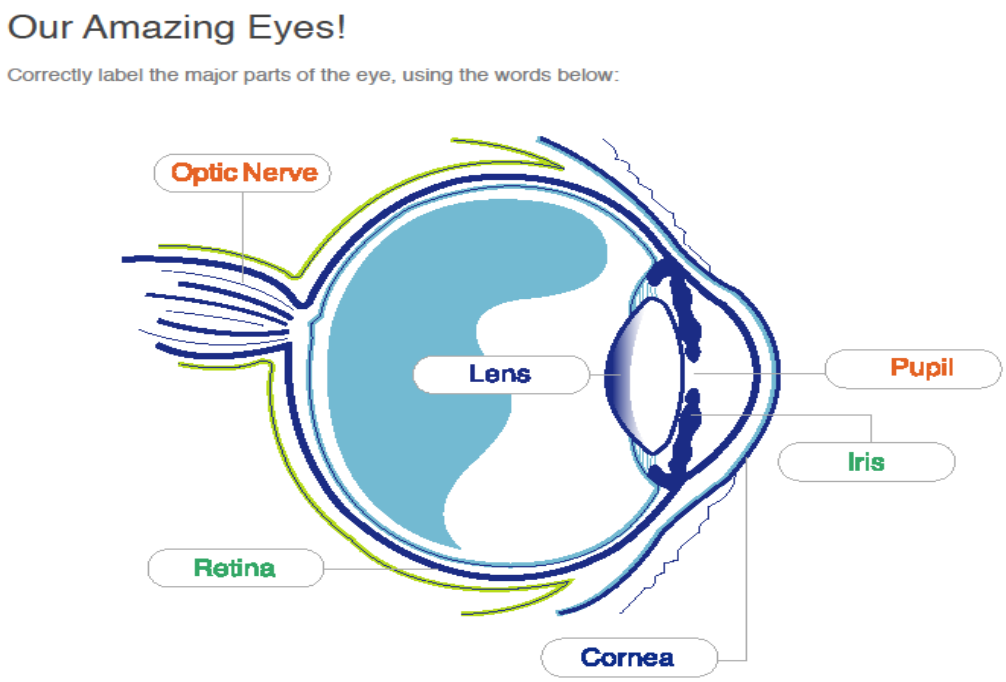
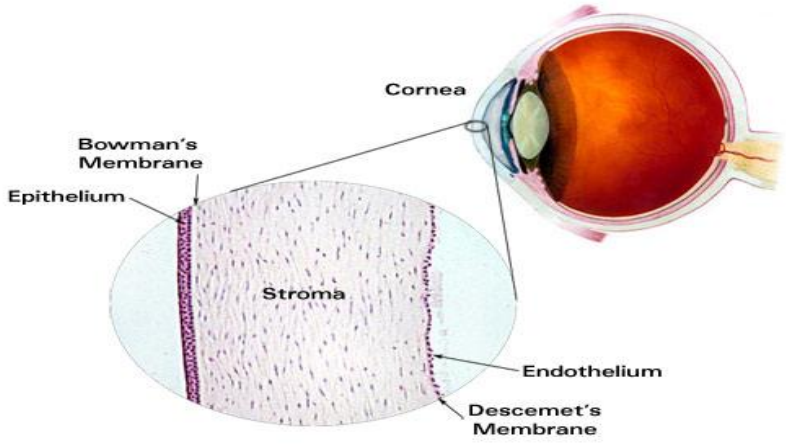
OCULAR ANATOMY

The eye is made up of layers: the outer layer consists of the **sclera** and the **cornea**; the middle layer, which consists of the **iris**, and the inner layer of photoreceptors and neurons , which consists of the **retina.**



The eye also contains three fluid-filled chambers. The volume between the cornea and the iris is known as the **anterior chamber**, while the volume between the iris and the lens is known as the **posterior chamber**; both chambers contain a fluid called **aqueous humor**. Aqueous humor is watery fluid produced by the **ciliary body**. It maintains pressure (called **intraocular pressure/ IOP**) and provides nutrients to the lens and cornea. Aqueous humor is continually drained from the eye through the **Canal of Schlemm**. The greatest volume, forming about four-fifths of the eye, is found between the retina and the lens called the **vitreous chamber**. The vitreous chamber is filled with a thicker gel-like substance called **vitreous humor** which maintains the shape of the eye.

