

Exploratory behavior of dominant and submissive rats

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The exploratory tendencies of dominant and submissive rats were examined in a Y-maze. The dominant rats showed significantly more alternation behavior in the maze than their submissive partners. There were no differences in activity between the groups, nor in defecation behavior. Dominant rats appear, therefore, to explore more than submissive rats in novel situations.

Banks (1962) carried out a time and motion study of fighting in mice and noted that the victorious mice showed more investigatory prefight behavior in the arena than the defeated mice. The victorious mice initiated activity sooner, explored the arena and the other mouse more, and were generally less fearful in the fighting situation. Tarte & Klugh (1965) reported that college females who had high dominance, as measured by an inventory, tended to show more alternation behavior than low dominant females. Although alternation is a very simple measure of exploratory tendencies in humans, the results of Tarte and Klugh suggest that high dominance may be associated with high exploratory tendencies in general, and may not be restricted to particular species and to situations where dominance behavior is elicited.

The aim of the present study was to see whether the greater exploratory tendency of dominant animals would manifest itself in situations irrelevant to the fighting situation, that is, whether the greater exploratory tendencies of dominant animals can be regarded as a general trait.

Method

The Ss were 32 female rats, age 115-119 days, from the Charles River Breeding Laboratories (strain CD) housed in pairs. For 17 days they were maintained on a feeding schedule of 24 h ad lib food and water and 24 h no food and ad lib water.¹ The rats were caged singly on Day 18. On Day 19 each pair of animals was put into the former home cage on three separate occasions and the first rat to assume a submissive posture (on its back with the other rat standing over it) was noted. The rats were returned to their single cages after each trial. They were kept in single cages for the remainder of the experiment with ad lib food and water.

On Days 21 and 23 each rat was given a 10 min period of exploration in an elevated Y maze. The maze was made of wood, with arms 6 in. wide and 22 in. long. It was elevated 25 in. The sequence of arms entered by each rat was noted by an observer looking at the rat through a screen. (An entry into an arm was defined as made when all four paws of the rat were in the arm.)

Results

The dominance measure was reliable. The dominant rat on a best of three criterion was the same as the dominant rat on a best of one criterion in 14 out of 16 pairs (binomial $p=0.002$). There was no association between dominance and weight; in eight pairs the dominant rat was heavier and in eight pairs it was lighter than the submissive rat.

The fighting pattern differed from that seen in spontaneous aggression between strangers of this strain. There was much tail lifting and investigation of the vaginal region. Vigorous grooming of one rat by the other occurred. On occasions, the dominant rat would pull the submissive rat off the cage wall by grabbing a limb and tugging, upturn the submissive rat, and vigorously groom it. The submissive rat often squealed mildly. In aggression between strangers of this strain there is more kicking with the hind legs, less vaginal investigation, and less grooming.

The measure of alternation behavior in the Y maze was the percentage of occasions on which a rat entered the three different arms on three successive choices, the measure used by Montgomery (1955). The sequence of arms entered was noted and each triad of successive choices examined. A triad such as ABC (where A, B, and C are the arms of the Y maze) was classified as an alternation. A triad such as BCB was classified as a repetition. The percentage of alternation shown by each rat was calculated for the whole 20 min period of exploration and the dominant rats were compared with their submissive partners by the sign test (Siegel, 1956). In 14 out of the 16 pairs the dominant rat alternated more than the submissive rat (binomial $p=0.002$). (A Wilcoxon matched pairs test was equally significant.) The median difference in the percentage of alternation between members of the pairs was 10.5%.

The difference between the dominant rats and their submissive partners on the number of arms entered (an activity measure) was not significant. Seven dominant rats were more active over the total exploration period, seven were less active, and two showed no difference from their submissive partner.

Discussion

These results show clearly that dominant rats do show more alternation behavior in this situation than do submissive rats. This result was not confounded by the weight of the rats or their activity.

It might be suggested that the difference between dominant rats and submissive rats stems from a difference in their levels of fear. This was not evident

here. All rats were sufficiently tame that they did not defecate much while on the elevated maze. Four rats did defecate; three of these were dominant and one was submissive. Activity scores might be taken as a measure of the level of fear, but not only was there no difference in the activity levels of the two groups of animals (as measured by the number of arms entered), but also Lester (1967) has indicated that an increased fear level may serve both to increase exploratory behavior and to decrease exploratory behavior, depending upon the initial level of fear.

It may be concluded from this study that dominant rats do possess a higher exploratory tendency (as measured by alternation behavior) than submissive rats in situations other than the fighting situation.

References

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Note

1. The rats were fed on alternate days in order to encourage competitive behavior and facilitate establishment of a stable dominance relationship. Before each pair of animals was fed, one piece of food was placed in the cage for which the animals competed. When this had been consumed, ad lib food was given.