Genetic selection of winner and loser rats in a competitive situation

GENETIC selection of behavioural characteristics has been observed, among others, in the Maudsley, Roman, and Tryon strain of rats[1]. Here we describe an experiment designed to test the hypothesis that rats could be selectively bred to win or lose in a food competition situation of the type reported by Lindzey *et al.*[2] with mice and later used by other authors with rats[3-8].

The apparatus is described in detail elsewhere[5]. Briefly, it consisted of a straight wood runway 100 cm long, connected at the extremities with two identical open-topped chambers; a guillotine door bisected the runway. The animals had food withheld for 20–22 h and were trained individually every 48 h to traverse the runway to be rewarded with food. They were then subjected to the contest situation, in which two rats were simultaneously introduced into the opposite sides of the apparatus. As the rats met in the middle of the runway, one pushed the other and gained the reward.

The offspring of three randomly selected couples of Wistar rats from our own colony, mantained by random breeding, were subjected to the competitive situation when about 80 d old. A stable hierarchy of winners and losers was obtained among seven females and seven males. The two male rats which consistently won were bred with the two females that were winners from their hierarchy. Similarly, the two loser rats of the female and male hierarchy were also bred. The offspring (F1) consisted of 15 rats which were descendants of winner couples (DW) and 14 rats which were descendants of loser couples (DL). At 80 d of age, competitive hierarchies were established independently for DW males, DW females, DL males and DL females. The two DW male rats which occupied the top of the hierarchy were mated with the two DW female rats which also occupied the first and the second positions. Similarly, the two DL males at the bottom of their hierarchy were mated with the two DL females which occupied the last two positions. Only one female and one male were put together for mating.

F2, consisting of 15 DL and 11 DW were tested against random-bred controls, using a fixed pair procedure. Each pair was made up by a DW or DL rat and a random-bred control of the same sex and age. Each pair was subjected to three experimental sessions consisting of five contests each. After that, the rats were selected for mating according to their number of wins (DW that won at least 13 out of the 15 contests and DL that lost at least 13 out of the 15 contests). F3 (31 DW and 31 DL) and F4 (32 DW and 32 DL), were subjected to the same procedure as F2. In the three generations (F2, F3 and F4) tested against randombred controls, the DW rats won about 75% of the contests while the DL rats lost nearly 80% of the contests. Throughout the generations, mating brothers and sisters was avoided when possible. At the F1 and F2 about 50% of the couples which were mated were brother and sisters while this dropped to about 10% in the following generations.

In F5, 60 pairs were formed, each consisting of a DW and a DL rat of similar weight. Thirty-seven pairs were females and the remaining 23 males. Each pair, deprived of food for about 22 h, was tested using the fixed pair procedure. Three experimental sessions were run, consisting of five contests each. The results (Fig. 1) show that DW rats consistently won more than 80% of the 15 contests. In all generations, records of weights were kept and correlations between weight and number of wins were calculated. No significant correlations were found.

These data indicate that genetic selection occurred. DW and DL rats probably have different behavioural or physiological characteristics, which are yet to be detected, that led them either to win or lose in the straight runway. The possibility that the results obtained were not due to genetic selection but to an influence of the mothers during weaning was excluded, as in the F4 and in the F5 generation, all rats were reared by foster mothers.

How winning and losing in the straight runway correlates with other competitive situations remains to be investigated.

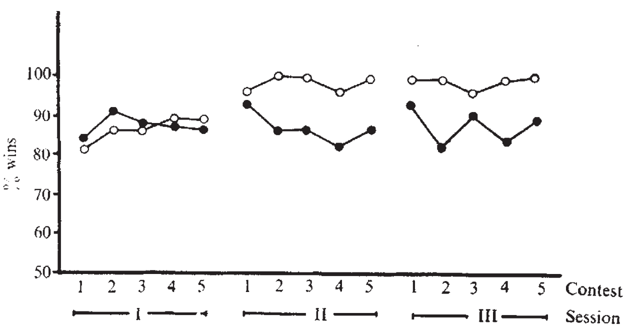

FIG. 1 Percentage of wins obtained by 23 DW males (●) and 37 DW females (○) when competing in a straight runway against 23 DL males and 37 DL females, respectively. The difference between the number of victories obtained and the casual level of 50% was significant in every contest. The statistical analysis was performed for females using the binomial test for large samples ($P \leq 0.001$) and using the binomial test for small samples for males ($P \leq 0.002$).

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1 Wahlsten, D., *Behav. Biol.*, **7**, 143 (1972).
2 Lindzey, G., Winston, H., and Manosevitz, M., *Nature*, **191**, 474 (1961).
3 Hsiao, S., and Schreiber, S. C., *Psychon. Sci.*, **10**, 117 (1968).
4 Wilson, W. J., *Psychon. Sci.*, **10**, 119 (1968).
5 Masur, J., Martz, R. M. W., Bieniek, B., and Korte, F., *Psychopharmacologia*, **22**, 187 (1971).
6 Masur, J., Karniol, I. G., and Palermo Neto, J., *J. Pharm. Pharmac.*, **24**, 262 (1972).
7 Work, M. S., and Rogers, H., *J. comp. physiol. Psychol.*, **79**, 414 (1972).
8 Terada, C. W., and Masur, J., *Eur. J. Pharm.*, **24**, 375 (1973).

Infectious particles in a marine ciliate

INFECTIOUS, self-reproducing particles of unknown origin have been demonstrated in various tissues and cells[1,2], notably fresh water protozoa[3], but not in marine protozoa. Advances in the development of culture media for marine ciliates[4] and the need for simple model systems for biochemical study of intracytoplasmic particles have led us to survey marine protozoa. Of 104 isolates made from twenty-one seawater samples taken from tidal pools and brackish backwaters along the South Florida coast, twenty-six were cultivated axenically as described before[4]. Of these, four contained in their cytoplasm infectious, self-reproducing particles, which we have termed 'xenosomes' (*xenos*, alien; *soma*, body).

The xenosomes were found in aceto-orcein-stained preparations[4] under the phase microscope (Fig. 1*a*). They seemed to be distributed randomly throughout the cytoplasm. We