Rat (Rattus norvegicus) Defensive Behavior in Total Darkness: Risk-Assessment Function of Defensive Burying

John P. J. Pinel, Dave G. Mumby, Farhad N. Dastur, and J. Gregory Pinel

Although rats (Rattus norvegicus) spend much of their lives in the darkness of burrows, defensive behavior in the dark has rarely been studied. We compared rats' reactions to aversive stimuli in dark and lighted 2-alley, burrowlike environments. Experiment 1 assessed reactions to an unsignaled airblast: Experiment 2 assessed neophobic reactions to an unfamiliar steel ball. Half of the rats were tested in light and half, in total darkness. In both experiments rats directed defensive burying and stretched approach toward the aversive stimulus. Darkness increased airblast-induced burying behavior but not burying behavior toward the unfamiliar object; it had no effect on stretched-approach behavior in either experiment. Because the location and nature of the aversive stimulus was ambiguous in Experiment 1 but not in Experiment 2, these results support the hypothesis that risk assessment is one function of defensive-burying behavior.

In the past decade the ethoexperimental approach has led to major advances in the study of rat defensive behavior (see R. J. Blanchard, Brain, Blanchard, & Parmigiani, 1989). This behavior has been studied in laboratory paradigms that mimic certain key features of threatening situations that rats are likely to encounter in the wild. The studies have focused on the responses of rats to various threatening test stimuli, some natural and some more controllable: potential predators (e.g., R. J. Blanchard, Blanchard, Rodgers, & Weiss, 1990), attacking conspecifics (e.g., D. C. Blanchard & Blanchard, 1990a), play-fighting conspecifics (e.g., Pellis, 1988), male conspecifics approaching the nest site (e.g., Stern & Kolunie, 1991), prey (e.g., Pellis et al., 1988), grid shock (Lester & Fanselow, 1992), and dangerous inanimate objects (e.g., Pinel & Mana, 1989). Our own ethoexperimental studies assess the defensive reactions of rats to an airblast (Experiment 1) and to an unfamiliar inanimate object (Experiment 2).

There has been recent interest in the effect of darkness on rat defensive behavior (Lester & Fanselow, 1992). In our studies we examine the effect of total darkness on the reactions of rats to threat. We initiated this line of research for two reasons. First, because many wild rats spend much of their lives in totally dark burrows, it seemed appropriate to assess their defensive behavior under similar conditions. Second, because total darkness precludes the gathering of visual information about threatening objects, we hypothesized that certain risk assessment behaviors would be more prevalent in the dark. In particular, we hypothesized that the defensive burying response would be more prevalent in the dark than in the light, in accordance with Coss and Owings's (1978) hypothesis that it serves a risk-assessment function (see D. C. Blanchard, Blanchard, & Rodgers, 1991). Coss and Owings reported that ground squirrels located a snake in a darkened laboratory burrow system by spraying dirt down its various arms (i.e., by using the defensive burying response) until they elicited a response from the snake. Once the ground squirrels located the snake, they constructed a dirt barrier between themselves and the snake, again by using the defensive burying response.

The term defensive burying refers to the rodent behavior of pushing, spraying, or otherwise moving materials toward or over sources of threat. This response can take a variety of forms, but when rats are tested on a homogeneous particulate substrate, such as sand or commercial bedding material, they typically propel the material with alternating forward pushing movements of their forepaws and shovelling movements of their heads. Defensive burying was coined before it became apparent that this behavior could serve a variety of defensive functions other than the covering (i.e., the burying) of threatening objects (see Pinel & Wilkie, 1983).

Our two experiments follow from the experiments of Pinel, Mana, and Ward (1989). Pinel et al. studied the interactions of rats with the source of a single brief electric shock in a burrowlike test chamber. The test chamber had two alleys, so that the topography of the rats' behavior in the alley with the shock source (i.e., the experimental alley) could be compared with the topography of their behavior in the other alley (i.e., the control alley). The floor of the test chamber was composed of commercial bedding material. The rats spent a substantial proportion of the test period directing stretched-approach sequences (Grant & Mackintosh, 1963; Van der Poel, 1979) and defensive burying sequences (Pinel & Treit, 1983; Pinel & Wilkie, 1983) down the experimental alley but not down the control alley.