Light enters the eye through the transparent, dome shaped **cornea**. The refractive power of the average cornea is equal to about 43.00 diopters while the crystalline lens is 17.00 diopters. The combination of these two results in a total refractive power of 60.00 diopters. The cornea consists of five distinct layers. The outermost layer is called the **epithelium** which rests on **Bowman's Membrane**. The epithelium has the ability to quickly regenerate while Bowman's Membrane provides a tough, difficult to penetrate barrier. Together the epithelium and Bowman's Membrane serve to protect the cornea from injury. The innermost layer of the cornea is called the **endothelium** which rests on **Descemet's Membrane**. The endothelium removes water from cornea, helping to keep the cornea clear. The middle layer of the cornea, between the two membranes is called the **stroma** and makes up 90% of the thickness of the cornea.

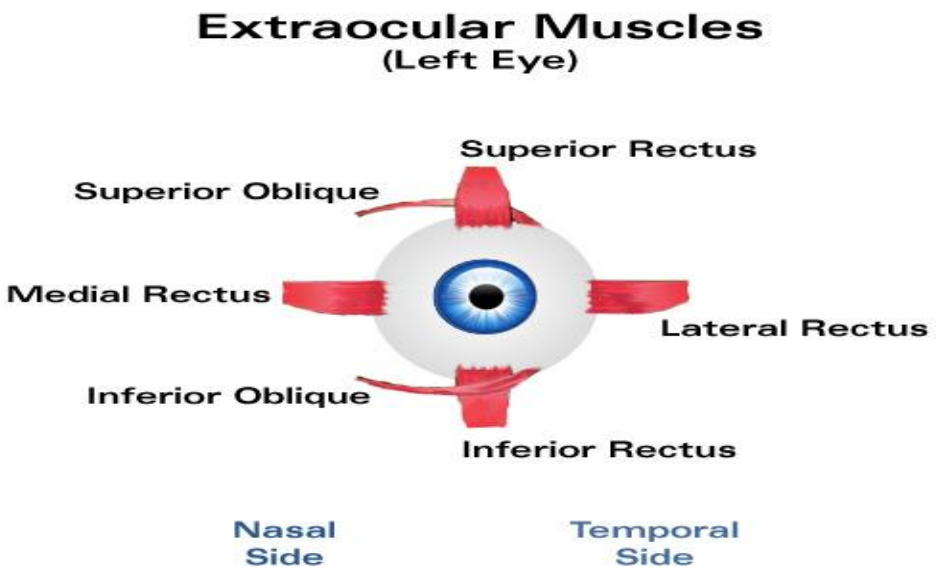


From the cornea, light passes through the **pupil**. The amount of light allowed through the pupil is controlled by the **iris**, the colored part of the eye. The iris has the ability to change the pupil size from 2 millimeters to 8 millimeters. Just behind the pupil is the **crystalline lens**. The purpose of the lens is to focus light on the retina.

The process of focusing on objects based on their distance is called **accommodation**. The closer an object is to the eye, the more power is required of the crystalline lens to focus the image on the retina. The retina consists of photoreceptor cells called **rods** and **cones**. Rods are highly sensitive to light and are more numerous than cones. There are approximately 120 million rods contained within the retina, mostly at the periphery. Not adept at color distinction, rods are suited to night vision and peripheral vision. Cones, on the other hand, have the primary function of detail and color detection. There are only about 6 million cones contained within the retina, largely concentrated in the center of the retina called the fovea. There are three types of cones. Each type receives only a narrow band of light corresponding largely to a single color: red, green, or blue. The signals received by the cones are sent via the **optic nerve** to the brain where they are interpreted as color. People who are color blind are either missing or deficient in one of these types of cones.

Extraocular Muscles

The stabilization of eye movement is accomplished by six extraocular muscles attached to the eye via the sclera. The six muscles and their function are:

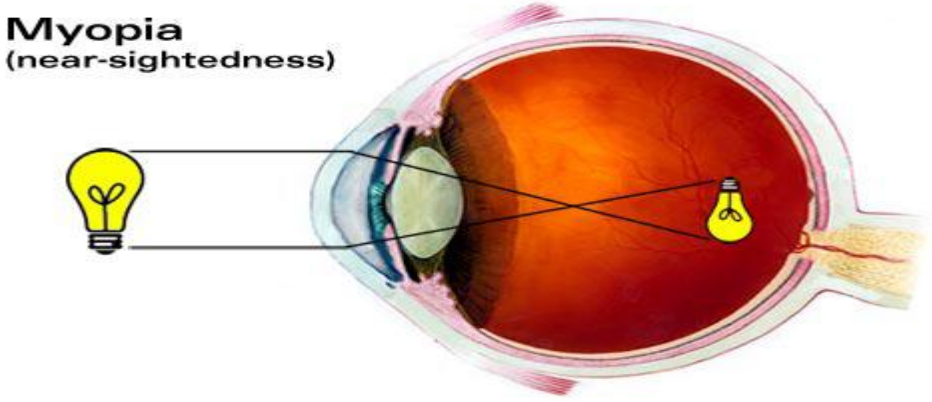


In addition to movement and tracking, extraocular muscles maintain alignment between the eyes. When the eyes are properly aligned, the brain is able to fuse the disparate images received by each eye into a single image. If any of the extraocular muscles are stronger or weaker than they should be, eye alignment can be affected making fusion difficult or impossible. Difficulty with fusion can cause double vision, also known as **diplopia**.

