FLIGHT


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In modern warfare the ability to see in the dark is of considerable importance to many branches of the Services. This ability is most important to night fighter pilots, the crews of night bombers and to the look-out men on ships. These are closely followed by spotters of A.A. units, members of the A.R.P. services and drivers of vehicles by night under the present conditions of black-out. The object of this article is to give an account of this faculty which is known as “night vision.”

The part of the eye that is sensitive to light is called the retina. It is the innermost of the three coats that form the eyeball. At its centre, at the back of the eye, is a yellow spot known as the macula, and in the middle of this is a small pit called the fovea centralis which marks the point of clear vision. In one of the outer layers of the retina lie two types of cells, known as cone cells and rod cells. Both types are distributed all over the retina except at the fovea centralis, which consists almost entirely of cones, and at the point of entry at the optic nerve, which is not covered by either. A complex substance, known as visual purple, is present in the rod cells and it has the most remarkable property of being bleached on exposure to light but regenerating rapidly in darkness or semi-darkness.

Vision depends on two mechanisms. One, governed by the cone cells, is concerned with form vision and colour vision and functions only in bright light. This is known as the photopic mechanism. The other depends on the rod cells and the presence in them of visual purple. It is concerned with appreciation of light and movement and functions in conditions of semi-darkness. This is known as the scotopic mechanism.

Everybody knows that after going from bright light into semi-darkness one can see very little at first, but that after an interval one begins to see more clearly. This is due to an increase in sensitivity of the rod cells caused by the regeneration of visual purple, and is known as dark adaptation. It increases rapidly in the first ten minutes, and a little less rapidly during the next 30 minutes, after which it is more gradual. At the end of one hour the sensitivity of the retina may be increased to anything between 50,000 and 100,000 times, and may continue to increase slowly up to 24 hours. In practice the eye is considered to be fully dark adapted, however, at the end of one hour.

The eyes of those whose work requires the use of their night vision should be fully dark adapted before going to their duties. This can be brought about by wearing dark goggles (which must fit closely round the edge) or by remaining in the dark, in either case for at least 45 minutes.

In order to test whether one’s eyes are dark adapted a star should be looked at directly and then the line of vision should be deviated slightly (about six degrees). If the star appears to be brighter in the second case the faculty of night vision is in use. The reason for this is due to there being no rod cells in the retina at the point of clear vision, at which images are sharpest during day. For the same reason moving objects can be seen more easily at night than stationary ones. These facts must be made use of in practice, and it must be remembered that the object is always seen more clearly by the dark-adapted eye if it is not looked at directly, but rather “out of the corner of one’s eye.” A clearer view of the object may also be obtained if the head is moved slightly from side to side or up and down in order to obtain an image on a more sensitive portion of the retina.

Night Blindness

The quality of night vision varies in individuals, and if the quality is very poor the condition is known as night blindness. This may be caused by a structural deficiency in the rod cells which may be an inherited defect or which may be due to disease, such as myopia (short-sightedness). In these cases the condition is permanent. On the other hand, night blindness may be caused by a deficiency of visual purple. It is this that has caused epidemics of night blindness throughout history; in famines in Russia and Austria; and during the last war among troops living under conditions in which feeding fell below standard.