The development of the mouse-killing response in rats¹

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Abstract

Previous experiments have suggested that a history of food competition facilitates mouse killing by rats. In the present experiment 126 rats were either (a) simply food deprived, (b) deprived and given food competition training, or (c) neither deprived nor trained. Rats which were simply food deprived killed more than did rats in the other two groups. The data suggest that cyclic food deprivation leads to the learning of habits which facilitate killing.

Introduction

In his fascinating book *African Genesis* (1961), Robert Ardrey documents the thesis that drives for territory and status are fundamental to the evolution of animal species, and that sexual drive plays a secondary role in the evolutionary process. Aggression, which mediates the achievement of territory and status, is seen to be the product of natural selection.

Although there are no systematic analyses of the heritability of animal aggression, data from numerous studies are congruent with the notion that individual differences in aggression have a genetic basis. For example, Karli (1956) has shown that some rats will attack and kill a mouse on their very first encounter, whereas "non-killers" will not kill even when starved (the "isolation-rearing" experiment). He has also shown that wild rats are more likely to kill than are domesticated rats (the "strain-differences" experiment). The additional fact that the offspring of "non-killers" may themselves kill led Karli (1961) to conclude: "La réaction d'attaque des rats 'tueurs' est une conduite innée transmise par la voie génétique."

Heimstra and Newton (1961) concentrated upon the Karli finding of a differential killing rate in wild and domesticated rats and hypothesized that environmental factors are crucial for the development of killing. They felt that wild rats experience more competitive environments than domesticated rats, and that this competition experience facilitates mouse killing. To test this proposition Heimstra and Newton trained domesticated rats to compete for a food supply which could be controlled by only one animal at a time. The rats received training for 15 days while under 22 hr. food deprivation. The control group was neither food deprived nor trained to compete for food. Following the 15th training trial, all Ss were given unlimited food and water. Twenty-four hr. later a single mouse was placed in each individual's cage and the latency to kill was recorded during the succeeding 20 hr. Fifty-five per cent of the competition-trained animals killed; none of the non-trained animals

killed. The authors concluded that killing is experience-dependent, and that "... either fighting or food competition would appear to be the most logical factors that would contribute to the development of a killing response." Unfortunately, Heimstra and Newton's "control" group experienced neither competition training nor cyclic food deprivation. The present experiment was designed to evaluate the contribution of cyclic food deprivation to the development of the mouse-killing response independent of the effects of competition training.

Method

The Ss were 126 adult male rats of the Sprague-Dawley and Long-Evans strains. They were maintained in individual cages in a room where the light-dark cycle was artificially reversed. All training and testing occurred during the dark phase of the lighting cycle.

The Ss of each strain were randomly divided into three groups: ND-NT Ss ($n = 56$) were neither food deprived nor trained to compete for food; D-T Ss ($n = 30$) were both deprived and trained to compete for food; D-NT Ss ($n = 40$) were food deprived, but not trained to compete for food.

Food deprivation and competition training procedures replicated those of Heimstra and Newton (1961) for the ND-NT and D-T groups. The D-NT Ss were food deprived in the same manner as the D-T Ss, but were never placed in the training apparatus. Food deprivation consisted of 22 hr. without food followed by 2 hr. feeding on a mixture of rat mash and water. In addition to the wet mash feeding, ND-NT Ss were given free access to solid rat pellets. All Ss had water continuously available.

Competition training involved the placing of a pair of deprived Ss in a 24 x 12 x 12-in glass test box with a wooden floor with a metal food container at the center. The food level in the 2-in high 1-in diameter cylindrical container was maintained at a level such that only one rat could feed at a time. Each daily competition training trial was of 5 min. duration.

Following the 15th training day all animals were fed wet mash and given, in addition, a large supply of solid food pellets. Twenty-four hr. later all food was removed from the cage and a single adult mouse was presented to each rat. The occurrence of killing was recorded at regular intervals during the following 24 hr.

Results and Discussion

Table 1 shows the effects of prior deprivation and competition training upon mouse killing by rats. Significantly more rats which had been only cyclically food deprived killed than did rats both deprived and trained to compete for food ($\chi^2 = 8.3$; $P < .01$). The present

Table 1. Effects of Food Deprivation and Competition Training on Mouse Killing by Rats.

Group	n	Per Cent Killing
ND-NT	56	17.8
D-NT	40	45.0
D-T	30	23.3

data support the conclusion of Heimstra and Newton (1961) that the development of the killing response is dependent upon the past experience of the animal. The data, however, oppose their conclusion that prior food competition is of great importance to the development of this response.

Since the rats were not deprived at the time of testing, habits learned during the cyclic food deprivation regimen must be more important than deprivation per se. That deprivation at the time of testing does not facilitate killing has been previously shown by Karli (1956).

In the present experiment the combined deprivation and competition training did not greatly facilitate killing as was found by Heimstra and Newton. It is possible that during competition training our rats learned social habits which interfered with the habits which result from cyclic food deprivation alone.

Campbell and Sheffield (1953) found that one of the primary effects of food deprivation is to increase the responsiveness of the animal to changes in environ-

mental stimuli. It is reasonable to suppose that under present training conditions cyclic food deprivation led to an increase in biting habits at the times of stimulus change (viz., feeding), and that these habits were aroused when the mouse was placed in the cage and led to killing. The rats both deprived and trained to compete for food may have learned to discriminate between food and another animal. When the mice were placed in their cage both biting and competitive non-biting habits were aroused and few mice were killed. This hypothesis would further suggest that the non-deprived rats never learned to associate stimulus change with biting habits.

References

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Note

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