

is not excluded, although that is considered unlikely.

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Effects of Beta Rays upon a Single Nerve Fiber. (19628)

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The histological changes of nerve fibers under severe irradiation by x-rays were reported by Janzen and Warren(1), and Davidoff *et al.*(2). Schmitz and Schaefer(3) were unable to demonstrate any changes of action potential of nerve fibers by irradiation. Audiat(4), Paulian(5), Rascanu(6), and others irradiated the nerve trunks and showed some changes of the action potential. It is the purpose of this report to deal with the effect of irradiation on the conduction of nerve impulse physiologically using a single nerve fiber of the sciatic gastrocnemius of the Japanese toad (*Bufo vulgaris*).

Methods. The source of beta rays was radon sealed in a glass tube (30 mg/cm² in thickness). The apparatus is shown schematically in Fig. 1. Two glass plates, covered with paraffin, carried parallel mica plates 10 μ thick that were insulated from

each other. One of the mica plates had a small shelf, where the radon tube can rest at a distance of 1 mm from the nerve fiber. A single motor nerve-muscle sample of the sciatic gastrocnemius of toad, made by the method of Shimizu and Tasaki(7,8) and immersed in Ringer's solution, rested on the glass plates. Precautions were taken in handling to make a bridge of a single nerve fiber between the pools without exposing Ranvier's rings to air. The action current between insulated poles was measured by an oscillograph and recorded photographically.

Results. 1. *Changes of threshold value of stimulus by irradiation.* The value of threshold stimulation was measured before and after irradiation for short intervals. To properly express the dose received by the nerve fiber, roentgen equivalent physical (rep) should be the unit employed. However, since the con-

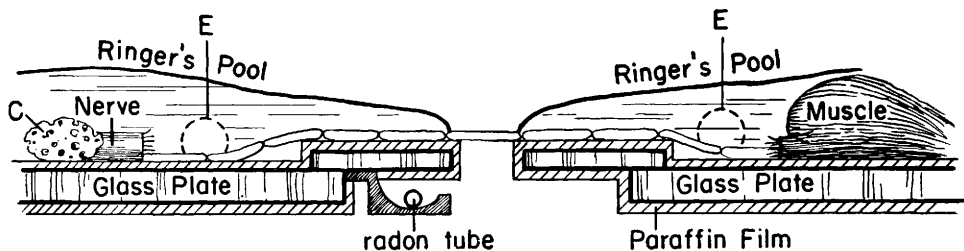


FIG. 1. Diagram of apparatus. C—cotton wool soaked in Ringer's fluid; E—electrode.

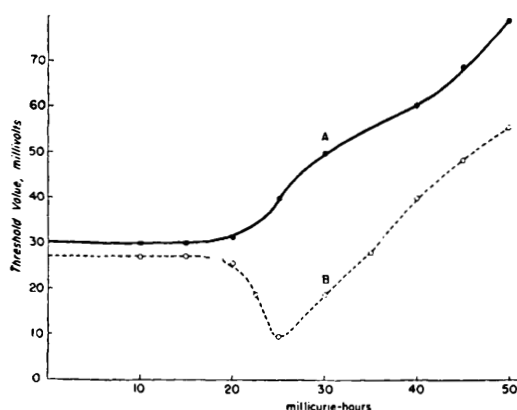


FIG. 2. Changes of threshold value of a single nerve fiber after irradiation. A—irradiated part; B—non-irradiated part.

ditions of the experiment such as filter and distance remained constant, the abscissa of Fig. 2 denotes relative values. The doses would be proportional to the millicurie-hours. The irradiation exposures are given in millicurie-hours, according to duration of exposure and intensity of the source. The decay of radon was taken into consideration. The ordinate indicates the value of threshold stimulus

in millivolts. Curve A shows the threshold value of the irradiated side of the bridge and curve B shows that of the non-irradiated side.* The threshold values of the irradiated side increased with increasing irradiation dose. The non-irradiated side first decreased for values between 20 and 30 millicurie-hours and then increased with further increase of doses. These lower values of threshold stimulus may be evidence for the occurrence of injury current from the irradiated region.

2. *Change of the action current by irradiation.* Some of the experimental data are shown in Fig. 3. At exposures higher than 20 mc h., the action current from the irradiated point became smaller in strength and in duration according to the doses administered and finally disappeared at 70 mc h.

