

PHYSICS



PROJECT WORK

TOPIC :- STRUCTURE  
AND FUNCTION OF THE  
HUMAN EYE

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MPCS (1010)



# STRUCTURE AND FUNCTION OF THE HUMAN EYE



The human eye is one of the most important sense organs. It enables us to see the object and colours around us. The eye ball is nearly spherical in shape.

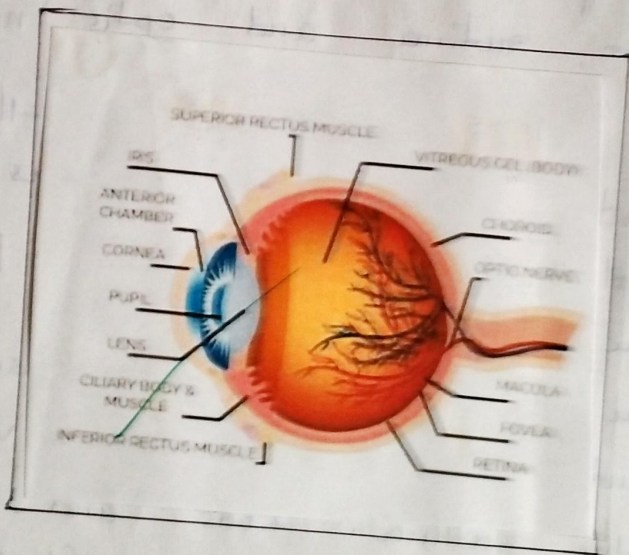
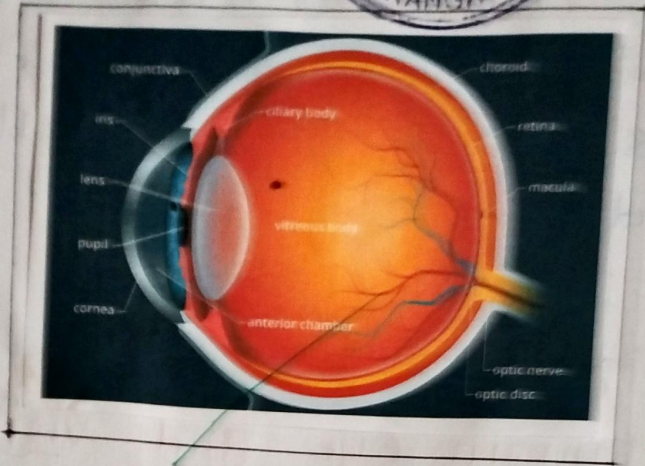
## Key Take Aways :-

### The Human Eye and Vision

The main parts of the human eye are the cornea, iris, pupil, aqueous humor, lens, vitreous humor, retina and optic nerve.

Light enters the eye by passing through the transparent cornea and aqueous humor. The iris controls the size of the pupil, which is the opening that allows light to enter the lens. Light is focused by the lens and goes through the vitreous humor to the retina. Rods and cones in the retina translate the light into an electrical signal that travels from the optic nerve to the brain.







# Eye Structure and function



To understand how the eye helps to know the eye structures and functions.

**Cornea**:- Light enters through the cornea, the transparent outer covering of the eye. The eyeball is rounded, so the cornea acts as a lens. It bends or refracts light.

**Aqueous humor**:- The fluid beneath the cornea has a composition similar to that of blood plasma. The aqueous humor helps to shape the cornea and provides nourishment to the eye.

**Iris and Pupil**:- Light passes through the cornea and aqueous humor through an opening called the pupil. The size of the pupil is determined by the iris, the contractile ring that is associated with eye color. As the pupil dilates, more light enters the eye.

**Lens**:- While most of the focusing of light is done by the cornea, the lens allows the eye to focus on either near or distant objects. Ciliary muscles surround the lens, relaxing to flatten it to image distant objects and contracting to thicken the lens to image close-up objects.



Vitreous humor - required to focus light. distance is is a transparent material that supports distance.

