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Strain differences in runway learning in the rat

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Running speed during runway conditioning was measured for 567 rats from 12 inbred strains: ACI, A990, A35322, F344, INR, IR, MNR/Har, MNRA, MR/Har, TS1, TS3, WAG. The results provide parametric data for methodological use and add to the standardization of these strains as behaviorally defined lines.

Hull (1934) originated use of the runway or alley as an instrument for the study of conditioning processes. It became the principal apparatus for much of the research in the Hull-Spence framework. Of course, the Skinner box has since replaced it as the primary device for the study of animal learning. However, this shift reflects a change in emphasis and objectives rather than an improved alternative method. The Skinner box provides a means of studying the structure of response sequences, while the runway provides a means for examining the topography of individual responses. For the latter purpose, the runway remains useful.

Since the runway played such an important methodological role, it is rather remarkable that there appears to be no literature relating genetic variation to runway learning. In fact, the runway seems to have been used as an instrument in genetic studies only as a social competition device (Masur & Benedito, 1974). One might reasonably have expected that the active and extensive investigation of heredity and maze learning originating with Tolman (1924) would have been extended to the runway—the ultimate simplification of the maze. The present study examined genetic variation in runway performance as reflected in strain differences. In other disciplines, recent years have seen a major concern with precise specification and standardization of lines of laboratory animals (International Committee on Laboratory Animals, 1971). This study is one of a number of studies (Harrington, 1971a, 1971b, 1979a, 1979b, 1979c, 1979d, 1979e, 1979f, 1979g, 1979h; Harrington & Hellwig, 1979a, 1979b) intended to provide behavioral standardization data for those 12 genetically defined lines of rats having the highest citation frequency in the behavioral literature.

METHOD

Subjects

Subjects were 567 rats, 114-128 days of age, with a minimum of 20 animals of each sex within each of the following 12 inbred strains: ACI/Har, A990/Har, A35322/Har, F344/DuHar, INR, IR, MNR/Har, MNRA (formerly MNR-a/Har), MR/Har, TS1, TS3, WAG/Har. All lines are designated by the standard nomenclature for this species and are described in the fourth international listing (Festing & Staats, 1973). Animals were bred and maintained at 25.5°C ± 1.1°C and 40% ± 5% relative humidity. Breeders and pups were housed under natural light cycle. Pups were handled for 1 min on alternate days from age 14 to 45 days. At 45 days they were transferred to individual cages with 24-h light cycle. More detailed descriptions are available elsewhere (Harrington, 1968).

Apparatus

The apparatus was a black closed runway 152.4 by 9 by 9 cm with a 5.4-cm opening in the top covered with 1.25-cm wire mesh. Sides and top were rapidly removable for conversion to an open runway. The runway was suspended in a white ganzfeld. Start- and goalboxes were 34.9 cm long with start and end gates 11.5 cm from the runway. The cross-section was the same as that of the closed runway except that top was solid between gate and runway. Proceeding from start to end, photocells were mounted 6.35 cm past the start gate and 4 cm past the end gate.

Procedure

Starting 2 weeks prior to testing, subjects were placed on restricted food intake and progressively reduced to 85% of projected ad-lib body weight. One day of pretraining preceded testing. Each animal was fed 10 45-mg Noyes pellets. After the pellets were consumed, each animal was transported to the test-apparatus site in its home cage. Five pellets were placed at the end of the goalbox. The animal was placed in the goalbox with head toward the gate. After the pellets had been consumed, the animal was returned to its cage. This goalbox feeding sequence was repeated twice more, first with three then with two pellets. Animals were tested for 10 days for 10 massed trials/day with alternate trials on the closed and the open runways. Reinforcement was 1 pellet/trial. Time between photocells was automatically recorded. Animals were arbitrarily assigned a running time of 5 min if they failed to enter the goalbox within that time period.

RESULTS AND DISCUSSION

The mean and standard deviations of running time per trial are shown for each strain and sex combination in Table 1. The fastest strains were MNRA, INR, TS3, and WAG. However, the INR line showed less intrastrain variance than did the others. This would seem to render it particularly useful for runway studies. In that context it is of some historical interest to note that this strain was created by inbreeding from the stocks used by Spence. The F344 line was distinguished by its poor runway performance.

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Table 1
Running Time of 12 Inbred Strains of Rats in an Alternating Closed and Open Runway

	Mean Time per Trial*			
	Males		Females	
Strain	Mean	SD	Mean	SD
ACI/Har	145	79	86	71
A990/Har	144	82	164	103
A35322/Har	98	64	92	86
F344/DuHar	209	84	164	76
INR	60	37	27	9
IR	143	78	103	53
MNR/Har	77	80	45	72
MNRA	48	63	31	52
MR/Har	90	74	37	29
TS1	138	82	52	31
TS3	59	44	34	28
WAG/Har	62	57	33	27

Note–N ≥ 20 for each sex within each strain.
**10 trials/day for 10 days.*

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