Eye Craziness!!!

## Lenses

Lenses are transparent curved optical devices. Eye lenses, also known as *aquula lenses,* are composed of crystalline transparent proteins arranged in approximately 20,000 layers with a refractive index of roughly 1.4. Each crystalline lens is enclosed in a capsular bag and suspended by fibrous strands called zonules. Eye lenses are biconvex-shaped to create a real image on the retina from converging light. After that, the brain inverts the already inverted image. The average adult human eye lens is about 5mm in thickness and 9mm in diameter. Because images are various distances from the eye, the contraction and relaxation of ciliary muscles around the lens, referred to as accommodation, changes the refractive index of the lens to focus the image on the retina. However, lenses’ accommodation abilities diminish with age because cell build-up makes lenses thicker and thus harder to accommodate. This occurrence is commonly referred to as Presbyopia.

## Iris

The iris, the coloured section of the eye’s surface, controls the amount of light that enters the eye. The colours of an iris are determined by the amount of melanin in it, making each iris unique in its colour pattern. The round opening in the centre of the iris, called the pupil, is dilated and constricted by dilator and sphincter muscles. Dilator muscles that go across the diameter of the pupil relax to dilate it in dim light, whereas sphincter muscles contract in bright light, causing the pupil to constrict. The iris is nourished by miniscule blood vessels.

Fun Fact: Doctors often determine a person’s neurological functionality based on the reaction of his/her pupils to light.

## Ciliary Body

The ciliary body, attached to zonules that suspend the crystalline lens, is located just behind the iris. Its main function is producing aqueous humor and controlling accommodation. In order for an eye to focus on objects within close proximity, its ciliary muscles contract, relaxing the zonules, which results in a thick and very curved lens with a high refractive index. This decreases the length of the focal point and thus focuses images close to the eye on the retina. To focus on objects farther away, an eye’s ciliary muscles relax, contracting the zonules. As a result of the zonules’ pulls on the lens, it becomes thinner and less curved, making the refractive index lower and the focal length longer. This enables the retina to remain the focal point of distant objects, allowing the eye to clearly see distant objects.

## Sclera

The sclera, also known as “The white part of the eye” (www.stlukeseye.com) is a tough and opaque layer that protects of the eye from damage. It is attached to the optic nerve and six extremely small extraocular muscles that control the eyes’ movements.

Fun Fact: Over time, scleras turn yellow.

## Retina

The retina is “a multi-layered sensory tissue that lines the back of they eye” (www.stlukeseye.com). It captures light rays through photoreceptors, and then converts them into electrical impulses. These impulses are sent to the brain through the optic nerve, and then are turned into images. The two types of photoreceptors found in the retina are rods, responsible for peripheral and night vision, and cones, which allow us to appreciate colour. About six million cones are contained in the macula, the portion of the retina responsible for central vision, but the cones are most densely packed in the central region of the macula, called the fovea. Approximately 125 million rods are spread throughout the peripheral retina. Rods function bet in dim light, as opposed to cones, which function best in bright light.

## Macula Lutea

The macula lutea, Latin for “yellow spot,” is an ovate yellow spot in the retina’s centre. Responsible for central vision, the centre of the macula, called the fovea, contains the largest concentration of cone cells in the eye. Macular degeneration, the progressive destruction of the macula, is a disease that creates a macular hole. Macular holes can also be caused by looking directly at the sun and the destruction of the blood vessel connected to the macula.

## Optic Nerve

The optic nerve is located at the back of the eye, near the centre of the retina. Its main function is transmitting electrical impulses from the retina to the brain. There is a blind spot in each of our eyes due to the absence of the retina’s sensory receptor cells where the retina meets the optic nerve. This is not normally noticeable because the vision of both eyes overlaps.

## Cornea

The cornea is a dome-shaped and transparent cover for the eye’s most exposed portion. The average adult cornea is only half a millimetre thick. Providing 2/3 of the eye’s focusing power, this powerful refracting surface is an essential component of the eye. Due to the fact blood vessels do not exist in the cornea, it is transparent and lustrous. The cornea is comprised of five layers: the epithelium, Bowman’s membrane, stroma, Descemet’s membrane, and the endothelium. Eyes are nourished by the aqueous humor, tear film, and blood vessels at the outermost edge of the cornea.