Experiment 1

The purpose of Experiment 1 was to test Coss and Owings's (1978) theory that one function of rodent defen-
sive burying behavior is risk assessment. We tested this theory by assessing the responses of rats to threat in a two-alley burrowlike environment similar to the one used by Pinel, Mana, and Ward (1989). The experimental rats were habituated and tested in total darkness; the control rats were habituated and tested in light. Our hypothesis was that rats tested in darkness would spray more bedding down the experimental alley than rats tested in light because the former lack visual information about the location and the nature of the threat. We also hypothesized that darkness would influence the incidence of stretched-approach behavior, but we did not predict the direction of this influence because good cases could be made for predicting both increases and decreases: Darkness might increase stretched approach by making it necessary to approach the aversive object to investigate it, or darkness might decrease stretched approach by eliminating the ability of vision to guide it.

The aversive stimulus in Experiment 1 was a single brief blast of compressed air to the face. There were two reasons for our choice of this aversive stimulus, rather than the more conventional electric shock. First, we decided to use an airblast because we assumed that risk-assessment behaviors would be most prevalent in situations in which both the location and the nature of the threat were ambiguous. Because the delivery of an airblast does not involve contact with a palpable stimulus object, we assumed that an airblast delivered in total darkness would be ideal for inducing risk-assessment behaviors. Second, we decided to use an airblast as the aversive stimulus because it typically elicits low levels of defensive burying under conventional lighting conditions (e.g., Terlecki, Pinel, & Treit, 1979). Because we were hypothesizing darkness-induced increases in defensive burying above the levels observed under normal lighting, it seemed prudent to use an aversive stimulus that had been shown to elicit low levels of burying.

Method

Subjects. Twenty 275- to 325-g male Long-Evans rats served as subjects. They were housed in groups of 2 or 3 in plastic cages with commercial ground corn cob bedding. They had continuous access to laboratory chow and water. The colony room was maintained on a 12:12-hr light–dark cycle, with light onset at 0800 hr. All handling, habituation, and testing occurred during the light phase. The rats were handled for about 2 min per day during each of the 9 days before the start of the experiment.

Apparatus. The test chamber is shown in Figure 1. It had black Plexiglas walls and a clear Plexiglas top and measured 32 cm wide × 19 cm high × 60 cm long. It comprised a start compartment (8 × 32 cm), a central compartment (20 × 32 cm), and two parallel alleys that led from the central compartment (each 32 × 9 cm). The floor of the chamber was evenly covered with a 5-cm layer of corn cob bedding. At the level of the bedding, in the center of the wall that divided the start compartment from the central compartment was a hole, 5 cm in diameter. A guillotine door could be lowered over the hole to contain the rat in the start compartment. Similar holes provided passage between the central compartment and each of the two alleys (there were no guillotine doors over these holes). A row of 35 air circulation holes (0.8 cm in diameter) lined the walls of both alleys and the central compartment 5 cm above the surface of the bedding. On the test day, a single blast of air was delivered to all subjects through a glass pipette, which had been inserted through a small hole at the end of one of the alleys, 5 cm above the level of the bedding. The pipette was connected by vinyl tubing to a tank of compressed air.

The test chamber was enclosed in a light-tight cabinet, which was situated in a dark testing room. The rats were observed and videotaped by an infrared camera (Panasonic WV-CD810) that was mounted on the ceiling of the light-tight cabinet. A 40-W white incandescent light mounted next to the camera provided illumination for the subjects that were habituated and tested in light.

Procedures. The 20 rats were randomly assigned to one of two groups (n = 10). Then, they received four habituation sessions, one per day for 4 consecutive days. To begin each habituation session, a rat was placed in the start compartment with the guillotine door lowered, the lid of the test chamber was secured, the door to the light-tight cabinet was closed, and, approximately 1 min later, the guillotine door was raised. The rat was removed approximately 10 min later. The conditions of habituation were different for the rats in the two groups, but they did not change from session to session. The rats of one group (dark group) were habituated in total darkness; those in the other group (light group) were habituated in light.

Figure 1. The test apparatus.
The test session was conducted on the day after the final habituation session. All rats were tested under the lighting condition to which they had been habituated. Before testing, an air-blast pipette was mounted through the end of one of the alleys. To begin each test session, the rat was placed in the start compartment, the test chamber lid was secured, the door to the light-dark cabinet was closed, and approximately 1 min later, the guillotine door was raised, which allowed the rat to move through the other compartments. When the rat approached to within 4 cm of the pipette, a brief blast of air (0.5 s, 4 psi) was delivered to its face. The 15-min test period began immediately after the air blast.