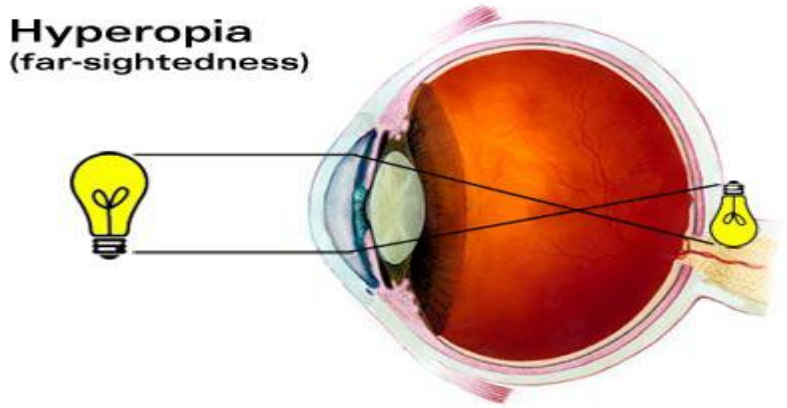
When the eye has a tendency to turn from its normal position (such as when the patient is tired), it is called a **phoria**. When the eye has a definite or obvious turning from its normal position, it is called a **tropia**.

When light comes to focus directly on the retina when accommodation is at rest no corrective lenses are needed for distance viewing this is called **Emmetropia.** The following conditions are when this is not the case.

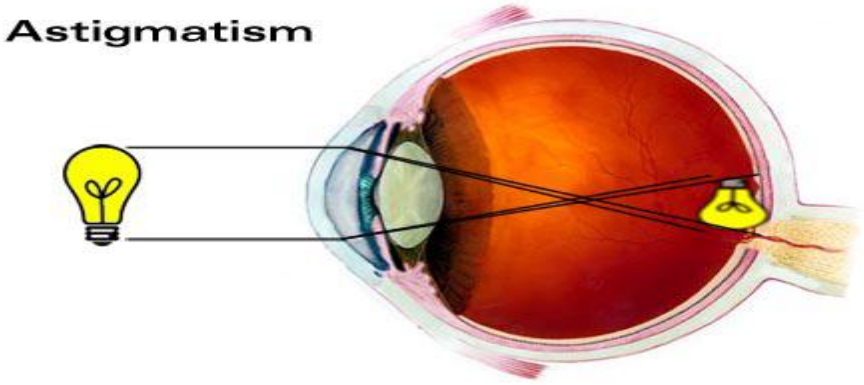
Myopia, also known as near-sightedness, occurs if the eye is longer than normal or the curve of the cornea is too steep, causing light rays focus in front of the retina. Patients with myopia are able to see objects at near, but distant objects appear blurred. Clear vision can be restored to most myopes through the use of minus-powered lenses.



Hyperopia, also known as far-sightedness, occurs if the eye is too short or the curve of the cornea is too flat, causing light rays to focus behind the retina. Patients with hyperopia are able to see objects at distance, but near objects appear blurred. Mildly hyperopic patients may be able to see clearly at near without correction by using accommodation to compensate. Clear vision can be restored to most hyperopes through the use of plus-powered lenses.



An even more common type of refractive error is **astigmatism**. Astigmatism occurs when the cornea has an oblong, football-like shape in one or more directions (or axes) causing light rays to focus on more than one point on the retina. Astigmatism is compensated for using cylinder powered lenses along the appropriate axis.



As eyes age, the crystalline lens begins to lose elasticity. With the loss of elasticity, the eye loses the ability to accommodate or focus at near. This typically becomes noticeable around 40 years of age. This condition where the crystalline lens is unable to add sufficient power to focus at near is known as **presbyopia**. The loss of elasticity in the crystalline lens continues until somewhere around the age of 65 when all the elasticity is gone from the lens as is all ability to accommodate. Presbyopia can be compensated for through the use of plus-powered lens segments, reading glasses, or magnifying devices.

(From the open optix ABO study guide at www.openoptix.org and eyeknowthat.com)