

Maternal retrieving behavior in rats as predicted by locomotor activity and weight of six-day-old pups

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On the 6th day postpartum, retrieval latencies, body weights, and two activity measures were quantified for the 88 pups of 10 primiparous albino rat mothers. Sex of the pups was identified on the 22nd day and stepwise linear regression analyses were performed. If individual differences among mothers are ignored, the best predictor of retrieval latency is pup activity: Mothers retrieve their less active pups faster. If individual differences are held constant, mothers retrieve their lighter pups faster. These findings are in contrast to studies in which inactivity was experimentally produced by killing or sedating the pups as well as to popular legends which assert that mother animals give preferential treatment to their stronger pups.

Smith and Berkson (1973) have reported that primiparous mothers retrieve their active young significantly faster than their nonactive young at 5 days of age postpartum. Nonactive young were sedated with Nembutal. No differences in retrieval times were found at 2, 10, and 15 days postpartum. Beach and Jaynes (1956) compared retrieval of two living and two freshly killed pups and observed that "during the first minute of the test most females showed a tendency to retrieve living pups more rapidly than dead ones [p. 114]."

Both pairs of authors emphasize the important stimulus properties of rat pup motility as one of the determinants of maternal retrieval behavior, though Smith and Berkson, by identifying the postpartum ages at testing, clearly indicate that the phenomenon seems to be limited to optimum retrieval age (Rosenblatt & Lehrman, 1963).

It should be noted that Smith and Berkson, like Beach and Jaynes, are comparing active and nonactive pups rather than comparing retrieval behaviors in response to varying levels of "normal" pup activity. To conclude that maternal retrieval preference for active as opposed to sedated or dead young is related to the cultural belief that animal mothers behave differentially towards their stronger and weaker young clearly goes beyond the data.

The present study was designed to examine several characteristics of 6-day postpartum rat pups to determine whether any combination of characteristics would permit reliable prediction of maternal retrieval behavior.

METHOD

Subjects

Ss were 10 primiparous Charles River albino rats, who were housed individually in 76 x 30 x 31 cm terraria from the 5th day

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prepartum until their litters were weaned. LD 12 : 12 (lights on: 0600) lighting conditions were maintained.

Procedure

On the 6th day postpartum each infant was weighed, color coded with nontoxic food coloring, placed 61 cm from the nest for retrieval testing, tested for locomotor activity, and toe clipped for future identification as to sex.

After weighing to the nearest 0.1 g and color coding, the pups were returned to the nest with their mother for 15 min of adaptation before the entire litter (maximum of nine) was moved in a group to the out-of-nest position. The mother was briefly removed. At the replacement of the mother, timing of retrieval was begun. Three Os recorded these retrieval latencies by stopping 10-pulse/sec impulses to electromechanical counters as each of their three pups was returned to the nest. A fourth O confirmed the color code as each pup was placed in the nest by the mother.

Locomotor activity for each pup was quantified as the latency to leave a 6.5-cm-diam circle and the number of circles and quadrants entered, where the consecutive concentric circles increased by 2.5-cm increments.

Data for all measures were recorded according to each pup's unique color code within litter and then translated to toe clipped number. On the 14th day of age each pup was ear punched, and on the 22nd day the sex of each pup was identified.

RESULTS AND DISCUSSION

First-order correlations were computed for retrieval latency, latency to leave the center circle, number of circles and/or quadrants entered, body weight, and sex. Following this analysis, a stepwise linear regression analysis was performed to determine whether any of these variables or combinations of variables provided a reliable predictor of retrieval latency.

First-order correlation coefficients indicated that both activity measures correlated at above chance levels with retrieval latency and with each other. All mothers tended to retrieve less active pups faster and more active pups more slowly. In addition, body weight of the pups correlated significantly with activity: The lighter the pup, the less active it was. Finally, after the sex of the pups was determined on the 22nd day postpartum, sex was (coded male = 0, female = 1) correlated with body

Table 1
First-Order Correlations for Retrieval Latency, Circle Leaving Latency, Lines Crossed, Sex, and Body Weight of Pups on Day 6

Variable	RL	CL	LC	Sex	Weight
RL	1.000				
CL	-.330**	1.000			
LC	.448***	-.403***	1.000		
Sex	-.171	.077	-.245*	1.000	
Weight	.126	-.174	.207	-.331**	1.000

Note—RL = retrieval latency, CL = circle leaving latency, and LC = lines crossed.

* $p \leq .05$

** $p \leq .01$

*** $p \leq .001$

weight. Female pups tended to weigh less than males on Day 6 (see Table 1).

Since the stepwise linear regression program used would only accommodate 50 sets of observations, a random sample of 50 pups was drawn from the original 88. All litters were about equally represented, and no first-order correlation from the sample differed significantly from that obtained on the original population.

The line-crossing activity measure was found to significantly predict retrieval latency ($F = 12.07$, $df = 1/48$, $p < .002$).

$$\bar{Y} = 111.5 + 2.64X$$

When the correlation of line crossing and retrieval latency was held constant, partial correlations of the remaining variables with retrieval latency were not sufficient to warrant their inclusion in the prediction equation.

It is clear from the present analysis that, when the range of pup activity is within normal limits, mothers tend to retrieve their less active pups faster than their more active pups. This finding is in direct contrast to the findings of Beach and Jaynes (1956) and Smith and Berkson (1973) for active and experimentally produced nonactive pups. Whether this difference is attributable to the complete lack of mobility of the experimental nonactive pups or to some other stimulus property of the pup produced by the treatment is at present unclear.

What is clear is that, contrary to popular legends which assert that mother animals favor their stronger (more active?) infants, these mothers did just the opposite.

Since a Sex by Litter ANOVA on the retrieval latency scores indicated highly significant differences among litters ($F = 6.47$, $df = 9/70$, $p < .0001$), it was decided to rank-order code each pup as a function of mean retrieval latency for its litter. Thus, all pups from the litter whose mother had the shortest mean latency were coded as 1s and all pups with the slowest mother were coded 10. All analyses were then repeated with the inclusion of this new variable. As expected, litter was found to correlate significantly ($r = .657$) with retrieval latency. However, when this correlation was held constant, of the partial correlations for the other variables with retrieval latency, only body weight contributed significantly to the regression analysis ($r_{xy \cdot z} = .334$, $F = 5.92$, $df = 1/48$, $p < .02$). Thus, with the unique individual differences of maternal retrieval speed held constant, mothers tended to retrieve their lighter pups faster than their heavier pups.

If it is assumed that lighter, less active pups are in some sense "weaker" than their heavier, more active siblings, the present findings may be interpreted as providing evidence directly contradictory to the legend that mother animals give their stronger offspring preferential treatment. Nevertheless, these data do not rule out the possibility that mother rats may ignore, or even cannibalize, severely debilitated offspring. Nor should one conclude that wild rat mothers or mothers of other species will show preferential treatment for their lighter and less active young, as did the mothers in the present study.

REFERENCES

- Beach, F. A., & Jaynes, J. Studies of maternal retrieving in rats: III. Sensory cues involved in the lactating female's response to her young. *Behaviour*, 1956, 10, 104-124.
- Rosenblatt, J. S., & Lehrman, D. S. Maternal behavior of the laboratory rat. In H. L. Rheingold (Ed.), *Maternal behavior in mammals*. New York: Wiley, 1963.
- Smith, L., & Berkson, G. Litter stimulus factors in maternal retrieval (*Rattus rattus*). *Animal Behaviour*, 1973, 21, 620-623.

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