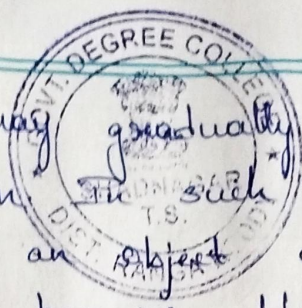


## The Retina and The Optic Nerve

The coating on the interior back of the eye is called the retina. When light strikes the retina, two types of cells are activated. Rods detect light and dark and help form images under dim conditions. Cones are responsible for color vision. The three types of cones are called red, green and blue, but each actually detects a range of wave lengths and not these specific colors. When you focus clearly on an object, light strikes a region called the fovea. The fovea is packed with cones and allows sharp vision. Rods outside the fovea are largely responsible for peripheral vision.

Rods and cones convert light into an electric signal that is carried from the optic nerve to the brain. Three-dimensional information comes from comparing the differences between the images formed by each eye.





Sometimes the eye may gradually lose its ability for accommodation. In such conditions the person cannot see an object clearly and comfortably. The vision becomes blurred due to accommodation defects of the eye lens. There are mainly three common defects of vision.

They are :-

- i) Myopia :- (Near sightedness)
- ii) Hypermetropia :- (Far sightedness)
- iii) Presbyopia :- (Age related far sightedness)

Myopia :- Some people cannot see objects at long distances but can see nearby objects clearly. This type of defect in vision is called "Myopia". It is also called 'near sightedness'.

For these people the maximum focal length is less than 2.5 cm. In such cases the rays coming from distant objects, after refraction through the eye lens, form an image before the retina.

The point of maximum distance at which the eye lens can form an image on the retina is called 'far point.'

The defect, in which people cannot see objects beyond far point is called 'Myopia.'



## Hypermetropia :-

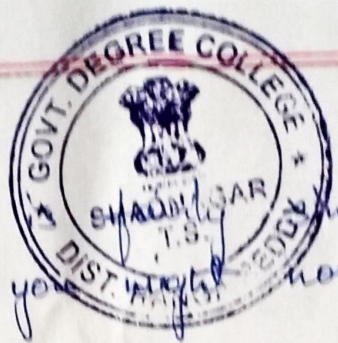
Hypermetropia is also known as "far sightedness". A person with hypermetropia can see distant objects clearly, but cannot see objects at near distances, because the minimum focal length of eye lens for the person of hypermetropia is greater than  $2.27 \text{ cm}$ . In such cases, the rays coming from a nearby object, after refraction at eye lens, forms an image beyond the retina.

## Presbyopia :-

Presbyopia is vision defect when the ability of accommodation of the eye usually decreases with ageing. For most people the near point gradually recedes away. They find it difficult to see nearby objects clearly and distinctly.

If you go to an eye hospital to get tested for vision defects, the doctor gives you a prescription that contains some information regarding type of lens to be used to correct vision.





## Weird Eye Facts:-

The functioning of the eye but there are some details you might not know :-

The eye acts exactly like a camera in the sense that the image formed on the retina is inverted. When the brain translates the image, it automatically flips it.

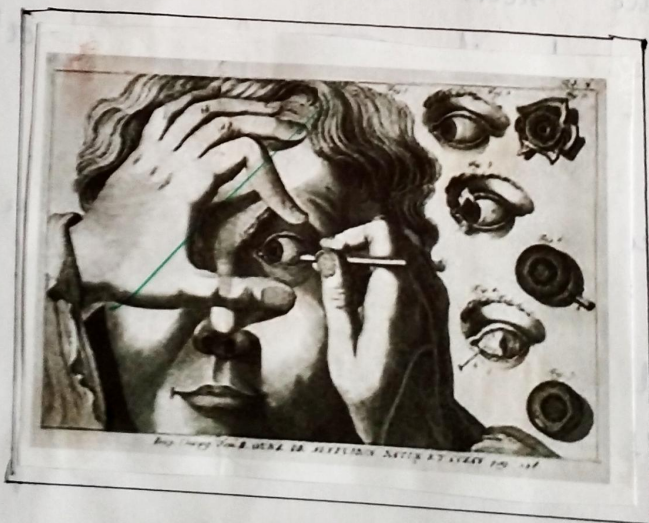
People don't see ultraviolet light, but the human retina can detect it. The lens absorbs it before it can reach the retina.

