



كلية المستقبل الجامعة
قسم الفيزياء الطبية
المرحلة الثانية

Medical Physics

Optics

Lecture 7

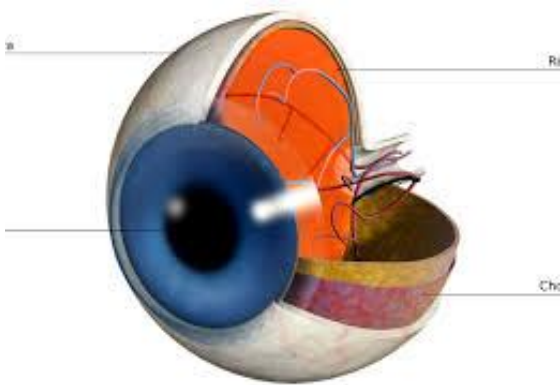
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Optical Device :

The Eye :

The human eye is optical instrument that reacts to light and allows vision; rod and cone cells in the retina allow conscious light perception and vision, including color differentiation and the perception of depth. The human eye can distinguish about 10 million colors .

The human eye is an optical instrument that enables us to view all the objects around us is a very complex organ.

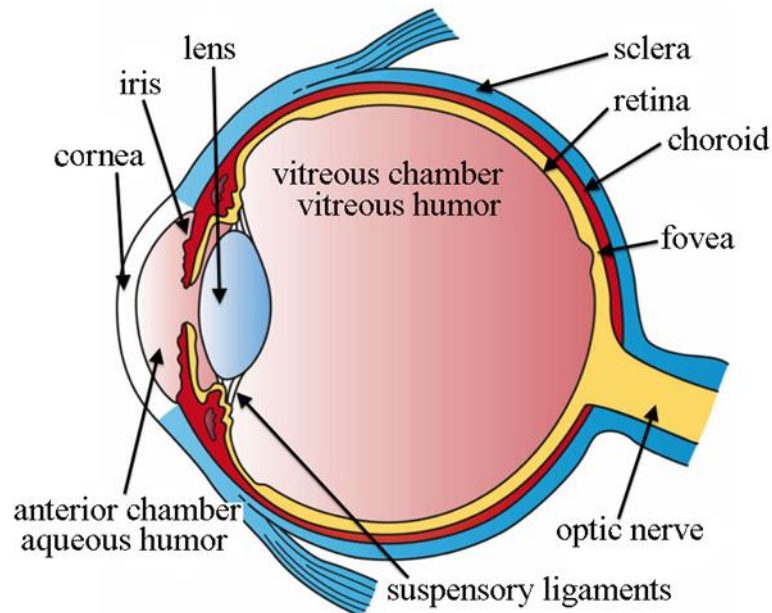


It helps us in visualizing objects and also helps us in light perception, color and depth perception. Besides, these sense organs are pretty much similar to cameras, and they help us see objects when light coming from outside enters into them.

That being said, it is quite interesting to understand the structure and working of a human eye. It also helps us in understanding how a camera actually functions. Let's have a glance at the human eye – it's structure and functions .

Structure of Human Eye :

A human eye is roughly 2.3 cm in diameter and is almost a spherical ball filled with some fluid. It consists of the following parts :



1- Sclera : It is the outer covering, a protective tough white layer called the sclera (white part of the eye) .

2- Cornea : The front transparent part of the sclera is called cornea. Light enters the eye through the cornea .

3- Iris : A dark muscular tissue and ring-like structure behind the cornea is known as the iris. The color of the iris actually indicates the color of the eye. The iris also helps regulate or adjust exposure by adjusting the iris .

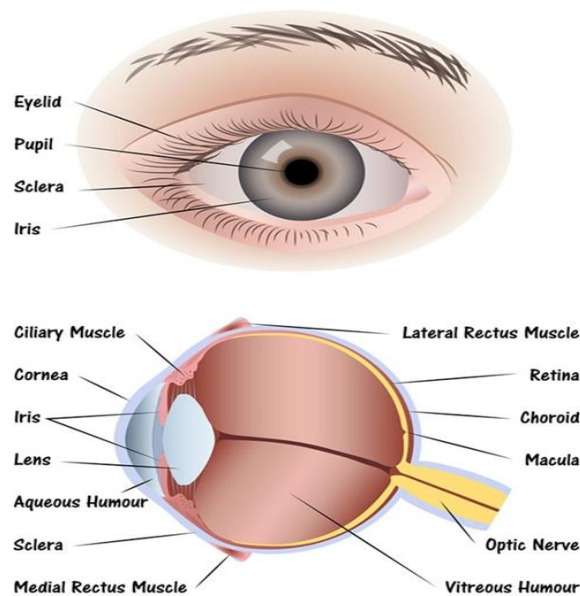
4- Pupil : A small opening in the iris is known as a pupil. Its size is controlled by the help of iris. It controls the amount of light that enters the eye.