All habituation and test sessions were videotaped and subjected to systematic analysis. The amount of time that each rat spent engaging in defensive burying and stretched approach was determined from the videotapes. Burying behavior is the forward pushing or spraying of bedding material with the forelimbs or snout (see Pinel, Symons, Christensen, & Tees, 1989). It typically occurs in bursts; a burst was considered to have ended when no bedding was moved for 1 s. Stretched approach is forward movement in a low, elongated, concave-back posture (see Pinel, Mana, & Ward, 1989). It occurs in sequences, which begin when the rat elongates its body by moving forward with its forepaws while leaving its hindquarters stationary. A sequence of stretched approach typically ends when the rat nears the target of its stretched-approach sequence and leans forward to sniff it or palpate it with its vibrissae in a posture of immobility (which has been termed stretched attention). We considered a sequence of stretched approach to have ended when the rat broke its stretched posture, typically by backpedaling away from the target of its approach. We divided total burying time and total stretched approach time into five categories, depending on their apparent target: (a) the end of the air-blast alley, (b) the end of the control alley, (c) the entrance to the air-blast alley, (d) the entrance to the control alley, and (e) none of these four targets.

Statistical analyses. Fisher’s exact probability tests were used to assess the significance of differences among the groups in the proportion of rats that displayed defensive burying and stretched approach. Other measures were subjected to analysis of variance. The criterion of statistical significance was $p < .05$ (two-tailed) for all comparisons. Burying scores were not normally distributed; some of the subjects displayed no burying behavior. Nevertheless, we subjected the defensive-burying results to parametric analysis for the sake of consistency with our analysis of the stretched-approach data; nonparametric analyses, the results of which are not reported in this article, revealed the same pattern of statistical significance.

Results

A few subjects displayed defensive burying and stretched approach during the four habituation sessions, but most did not. Accordingly, the differences between the groups during the habituation sessions were insignificant, as were the declines that occurred in both behaviors over trials. On the last habituation session before the test, the overall mean durations of defensive burying and stretched approach were approximately 4.0 and 1.5 s, respectively. However, during the test session, the rats in the dark condition directed substantially more burying at the end of the experimental alley and at the entrance to the experimental alley than did the rats in the light condition.

The top panel of Figure 2 illustrates the proportion of rats in each group that displayed defensive burying behavior and stretched approach behavior during the test session. More of the rats in the dark group displayed defensive burying during the test session than did the rats in the light group, but this difference was not statistically significant, $p > .05$. 

Figure 2. The incidence of defensive burying and stretched-approach behaviors under dark and light conditions in Experiment 1.
All rats engaged in stretched approach. The bottom panel of Figure 2 illustrates the mean amount of time that all of the rats in each group spent engaging in defensive burying and stretched approach. The rats in the dark group spent significantly more time burying than did the rats in the light group, $F(1, 18) = 4.36, p < .05$. There was no significant effect of the lighting condition on the amount of time spent in stretched approach.

Figure 3 illustrates the mean amount of time that the rats in each group spent directing their burying behavior (top panel) and stretched-approach behavior (bottom panel) at each of the four targets during the test. The amount of burying and stretched approach that was not directed at one of these four targets was negligible ($M < 2$ s) in both conditions.

Analysis of the data in Figure 3 revealed different patterns of statistical significance for burying and stretched approach. There was a significant main effect of target on both burying, $F(3, 72) = 3.51, p < .05$, and stretched approach, $F(3, 72) = 39.62, p < .001$. In contrast, lighting condition had a significant effect on burying, $F(1, 72) = 7.01, p < .001$, but not on stretched approach, $F(1, 72) < 1.00$. The interaction between the effects of target and lighting condition on burying was almost statistically significant, $F(3, 72) = 2.46, p < .07$; the interaction between the effects of target and lighting condition on stretched approach was not, $F(3, 72) < 1.00$. The interaction between the effects of target and lighting condition on burying reflected the high levels of burying that were directed at the end of the experimental alley and the entrance to the experimental alley in the dark condition (see Figure 3).

Discussion

In Experiment 1, a single blast of air to the face of rats elicited numerous sequences of stretched approach and defensive burying (see Figure 2). Most of the sequences of stretched approach and defensive burying were directed at the end of the experimental alley or the entrance to the experimental alley; few were directed at the end of the control alley or the entrance to the control.

