Effect of Ultraviolet on Electrical Properties of Nerve.* (19325)

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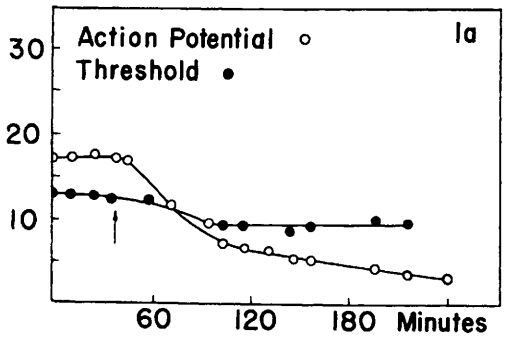
We investigated the effect of a single wave length (2537A) on the action and resting (injury) potentials, the threshold and the recovery changes following a single shock.

Experimental. The sciatic nerve of *Rana pipiens* dissected to the ankle was kept immersed in Ringer's solution on polished silver electrodes during irradiation. The action potential was measured with a differential amplifier feeding into an oscilloscope. Square waves of 0.1 millisecond duration were delivered to the nerve at a frequency of 3/sec. Injury potentials were measured with a Leeds and Northrup type K potentiometer and a Rubicon 3402HH galvanometer. Electrodes were calomel half-cells led to the nerve via agar-KCl bridges. Measurements of excitability changes were made by noting the strength of a second stimulus required to give 50% of the total A fiber response at given intervals following a maximal conditioning A shock. The ultraviolet source was a General Electric sterilamp giving more than 85% of its ultraviolet output at 2537A. The intensity of the irradiation was of the order of 100 egs/mm^2/sec. and was continuous throughout each experiment.



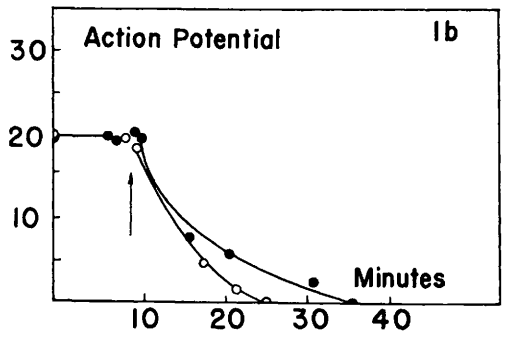
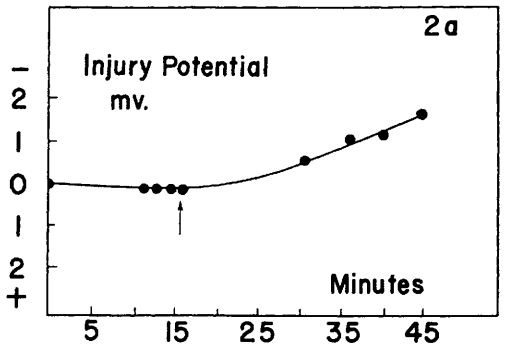


FIG. 1a. Effect of ultraviolet on action potential and threshold of frog sciatic nerve. The arrow indicates the onset of radiation. Fig. 1b. Effect of ultraviolet on action potential of the peroneal branch of the frog sciatic nerve. Intensity for lower nerve (circles) 2.4 times that of upper (dots).



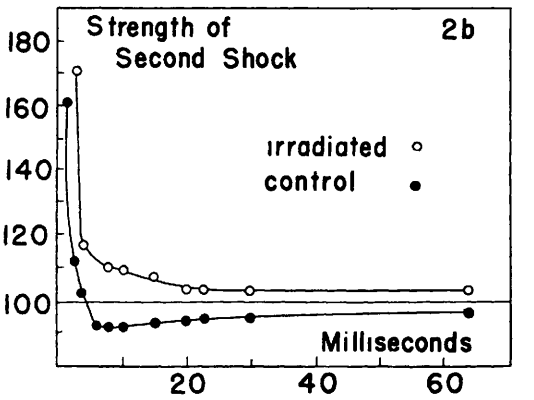


FIG. 2a. Depolarizing effect of ultraviolet on the frog sciatic nerve. Fig. 2b. Effect of ultraviolet on excitability changes following a single shock.

Results. Intense irradiation typically produced a sigmoid shaped survival curve (Fig. 1a). The survival time of a thin nerve as

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illustrated in Fig. 1b was only 15 minutes. Survival times for the sciatic nerve ranged from 1.5 to more than 4 hours over all seasons (11 experiments). An increase of intensity decreased the survival time (Fig. 1b). If failure is exclusively the result of the lowering of the action potential below a critical level, little change in threshold would be expected. A decrease in threshold averaging 15% in 10 experiments (Fig. 1a) was found. The extreme rise obtained with single fibers(1) was absent. Continuous irradiation leads to a progressive depolarization of the treated region. Six identical results were obtained; one is illustrated in Fig. 2a. During irradiation the supernormal period disappears and the relative refractory period becomes extensive (5 experiments) as shown in Fig. 2b. Cysteine (0.02 M), at pH 7, calcium chloride (0.02 M) and visible light (2000 watts) were ineffective in retarding the fall in action potential. Both short and long periods of illumination were equally ineffective in producing photoreactivation.

Discussion. Ultraviolet appears to affect nerve in much the same way as several metabolic inhibitors. Cyanide and nitrogen, for example, cause a fall in resting potential with little or no change in threshold(2). Ultraviolet differs from the effect of methylfluoracetate(3) in that the latter affects the threshold strikingly while leaving the resting potential unaltered. It appears probable that a major effect of ultraviolet on nerve is the result of the inhibition of one or several respiratory enzymes. Since the magnitude of the threshold change is slight, little direct effect on the membrane seems involved.

Summary. Ultraviolet irradiation of nerve at 2537A leads to a fall in action potential, a depolarization and a prolongation of the relative refractory period. A slight fall in threshold was observed.

1. Hutton-Rudolph, M., *Helv. Physiol. Acta,* 1943, v1, C15.

2. Wright, E., *Am. J. Physiol.,* 1947, v148, 174.

3. Boyarsky, L. L., Rosenblatt, A., Postel, S., and Gerard, R. W., *Am. J. Physiol.,* 1949, v157, 291.

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Effect of Hypophysectomy on Pigmentation and Ascorbic Acid Excretion in Black Rats.* (19326)

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It was previously observed that adrenalectomy in black rats was associated with a marked increase in the deposition of melanin in the hair follicles and bulbs in these animals(1). This report is concerned with the effect of hypophysectomy on pigmentation in black rats.

Experimental procedure. Male and female black rats of the Long-Evans strain, bred in our laboratories, were hypophysectomized when the animals were between 50 and 60 days of age, by the Hormone Assay Laboratories in Chicago. The weight of the males ranged from 125 to 150 g and of the females from 100 to 125 g. After hypophysectomy, the rats were fed a normal experimental diet supplemented with small amounts of canned dog food or evaporated milk. The fur on the back was shaved and the degree of pigmentation and hair growth recorded. A number of animals were placed in metabolism cages and the urine was collected for 24-hour periods. Ascorbic acid was determined by the method of Rowe and Kuether(2). At the conclusion of the experiments, the rats were sacrificed and the adrenal glands were removed, weighed, and prepared for pathological study.

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