PHOTOSENSITIVE PIGMENTS FROM THE RETINA OF THE FROG

THE recent spectrophotometric demonstration by Wald[1] of a light-sensitive pigment from the retina of the chicken whose absorption spectrum resembles the chicken bright visibility curve, is the first direct evidence of the presence of a photosensitive substance in the cones. Since the chicken retina contains cones predominantly and differs in this respect from the retinas of many vertebrates, it seemed worth while to look again[2] for a cone pigment in the retina of the frog, whose rod-cone population is more nearly like that of man.

The retinas were treated as described earlier[3] and extracted with a 2 per cent. digitalin solution (Eimer and Amend, Digitalin, "cryst.", G 57). All operations were performed in very dim red light containing no wave-lengths shorter than 640 mμ. About 10 frogs were used for each ml of extractive.

The absorption spectrum of the solution as prepared, and buffered at pH 9.0, was measured in a depth of 2 cm, from 440 mμ to 650 mμ, using Shlaer's photoelectric spectrophotometer.[4] The solution was then exposed for 30 minutes to extreme red light, obtained with a 100 watt lamp at a distance of 6 inches, and a Wratten filter, No. 88, which transmits only above 680 mμ. After again measuring the spectrum another thirty-minute exposure was given and a third spectrum

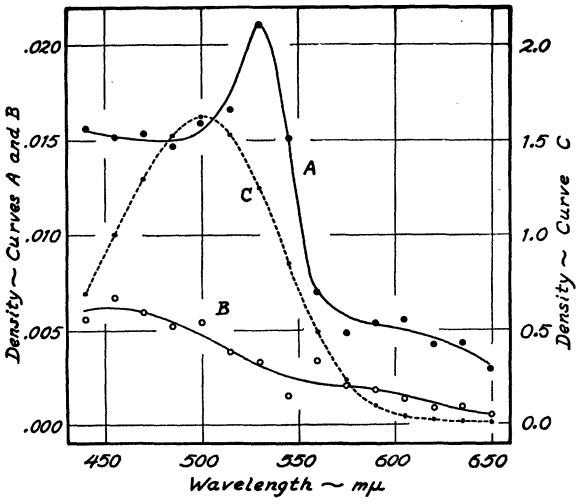

FIG. 1

recorded. Finally the solution was illuminated for ten minutes with white light and measured a fourth time.

The figure is from an experiment typical of several. Curve A results when the absorption spectrum of the solution after the first exposure is subtracted from that of the unexposed solution. This difference curve represents a light-sensitive substance or substances distinctly different from visual purple. The substance is so sensitive that even the monochromatic measuring light of the spectrophotometer causes some decomposition. Consequently, curve A may not describe exactly the absorption spectrum, but the true maximum may be farther toward the red than 530 mμ. Refinements in the procedure are necessary before its exact position can be established.

Curve B is the difference in density caused by the second exposure to red light. Practically all the substance with maximum absorption at 530 mμ disappeared during the first exposure; a further proof that it was not visual purple.

It is possible that more than one photosensitive pigment may be represented by curves A and B. On the basis of human color vision theory[5] one might expect three different substances from the cones if the frog retina resembles the human.

Curve C shows the difference in density that occurred during the ten-minute exposure to white light. This is the typical absorption spectrum of visual purple. It is significant that its concentration is considerably greater than that of the material represented by curve A, which confirms the prediction made by Hecht[5] from considerations of rod and cone sensitivity in the human eye.

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GENERAL MUSCULAR HYPERTROPHY INDUCED BY ANDROGENIC HORMONE

IN the guinea pig, the temporal muscles show a pronounced difference in size in the two sexes. In the adult female, they are comparatively small and flat; in the adult male they are much larger and can be felt as distinct protuberances over the upper part of the skull surface. This difference between the two sexes can be quite readily recognized in the normal adult animals.

In the course of experiments with gonadotropic hormone (Follutein), the temporal muscles of adult female guinea pigs underwent considerable hypertrophy. Injections of adequate amounts of gonadotropic hormone in such adult female animals over a period of several weeks resulted in an enlargement of the temporal muscles; they became rounded and protuberant much as in the normal adult male. This change was gradual and progressive and depended upon dosage and duration of treatment.

A survey of the various muscles in the treated animals showed that the induced growth was not limited

1 G. Wald, *Nature*, 140: 545, 1937.

2 W. Kühne, "On the Photochemistry of the Retina and on Visual Purple," Macmillan and Company, London, 1878 (see especially page 22).

3 S. Hecht, A. M. Chase, S. Shlaer and C. Haig, SCIENCE, 84: 331, 1936.

4 S. Shlaer, *Jour. Opt. Soc. Amer.*, 28: 18, 1938.

5 S. Hecht, Handbook of General Experimental Psychology, Clark University Press, Worcester, Mass., 1934; Chapter 14 (see especially page 793).