Reaction of male mouse fighters to male castrates treated with testosterone propionate or oil*

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Pretrained male mouse fighters were tested against male castrates injected with testosterone propionate or oil. The fighters showed a greater amount of aggressive acts toward hormone-treated castrates than oil-treated ones. Results were discussed in terms of aggression-promoting pheromone mediated by androgen.

In a previous experiment, Lee & Brake (1971) have established that male mouse fighters make differential reactions to mature male and female mice. The fighters are more aggressive towards males than towards females. Two mechanisms may explain this finding: the female pheromone may inhibit the male aggressive tendency, and the male pheromone may elicit aggressive acts of the fighters (Mugford & Nowell, 1970a). The second possibility was investigated, and the results indicated that the fighters attacked intact males more often and for a longer period of time than deodorized males. The fighters likewise showed differential reactions towards sham-operated and castrated males. Mugford & Nowell (1970b) have also reported that fighters showed a greater amount of aggressive acts towards androgenized females than towards ovariectomized or intact females. Thus, androgen may be the mediating agent for the production of aggression-eliciting pheromone. The present experiment provides further behavioral evidence to support this notion. Male mouse fighters were tested against castrates receiving testosterone propionate (TP) injections and castrates injected with oil. If androgen was indeed the mediating agent of the aggression-promoting pheromone, the fighters should be more aggressive towards hormone-treated males.

SUBJECTS

Eight male DBA/2J (DBA) inbred

mice were trained to be fighters. They were purchased from Jackson Laboratory at 6 weeks of age and housed singly upon arrival. They were trained to fight at 13 weeks of age, and tested when 17 weeks old.

Sixteen mature A/J (A) mice were tested when approximately 17 weeks old. All animals were maintained with food and water ad lib, except during testing periods.

APPARATUS

The apparatus was a living quarter consisting of two compartments, each measuring 18 x 18 x 18 in. There was a hole in the partition allowing the mice to enter each compartment. Two stopwatches and one electric timer were used to record latencies of attack and cumulative attack time, and a hand counter was used to register the number of attacks. TP, purchased from Searl Chemical Company, was dissolved in commercial Wesson oil (200 micrograms per .2 ml).

PROCEDURE

Training Fighters

The mouse was trained to fight with a combination of the dangling and the latency methods (Scott, 1966). Twenty daily trials of the dangling method were given. After the last trial, a passive mouse was placed in the compartment next to the one occupied by the S for a maximal interval of 3 min. As soon as the fighter attacked, the mice were separated. At the end of the training, all fighters attacked a passive mouse within 3 min.

Experiment Proper

All A mice were castrated. Three weeks after castration, half of the mice were injected with 200 micrograms of TP for 5 days and the other half were injected with oil. One day after the last injection, the mice were tested. Three days before testing, the fighter was given 10 trials of training with the dangling method and then released in the living quarter, which contained a nesting box and nesting materials. Food, water, and the nesting box and materials were removed before a S was

placed in the compartment opposite to the one occupied by the fighter. The social interactions were observed for 30 min after the first attack took place. The latency of the first attack, the total number of attacks, and the cumulative time of attack were recorded. In addition to these measures, the social interactions, such as grooming, sniffing, and chasing between the animals, were also noted.

On the first testing session, half of the fighters were tested with hormone-treated and the other half with oil-treated Ss. The testing order was reversed on the second session. The two sessions were separated by 1 nontesting day. Bedding, nesting materials, food, and water were changed before a new fighter was tested. One fighter escaped after the first testing session; thus, the data of this S were not included in the analysis.

RESULTS AND DISCUSSION

Table 1 shows the mean latency of the first attack, the mean number of attacks, and the mean cumulative attack time. DBA fighters did not show a differential response to TP-treated or placebo Ss in terms of the mean latency of the first attack, as indicated by Wilcoxon matched-pairs signed-ranks test. However, the fighters attacked TP Ss more often ($T = 0, p < .01$) and for a longer period of time ($T = 0, p < .01$) than did placebo Ss. Thus, trained fighters were more aggressive towards hormone-treated castrates than towards oil-treated ones.

Two explanations are offered to account for the results. The first one is that TP-treated castrates may react aggressively to the fighters and thus increase the probability of the aggressive tendency of the fighters. The following reports tended to support this hypothesis. Beeman (1947) reported that androgen-treated castrated mice restored their preoperation fighting tendency. Tollman & King (1956) demonstrated that androgen-treated intact mice were more aggressive than oil-treated intact mice. However, the observation of social encounters among animals did not seem to substantiate this view. The TP-treated A mice never initiated any

Table 1
Mean Latency, Number of Attacks, and Cumulative Attack Time Exhibited by Fighters Toward TP-Treated or Oil-Treated Castrates

Latency	Oil	51.71 Sec
	TP	41.50 Sec
Number of Attacks	Oil	16.30
	TP	33.40
Cumulative Attack Time	Oil	9.36 Sec
	TP	23.64 Sec

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aggressive acts and never fought back when attacked by fighters. The second explanation, a more plausible one, is that TP treatment might produce aggression-promoting odors in treated mice. Thus, fighters react to the signal with an increase of aggressive attacks. Mugford & Nowell (1970b) have demonstrated the same differential reactions of aggressive male mice towards TP-treated spayed females and oil-treated spayed controls. Recently, it was found that androgen injection released aggression-promoting

pheromone from urine and the preputial gland (Mugford & Nowell, 1970a, 1971).

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