Hoarding and neonatal irradiation¹

MARTIN MANOSEVITZ

RUTGERS UNIVERSITY

Swiss albino mice, half treated with (300-r) irradiation on day of birth and half untreated were run in a hoarding test. The treated Ss hoarded 49% less than the controls. This finding was opposite of the expectation. Irradiation also reduces body weight and this effect persists into adulthood. The association between hoarding and activity and emotionality was also investigated. Hoarding performance was unrelated to activity or fear.

In a series of investigations on the determinants of hoarding we have studied genetic and environmental factors which influence this behavior (Manosevitz, 1965, 1966; Manosevitz & Lindzey, 1966). It is assumed that several variables operate in a complex manner to determine the rate and amount of hoarding. Two such variables, activity and fear or emotionality appear to be of central importance in this behavior (Ross, Smith, & Woessner, 1955). However, to date these variables, as they influence hoarding, have been studied relatively little.

The use of X irradiation as a tool in behavioral research has been suggested by a number of writers (e.g., Furchtgott, 1963; Sharp, 1963). The many behaviors that are affected by ionizing radiation (e.g., maze learning, locomotion, avoidance conditioning) have been summarized by Furchtgott (1963). Generally these effects are a function of dosage, age of exposure, and the behavioral measures used.

In an earlier study of irradiation (300-r) delivered at birth, Manosevitz & Rostkowski (1966) demonstrated that irradiated mice eliminate more in the open field and are more active than non-irradiated animals.

It has been suggested that there is a positive association between general activity and hoarding. Smith, Ross, & Woessner (1955) after summarizing several studies, state: "Undoubtedly a comparison of hoarding scores with activity scores would indicate a positive relationship" (p. 319). Several workers have suggested that there is a positive association between emotionality or fear and hoarding (Bindra, 1948; Broadhurst, 1958; Hess, 1953; Manosevitz, 1965; Smith & Powell, 1955) and they have provided some confirmatory support for such a relationship. Given our earlier findings (Manosevitz & Rostkowski, 1966) on activity and elimination and the presumed association between these variables and hoarding, we became interested in what effect irradiation would have upon hoarding. It was expected that irradiated animals would hoard more than non-irradiated animals. This expectation was based on the following line of reasoning.

From previous findings and suggestions in the literature we assumed that hoarding is positively associated

with general activity level. In our own experiments we have demonstrated that irradiated Ss are more active than non-irradiated Ss. Hoarding is also assumed to be, on the basis of previous findings, positively related to fear or emotionality, and we have shown that irradiated Ss eliminate more than non-irradiated Ss in the open field. Open field motility and elimination serve as our indices of activity and emotionality, respectively; both have been used previously in this way.

The purpose of this experiment was to determine whether ionizing radiation influences hoarding performance. Half of the Ss were exposed to irradiation and the other half were not. All were tested in a standard hoarding test. In addition, we were interested in determining whether hoarding was associated with open field activity and elimination in accordance with our expectations.

Method

The Ss were 20, SWR/J mice² selected from the larger group used in the earlier study (Manosevitz & Rostkowski, 1966). Ss were randomly selected within certain age restrictions, 55-75 days old. The mean age of the non-irradiated group, when the hoarding test started, was 59 days, for the experimental group 63. An equal number of males and females were used and half of each group had been treated with 300-r X irradiation. The Ss, treatment and other relevant information have been reported in our previous publication. The hoarding apparatus and testing procedure have been reported previously (Manosevitz, 1965). In brief, the test consisted of 15 daily, 1-hr. trials during which each S is able to retrieve food pellets to his home cage. The alleys are attached to the home cages and are constructed of wood and painted white. The tops of the alleys are covered with flashed opal glass. The food supply is at the end of the alley 18 in. from the home cage. In addition to the usual room lights two fluorescent lights (40 w each) centered 8 ft. above the apparatus were turned on during each trial. For each S the following data was available; weight on day that S was placed in hoarding cage, total hoarding score, and from the the previous study; open field activity and defecation scores. The collection and treatment of the data from the previous study has already been reported.

