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Notes and Comment

Comment on Brain, Benton, Howell, and Jones: "Resident rats' aggression toward intruders"

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Brain, Benton, Howell, and Jones' (1980) objective was "to examine features of residents and intruders that would allow the designing of an aggression test that uses the minimum number of resident animals and produces a faster behavioral response than in previous studies" (p. 331). Four categories of resident and six categories of intruder were employed; combinations of social or isolate housing and intact or castrated male and female intruders were examined.

The following comment is intended as a critical discussion of a few specific methodological issues that have been raised by the procedures described by Brain et al. (1980). In all fairness, the issues are complex, unrefined, and currently appear to be the immediate concern of a relatively small group of active investigators. Furthermore, the literature is dispersed, and no satisfactory, comprehensive reviews are available. However, since Brain et al. (1980) suggest that their approach has some unique advantages, and since they do not appear sensitive to several methodological concerns that have recently surfaced in the few available reports, this comment is aimed at the need for a broader awareness of some problem areas in this field of research. Specifically, this comment will deal with the following items: the ovarian, lactational, and pregnancy status of females used as residents and as intruders; the effects of repeated attacks upon the intruder's behavior; intruder age; age of intruder castration; and the relative importance of test duration.

Age of castration has been identified as a significant variable, particularly in the male, and investigators should specify the approximate age of subjects when the surgery was performed. If castrations of male intruders were prepubertal, one would expect little or no attack by intact male residents, since it has been demonstrated that highly aggressive males (that kill or severely wound intact, mature male intruders) will not attack mature males that were castrated at 1 day of age and minimally attack mature males castrated at either 10 or 30 days of age (Flannelly & Thor, 1978). Since the cohabiting male residents made a median number of 4.5 attacks upon the castrated male intruders used by Brain et al. (1980) during a 10-min exposure, one can assume that castrations were postpubertal. This number of attacks corresponds with that reported by Thor and Flannelly (1976b), who compared attacks by reliably aggressive resident males following exposure to intact males, castrate males, and castrate females. The point is that some readily available information can increase the archival value of a report. For example, the Brain et al. (1980) report may have some bearing upon the significance of interval between castration and test—a potential variable that may merit additional experimental attention—that is, does exposure to gonadal hormones during puberty establish subsequent long-term stimulus characteristics that contribute to attack by residents?

The assumption by Brain et al. (1980) that 3 months of sharing the same cage firmly establishes social organization (p. 332) is probably valid. However, since all subjects were the same age (intruders and residents) at the start of the experiment, this assumption seems to have determined age of intruders as well as social groups. It has been demonstrated elsewhere (Thor & Flannelly, 1976a) that 60-80-day old male intruders are readily attacked by male residents (mean attack latency = 60.4 sec), and the speculation exists that young males are quite vulnerable to resident attack because of peak gonadal testosterone output at puberty. Young males that provoke vigorous resident attack are not correspondingly aggressive as residents! This simple observation seems to convey a variety of implications regarding key theoretical issues, including the reason that male residents concentrate their aggression on novel male intruders. The experimental strategy of using intruders and residents of varying ages would appear to enlarge our understanding of the developmental variables that influence aggression.

Under the subtitle "Aggression Test," Brain et al. (1980) briefly refer to a method of counterbalancing, with each resident unit receiving an intruder of a different type on each day over 6 consecutive days of testing. This was accomplished "in such a way as to counteract the effects of previous behavior on that subsequently observed" (p. 332). But no further descriptive detail or supporting data on order effects are given. The point here is that prior exposure of an intruder to an aggressive resident can modify subsequent aggression-stimulating qualities of the intruder, according to some investigators (Lore, Flannelly, & Farina, 1976). Conversely, colonies of laboratory rats subjected to repeated incursions by for-

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eign males become increasingly aggressive (Blanchard, Takahashi, & Blanchard, 1977). Hence, the details of repeated intruder exposures are of practical as well as of theoretical interest; investigators who limit each intruder to only one test exposure may wish to reconsider their more conservative approach.

Information describing the condition of intact resident females (nonpregnant, pregnant, or lactating) during testing does seem to be necessary. Intact resident females are reported by Brain et al. (1980) as showing significantly more attacks and significantly longer cumulative attack time than castrate females when confronting group-housed female intruders. But one cannot determine from the reported results whether all, some, or any of this difference can be attributed to maternal aggression. A subjective impression by the authors (in the Discussion) suggests that most of the attacks by females may have been by females that had just given birth. Under the subtitle "Residents" (in the Methods section), litters are said to have been "always removed at birth" (p. 331). Did an observer or videocamera maintain continuous observation to assure the removal of pups immediately after birth and before suckling? Litter removal is known to cause a rapid decline in maternal aggression of the lactating rat: "When the litter is removed, fighting levels 4 hr later are reduced to near virgin levels" (Erskine, Barfield, & Goldman, 1978, p. 217). The point is not moot, since maternal aggression in rodents does appear to require suckling (Gandleman & Svare, 1974; Svare & Gandleman, 1976). If pups were removed at birth, why is it suggested by Brain et al. (1980) that "It is likely that this form of attack is related to pregnancy/lactation in female residents" (p. 334), and that "this form of attack seems related to the 'maternal' aggression described elsewhere" (p.334)? Furthermore, since postparturitional estrus occurs within hours after giving birth, one may also question whether any copulation occurred immediately prior to or during testing that could have influenced reactive behavior to a foreign conspecific (see Thor & Flannelly, 1979). In a similar vein, it would be of interest to know if female intruders were tested for ovarian state prior to test, that is, were some females sexually receptive during exposure? Some male residents may have exhibited more copulatory than aggressive behavior. It is also conceivable that a resident male may have faced the challenge of exposure to simultaneously receptive resident and intruder females.

Brain et al. (1980) stress the functional utility of their proposed 10-min aggression test. It has long been noted, however, that intruder-elicited aggression in rats is remarkably tenacious; an alpha male may hound a male intruder for days or weeks (Barnett, 1955). This dogged persistence has been observed in laboratory rats as well as in wild rats and seems to raise a number of interesting questions that could profitably be explored in a variety of laboratory experiments. By limiting their aggression test to 10 min, Brain et al. (1980) may have missed some interesting data describing change in quality and/or intensity of aggression over time.

Sexual dimorphism in social stimulation of aggressive behavior is undoubtedly a critical variable, and laboratory observations of intruder-elicited aggression will certainly contribute to our further understanding of aggressive behavior. However, determinants of intruder-elicited attack have only recently been subjected to controlled, experimental investigation, and the adoption of any single paradigm would seem to be unwarranted at the present, early stage of investigation. On the contrary, it appears that a broader acceptance of diversity in theoretical and experimental designs would be a more productive research strategy and a stimulus to new effort.

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