CHAPTER - 11 Sense Organs

The following lesson is of Class 10 for the subject of Biology, Topic - Working of an eye which is covered in Chapter 11 titled 'Sense Organs' starting on Page No 138 of your text book titled 'Concise Biology - Selina Publications and is being submitted to you on **07.10.2024**

How do we see?

1. Firstly the light rays reflected from the surface of an object enter the eyes passing through the transparent structures [ie. Conjunctiva, Cornea, aqueous humour, eye lens and vitreous humour]

ii The curvature of the Cornea and lens bends the light rays to form an image on retina The image formed on retina is inverted and real. Light energy of the image produces chemical changes in the sensitive cells of retina, which generate nerve impulses. When these impulses are carried to brain by the optic nerve, the nerve centres coordinates these impulses and we see an erect object. So it is the brain which is responsible for seeing the objects upright even if the image formed in the eye is inverted. [Please look at Fig 1]

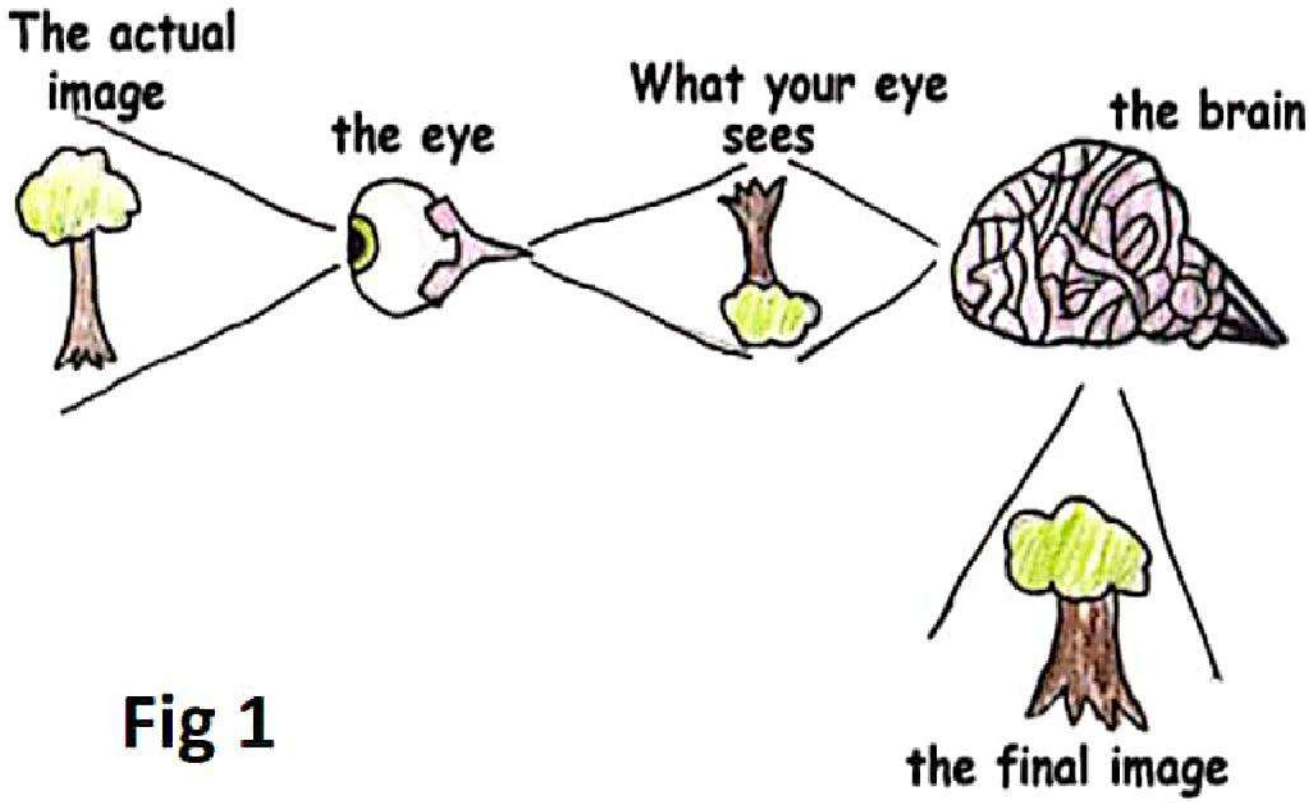


Fig 1

Power of Accomodation of an eye

The process of focussing the eye [or adjustment of the eye] for a clear vision of objects at varying distances is called Accomodation. This is brought about by a change in the curvature of the elastic eye lens, making it more convex or concave with the help of ciliary body and suspensory ligaments. Human eye has remarkable power of accomodation to see both nearby and far of things with equal clarity.

