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B.Sc HONS Part-III paper — VI

Topic :- Physiology of vision

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Q. Give a ditailed account of the physiology of vision.

The ability to see objects is called vision. Vision is effected only in the presence of light. Vision is the result of a photochemical reaction occurring in the rods and cones. The light rays falling on the eye pass through the following components :

Cornea → Pupil → Aqueous humour → Lens → Vitreous humour → Nerve fibres → Rods and Cones.

The lens filters the ultraviolet rays. When light hits the rods and cones, it causes a photochemical reaction in the pigments. The pigments split. It produces an impulse. This impulse travels through the optic nerve to the visual ganglion of the brain. In the brain the impulse is decoded and interpreted as light. The split up pigments are reduced to vitamin A and immediately the pigment is resynthesized for continuous vision.

Photochemical reaction :

The outer segment of rods contains rhodopsin. It is a chromoprotein containing carotenoid pigment. It is a derivative of vitamin A. When light falls on rods rhodopsin undergose a series of reactions within a reaction of a second. All these reactions constitute photochemical reaction. In this reaction first of all rhodopsin is converted into lumirhodopsin and then to metarhodopsin. The metarhodopsin is then split into retinene and opsin. The breakdown of rhodopsin into retinene and opsin is a reversible reaction and rhodopsin can be resynthesized from these in the dark. The retinene is then reduced to vitamin A, by the enzyme alcohol dehydrogenase in the presence of NAD.

The rhodpsin must be resynthesized immediately for the next response. The synthesis of rhodopsin can take place either from retinene or from vitamin A. The synthesis from retinene is a fast process while that from vitamin A is slow process.

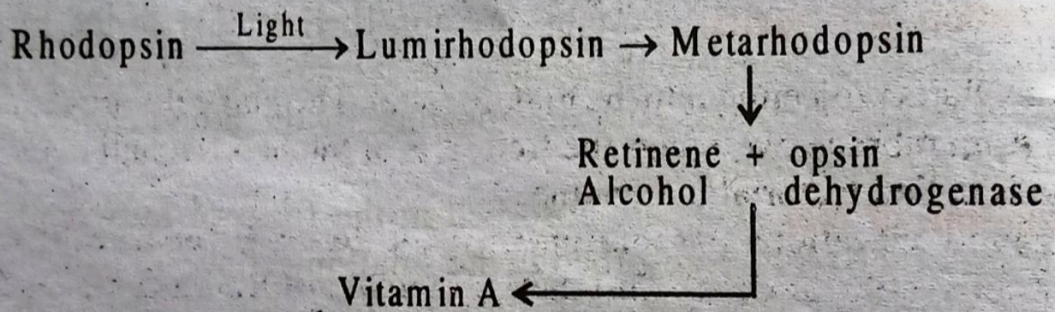

Fig. Photochemical reaction.

The pigment in the cone is called iodopsin. When light hits the cones, iodopsin undergoes the same series of reaction as the rhodopsin. The only difference is in the opsin. Cone opsin is called photopsin.

Colour Vision : Colour vision is effected by the cones. Human eye can discriminate as many as 160 different colours. These colours are formed by the mixing up of three primary colours, namely red, green and blue. There are several theories to explain the mechanism of colour vision, the accepted one is trichromatic theory.

Trichromatic theory was proposed by Young (1801). Later it was elaborated by Helmholtz. According to this theory, there are 3 types of cones-one for red, another for green and third for blue colour. They contain three different Photochemical substances. Each substance is stimulated by a different wave length. If any one of these cone types is stimulated, it will give the appropriate sensation. It is believed that a particular colour is perceived by its wave length stimulating one, two or all three cone types to a varying degree, colour vision therefore is the result of differential stimulation of three different types of cones.