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THE ABSENCE OF AVOIDANCE RECOGNITION BY THE MOUSE
SUBJECTED TO CHRONIC INVARIANT γ -RAY EXPOSURES¹

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Running Title: γ -Radiation Recognition Avoidance

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INTRODUCTION

The question of recognition of ionizing radiations by mammalian subjects has been studied by Andrews and Peterson (1). Recognition of X-rays by mice was not observed when acute exposures of 10 r/min or less were used, questionable avoidance was noted as rates approached 50 r/min, and definite avoidance response was noted at dose rates above 50 r/min.

Several other studies have been done on radiation recognition and behavioral disturbance reactions in radiation fields (2-6). However, experimental evidence of radiation recognition by mammals during exposure to protracted low-intensity γ -rays is not available. This study was done to test the ability of mice to discriminate between different chronic radiation intensities.

METHODS

Thirty RF strain* female mice 12 ± 2 weeks of age were used. They were randomly placed in three Lucite cages with connecting Lucite tunnels. Once placed in one of the three

*Mice were obtained from the LASL stock breeding colony.

cages, all 30 animals had freedom of choice of any cage or position from 60 to 300 cm from a 3-curie Co^{60} source. The test setup is shown in Fig. 1. The 30 mice remained in this three-connecting cage setup for 32 days. Cages were changed two times each week, and at each cage change mice were randomly chosen and placed 10/cage in one of the three cages. During the 32-day period, mice were fed Purina lab chow and water ad libitum and given an oatmeal supplement twice weekly. Environmental conditions for all positions in the cage-run setup were uniform and equidistant from the floor and from light sources. Environmental indicators (other than radiation intensity) as to direction to and from the source were assumed to be absent.

Dosimetric methods were used to determine the average source-to-specimen (mouse) distance during the 32-day exposure period. Individual AgPO_3 glass rods were implanted aseptically subcutaneously at the abdominal midline 1 cm posteriorly to the xiphoid in each mouse. Three identical AgPO_3 rods were positioned as stationary dosimeters at each of five positions on the cage-run setup, as shown in Fig. 1. AgPO_3 rods were 6 mm in length and 1 mm in diameter. They are extremely stable, unaffected by body fluids, and have a reliable dose range of from 10 to 10^5 r of γ -rays. γ -Ray exposures within the reliable range cause formation of stable

fluorescent loci within the rods which, when excited by near ultraviolet light, produce illuminescence of a wavelength of 6400 Å. Fluorescence is relative to the total dose absorbed, and a Turner fluorometer was used to determine the total doses. A 3-curie Co⁶⁰ source was used to provide the γ -radiation environment for this study. The mice were checked daily, and the number of mice at each position in the cage-run assembly was recorded.

RESULTS AND CONCLUSIONS

The total accumulated doses at each fixed position in the cage-run assembly (Fig. 1) are shown in Table I. The center cage dose, position 3 (Fig. 1), was found to be 2100 rads, while the doses at positions 1 and 5 were 5700 and 900 rads, respectively (Table I). Dosimeter readings indicated a dose rate range of from 7.57 rads/hr to 1.2 rads/hr. The average accumulated dose received by implanted dosimeters was 2.628×10^3 rads, and individual doses ranged between a minimum dose of 2.33×10^3 rads and a maximum of 2.8×10^3 rads. The dose distribution and average dose value for the mice indicated that the mice spent a proportionately greater time during the 32 days of irradiation on the high dose side of the midline cage. With an average total dose of 2.628×10^3 rads, the average relative position

during the 752-hr exposure period would fall between positions 2 and 3, where the average dose rate was 3.49 rads/hr.

The results of this study indicate that continuous low-intensity γ -rays do not provoke a recognition response sufficient to stimulate avoidance, even though the exposures are continued until the accumulated dose is in the lethal range. The average dose for all mice, compared to doses at fixed positions, contrarily indicate a tendency toward positions closer to the source. If the chosen average position near the source represents recognition and desire for the sensation recognized, one would be hard put for an explanation. The possibility of a sensation of warmth from ionizing radiation is not completely ruled out, but this is highly doubtful, since at 5 r/hr the mice would absorb roughly 10^{-5} gram calories/hr, or 7.52×10^{-3} gram calories during the entire 32-day exposure. It is concluded that chronic invariant γ -radiations of low dose rates do not stimulate avoidance recognition in the mouse.

SUMMARY

Mice were allowed the freedom of position choice in a cage-run assembly during a 32-day exposure to chronic invariant γ -rays with a dose rate range of between 7.6 and 1.2 rads/hr to determine the possibility of radiation recognition and avoidance. Individual AgPO_3 glass dosimeters implanted in the mice were used to determine the average source-to-specimen distance during the 32-day exposure period. Recognition by avoidance was not indicated, but rather the average source-to-specimen distance indicated a positive tendency toward positions closer to the source.

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Fig. 1. Arrangement of exposure cages for radiation recognition.

TABLE I
TOTAL DOSE READINGS AND DOSE RATES AT FIVE POSITIONS
IN γ -RAY EXPOSURE CAGE-RUN ASSEMBLY

Position No.	Total Dose (rads x 10 ³)	Dose Rate* (rads/hr)
1	5.7	7.57
2	3.22	4.28
3	2.1	2.79
4	1.1	1.46
5	0.9	1.20

*Average based on a 752-hr run.

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