interreinforcement intervals (Colotla et al, 1970), but this means of control is limited to intervals that maintain high frequencies of postpellet drinking, i.e., those intervals in which reinforcement is available shortly after the cessation of drinking.

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The primacy of size-age dimension over familial relationships in shock-elicited aggression in rats*

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In a shock-elicited fighting situation, young rats tested between 34 and 47 days of age exhibited significantly more attacks when paired with a littermate as compared with a natural or a surrogate mother. Attack suppression occurred during the initial test sessions only for the natural mother paired with her young when contrasted with the number of encounters between the young and the surrogate mother.

If rats are shocked together, consistent attack behavior is observed. This pain-aggression syndrome was originally conceived as reflexive in character with fighting considered as an unconditional response to pain (Ulrich & Azrin, 1962). Even paired housing over several weeks did not alter the fighting rate, although this latter position has been challenged

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(Roberts & Larson, 1967). Furthermore, fighting is monotonically related to age. From 33 days of age to 43 days, fighting probability (i.e., number of attacks/total number of shocks) increased from .27 to .41 (Hutchinson, Ulrich, & Azrin, 1965).

It was observed by one of us (RPJ) in the Juvenile Court of Bridgeport that behavior-problem children were frequently the recipients of an

inordinate amount of parental beatings. The children, in turn, would aggress toward their peers with such intensity that it was often the cause of law-enforcement difficulties and consequent referral to the Juvenile Court. In an attempt to validate experimentally this clinical observation and to extend the nature of the variables affecting pain-elicited fighting, young rats were shocked in the presence of another peer, their own natural mother (NM), or a surrogate mother (SM). It was hypothesized that young rats paired with their NMs would exhibit less aggression than those paired with SMs. It was further expected that the number of encounters between littermates would be greater than that exhibited in the presence of NM or SM.

SUBJECTS

The Ss were 20 male and 22 female Sprague-Dawley albino rats. There were seven litter groups born within the laboratory: four were all male, one was all female, and two were mixed, i.e., half male and half female. All Ss were weaned at 34 days of age. The seven NMs, weighing on the average 288 g, were matched with seven SMs who had a mean weight of 295 g. Half of all the peer groups were tested in the presence of NM and the other half with SM.

APPARATUS

The experimental chamber measured 10 x 12 x 9 in. Two sides were of sheet metal, while the remaining sides and ceiling were made of clear Plexiglas. The grid floor consisted of 20 steel rods, 1/8 in. in diam and spaced .5 in. apart. A small 15-W lamp provided the sole source of illumination in the darkened testing room. Auditory masking was provided by a white-noise generator. Scrambled shock was delivered by a Lafayette constant-current stimulator. Shock intensity was 1.50 mA for the first 3 days and 1.75 mA for the remainder of testing.

PROCEDURE

On the day after weaning, each young was paired with either a NM or SM and with another young from the same litter group. This resulted in three pairings per litter-test group, i.e., young No. 1 was shocked with young No. 2, and both were independently shocked with the mother. The order of testing was balanced throughout the experiment and was identical for all litter groups.

A trial consisted of 30 shock presentations. Since each S was tested twice per day, a total of 60 shocks for 12 consecutive days was administered. The intershock interval was 8 sec, while shock duration was 1 sec. The intertrial interval was 60 sec.

Fig. 1. Median number of attacks between the young pitted against either the natural or surrogate mothers.

The major dependent variable was the number of attacks observed by two independent judges. An attack was defined as any manifestation of the stereotyped fighting posture of Ulrich & Azrin (1962) on the part of either S. This stance consisted of rearing on the hind legs with back arched, teeth bared, and paws raised to head level in boxer-like fashion. In order to be considered an attack, this posture had to be coupled with vigorous pawing and biting movements, resulting in physical contact with the other S. Inter-O reliability was always greater than 90% agreement in defining an attack.

RESULTS

Figure 1 presents the median number of attacks observed in the presence of NM or SM. While there was a tendency over the first 5 days of

testing (ages 35 to 39 days) for the number of interactions between young and NM to be less than that exhibited between the young paired with SM, only the differences between the first 2 days proved to be statistically reliable (Mann-Whitney $U_s = 7.5$ and 9.0 , $ps = .016$ and $.054$, respectively, $n_1 = n_2 = 7$).

Figure 2 presents the median number of encounters between the peers of both NM and SM, as well as the number of attacks between either mother and the combined scores of both young in each litter-test group. By combining the total number of attacks out of 60 shock presentations accumulated by both young against a particular mother, it would be even more difficult to demonstrate discriminated aggression. However, the

largeness of this effect is strikingly obvious. Except for the first 4 or 5 days, young pitted against young of either mother exhibited significantly more aggression than the combined scores of both young pitted against NM or SM throughout the remainder of testing. ($U_s = 0-11$, $ps = .000-.049$, $n_1 = n_2 = 7$).

DISCUSSION

These findings indicate that the size-age dimension rather than familial relationships exerted a stronger influence on the pain-aggression syndrome. Evidence was presented indicating that the consanguineous relationship was correlated with attack suppression over only the initial days of testing. It is unclear at this time whether this was primarily due to the maternal relationship or the simple expediency of living together for 34 days.

Young rats can learn to discriminate their aggression. These animals suppressed their aggression in the presence of a large figure (NM or SM) and were increasingly aggressive toward each other. This may be conceptualized as a decrease in the threshold for aggression in a relatively "safe" situation (peer vs peer), while a threshold increase was exhibited in the "unsafe" situation against the larger figure.

Another important consideration was the age (and size) of the young during testing. Our Ss were weaned on Day 34. Testing began on Day 35 and continued through Day 47. Normally, rats are weaned at 20 days of age. Our animals were deliberately kept with their natural mothers 14 additional days to optimize the NM-child relationship. It was felt this would result in greater attack suppressions between young and NM when contrasted with young and SM. This did not occur except for the first 2 days of testing. It is possible that the experiment began just as some sort of instinctual maternal-child process was decreasing in importance. Perhaps if the rats in this study were weaned and tested between 20-30 days of age, the contrast between NM and SM would have been greater. Future research should clarify the nature of this process.

Fig. 2. Median number of attacks between the peers of both mother groups, and between the combined young of either mother and the mother.

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