The reason humans evolved to not see UV light is because the light has enough energy to damage the rods and cones. The human retina can detect it. The lens absorbs it before it can reach the retina.

Blind people who still have eyes can sense the difference between light and dark. There are special cells in the eyes that detect light but aren't involved in forming images.

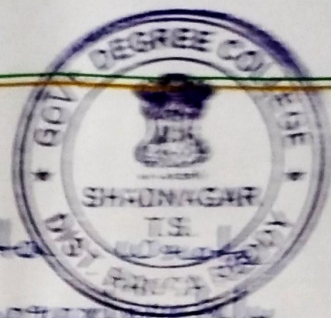
Eye color can change over time, mainly due to hormonal changes or chemical reactions in the body.







# Ancient India



The Indian surgeon Sushruta, the Sushruta Samhita in approximately the sixth century A.D. which describes 70 Ocular diseases (of these, 51 surgical) as well as several ophthalmological surgical instruments and techniques. His description of cataract surgery was compatible with the method of couching. He has been described as one of the first cataract surgeons.

# Medieval Islam

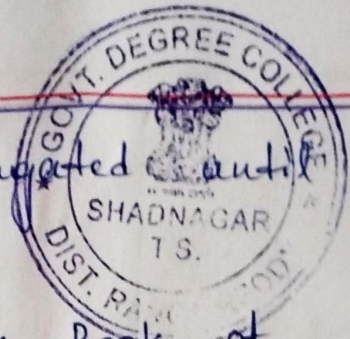
Main article : Ophthalmology in medieval Islam.

Anatomy of the Eye, 1200 A.D.

Medieval Islamic Arabic and Persian Scientists (unlike their classical predecessors) considered it normal to combine theory and practice, including the crafting of precise instruments and therefore, found it natural to combine the study of the eye with the practical application of that knowledge. Hunayn ibn Ishaq and others beginning with the medieval Arabic period, taught that the crystalline lens is in the exact center of



the eye. This idea was propagated until the end of the 1500s.



Ibn al-Haytham (Alhazen), in his Book of Optics explained that vision occurs when light lands on an object, bounces off, and is directed to one's eyes.

Ibn al-Nafis, an Arabic native of Damascus, wrote a large text book, the polished Book on Experimental Ophthalmology, divided into two parts, On the Theory of Ophthalmology and simple and Compound Ophthalmic Drugs.

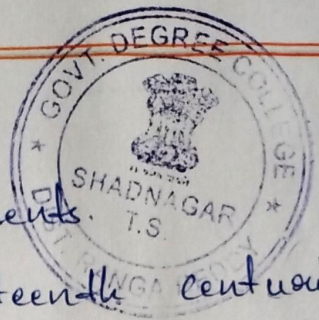
Avicenna wrote in his Canon "rescheth", which means "retiformis" and Gerard of Cremona translated this at approximately 1150 into the new term "retina".







