Hoarding in the mouse

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Abstract Two studies of inbred strains of mice produced hoarding rates that were well below the only previously reported findings for this species. Comparison of four strains revealed significant genotype differences in the rate of hoarding. Comparison of three strains subjected to group and individual food deprivation provided limited evidence for genetic variation as a determinant of hoarding and clear evidence of an interaction between genotype and experimental treatment in their effects upon hoarding.

Introduction This paper presents findings concerning the incidence and determinants of hoarding in the mouse. A principal purpose of the note is to report that the only previous studies of *Mus musculus* hoarding (Smith & Ross, 1953a, 1953b; Ross & Smith, 1953) produced results that appear not to generalize to our laboratory.

During the past three years we have conducted a number of hoarding studies involving a total of more than four hundred animals. Because of the relatively small incidence of illuminating findings we will make no attempt to summarize all of these data, but will report briefly a study concerned with the effects of strain and group competition for food upon hoarding.

Study 1 This study compared the hoarding of four different strains or genotypes and it also examined the possibility that raising animals in a large cage where food was presented on the floor, rather than in a food hopper, would increase the hoarding response beyond that which had been observed conventionally in our laboratory.

Procedure. The Ss of this study were 42 inbred mice dis-

Table 1. Strain Comparison of Hoarding

Genotype	N	Median	Mean	Range
A	13	.00	.92	6
C57/BL/1	7	3.00	11.43	54
DBA/8	12	7.50	15.6	60
C3H/Bi	10	5.5	7.3	22

tributed across four different genotypes (A, C57/BL/1, DBA/8, C3H/Bi) as indicated in Table 1. When 80 to 90 days of age they were placed in individual hoarding cages and given 30 min. hoarding trials for 10 consecutive days. Hoarding cages (4x4x5 in) were made of wood with hardware cloth tops and the hoarding alleys (3x3x12 in) were made of masonite with hardware cloth tops. Twenty Purina Fox Chow food pellets were placed at the end of the alley at the start of each trial and upon completion of the trial all hoarded pellets were removed.

Results. The results summarized in Table 1 and Fig. 1 are clearly suggestive of strain differences and they also indicate that the conditions under which these mice were raised did not serve to raise appreciably the average level of the hoarding response. The highest average for any strain was less than two pellets per day, which compares very unfavorably with Smith and Ross' averages of five to 13 pellets hoarded per day and is very similar to what we have observed in numerous other studies in our laboratory. Use of the median test ($p < .001$) and Link and Wallace's range method for comparison of multiple groups ($p < .05$) both indicate significant strain differences. The latter analysis suggested that the A strain was significantly inferior to all other strains which in turn did not differ significantly among themselves.

Study 2 This study was intended to examine the effects of a severe adult stress involving group competition for food upon the hoarding response. It involved the study of animals of three different genotypes divided into those that were individually deprived of food and those that were forced to compete with other animals in a group for food. It was our expectation that the experience of being deprived of food under circumstances of active competition would increase the tendency to hoard.

Procedure. The Ss consisted of 90 mice representing three different inbred strains (A, C57/BL/1, DBA/8) and two different treatments as summarized in Table 2. The group food deprivation treatment involved placing 12 animals (85 days of age or older) in a large metal cage and maintaining them for 10 days on an 85% of normal weight food deprivation schedule. There was open competition for the food presented to the group. In the individual dep-

Fig. 1. Comparison of hoarding in four strains of mice.

Table 2. Effects of Strain and Food Deprivation Upon Hoarding

Genotype	N	Deprivation Condition	Median	Mean	Range
A	15	Group	4.0	4.27	18
A	15	Individual	6.0	6.53	23
C57/BL	15	Group	2.0	10.73	52
C57/BL	15	Individual	3.0	3.40	12
DBA/8	15	Group	5.0	12.60	71
DBA/8	15	Individual	2.0	4.33	13

privation condition the animals were maintained on a comparable deprivation but housed and fed alone.

Approximately 20 days after the deprivation experience Ss were placed in individual hoarding cages, maintained on a light food deprivation schedule for 14 days, and then given 10 consecutive, daily 1-hr. hoarding trials following the procedure just described.

Results. The descriptive findings are summarized in Table 2. Complexity of design forced us to depend upon the robustness of analysis of variance in spite of the fact that the data were not normally distributed. The results of a trend analysis of variance indicate the expected decrease in hoarding over successive trials but provide no evidence for strain differences in average rate of hoarding. There is evidence for strain differences in the slope or change in rate of hoarding over trials ($p < .001$), with the C57/BL/1 animals failing to reveal the usual reduction in rate over the ten trials. Moreover, although there is only suggestive evidence of a treatment effect upon the

average of hoarding ($p < .10$), there is a significant interaction between treatment and strain ($p < .01$) in their effects upon the slope of the hoarding response curve. Thus, the results provide limited support for the importance of genetic variation as a determinant of hoarding and also provide evidence for an interaction between genetic and ontogenetic determinants of hoarding. There is little evidence for the direct effect of group competition for food upon the hoarding response. Finally, the general rate of hoarding remained at about the level we had previously observed (highest group average less than two pellets per day) and well below the rates reported by Smith and Ross.

The evidence from these two studies is consistent with the findings of Stamm (1954, 1956), working with the rat, in identifying genetic variation as a determinant of hoarding.

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