Our hypothesis that defensive burying would be more prevalent under conditions of total darkness was confirmed. There was little defensive burying in the light condition (see Figure 2), and what little there was was directed equally down both the experimental and control alley (see Figure 3). This observation is consistent with Coss and Owings’s (1978) suggestion that rodents use the defensive burying response to locate sources of threat in dark environments. The rats that received the air blast in the dark could have no precise knowledge of the nature (e.g., animate or inanimate) or the precise location of the threat. In contrast, the rats that received the air blast in light could readily see the pipette through which the air blast was administered.

An alternative interpretation of the elevated levels of defensive burying in tests in darkness is that the rats may have been more fearful (see Lester & Fanselow, 1992). Arguing against this interpretation is the observation that the levels (see Figure 2) and distribution (see Figure 3) of stretched approach were almost identical in the two lighting conditions. The duration and direction of stretched approach has previously been shown to be sensitive to different levels
of foot shock (Pinel, Mana, & Ward, 1989). Also arguing against this interpretation are the results of Experiment 2.

Experiment 2

If risk assessment is one function of defensive burying in the dark, less defensive burying may occur in dark environments in which the nature and location of the threatening stimulus is unambiguous. In Experiment 2, we assessed the effect of lighting condition (dark vs. light) on the defensive burying that was elicited by an encounter with an unfamiliar, inanimate object. We hypothesized that darkness would not significantly increase such neophobic burying because the rats would obtain substantial tactual information about the location and nature of the test object during their initial contact with it and thus have less need to engage in risk assessment through defensive burying.

Experiment 2 also served to test the alternative interpretation of the results of Experiment 1, that is, that the rats spent more time burying the air-blast source when they were tested in the dark because they were more fearful. Unlike the risk-assessment hypothesis, this hypothesis predicted that rats would spend more time burying sources of threat in the dark than in the light, regardless of their degree of ambiguity.

Method

Subjects. Forty 275- to 325-g male Long-Evans rats served as subjects. They were housed under conditions identical to those of Experiment 2, and they were subjected to similar prehandling.

Apparatus. The test chamber was the one that had been used in Experiment 1.

Procedure. The 40 rats were randomly assigned to one of four groups \((n = 10)\). Then, they received four habituation sessions, one per day for 4 consecutive days. The rats in two of the four groups were habituated and tested in the dark; the rats in the other two groups were habituated and tested in the light. The conditions of habituation were identical to those of Experiment 1, except that the test object was present in the test chamber during habituation for the rats in one of the two dark groups and for those in one of the two light groups. The test object was a steel ball, 7 cm in diameter. It was positioned at the end of one of the alleys (the right alley for half of the rats in each group and the left alley for the other half) during each habituation session, always at the end of the same alley for a given rat.

The test session was conducted on the day after the final habituation session. Each rat was placed in the start compartment, the test chamber lid was secured, the door to the light-tight cabinet was closed, and approximately 1 min later, the guillotine door was raised. All rats were tested under the lighting condition to which they had been habituated. The steel ball was situated at the end of one of the alleys during all tests; thus, the rats in two of the groups that had been habituated without the ball (the neophobia groups) encountered the ball for the first time during the test, whereas the rats in the two groups that had been habituated with the ball (the control groups) encountered the ball for the fifth time during the test (in the same position as it had been during the habituation sessions). Accordingly, the design was a 2 \( \times \) 2 factorial with the following four groups: (a) dark–neophobia, (b) light–neophobia, (c) dark–control, and (d) light–control. The 15-min test session began as soon as each rat contacted the ball.

All habituation and test sessions were videotaped and subjected to analysis. We measured the same behaviors that were measured in Experiment 1, the total amount of time spent burying and in stretched approach and the amount of time spent directing burying and stretched approach at various targets. These targets included (a) the ball, (b) the entrance to the ball alley, (c) the end of the control alley, and (d) the entrance to the control alley. We also measured the amount of time that each rat spent contacting the ball when they first encountered it during the test. The statistical analyses were the same as those of Experiment 1.

Results

As in Experiment 1, the levels of defensive burying and stretched approach were low during the four habituation sessions, and none of the differences between days or conditions during the habituation phase was statistically significant. On the last habituation session before the test, the overall mean durations of defensive burying and stretched approach were 7.7 s and 8.4 s, respectively (also see the control data in Figure 5). The main finding of Experiment 2 is that during the test the rats in the neophobia groups directed more defensive-burying and stretched-approach behavior at the ball than did the rats in the control groups. As hypothesized, there was no significant effect of lighting condition on any of the measures.