Results and Discussion

Body Weight. The irradiated Ss were lighter than the control animals on the day that the Ss were placed in hoarding cages ($F = 7.98$, $df = 1/16$, $p < .025$). The usual sex difference in body weight, males heavier than females, was also observed ($F = 50.4$, $df = 1/16$, $p < .001$), and there was no interaction between sex and treatment. These results closely parallel those reported earlier

Table 1. Means for Each Measure

Measure		Controls	Experimentals
Hoarding, (15 trials)	$\bar{x}$	195	96
Openfield activity (5 trials)	$\bar{x}$	35	69
Openfield defecation, (5 trials)	$\bar{x}$	13	14

(Manosevitz & Rostkowski, 1966) and further demonstrate that the irradiation delivered to the neonate has a relatively permanent effect on total body weight.

Hoarding. The means for each measure are presented in Table 1. The major finding is that Ss exposed to a 300-r dose of radiation on day of birth hoard significantly less than untreated animals ($F=5.29$, $df=1/16$, $p<.05$). The treated animals hoard 49% less than the controls. When hoarding performance for all 15 days is plotted both curves are relatively flat and are widely separated across all trials. At no point do the two curves overlap. Although the females hoarded more than the males the differences were not significant and treatment did not differentially effect either sex. Thus, our expectation is firmly rejected. The results indicate that irradiation reduces hoarding performance.

Activity and Elimination. The association (product moment correlation coefficient) between hoarding and activity ($r=-.26^3$), and hoarding and elimination ($r=-.25$) were low and not significantly different from zero. The correlations are negative, although we had expected them to be positive. There are two explanations of these findings. Hoarding may not be related to general activity, or hoarding and emotionality may be unrelated. It is also possible that irradiation affects Ss in an abnormal manner, rendering them more active and fearful but decreasing their hoarding performance. Although these hypotheses are post hoc, they can be readily subjected to test.

The marked effect that radiation delivered to the neo-

nate has upon hoarding, in the adult mouse, and the relatively permanent effect it has upon body weight appears to be established. The question of how radiation produces a decrease in hoarding performance requires further investigation, as do the associations between activity, fear and hoarding.

References

- Bindra, D. What makes rats hoard? *J. comp. physiol. Psychol.*, 1948, 41, 397-402.
- Broadhurst, P. L. Determinants of emotionality in the rat III: Strain differences. *J. comp. physiol. Psychol.*, 1958, 51, 55-59.
- Furchtgott, E. Behavioral effects of ionizing radiations: 1955-61. *Psychol. Bull.*, 1963, 60, 157-199.
- Hess, E. H. Shyness as a factor influencing hoarding in rats. *J. comp. physiol. Psychol.*, 1953, 46, 46-48.
- Manosevitz, M. Genotype, fear and hoarding. *J. comp. physiol. Psychol.*, 1965, 60, 412-416.
- Manosevitz, M. Hoarding and inbred strains of mice. *J. comp. physiol. Psychol.*, 1966, in press.
- Manosevitz, M., & Rostkowski, J. R. The effects of neonatal irradiation on postnatal activity and elimination. *Rad. Res.*, 1966, in press.
- Ross, S., Smith, W. I., & Woessner, B. L. Hoarding: An analysis of experiments and trends. *J. gen. Psychol.*, 1955, 52, 307-326.
- Sharp, J. C. Prenatal irradiation and postnatal behavior. In Werboff, J. (Ed.), *Prenatal irradiation effects on CNS development and postnatal behavior*. Conference proceedings, sponsored by the American Institute of Biological Sciences, Washington, D. C., 1963. Pp. 92-110.
- Smith, W. I., & Powell, E. K. The role of emotionality in hoarding. *Behaviour, Leiden*, 1955, 8, 57-62.

Notes

1. This research was conducted under support provided by grant MH-11276 from the National Institute of Mental Health and a grant from the Rutgers University Research Council. The author would like to thank J. M. Abec, R. B. Campenot and C. F. Swencionis for their help in conducting this research.
2. We are grateful to D. J. Nash for providing us with the animals and radiation facilities.
3. All correlations were computed separately for irradiated and non-irradiated Ss and there were no significant differences between them.