For distant objects - Lens is more flattened / thinner
For nearby objects - Lens is more convex ~~or~~ rounded
These changes in the eye lens are brought about by the contraction and relaxation of ciliary muscles.

⇒ When ciliary muscles are relaxed, suspensory ligaments are under great pressure, hence the lens becomes flat for viewing distant objects

⇒ When the object is near, ciliary muscles contract pressure on ligaments is released making it loose and the lens on its account of its elasticity, becomes thicker and more convex

All children may please look at Fig 11.4 of your text book showing accomodation of eye for distant and near objects

Light and dark adaptation

Dark adaptation - When someone comes from a brightly lighted area into a dark room, s/he experiences difficulty in seeing objects for few seconds, then the person adapts to the condition and has a proper vision. This improvement in vision is called dark adaptation This change is due to regeneration of the visual purple or rhodopsin, which works in dim light and dilation of pupil which permits more light to enter the eyes.

Light adaptation - When a person with dark adapted eyes i.e. a person coming out of a dark room into a brightly lighted area, he/she experiences difficulty in seeing objects for a short period, then the person comes back to normal viewing through light adaptation Light adaptations is due to reverse of the changes occuring in dark adaptations i.e. visual purple or rhodopsin is bleached reducing their sensitivity and the pupil constricts to reduce the amount of light entering the eyes.

Colour vision - is possible through cones of retina that release iodopsin and help us to see in bright light. In the dark the cone cells donot function as they are sensitive only to bright light. Thus we cannot make out the colours of the flowers - red, violet or purple colours in a garden on a moonlit night, because then only the rod cells function and not the cones.

Common defects of the eye -

1. Myopia - Near or short sightedness.
It is an eye defect in which the person can see nearby things clearly but distant things are blurred. In this eye defect the image of the distant objects is formed in front of the retina either because the lens has become too convex or due to elongation or lengthening of eyeball from front to back. A concave lens is used to correct this disorder which causes the light rays to diverge before they strike the eye lens. Power of spectacles is represented in minus " - "

[Please look at Fig 11.6 - Myopia & its correction of book]

2. Hyperopia - Far or Long sightedness
In this eye defect the image of the nearby objects falls behind the retina so the image of nearby objects is blurred, while distant vision is clear.

Hyperopia is caused by either too flattening of the lens or shortening of eyeball from front to back. A convex lens is used to correct this disorder which cause the light rays to converge before they strike the eye lens. The power of spectacles is represented in plus "+"

[Please look at Fig 11.7 - Hyperopia & its correction]

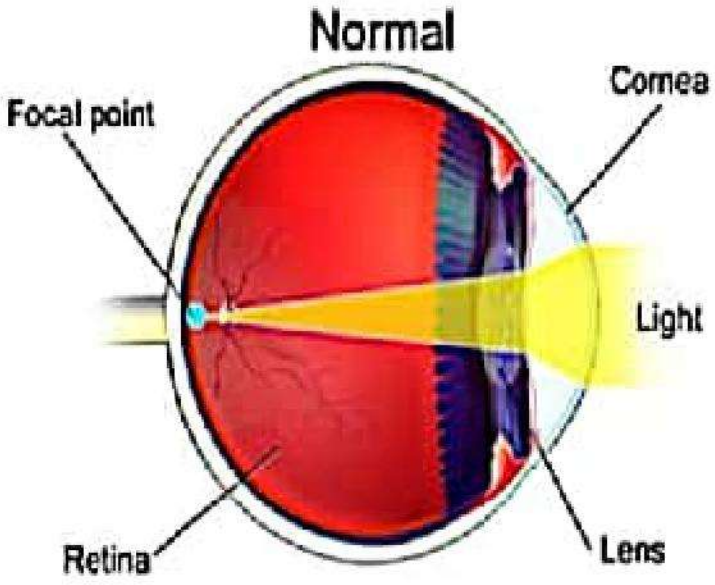
3 Astigmatism Uneven curvature of the cornea or the lens is responsible for imperfect image in which some parts of objects are seen in focus and others out of focus. It is corrected by using cylindrical lenses.

[Please look at Fig 2 on next page]

4. Presbyopia This disorder generally affects older people. They cannot see nearby objects clearly as their lens loses flexibility resulting in a kind of far sightedness. This is corrected by using convex lenses.

5 Cataract is a condition in which lens becomes opague and visibility decreases This is called cataract It can be corrected by surgically removing the eye lens and by using spectacles with highly convex lenses, compensating for the missing lens or in a new technique, a small plastic lens is implanted behind or infront of the iris.

