The Transfer of Passive Avoidance of Darkness From Rats to Mice

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The purpose of this project was to investigate the possibility that a brain extract from a donor rat trained to avoid darkness would cause an untrained recipient mouse to avoid darkness if the extract was injected into or fed to it.

The donor male Sprague-Dawley rat was trained to avoid a dark chamber by administering five 5-sec shock periods on six consecutive days. One hour after the last training session, the donor was sacrificed, its brain excised and quick-frozen within 30 sec of death, and stored at 0 C for future use. One day after the brain was excised it was macerated in a Potter-Elvehjem tissue grinder with 10 ml distilled water. This suspension was then centrifuged at 20,000 g for 1 hr at 0 C and the supernatant was then frozen for future use. An extract was prepared, in the same way, from an untrained donor.

Male Swiss albino mice, used as recipients, were tested for dark preference on 3 consecutive days. Those mice which did not spend at least 90 sec of a 3-min test in the dark on each of 3 days were discarded.

Nine mice were divided into 3 groups as follows: Group A (control) received no extract; Group B was subdivided so that 2 mice received 0.5 ml untrained-brain extract intraperitoneally and one mouse received 0.5 by force feeding; Group C consisted of 3 mice treated as those of Group B except that trained-brain extract was used.

Each day for 7 days the mice were individually tested for 5 min. The basic procedure listed here was taken from personal correspondence with Dr. G. Unger, Baylor University College of Medicine, Texas Medical Center, Houston, Texas.

The data were analyzed as a split-plot design in time (Steel and Torrie, 1960). Period in days was treated as subplot. The main plot consisted of mice. The other four treatments were considered as a 2×2 factorial in time. One of the factors was training of the donor rats and the other was the method of administering the extract to the mice.

The least squares analysis (Steel and Torrie, 1960) of data given in Table I is shown in Table II.

Table III exhibits average responses due to type of material mice received from donor rats.

The mice that received material from the trained rat spent on the average, 167 fewer seconds in the dark box than those mice that received untrained rat material. This difference, indicated in the statistical analysis, is significant at the 1% level. The method of administering the material showed little or no difference.

The effects due to time in days and methods of treatments are shown in Table IV.

The analysis of variance shows a highly significant effect due to the interaction of days with type of donor rats. The main effects of days is also very large. The mice that were force fed followed the same response pattern as those receiving the same material intraperitoneally.

TABLE I. NUMBER OF SECONDS MICE SPENT IN DARK BOX

Type of Donor	Administering Method	Mouse No.	Day 1	2	3	4	5	6	7	Total
Trained	Injected	1	17	0	8	0	0	130	105	260
		2	10	0	0	0	0	90	145	245
	Force Fed	1	30	0	0	0	0	69	150	249
Un-Trained	Injected	1	190	295	200	137	115	300	155	1392
		2	170	290	218	137	130	287	170	1402
	Force Fed	1	169	291	200	231	119	301	145	1456
Control		1	246	200	205	159	139	200	201	1350
		2	205	209	200	189	180	210	205	1398
		3	300	230	215	169	179	190	239	1522

TABLE II. ANALYSIS OF VARIANCE OF THE TIME MICE SPENT IN A DARK BOX AFTER BEING ADMINISTERED BRAIN MATERIAL FROM DONOR RATS.

Source	D. F.	Mean Square
Total	62	
Treatments (T)	4	
Control vs. Others	1	99,233**
Trained vs. Untrained (B_1 vs. B_2)	1	291,000**
Injection vs. Force Fed (C_1 vs. C_2)	1	147
$B \times C$ Interaction	1	186
Among Mice in Treatments (pooled) (Error for testing above contrasts)	4	2,274
Days	6	10,909**
Days $\times$ Treatments ($D \times T$)	24	
$D \times A$	6	4,145**
$D \times B$	6	10,208**
$D \times C$	6	544
$D \times B \times C$	6	735
Mice $\times$ Days in Treatments (pooled)	24	326

** Indicates Significance at the 1% level.

A represents control vs. others.

B represents training of donors.

C represents method of administering extract.
D represents periods in days.

TABLE III. AVERAGE TIME IN SECONDS THE MICE SPENT IN THE DARK BOX.

Type of Donor Rat	Methods of Administering		
	Injection	Force Fed	Average
Trained	36 (14)*	36 (7)	36 (21)
Untrained	200 (14)	208 (7)	203 (21)
Control	———	———	203 (21)
Average	118 (28)	122 (14)	144 (63)

*The values in parentheses indicate the number of observations used to obtain the associated average.

TABLE IV. AVERAGE TIME TO THE NEAREST SECOND THE MICE SPENT IN THE DARK BOX DURING THE 5-MIN TEST EACH DAY IN EACH TREATMENT.

	Material from Trained Rat			Material from Untrained Rat			
	Injected	Force Fed	Avg	Injected	Force Fed	Avg	Control
Number of Mice	2	1	3	2	1	3	3
Day 1	13	30	19	180	169	176	250
2	0	0	0	293	291	292	213
3	4	0	3	209	200	206	207
4	0	0	0	137	231	168	172
5	0	0	0	123	119	121	166
6	110	69	96	294	301	296	200
7	125	150	133	163	145	157	215
Avg.	36	36	36	200	208	203	203

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LITERATURE CITED

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