Chapter 11 - Human Eye and Colourful World

Structure of Eye

The front part of the eye is covered by a transparent spherical membrane called the cornea. Light enters the eye through cornea. The space behind the cornea is filled with a liquid called aqueous humour.

Just behind the cornea is a dark coloured muscular diaphragm called iris which has a small circular opening in the middle called pupil. The pupil appears black because no light is reflected from it.

The iris regulates the amount of light entering the eye. It regulates the light by adjusting the size of the pupil.

The eye lens is a convex lens made of a transparent jelly - like proteinaceous material. The eye lens is hard at the middle and gradually becomes soft towards the outer edges. The eye lens is held in position by ciliary muscles. The ciliary muscles help in changing the curvature and focal length of the eye lens.

The inner back surface of the eye ball is called retina. It is a semi-transparent membrane which is light sensitive and is equivalent to the screen of a camera. The light sensitive receptors of the retina are called rods and cones. When light falls on these receptors they send electrical signals to the brain through the optic nerve. The space between the retina and eye lens is filled with another fluid called vitreous humour.

The light coming from an object enters the eye through cornea and pupil. The eye lens

converges these light rays to form a real, inverted and diminished image on the retina. The light sensitive cell of the retina gets activated with the incidence of light and generates electric signals. These electric signals are sent to the brain by the optic nerves and the brain interprets the electrical signals in such a way that we see an image which is erect and of the same size as the object.

The process by which the ciliary muscles change the focal length of an eye lens to focus distant or near objects clearly on the retina is called the accommodation of the eye.

The ability of the eye to focus objects lying at different distances is called the power of accommodation of the eye.

The distance between the near point and the far point is called the range of vision.

Colour vision is possible only through cones of the retina which are stimulated only in bright light. You cannot make out the red, violet or purple flowers in a garden on moonlight, because then only rods function and not cones.

Defects in the Eye

Colour blindness (colour vision deficiency) is a condition in which certain colours cannot be distinguished, and is most commonly due to an inherited condition.

Cones (colour sensitive receptors) containing single visual pigments selective for red, green, and blue light, are present in the normal human eye.

Disturbances of colour vision will occur if the amount of pigment per cone is reduced or if one or more of the three cone systems are absent.

Protanomaly is referred to as "red-weakness", an apt description of this form of colour deficiency.

Deuteranomalous person adjust your television and he would add more green and subtract red. He is considered "green weak".

Nyctalopia (Greek for "*night blindness*") is a condition making it difficult or impossible to see in relatively low light. It is a symptom of several eye diseases.

Night blindness may exist from birth, or be caused by injury or malnutrition (for example, a lack of vitamin A).

The outer area of the retina is made up of more rods than cones. The rod cells are the cells that enable us to see in poor illumination. This is the reason why loss of side vision often results in night blindness.

A **cataract** is an opacity that develops in the crystalline lens of the eye or in its envelope. Early on in the development of age-related cataract the power of the crystalline lens may be increased, causing near-sightedness (myopia), and the gradual yellowing and opacification of the lens may reduce the perception of blue colours.

Cataracts develop from a variety of reasons, including long-term ultraviolet exposure, exposure to radiation, secondary effects of diseases such as diabetes, hypertension and advanced age; they are usually a result of denaturation of lens proteins

There are various types of cataract, e.g. nuclear, cortical, mature, hypermature. Cataracts are also classified by their location, e.g. posterior (classically due to steroid use and anterior (common (senile) cataract related to aging).

Hypermetropia or hyperopia is an eye defect in which distant vision is clear while near vision is blurred.

In the case of a normal eye the rays of light from the object fall on the eye and converge on the retina but in the case of a hypermetropic eye the light rays are focused behind the retina.

Myopia is an eye defect due to which the eye is not able to see distant objects clearly.

Myopia is the defect of the eye due to which the eye is not able to see the distant objects this defect is commonly known as nearsightedness.

Astigmatism is the most common vision problem resulting in distorted images, as light rays are prevented from meeting at a common focus. Astigmatism may accompany Hypermetropia or Myopia

Presbyopia is caused when the centre of the eye lens hardens making it unable to accommodate near vision. This condition generally affects almost everyone over the age of 50 - even those with myopia.