## Modern Period:-

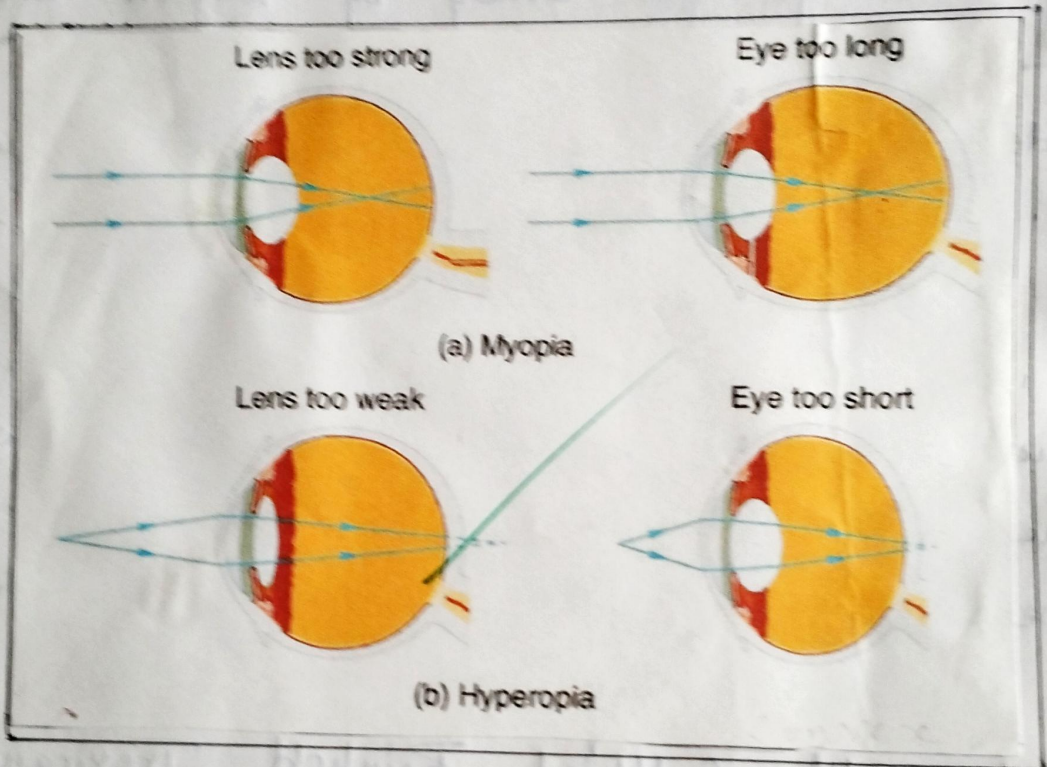


### Early Ophthalmology instruments.

In the seventeenth and eighteenth centuries, hand lenses were used by Malpighi, microscopes by Leeuwenhoek, preparations for fixing the eye for study by Ruysch, and later the freezing of the eye by Petit. This allowed for detailed study of the eye and an advanced model. Some mistakes persisted such as the pupil changed size (seen to be vessels of the iris filling with blood), the existence of the posterior chamber, and the nature of the retina. Unaware of their functions, Leeuwenhoek noted the existence of photoreceptors. However, they were not properly described until Gottfried Reinhold Treviranus in 1834.

Approximately 1750, Jacques Daviel advocated a new treatment for cataract by extraction instead of the traditional method of couching. Georg Joseph Beer (1763-1821) was an Austrian ophthalmologist and leader of the first Viennese school of Medicine. He introduced a cataract (Beer's operation), as well as having popularized the instrument used to perform the surgery (Beer's knife).







# Short - Sightedness (Myopia)

A Short Sighted person's focus is focusing before the back of the eyeball. The "concave lens" pushes the rays of light further apart so, that they arrive together in proper focus at the back of the eye. A concave lens is used to correct short-sightedness.

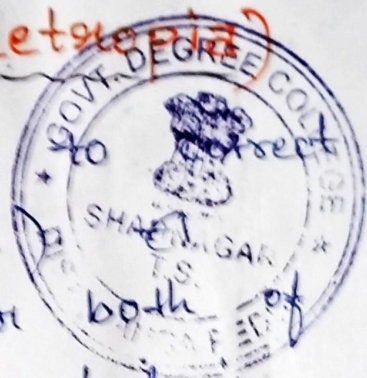
The person is suffering from an eye defect called myopia. A concave lens of power  $-1.25\text{D}$  is required by the person to correct this defect. Myopia is caused by the shape of the eye, either the eyeball is slightly too long or the cornea (the clear covering of the front of the eye) is too steeply curved. Myopia is corrected by spectacles or contact lenses with lenses which are "minus" or concave in shape.



