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# Yohimbine does not impair performance on an olfactory discrimination

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The anxiogenic compound yohimbine inhibits intermale attack and increases conspecific sniffing; however, it decreases preference for male odors. This experiment explored the generality of yohimbine's olfactory effects by assessing drug effects on searching for buried food items. Drug treatment had no effect on the location of buried or unburied rewards. This finding suggests that yohimbine's olfactory effects may be restricted to conspecific odors. These findings underscore the need for further study of olfactory function among drugs having antiaggressive effects in common.

There is increasing evidence that the aggression-modulating effects of a rather heterogeneous array of drugs may be importantly mediated by their effects on olfactory processes. The potent antiaggressive drug fluprazine (DU 27716), for example, not only inhibits conspecific attack and increases conspecific sniffing during social interactions (e.g., Flannelly, Muraoka, Blanchard, & Blanchard, 1985; Olivier, van Dalen, & Hartog, 1986) but also increases preferences for conspecific male odors (Kemble, Schultz, & Thornton, 1986) and moderately impairs the location of buried food items by olfaction (Thornton & Kemble, 1986). Generally consistent with this suggestion, the antiaggressive actions of both diazepam and scopolamine have also been suggested to be at least partially mediated by drug-induced shifts in olfaction (Dixon, 1982; Soffie & Lamberty, 1988). The present experiment examined the effects of treatment with the potent anxiogenic compound yohimbine on olfactorially guided food searching. In previous research, we (Kemble, Behrens, Rawleigh, & Gibson, in press) found that this drug inhibited attack behavior, increased conspecific sniffing, and produced a transient decrease in preference for conspecific male odors. If yohimbine's olfactory effects are somewhat generalized, as they appear to be for fluprazine, then some disruption of this olfactory discrimination might be expected.

## METHOD

### Subjects

The subjects were 18 experimentally naive male Holtzman albino rats, weighing 340-452 g at the beginning of the experiment. The rats were individually housed in stainless steel cages throughout the experiment.

### Apparatus

Testing was conducted in a 113×113×46 cm open field constructed of 0.6-cm plywood painted flat black. The floor of the open field was covered with 6 cm of fir shavings and divided into 22×22 cm segments by white lines that continued up each wall to permit accurate placement of the food beneath the shavings.

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### Procedure

All animals were prehandled for 2-3 min/day and given a single piece of chocolate-flavored cookie on 2 consecutive days. At the conclusion of prehandling, the rats were food deprived, and training was initiated 23 h later. The 23-h deprivation schedule was continued throughout the experiment. Amount of food (Purina Lab Chow) was adjusted to maintain the rats at 75%-85% of ad-lib weights. The rats received one trial per day throughout the experiment.

During the first 14 trials, the rats were trained to locate a 2.5-g (±0.5 g) piece of chocolate-flavored cookie (Nabisco Oreo), which was placed on the surface of the fir chips in the center of one of the 25 open-field segments. The position of the reward was randomly varied over trials. On each trial, the rat was gently placed in one corner of the apparatus and given up to 10 min to locate and grasp the cookie. Latencies were recorded by stopwatch. Any uneaten reward was placed in the home cage with the rat at the end of the trial. By Trial 14, the rats achieved a high level of accuracy in locating the reward (100% success rate for all rats on Trials 7-14).

On Trial 15, the effects of yohimbine on reward finding at the surface were assessed. Latency-balanced groups of 9 rats received intraperitoneal injections of 2.0 mg/kg yohimbine (drug group) or an equivalent volume of isotonic saline (saline group) 30 min prior to the trial. At the conclusion of Trial 15, the rats received ad-lib access to food and water for 5 days to allow for recovery from drug effects before training was resumed.

On Trials 16-29, the rats were trained to locate the reward when it was buried beneath the fir shavings. The depth of the reward was gradually increased to 1.0 cm (Trials 26-29), and training continued for four additional trials. At the end of this training period, the rats located the buried reward with high accuracy (100% success rate for all rats during the last four trials).

Drug effects on buried reward retrieval were assessed on Trial 30. Thirty minutes prior to this test, the rats ($n$ = 9) that had previously received saline injections were treated with yohimbine, and the rats ($n$ = 9) that had previously received yohimbine were injected with saline.

## RESULTS AND DISCUSSION

The mean latency of the drug group to locate rewards placed on the surface ($M$ = 34.0 sec) was considerably higher than that of the saline group ($M$ = 10.0 sec); however, this was due entirely to the aberrant performance of 1 drug-treated rat (latency = 203 sec). The performance of all other rats was similar, with no suggestion of a group difference [$t(16) = 1.10, p > .10$]. When the reward was buried (Trial 30), the retrieval latencies of both groups increased similarly (drug group, $M$ = 48 sec;

saline group, $M = 33$ sec), with no reliable group difference ($t < 1.0$).

Yohimbine decreases male conspecific odor preference (Kemble et al., in press) but has no effect on discrimination. This may reflect a rather specific shift in reactivity to conspecific odors. Generally consistent with this possibility is the selective effect of the antiaggressive drug scopolamine on responsiveness to the odors of familiar, but not unfamiliar, juveniles (Soffie & Lamberty, 1988) and the aggression-enhancing olfactory properties of urine from diazepam-treated mice (Dixon, 1982). Indeed, the potent increases in freezing behavior, decreases in attack, and hypoalgesia (Rodgers & Randall, 1986; Williams & Scott, 1989; Williams, Worland, & Smith, 1990) produced by the odors of dominants or cats also lend plausibility to this suggestion.

Alternatively, however, it might be suggested that yohimbine's apparent olfactory effects are, in fact, secondary to its well-characterized anxiogenic properties (e.g., Charney, Heninger, & Redmond, 1983; Davis, Redmond, & Baraban, 1979; Harris & Newman, 1987; Tsuda, Ida, & Tanaka, 1988). It should be noted, however, that drug effects on odor preference were found among animals thoroughly familiar with, and presumably unafraid of, the preference apparatus (Kemble et al., in press). If olfactory effects were entirely secondary to anxiogenesis, it would seem that yohimbine should have been without effect. Moreover, though some forms of exploration seem to be inhibited by yohimbine (e.g., File, 1986), novel open-field entries are unaffected (Rawleigh, Gibson, & Kemble, 1990), suggesting that anxiogenic effects may be somewhat situation dependent. The fact that social interaction tests are among the most reliable and sensitive indicators of anxiogenic and anxiolytic drug effects (e.g., File, 1980; Guy & Gardner, 1985) argues that some aspect of the social encounter is a particularly potent source of anxiogenesis. If so, drug-induced shifts in olfactory responsiveness may be important contributors to their anxiolytic, anxiogenic, and/or antiaggressive actions. In any case, the possible mediation of these actions via altered olfactory function clearly merits closer examination.

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