

## The "Red" Receptor of *Testudo*.<sup>1</sup>

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(With 1 figure in the text.)

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By means of the micro-electrode technique, applied as described in detail by GRANIT and SVAETICHIN (1939), I have recorded with cathode ray and condenser coupled amplifier the "spikes" of activity from single units in the cone-retina of the tortoise (*Testudo graeca*). It was found to be particularly easy to isolate a "red" receptor in this eye, in fact, the records of single units in Fig. 3 of my recent paper in the same volume of This Journal (GRANIT, 1941) are all samples of this "red" receptor. The whole retina has been illuminated with light from a Tutton monochromator, and the energy measured necessary for a constant response such as the absolute threshold or the cessation of "flicker", caused by intermittent stimuli. For energy control etc., see the paper by GRANIT and SVAETICHIN (1939).

The curve drawn in full between the large circles in Fig. 1 shows inverse relative energies in per cent of the maximum, placed in  $0.620 \mu$ . Behind this curve are the averages of 81 readings with 5 animals. With three of them the absolute threshold for a single "on"-spike was studied, with the other two the cessation of "flicker" for respectively an "on"- and an "off"-spike was the constant index necessary for the measurements. The curve was independent of the index used. The eyes were in different states of adaptation but this factor also had no influence on the distribution of sensitivity of the "red" receptor. The state of adaptation merely determines the general level of excitability.

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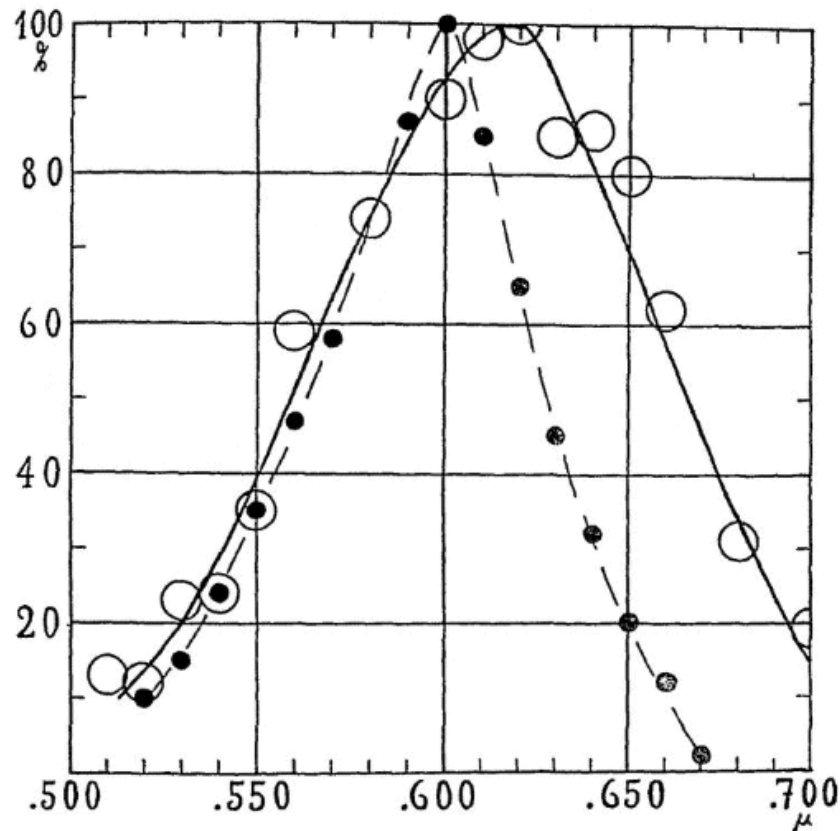


Fig. 1.

In this respect the curve for the "red" receptor radically differs from most of the visibility curves, obtained from lightadapted eyes of frogs. Nearly all receptors which in the photopic frog's eye are sensitive to long wave-lengths become greensensitive during dark-adaptation and finally their visibility curves acquire the shape of absorption curves for visual purple (GRANIT and SVAETICHIN, 1939) with maxima around  $0.500 \mu$ .

For comparison I have added in dotted lines between the small filled circles the "reddest" receptor that I have found in the light-adapted frog's eye. Two spots in the same eye gave this narrow, unusually stable and precise visibility curve, based on a group of 3—4 very large spikes. With the electrode in the first spot were obtained 20 readings during 50 min., from the second

spot 29 readings during 32 min. The maximum of the 49 averaged observations is in  $0.600 \mu$ , a somewhat unusual result, as the sensitivity maxima of receptors in the photopic frog's eye rarely go beyond  $0.580 \mu$  and, as a rule, are gathered around  $0.560 \mu$ .

The remarkable red-sensitivity of the most common type of receptor in the cone-retina of the tortoise also dominates visibility curves based on diffuse discharges made up of several active units. Under such conditions the maximum in the eyes of light-adapted frogs is between  $0.550$ — $0.560 \mu$ .

#### References.

- GRANIT, R., This Journal. 1941. In course of publication.  
 GRANIT, R. and G. SVAETICHIN, Upsala Läkaref. Förhandl. N. F. 1939. 45. 161.