5- Lens : Behind the pupil, there is a transparent structure called a lens. By the action of ciliary muscles, it changes its shape to focus light on the retina. It becomes thinner to focus distant objects and becomes thicker to focus nearby objects.

6- Optic nerves: Optic nerves are of two types. These include cones and rods :

A - Cones: Cones are the nerve cells that are more sensitive to bright light. They help in detailed central and colour vision .

B- Rods: Rods are the optic nerve cells that are more sensitive to dim lights. They help in peripheral vision .

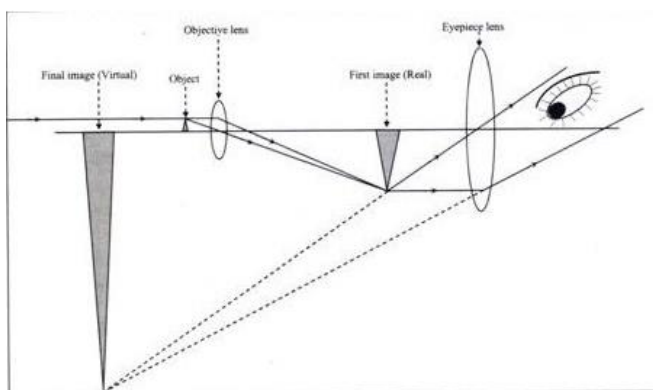


At the junction of the optic nerve and retina, there are no sensory nerve cells. So no vision is possible at that point and is known as a **blind spot**.

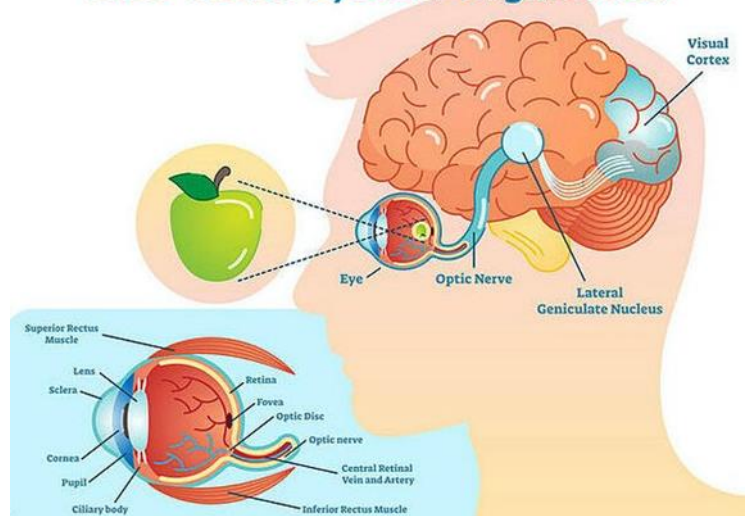
An eye also consists of six muscles. It includes the medial rectus, lateral rectus, superior rectus, inferior rectus, inferior oblique, and superior oblique. The basic function of these muscles is to provide different tensions and torques that further control the movement of the eye .

How Do Eyes Work :

- 1- The images we see are made up of light reflected from the objects we look at .
- 2- This light enters the eye through the cornea, which acts like a window at the front of the eye .
- 3- The amount of light entering the eye is controlled by the pupil, which is surrounded by the iris – the coloured part of the eye .
- 4- Because the front part of the eye is curved, it bends the light, creating an upside down image on the retina. The brain eventually turns the image the right way up .
- 5- When the light rays move through the various mediums, they experience refraction of light .
- 6- Refraction is change in direction of the rays of light as they pass between different mediums .



How Visual System Organized



The table below shows the refractive indices of the various parts of the eye :

Medium	Refractive Index
Air	1.000
Cornea	1.376
Aqueous Humor	1.336
Lens	1.42
Vitreous Humor	1.336

7-The light rays finally are received and focused on the retina.

8- The retina contains photoreceptor cells called rods and cones and these basically detect the intensity and the frequency of the light.

9- Further, the image that is formed is processed by millions of these cells, and they also relay the signal or nerve impulses to the brain via the optic nerve.