Summary. We have made some physiological investigations of the response of a single nerve fiber to beta rays. Small exposures, up to 20 millicurie-hours at a distance of 1 mm in air with the filter shown, showed no effect.

* Each point represents an average of several experimental observations.

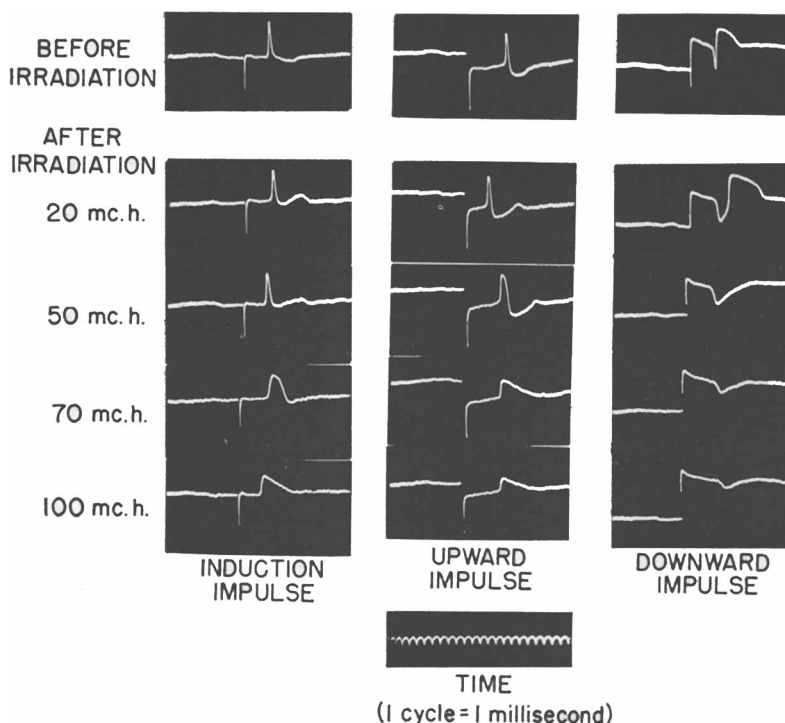


FIG. 3. Changes of action current of a single nerve fiber.

Moderate exposures (20-30 mc h.) evoked an injury current from the irradiated region. At higher exposures, the threshold value of stimulus increased and the action current decreased in strength and duration, and ultimately disappeared at 70 millicurie-hours. Complete breakdown occurred at the highest doses.

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A Method of Human Plasmapheresis.* (19629)

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Although there has been considerable investigation of plasmapheresis in experimental animals(1) very little information is available concerning similar studies in humans. Co Tui *et al.*(2) in the course of investigating the problem of multiple blood donations during World War II, found that the ability of man to regenerate plasma proteins was virtually unlimited provided the red blood cells were returned to the donor. In the present study 16 liters[†] of plasma were removed from a patient with multiple myeloma over a period of 35 days. Since the cellular elements of his blood were restored, our patient experienced no ill effects from the procedure and the erythrocyte, hemoglobin, hematocrit and serum bilirubin remained essentially unchanged.

Method. The patient was bled daily in the

amount of 500 cc into a Transfuso-Vac bottle[‡] (closed system). The bottle was inverted and refrigerated at 4°C for 24 hours which permitted the red cells to settle into the upper portion and neck of the donor bottle. On removal from the refrigerator care was taken not to disturb the red cell layer and a recipient set was attached to the bottle after an 18-gauge needle had been inserted into the air-vent to insure release of any remaining vacuum. The erythrocytes were permitted to flow through the recipient set into an arm vein until only the plasma was left in the bottle. Cells remaining in the lower part of the system were then flushed through with small amounts of sterile physiological salt solution. In the event that adequate sedimentation of erythrocytes is not obtained after 24 hours the blood may be centrifuged at 1000 r.p.m. for 30 minutes in the inverted donor bottle. Prolonged centrifugation at high speed is to be avoided, since it may produce excessive packing of the red blood cells. Plasma proteins were determined on the plasma layer by electrophoresis and by a modification of the Howe sodium sulfate method. The patient was placed on a nitrogen balance program in the

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[†] 15 additional liters of plasma removed subsequently without detriment to the patient.

[‡] The transfusion apparatus is that prepared by Don Baxter & Co., Glendale, Calif.