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Optic Nerve Response to Retinal Stimulation in the Rabbit.*

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With changes in intensity and duration of light, the retinal potential undergoes slight changes in form, while the nerve discharges show transformations corresponding to the form of the stimulus.

The fore part of the rabbit's brain was removed under ether, exposing the optic nerves. Records were taken from one nerve and from across the corresponding retina. Light intensities used were high but within the physiological range, as indicated by reduction of response with reduction of intensity. Experiments were conducted in a dark room, flashes being delivered at about 1 per second from a 2-mm slit in the lamp housing, in front of which a sector disk was rotated. A lens projected an image of the slit on the rabbit's cornea, the eye thus focused an image of the lens on the retina. This image stimulus was compared with one from a diffusing screen close to the cornea illuminated with a 1¼-inch spot of light.

With flashes as short as 5 ms the retinal potential shows the usual *a* wave, a diphasic *b* wave, and no *c*. The "off" effect does not appear. With longer durations the *b* wave assumes its conventional

Fig. 1.

A, B, C, records from retina, light 18,000 candles per sq ft on 10 sq mm retinal image, durations of 7, 85, and 195 ms respectively, as marked. D.C. amplifier. Oculomotor nucleus destroyed after A. D, E, F, records from optic nerve, same stimulus, 101 ms duration, but with apertures at lens of 72, 30, and 8 mm diameter, ratios of 1, 1/6, and 1/81 areas of image. G, 72 mm aperture, intensity 1,800 candles per sq ft, or 1/10th the previous. This record falls between 1/6th and 1/81st aperture records in amplitude. H, photocell record. I, like D, shorter duration, 40 ms. The "off" spike is summed with the second "on" wave.

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monophasic form which does not return to the base line during illumination. (Fig. 1.) Between 5 and 200 ms duration, and between 18,000 and 200 candles per sq ft, the form of the retinal *b* wave changes surprisingly little.

On the contrary, the nerve discharge alters progressively over these ranges. The characteristic "on" response to a short bright flash occurs in two parts, the first consisting of a sharp initial spike followed usually by a decreasing series at 10-ms intervals, and the second, a rise which falls off during further illumination, its peak at about 30 ms after the first. The "off" response consists of a spike series similar to the first "on".

As *duration* is decreased, the "off" response decreases in amplitude, but is still distinct at 7 ms, while the "on" discharges decrease only at still shorter durations. As *intensity* is decreased, the "on" responses decrease in amplitude more rapidly than the "off", and the first "on" discharge more rapidly than the second, suggesting that different fibers are involved. The second "on" response and the "off" may sum quantitatively, again indicating different fibers in

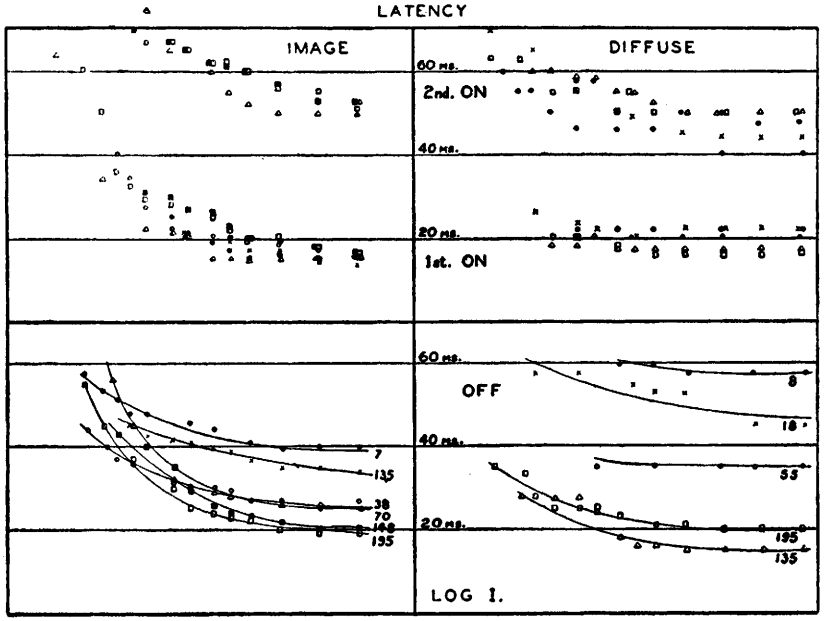

FIG. 2.

Latency of response vs. log. intensity for the three prominent waves of optic nerve. Left, 10 sq mm image on retina; right, diffusing screen at cornea, nearly whole retina illuminated. Range of intensity, 18,000 to 500 candles per sq ft. Stimulus duration in milliseconds at right.

these two responses. With decrease of either intensity or duration, the latencies of all responses increase. (Fig. 2.)

We infer from such records that the retinal activity arises in elements distal to the ganglion cell layer, and probably in the sense cells; and that the total *b* wave represents the summation of impulses which are individually briefer. Records obtained with and without a diffusing screen are so closely similar as to indicate that the responses observed following projection of a small bright image on the retina are chiefly due to stray light, illuminating the retina as a whole by internal dispersion from the image.

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Influence of Aldehydes on Transplanted Tumors.

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Strong obtained retrogressive changes and liquefaction of spontaneous tumors in mice[1, 2] and in dogs[3] by heptaldehyde. He also observed that the low boiling fraction of the oil of gaultheria was more effective than heptaldehyde alone,[4] an effect probably due to the presence of naturally occurring antioxidants which prevent the autooxidation of heptaldehyde. Boyland and Mawson[5] were able to induce some inhibition of both grafted and spontaneous tumors with citral, but heptaldehyde only inhibited the latter.

On the other hand, Baumann, Kline, and Rusch[6] were unable to influence a spontaneous mammary adenocarcinoma, or tumors induced by ultraviolet light, or by benzpyrene by adding heptaldehyde to the diet of mice. Clarke[7] found that heptaldehyde had no significant effect upon a transplanted spindle cell sarcoma in 14 rats. Orr and Strichland[8] were likewise unable to affect spontaneous and trans-

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