Mating and responsiveness to a nociceptive stimulus

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Ten minutes of mating produced transient changes in the responsiveness to a nociceptive stimulus. Responsiveness to a nociceptive stimulus was measured by placing the animals on a hot plate. Mating produced a transient increase in escape latencies of males and a transient decrease in escape latencies of females.

It has recently been reported that mating increases the amount of beta endorphin immunoreactive material in the peripheral circulation of male hamsters (Murphy, Bowie, & Pert, 1979). One of the difficulties in interpreting this observation is the ambiguity about the ability of peripherally circulating beta endorphin to penetrate the blood-brain barrier and act directly on the brain (Cheung & Goldstein, 1976; Kobayaski, Palkovits, Miller, Chang, & Cuatrecasas, 1977; Ogawa, Panerai, Lu, Forshack, Havlicek, & Friesen, 1979). Beta endorphin is a potent centrally acting analgesic (Tseng, Loh, & Li, 1976), and Tseng, Ostwald, Loh, and Li (1979) have demonstrated that the effects of exogenously administered beta endorphin in hamsters can be antagonized by opioid antagonists.

Since mating has been demonstrated to produce a reduction in responsiveness to nociceptive stimuli in male rats (Szechtman, Simantov, & Hershkowitz, Note 1) and vaginocervical stimulation produces analgesia in female rats (Komisaruk, 1974), the present experiment was designed to determine whether mating stimulation decreases responsiveness to a nociceptive stimulus in either male or female hamsters. This experiment used a warm-plate procedure sensitive enough to detect the analgesic effects of 10 mg/kg of morphine sulfate in female and male hamsters (Ostrowski, 1979). In female hamsters, this dose of morphine produces effects on female sexual behavior roughly comparable to the effects of the amount of mating stimulation used in the present study (Ostrowski, 1979).

METHOD

Subjects

The subjects were 59 adult (from 60 to 90 days of age) Syrian hamsters (*Mesocricetus auratus*), 20 males and 39 females, purchased from Engle's Laboratory Animals, Inc. (Farmersburg,

Indiana). They were housed by sex in groups of four animals per cage, in solid-bottom plastic cages (30 x 30 x 17 cm). Purina Rat Chow and water were always available in the home cages. The colony room was maintained at 22°C on a 14-h/10-h light-dark cycle, with the onset of the dark phase of the cycle occurring at 1400 h. The females had been ovariectomized under sodium pentobarbital anesthesia and received a subcutaneous estradiol implant at that time (Noble, 1977). Females were injected with progesterone (.4 mg in .1 ml of oil injected subcutaneously) 4 h before testing. Sexually active males and receptive ovariectomized females, housed in the same room, were used in the mating session.

Apparatus

A round (15-cm-diam) hot plate maintained at 43.5°C ($\pm 1.5^\circ\text{C}$) was used for the analgesia test. The hot plate was enclosed with hardware cloth mesh (1.27 x 1.27 cm). For the mating session, a glass chamber (13 x 25 x 38 cm) was used.

Design

The subjects were assigned to four different groups: Group 1 was formed of females (N = 20) that were permitted to mate with sexually active male hamsters. Group 2 was formed of males (N = 10) that were permitted to mate with a stimulus female. The subjects of Group 3 (N = 19 females) and the subjects of Group 4 (N = 10 males) were not permitted to mate but were placed in the test chamber alone for 10 min. All subjects were tested for analgesia within 5 sec of being removed from the test chamber and retested for analgesia 30 min later. Testing began at 1600 h.

Procedure

Mating session. Each subject was placed in a test chamber for 10 min, and at the end of this time a stimulus female or a sexually active male was introduced into the test chamber. The subjects were permitted to mate, and the number of intromissions and ejaculations were recorded. The experimental subjects were removed from the test chamber immediately after the first ejaculation occurring between 9 and 10 min after the first intromission. Upon removal, the subjects were tested immediately for analgesia. The subjects of the control groups were maintained in the test chamber for 10 min and then were tested for analgesia.

Analgesia test. After the mating sessions, all subjects were tested for analgesia. Each subject was placed on the hot plate. The latencies to paw shake and to escape were recorded, and the number of paw shakes was scored. A paw shake was scored whenever the subject removed one leg from the floor with rapid movements of the paw. Escape was recorded as soon as the subject had all four legs in contact with the cloth mesh. Thirty minutes later, all subjects were retested on the hot plate, following the same procedure.

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Table 1
Mean Latencies (in Seconds) to Paw Shake and Escape
Measured on the Hot Plate after 10 Min of Mating

		Time Postmating			
		Immediately		30 Minutes	
	N	Mean	SEM	Mean	SEM
Paw-Shake Latency					
Mated					
Females	20	33.45	6.40	11.42	1.87
Males	10	41.51	5.35	15.52	3.45
Unmated					
Females	19	27.50	3.60	19.37	9.84
Males	10	35.04	8.35	20.67	5.10
Escape Latency					
Mated					
Females	20	75.73	6.57	23.43	5.24
Males	10	87.54	14.78	39.50	10.32
Unmated					
Females	19	77.97	9.98	66.86	13.49
Males	10	71.58	7.97	33.05	6.62

RESULTS

Latency to Paw Shake

A two-way ANOVA for repeated measures was used to evaluate the data. Immediately postmating, both males and females had longer latencies to paw shake than did the unmated controls, but the main effect of mating was not significant. Overall, there was a decrease in the latency to paw shake with repeated testing [trials, $F(1,55) = 434.47$, $p < .001$], and the interaction between mating and repeated testing was produced by a much larger decrease in paw-shake latency of the mated animals, both males and females, with repeated testing (see Table 1).

Latency to Escape

There were no significant main effects of either sex or mating on latency to escape. In all groups, the latency to escape decreased with repeated testing [$F(1,55) = 33.69$, $p < .001$] and a significant interaction between mating and trials [$F(1,55) = 3.84$, $p < .05$]. Mated animals displayed a larger decrease in escape latency than did unmated animals. Mated males had higher average escape latencies than did unmated males, but mated females had lower average escape latencies than unmated females (see Table 1).

DISCUSSION

Although no significant main effects of mating were observed, the interactions between mating and repeated testing suggest that mating may produce a transient analgesia. While mating appears to slightly modify the response to the nociceptive

stimulus used in the present experiment, mating has less effect on the responsiveness to the hot plate than does 10 mg/kg of morphine sulfate (Ostrowski, 1979). The interaction between sex and the effects of mating, which can be interpreted as indicating that mating has more of an analgesic effect in males than in females, is potentially interesting because, while several studies have demonstrated the effects of opioid antagonists on male sexual behavior (Gessa, Paglietti, & Pellegrini Quarantotti, 1979; Hetta, 1977; Murphy et al., 1979; Myers & Baum, 1978), opioid antagonists have little if any effect on sexual behavior in female hamsters (Ostrowski, 1979; Ostrowski, Stapleton, Noble, & Reid, 1979). Possibly, the endogenous opioids play a larger role in male sexual functioning than in female sexual functioning.

REFERENCE NOTE

1. Szechtman, H., Simantov, R., & Hershkowitz, M. *Effects of naloxone on copulation in rats and the role of endogenous opiates in a spontaneous rewarding behavior*. Paper presented at the meeting of the Society for Neuroscience, Atlanta, 1979.

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