[Please look at Fig 3 on next Page]



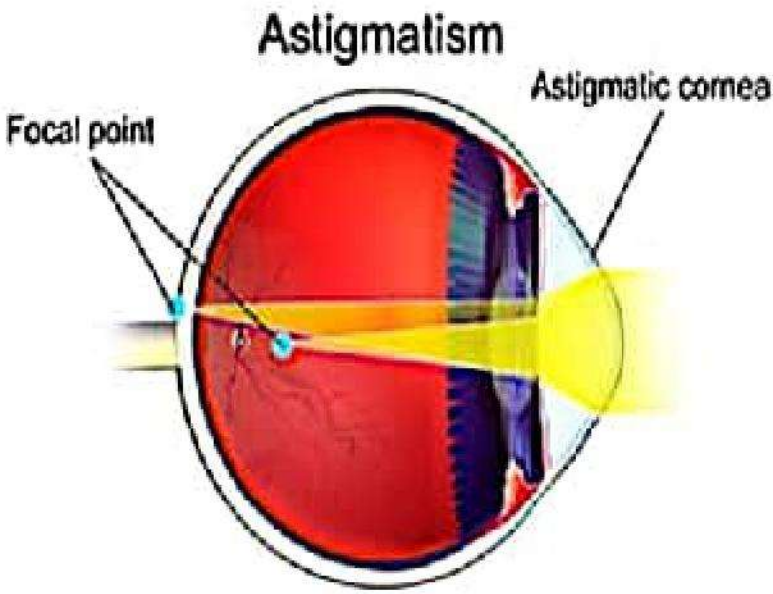


Fig 2

Astigmatic cornea distorts the focal point of light in front of and/or behind the retina

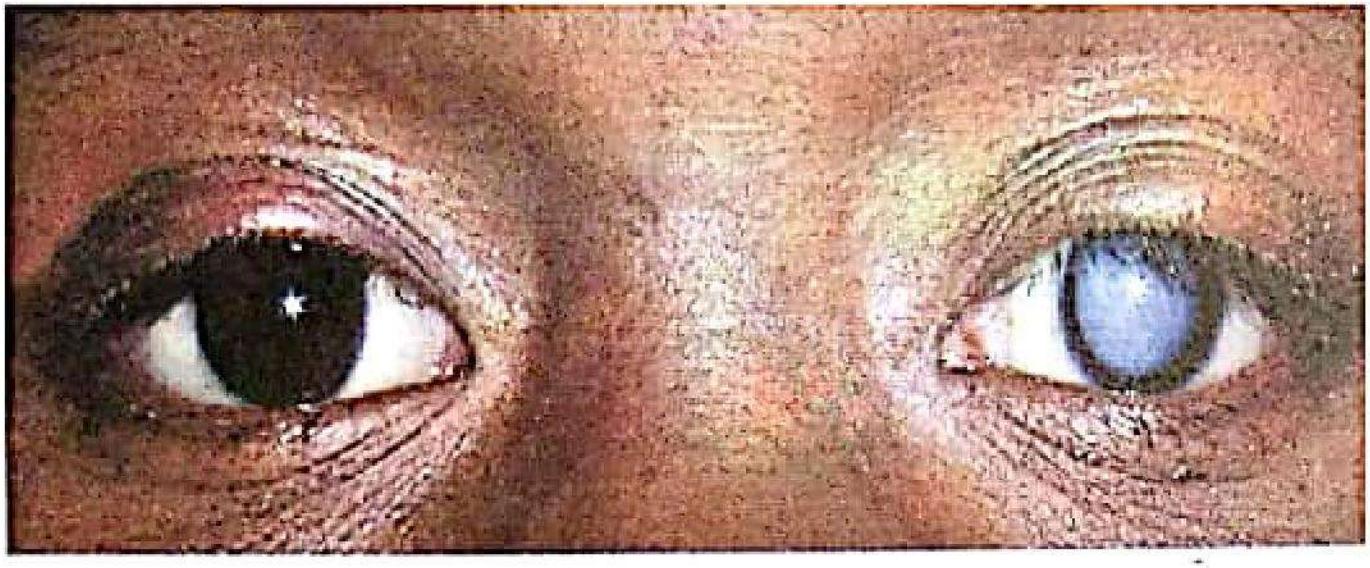


Fig 3 Cataract

6 Night blindness. In this condition, a person feels difficulty in seeing in dim light or during the night. It is because of the non formation of rhodopsin, the pigment of the rods. In absence of rhodopsin rods cannot function and person cannot see in dim light. Vitamin A deficency causes night blindness because rhodopsin is synthesised from Vitamin A.

7. Colour blindness - Some people by birth cannot distinguish between certain colours such as red and green. This is a genetic disorder, most common in males than in females.