Fun Fact: There are more nerve endings in the cornea than anywhere else in the body.

## Choroid

The choroid includes the many layers of blood vessels between the retina and sclera. It is attached to the ciliary body and select parts of the optic nerve. The purpose of these vessels is to nourish the back of the eye.

## Aqueous Humor

The aqueous humor is a thin, watery fluid produced by the ciliary body that fills the space between the cornea and the iris. This fluid nourishes the cornea and lens and contributes to an eye’s shape. Nourishment for the ciliary body comes from blood vessels.

## Vitreous

The vitreous is a thick transparent substance filling the centre of the eye composed primarily of water. It is firmly attached to certain areas of the retina and comprises about 2/3 of the eye’s volume, contributing to the eye’s form and shape. The vitreous’ high viscosity returns the eye to its normal shape, after having been compressed.

## Tear Film

Tears maintain moisture in the eye, create an even surface through which light may pass, nourish the eye, and serve as a protection against injury and infection. Tears are created by tiny glands that encompass the eye. Layers of oil, water, and mucous comprise tear film. The bottommost layer, the mucous layer, coats the cornea, enabling the tear film to be evenly distributed. The aqueous layer, comprised of water and proteins from glands, including the lacrimal gland, promotes evenly distribution of the tear film, control of infectious agents, and osmotic regulation. The outermost layer, the lipid layer, is composed of oils secreted by the meibomian glands. This layer, unable to be dissolved in water, serves as a barrier that retards evaporation and seals the tear film.

Fun Fact: Thin tear films require more oxygen; therefore having a thin tear film may prevent you from wearing contact lenses.

## Conjunctiva

The conjunctiva is a thin transparent tissue that covers the entire outer surface of the eye (the cornea and sclera) and the inside of the eyelids. In addition to protecting the eye from microbes and germs, the conjunctiva secretes oils and mucous which moisten and lubricate the eye. The conjunctiva is nourished by miniscule blood vessels barely visible to the naked eye.

## Eyelids

In addition to protecting eyes from the environment, injury, and light, eyelids maintain a smooth corneal surface by evenly spreading tears over the eye’s exterior. Eyelids are composed of an outermost layer of skin, a middle layer of tissue and muscles (including the circular orbicularis oculi muscle that closes lids, the levator muscle that elevates lids, and the smooth Mueller’s muscle that gives lids tone and elasticity), and an innermost layer of cunjunctival tissue. The conjunctival tissue includes oil-producing meibomian glands that lubricate the eye.

## Extraocular Muscles (EOMs)

Six tiny muscles that surround the eye and control its movements, commonly referred to as extraocular muscles, work in unison to move the eye. The primary functions of the four rectus muscles (superior, medial, lateral, and inferior rectus) are to control the eye’s vertical and horizontal movements, whereas those of the two oblique muscles (inferior and superior oblique) are inward and outward rotation. Most pairs of eyes work in unison to ensure the alignment of both eyes.

Additional references:

http://www.tedmontgomery.com/the\_eye/lens.html

http://en.wikipedia.org/wiki/Macula

http://en.wikipedia.org/wiki/Tears

http://en.wikipedia.org/wiki/Extraocular\_muscles http://dragon.uml.edu/psych/bspot.html (below)

# Experience Your Blind Spot

Close one eye. Fix your gaze on either the top or bottom "X". View from a distance of about 80cm. Gradually move toward the screen while keeping your gaze fixed on the X. The eye pictured on the same side as the eye that you are using is the one that will disappear as you move toward the screen. The disappearance will occur when you are gazing from about 45 cm. and the projection falls on your blindspot. Hold your viewing distance constant and glance at the object that disappeared. You will see it when you look at it, but will not see it when the projection from it falls on your blindspot. The top figure works well on high resolution monitors and the bottom figure works best for low resolution monitors.