The top panel of Figure 4 illustrates the proportion of rats in each group that displayed defensive-burying and stretched-approach behavior on the test day. More of the rats in the two neophobia groups displayed burying behavior than did the rats in the two control groups, but this difference was not statistically significant \((p = .07)\). All rats engaged in stretched approach.

The bottom panel of Figure 4 illustrates the mean amount of time that the 10 rats in each group spent in defensive-burying and stretched-approach behavior. The rats in the two neophobia groups spent significantly more time burying, \(F(1, 36) = 14.38, p < .001\), and significantly more time in stretched approach, \(F(1, 36) = 23.18, p < .001\), than did the rats in the two control groups. The main effects of the lighting condition and the interaction effects were not statistically significant.

Figure 5 illustrates the mean amount of time that the rats in each group spent directing their defensive burying behavior (top panel) and stretched-approach behavior (bottom panel) at the four targets during the test. The amount of defensive burying and stretched approach that was not directed at one of these four targets was negligible \((M < 0.02)\) in all conditions. Analyses of the data in Figure 5 revealed the same general pattern of statistical significance for defensive burying and stretched approach. There was a significant main effect of target, for burying, \(F(3, 144) = 16.76, p < .0001\), and for stretched approach, \(F(3, 144) = 45.68, p < .0001\), a significant main effect of the neophobia condition versus the control condition, for burying, \(F(1, 144) = 18.75, p < .0001\), and for stretched approach, \(F(1, 144) = 34.65, p < .0001\), and no significant effect of light
RAT DEFENSIVE BEHAVIOR IN THE DARK

Figure 4. The incidence of defensive burying and stretched-approach behaviors under dark and light conditions in Experiment 2.

Figure 5. The targets of defensive burying and stretched approach in the two neophobia groups. In contrast, there was little defensive burying or stretched-approach behavior in the two control groups during the tests (see Figure 4). The vast majority of the defensive burying and stretched approach that was observed in the neophobia subjects on the test was directed at the ball (see Figure 5). As hypothesized, lighting condition had no significant effect on defensive burying. Also, it had no significant effect on stretched approach. These observations are consistent with one of the two interpretations of the results of Experiment 1, but they are inconsistent with the other: They are consistent with the suggestion that the defensive burying response can serve a risk-assessment function in rats, but they are inconsistent with the suggestion that rats are generally more fearful in the dark.

The results of Experiment 2 confirm previous reports of neophobic burying in rats. Terlecki et al. (1979) were the first to show that rats will bury unfamiliar objects that are encountered in familiar test environments. In Terlecki et al.’s study, male rats buried an unfamiliar flash cube and a mouse trap but not a wire-wrapped dowel or a piece of vinyl

Discussion

An encounter with an unfamiliar steel ball in a familiar test environment elicited sequences of defensive burying and stretched approach in the two neophobia groups. In
tubing. Although the neophobic burying of wire-wrapped dowels is rare in both male or female rats of all ages, Pinel, Petrovic, and Jones (1990) recently found that lactating female rats reliably bury them when they are encountered near the nest site.

**General Discussion**

Our experiments were conducted for two purposes, one general and one specific. The general purpose was to compare rats' reactions to threat in totally dark or in lighted burrowlike environments. The observation of differences in the ways that rats respond to threat in these environments (Experiment 1) suggests that future studies of rat defensive behavior must not focus exclusively on their behavior in the light (see also Lester & Fanselow, 1992). Because many rats live in the dark, this is particularly true of ethoexperimental studies whose primary objective is to gain insights into how rats defend themselves in their natural environments.

The specific purpose of our experiments was to evaluate Coss and Owings's (1978) theory that one function of the rodent burying response is risk assessment. When considered together, the results of Experiments 1 and 2 support this theory. Our hypothesis was that the defensive burying response would be more prevalent in situations in which the source of threat was ambiguous. In Experiment 1, the experimental subjects were confronted with such a situation: They received a blast of compressed air to the face from an unknown source in a totally dark environment. In support of the risk-assessment hypothesis, these rats displayed much more burying behavior than did the control rats, which were tested in the light. The experimental rats in Experiment 2 were also tested in the dark, but the threatening stimulus in this experiment was a concrete object, an unfamiliar steel ball. Because the rats thoroughly palpated the ball when they first encountered it, its location and general nature were unambiguous. As hypothesized, the rats in Experiment 2 that were tested in the dark did not direct significantly more burying behavior at the steel ball than did the rats that were tested in the light. The theory that rats are more defensive in the dark can account for the results of Experiment 1 but is inconsistent with the results of Experiment 2.