8. Corneal opacities - The cornea of some patients gets scarred and turns opaque [white] and non functional. Such defects can cause anything from minor irritation to vision problems and even blindness. In such cases, the defective cornea can be replaced by a healthy cornea from a donated eye.

9. Squint In this defect, the two eyes somewhat converge leading to what is called - "cross eye" An opposite condition appears when they diverge and is called the "wide eye" Both conditions may cause double vision or diplopia Surgery and suitable exercise can correct these defects. [Please look at Fig 4 on next page]

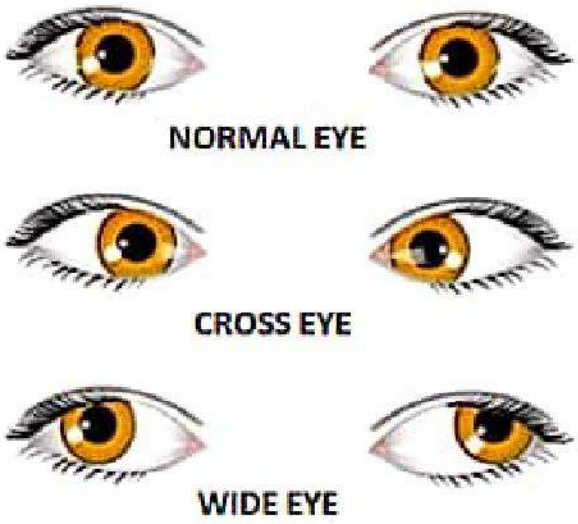


Fig 4 Squint in the eye

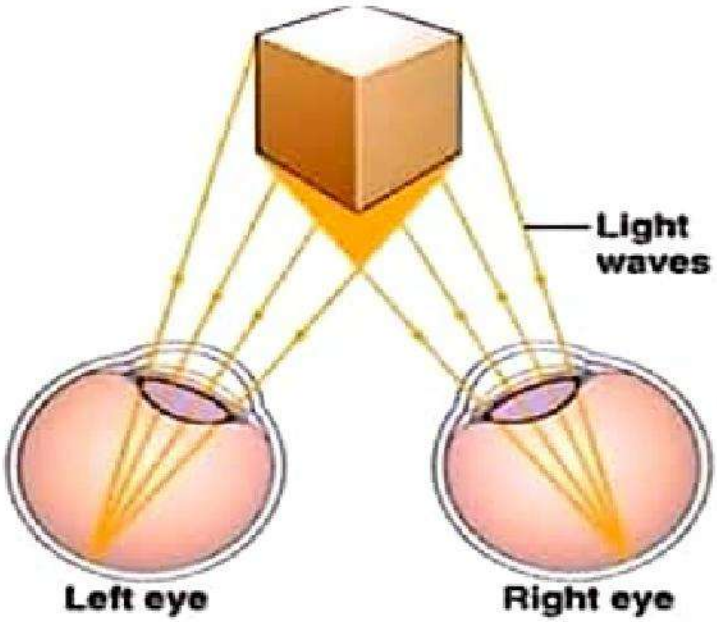


Fig 5 Stereoscopic vision

Stereoscopic or binocular vision

We have the ability to perceive depth or the relative distance of the object due to simultaneous focussing of an object in both the eyes. The brain correlates the two images and interprets them as a single impression This kind of "overlapping" in the brain gives a three dimensional effect. It is also called stereoscopic or binocular vision. [Fig 5]

To understand the concept of stereoscopic vision - Hold a pencil horizontally with its point facing inward at about arm's length. Close one eye and try to touch the point of the pencil with the point of another pencil in your other hand, starting from a position with the arm at the side of your body. With one eye closed you cannot do it speedily, but with both eyes open, you can do so more easily and quickly. This is because of the stereoscopic vision.

After image or Persistence of vision. If one looks at a brightly coloured object and then looks at dark surface, an image of the object in the same colour will persist This is called persistence image or after image The impression of an image remains on the brain for about one tenth of a second.

If another image is imposed before the first image has been wiped out, an illusion of continuous movement is experienced. This is the underlying principle on which the technique of motion pictures is based. In a movie, pictures are projected on a screen at the rate of about 24 pictures per second, but we cannot see the individual frames on account of after images in our eyes. We see a life like continuous movement on the screen which is an illusion.

Home assignment -

Q1 Give reason -
A person from bright sunlight outside enters a poorly lit room and feels blinded for a short while

Q2. Draw a well labelled diagram showing 'Myopia' and how this eye defect can be corrected.

Q3 Draw a well labelled diagram depicting -
(i) Hyperopia
(ii) How hyperopia can be corrected.

Q4 What is - Power of accomodation of the eye

THANK - YOU