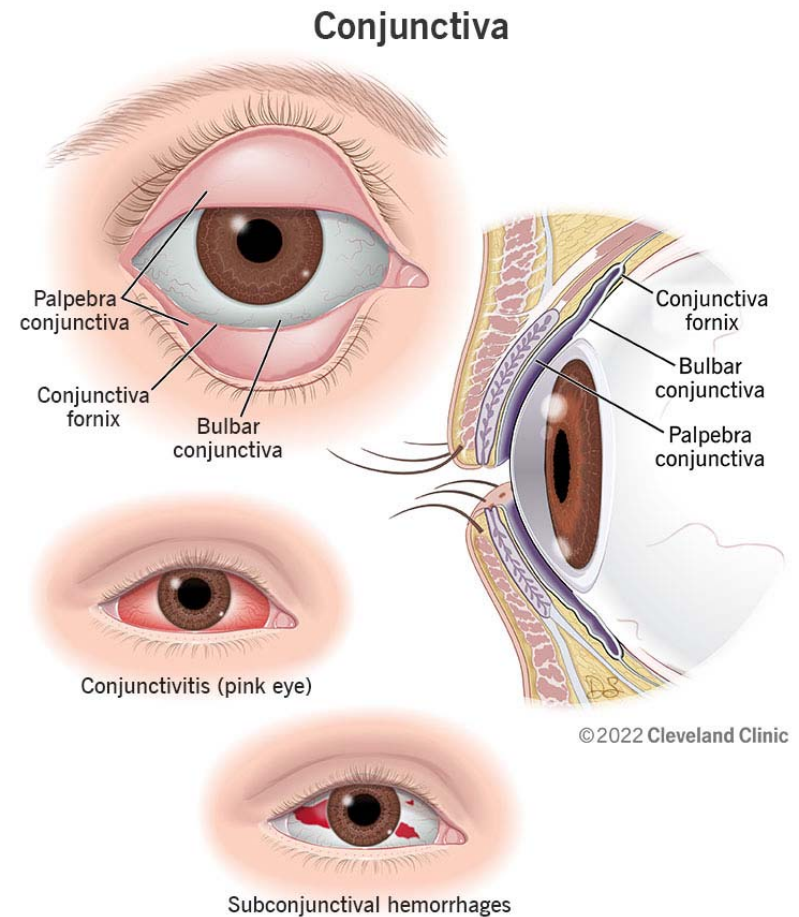
The eyebrows: which arch transversely above the upper eyelids, help protect the eyeballs from foreign objects, perspiration, and the direct rays of the sun.



The conjunctiva:

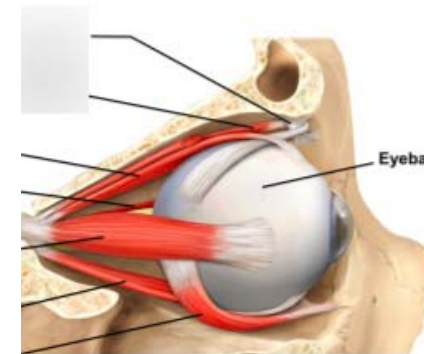
is the delicate mucous membrane lining the inner surface of the lids from which it is reflected over the anterior part of the sclera to the cornea. Over the lids it is thick and highly vascular, but over the sclera it is much thinner and over the cornea it is reduced to a single layer of epithelium. The line of reflection from the lid to the sclera is known as the conjunctival fornix; the superior fornix receives the openings of the lacrimal glands.

Movements of the eyelids are brought about by the contraction of the orbicularis oculi and levator palpebrae superioris muscles.

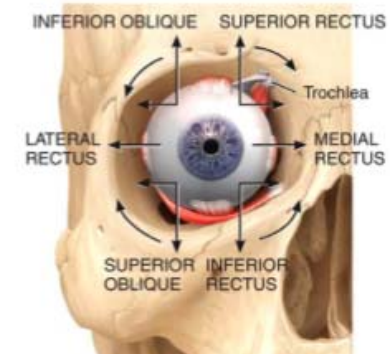


Muscles of the Head That Move the Eyeballs (Extrinsic Eye Muscles) and Upper Eyelids: Muscles that move the eyeballs are called extrinsic eye muscles because they originate outside the eyeballs (in the orbit) and insert on the outer surface of the sclera (“white of the eye”).

MUSCLE	ACTION	INNERVATION
Superior rectus	Moves eyeballs superiorly (elevation) and medially (adduction), and rotates them medially.	Oculomotor (III) nerve.
Inferior rectus	Moves eyeballs inferiorly (depression) and medially (adduction), and rotates them laterally.	Oculomotor (III) nerve.
Lateral rectus	Moves eyeballs laterally (abduction).	Abducens (VI) nerve
Medial rectus	Moves eyeballs medially (adduction).	Oculomotor (III) nerve.
Superior oblique	Moves eyeballs inferiorly (depression) and laterally (abduction), and rotates them medially.	Trochlear (IV) nerve.
Inferior oblique	Moves eyeballs superiorly (elevation) and laterally (abduction), and rotates them laterally	Oculomotor (III) nerve.
Levator palpebrae superioris	Elevates upper eyelids (opens eyes).	Oculomotor (III) nerve.



a) Right lateral view of right eyeball



(b) Movements of right eyeball in response to contraction of extrinsic muscles

Physiology of Vision:

1. Light Enters the Eye: Light reflects off objects and enters the eye through the cornea, the clear outer layer.
2. The light passes through the pupil, the black opening in the center of the eye. The iris (the colored part) adjusts the pupil size to control how much light enters.
3. Behind the pupil, the lens focuses the light onto the retina at the back of the eye. The lens changes shape to focus on near or far objects.
4. The retina contains special cells called photoreceptors (rods and cones) that detect light and color and convert them into electrical signals.
5. These signals travel through the optic nerve to the brain, specifically the visual cortex in the occipital lobe, where they are interpreted as images.