Support for our premise that the air blast in Experiment 1 was a more ambiguous aversive stimulus than the unfamiliar steel ball in Experiment 2 can be derived from a comparison of the top panels of Figures 3 and 5. In Experiment 1, much of the burying behavior was poorly directed: Over half occurred in the central compartment and was directed at the entrance to the airblast alley rather than directly at the end of the alley, where the airblast was experienced. In contrast, in both the dark and the light neophobia conditions of Experiment 2, almost all burying behavior occurred in the experimental alley and was directed at the steel ball. The relative levels of threat-directed defensive burying in the two experiments are consistent with the view that ambiguous sources of threat attract more defensive burying behavior—albeit less directed—than well-defined sources. In Experiment 1, 63.2 s of defensive burying in the dark (29.7 s + 33.5 s) was directed in the general direction of the air blast (see Figure 3), whereas in Experiment 2 only 45.4 s of defensive burying in the dark (42.8 s + 2.6 s) was directed in the general direction of the steel ball in the neophobia condition.

Although defensive burying was the focus of the present experiments, stretched approach, another putative risk-assessment behavior, was monitored in both. In both experiments, the aversive stimuli were the focus of numerous stretched-approach sequences. The presence of comparable levels and distributions of stretched-approach behavior in both experiments suggests that the aversiveness of the two test stimuli was approximately the same—Pinel, Mana, and Ward (1989) found the levels and distribution of stretched approach to be sensitive to variations in the level of footshock. However, lighting condition had no significant effect on the prevalence or direction of stretched-approach behavior in either experiment. This result was unanticipated because the topography of rat stretched-approach sequences seems to be influenced by visual feedback in some situations (see Pinel, Mana, & Ward, 1989). Our finding that the incidence of rat stretched-approach behavior was unchanged by total darkness suggests that rat stretched-approach behavior can also be controlled by nonvisual feedback. In the dark, stretched-approach behavior presumably provides the rat with olfactory and vibrissae-mediated tactile feedback.

The rats that were tested in the light did not perform stretched-approach sequences from behind piles of accumulated bedding, as described by Pinel, Mana, and Ward (1989). There are several possible explanations for this discrepancy, but the most likely is that the aversive stimuli that we used in these studies (i.e., an airblast and an unfamiliar object) were not aversive enough to elicit them—Pinel, Mana, and Ward (1989) used an 8-mA electric shock.

Risk assessment has recently become an important focus of defensive-behavior research (see D. C. Blanchard et al., 1991; Pinel & Mana, 1989). There are two reasons for the burgeoning interest in this aspect of defense. First, the revelation that rats and other animals (see MacDonald & Pinel, 1991) respond to threat in ethoexperimental contexts by engaging in a variety of behaviors that appear to be aimed at acquiring information about sources of threat has supported a more cognitive view of animal defensive behavior (e.g., D. C. Blanchard et al., 1991). Second, recent experiments have shown that risk-assessment behaviors respond differently to physiological and pharmacological manipulations than do other defensive behaviors. For example, Gray, Terlecki, Treit, and Pinel (1981) showed that lesions of the posterior septum, which greatly intensify defensive attack in rats, abolish defensive burying, and D. C. Blanchard and Blanchard (1990b) found that injections of diazepam at doses that had little effect on other defensive behaviors, significantly reduced the stretched-approach behavior that was directed by rats at a wooden block saturated with cat odor or the entrance to a chamber in which they had previously seen a cat. Our observation that darkness increases the defensive burying of a source of aversive stimulation raises the issue of how darkness affects other de-
defensive responses, such as freezing, flight, and defensive attack.

In summary, in Experiment 1 rats directed more defensive burying at the source of a single airblast when they were tested in darkness than when they were tested in light. Two explanations were proposed for this observation: First, defensive burying serves a risk-assessment function in rats when there is no visual information about an ambiguous source of threat, or second, rats are generally more fearful in the dark. The observation in Experiment 2 that darkness did not increase the neophobic burying of a palpable, and thus presumably less ambiguous, test object supports the first interpretation but not the second.

References


Received February 5, 1993
Revision received July 29, 1993
Accepted August 3, 1993