10694

Simple Method of Measuring Brightness Threshold of Dark Adapted Eye at All Ages.

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The relation between the vitamin A status of the body and the eye's ability to adapt to the dark is now well established.[1-5] The chemical mechanism underlying this relation has been studied by Wald.[6]

While several instruments for measuring dark adaptation are available,[7-10] none is applicable to infants and very young children. In the course of an investigation[11] of the vitamin A requirements of infants, necessity impelled us to devise a method for measuring their ability to adapt to the dark. Fortunately, our task was simplified by a number of recent studies of this function in adults. It has been demonstrated that whereas the dark adaptation of persons with certain diseases is more or less delayed,[2, 12] alterations in the vitamin A status of clinically normal individuals are accompanied by a simple rise or fall of the visual threshold, the speed of adaptation remaining constant.[3, 4, 5] Hence, where it is not possible or convenient to measure the complete time course of dark adaptation, it is sufficient for purposes of dietary studies of normal subjects to determine the final or equilibrium threshold alone.[4] The present apparatus and procedure accomplishes this in a satisfactory and simple manner.

In measurements of the precise course of dark adaptation, fixation

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of the eye in relation to the direction of the stimulus is essential to insure that the portion of the retina measured is the same throughout the test. If only the final or equilibrium threshold of the most sensitive portion of the retinal periphery after complete dark adaptation is to be determined, fixation is unnecessary. Such a measurement is most simply accomplished by moving the test field of an adaptometer over the entire visual field on both sides and increasing its brightness until it is visible to the subject. The test may be made objective in children and adults by asking them to tell the direction from which they see the light, by turning off the light on occasion, and in a variety of ways which will occur to the operator.

We have made similar tests upon infants by utilizing the amazingly pronounced positive phototropism which they possess even for intensities close to the visual threshold of adults and children. The infant is placed upon its back and a tube of luminous paint (actually a radium paint pendant used on electric light chains) is attached to the center of the forehead with adhesive plaster. After 30 minutes of darkness the test field is held in the hand of the operator and moved slowly from side to side through 180 degrees of arc at a distance of about 10 cm from the eyes of the infant. When the test field is made sufficiently bright the infant sees it in the periphery of its visual field and turns its head in a corresponding direction. This movement is clearly indicated by the direction of motion of the luminous tube. The response is easily distinguishable from random movements.

Fig. 1 is a diagrammatic representation of the portable instrument† we have been using for such studies. No new principles of design are involved, its unique features being extreme portability and the fact that the test light unit is constructed so as to fit into the hands of the operator. The light from a 3.8 volt flashlight lamp *L*, operated at 0.28 amperes by battery *B* through a 6 ohm rheostat *R* and ammeter *A*, passes through a 1:10 neutral photometric wedge *W* and wedge balancer *WB*, diaphragm D_1, one of 4 neutral filters *F*, a violet glass filter *VF* (No. 511 Corning), and flashed opal glass *FO*. The latter is diaphragmed, D_2, to form a test field of 12 mm diameter, which at a distance of 10 cm from the eye subtends a visual angle of 7 degrees. The wedge and series of filters ride in a frame equipped with spring catches which hold them at the position selected by the operator, who manipulates them by means of the rods *C* which protrude from the light-tight metal housing *H*. The neutral filters regu-

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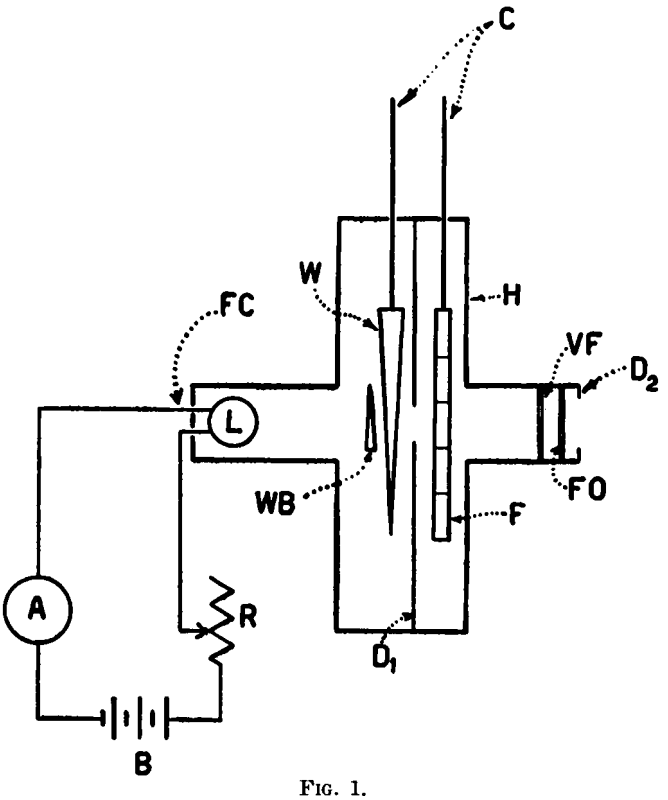

FIG. 1.

late the intensity in steps of one logarithmic unit (1:10). The wedge interpolates between any 2 filters in steps of 0.3 log units (1:2). The total range is just over 5 log units (1:100,000). The battery, ammeter, and rheostat form a unit which is conveniently placed out of the subject's view. This unit is connected by a flexible cord *FC* to the test light (with its appurtenances) held in the operator's hand. The entire apparatus is accommodated by a portable typewriter case.

The densities of the wedge and filters were measured by the method of Hecht, Shlaer, and Verrijp[13] with a Martens polarization photometer, and a brightness determination for one setting of the wedge and filters made with a Macbeth illuminometer. The brightness unit adopted was the micromicrolambert (foot-candles x 1.076×10^9) expressed for convenience in logarithms. A table was prepared giving the brightness in these terms for each setting of the wedge and filters.

Violet light was adopted to provide a convenient differentiation between cone (violet-appearing) and rod (colorless) readings in

[13] Hecht, S., Shlaer, S., and Verrijp, C. D., *J. Gen. Physiol.*, 1933, **17**, 237.

children and adults, to insure a degree of spectral purity, and because the rods, of primary interest in vitamin *A* estimations, are maximally sensitive to this part of the spectrum.

With children and adults it is possible to obtain an approximate measure of the speed of dark adaptation by exposing the eyes to a bright light for 2 or 3 minutes, following which observations of the rapidly descending threshold are made at frequent intervals until dark adaptation is relatively complete.

Measurements we have made of the visual thresholds of infants, children, and adults using this apparatus and procedure will be described elsewhere.

10695 P

Prolonged Administration of Cobra Venom in Relation to Kidney and Liver Function.

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The increasing therapeutic use of cobra venom as an analgesic in advanced malignant disease[1] and the extension of such clinical usage to other chronic painful conditions,[2, 3] prompted the senior author to further pharmacological study of the effect of repeated administration of the drug for prolonged periods on certain vital physiological functions. The present communication describes the effect of repeated injection of large doses of cobra venom for long periods of time on the kidney and liver function of rabbits. A standard solution of the drug, prepared in these laboratories and assayed biologically to ensure a content of 5 mouse units of cobra venom per cc, was administered to a series of rabbits in doses of 5 or 10 mouse units daily 5 and sometimes 6 times a week. The results obtained in 10 such animals are exhibited in Table I. The weight of each rabbit, its kidney function, liver function and general condition were recorded at the beginning of the investigation. All the rabbits were kept on a liberal diet of rabbit food (Purina Chow) supplemented with fresh greens. In some rabbits the venom solution was injected intra-

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