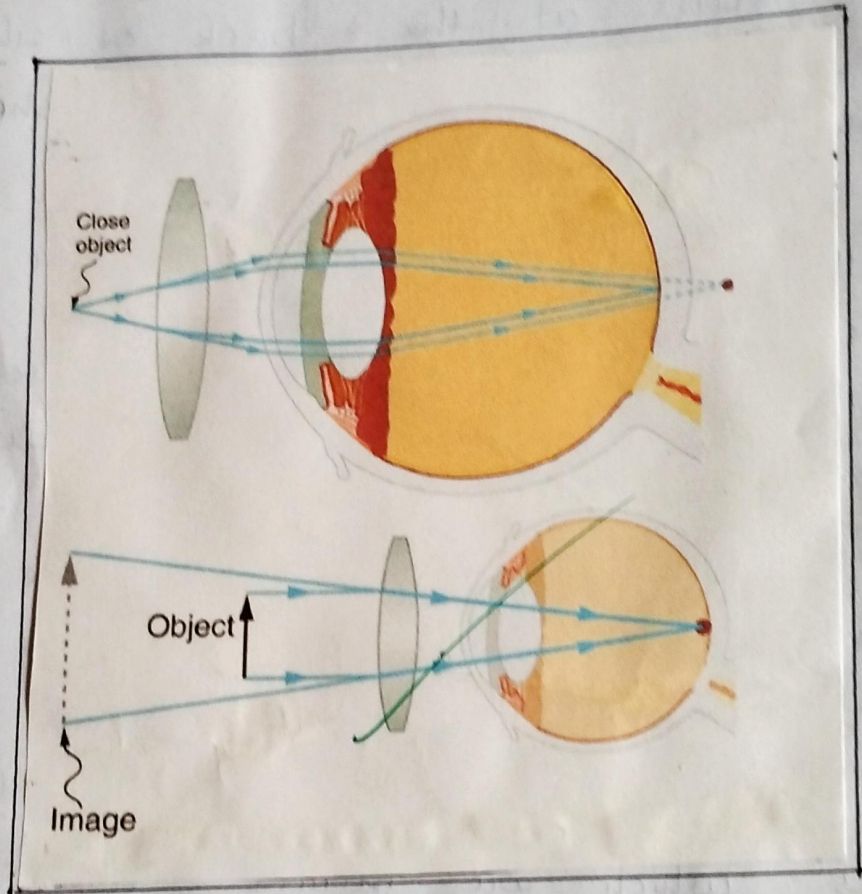
## Long-Sightedness (Hypermetropia)

These lenses are used for long-sightedness (hypermetropia). A convex lens has either one or both of its surfaces curving outwards, that is, wider divergence from the plane at the centre.

The simplest, cheapest and safest way to correct long sight is with glasses. "Convex prescription lenses" (called plus lenses) are used to bend light rays slightly inwards to give a little bit of additional focusing power to the eye.



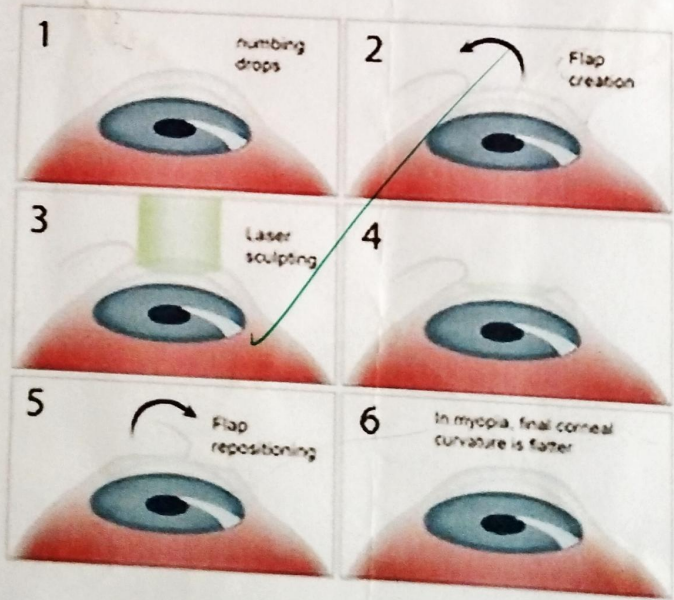








### LASIK EYE SURGERY





## Lasex Treatment of Eyes:-

Laser eye corrections have been safe and effective. However, other medical treatments, it is important to choose an experienced and qualified surgeon. 3. The procedure is quick - it lasts less than 10 minutes - and is generally painless.

LASIK often offers improved vision without the hassle of glasses or contact lenses. In general, you have a very good chance of achieving 20/25 vision or better after refractive surgery.

Eyesight problems, such as myopia, are also known as refractive errors. Short sight leads to blurred distance vision, whilst close vision is usually normal. Short-sightedness is a very common problem that can be corrected by glasses or contact lenses, or cured with laser eye surgery.



*Mx*