THE EFFECT OF SYNTHETIC SCOTOPHOBIN ON MOTOR ACTIVITY IN MICE

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Abstract. The motor activity of mice treated by scotophobin (1, 2, 4, 6 μg) was tested in a photoresistor actometer 24, 48 and 72 h after injection. Scotophobin in doses of 4 and 6 μg per mouse increased significantly the motor activity as compared with controls injected with saline only. This result suggests that shortening of dark box time, found by some authors after injection of scotophobin, seem to be the consequence of the enhanced motor activity of mice. Thus the effect of scotophobin on the behavior of animals is not specific and this substance can not be considered responsible for the “memory transfer”.

INTRODUCTION

The basis of the so called “memory transfer” is the assumption that learned behavioral patterns may be transmitted to naive animals by means of substances formed in the brain during training. Ungar named scotophobin the pentadecapeptide isolated from the brains of rats trained to avoid darkness. According to him and some others (1, 4, 6, 7, 9, 10) scotophobin is specifically responsible for the transfer of “fear of the dark”. This finding has been the subject of controversy (3, 8, 12). We were also not able to replicate the essentials of Ungar's results (13).

In our investigation concerning methodological aspects of Ungar's experimental procedure we have found insufficient support for Ungar's assumption that the “dark box time” (DBT) of normal noninjected mice does not change during testing (11). We also observed a high negative cor-
relation between DBT and the number of runs from one part of the maze to another. This result seems to indicate that the shortening of DBT observed after injection of scotophobin may be a secondary effect due to the influence of this peptide on motor activity of the mice. In Ungar's type of maze, it is impossible to simultaneously measure DBT and motor activity. The number of runs does not appear to be a precise enough indicator of mobility. The aim of the present experiment was to check by means of more sensitive measurement with the use of actometer, whether scotophobin affects the motor activity of mice.

**MATERIAL AND METHODS**

Male Swiss-albino mice weighing about 25 g obtained from commercial supplier were used. Standard diet (pellets) and water for drinking was provided ad lib. The animals were randomly divided into two groups: the experimental mice were injected i.p. with synthetic scotophobin dissolved in saline, while control animals were given saline only (0.3 ml of 0.9% NaCl per mouse). In Experiment I, 29 scotophobin injected and 9 saline injected mice were used; the former group received doses of 1, 2 and 4 µg scotophobin per mouse, and the motor activity was measured 24 h after injection in all experimental and control mice. In Experiment II 29 mice were examined; 14 mice received 6 µg of scotophobin and 15 mice served as control. Motor activity was tested three times in both groups; 24, 48 and 72 h after injection. The motor activity was measured in a photoresistor actometer and movements of each mouse were recorded by means of a photocell. Each animal was put into the actometer separately for 1 h and the activity was determined after 15, 30, 45 and 60 min. The control and scotophobin injected animals were tested at the same time each day in the morning.

The results were analysed with mixed design ANOVA (5), additionally some results were examined by Duncan test.

**RESULTS**

For Experiment I a 4 × 4 of mixed design ANOVA indicated that the number of movements across the successive 15 min intervals (0–15, 16–30, 31–45, 46–60 min) among the three groups of scotophobin injected animals (1, 2 or 4 µg Sc per mouse) and one control group were statistically significant \((F = 3.75, \ df = 3/34, \ P \leq 0.05)\). Further, statistically significant differences were found in the activity of mice during the four blocks of 15 min intervals \((F = 62.72, \ df = 3/9, \ P \leq 0.001)\). The
interaction between different doses of scotophobin and the four intervals of time was not a significant source of variation. Figure 1 shows the activity counts in three experimental and control groups during 1 h of testing. One can see the increase of motor activity in mice injected with 2 and 4 μg of scotophobin, but only after 4 μg was this increase significant (P ≤ 0.05, Duncan test). In relation to the control group, mice injected with 1 μg of scotophobin showed an overall lower level of motor activity, although this effect was not statistically significant.

![Graph showing the effect of different doses of scotophobin](image)

**Fig. 1.** The effect of different doses of scotophobin (Sc) on the motor activity of mice.

The results of Experiment II (Fig. 2) with a higher dose of scotophobin than in Experiment I clearly show that this substance increased the motor activity of mice as compared with controls. This effect was found in all period of time investigated: 24, 48 and 72 h after injection of 6 μg of scotophobin (F = 8.07, df = 1/27, P ≤ 0.01). The number of movements did not change in experimental or control group during each of the three successive days of observation.

Differences in mobility of the mice during the four consecutive inter-
vals of the 1 h test on all 3 days were significant \((F = 67.45, df = 3/81, P \leq 0.001)\). Duncan test clarified this finding by indicating that the number of movements in the first 15 min block was higher \((P \leq 0.01)\) than the subsequent 15 min blocks, which did not differ from each other. The interaction of test intervals and dose level was not significant.

![Graph showing the increase of the motor activity of mice in different time after scotophobin (Sc) injection.](image)

**DISCUSSION**

Our results show that high doses of scotophobin (4 and 6 μg) raise the motor activity in mice for at least up to 3 days after injection (longer periods of time were, however, not examined). Up to now, it is difficult to explain the mechanism of this effect. One possibility might involve the action of scotophobin compared to that of some other short peptides nonspecific to the CNS. For example low molecular peptides obtained by digestion of fibrinogen and injected i.p. or i.c. depress the motor activity of highly active rats, while they stimulate that of moderately active rats (11). Other alternative could be that scotophobin acts in a man-
ner similar to neurohormones. De Wied (2) demonstrated that the derivatives of scotophobin affect the passive avoidance performance and extinction.

Our assumption that scotophobin acts unspecifically on behavior of the animals is in agreement with the ideas of Miller (8) and Goldstein (3). Experiments by Miller have indicated that rats trained by Ungar's procedure do not learn to avoid darkness but "come to avoid other apparatus cues", and therefore the substance synthetized in the brain would not be specifically related to a dark avoidance reaction. On the other hand, scotophobin appears in the brain during the first days of the training and thereafter the amount of this peptide gradually diminishes, although the dark avoidance reaction in the animals is well consolidated. It seems therefore that the presence of scotophobin may be connected with nonspecific arousal. Scotophobin applied to naive animals may provoke arousal, which in our experiments was reflected by increased motor activity. Goldstein, among other objections to Ungar's experiments, suggested that training of dark avoidance reaction is stressful to the animals and scotophobin synthetized in the brain is connected only with the stress of animals and does not specifically affect the behavior of naive animals. This substance may, among other effects, cause the increase in motor activity.

The authors are gratefuly indebted to Professor Jerzy Maj for the facilities to use the actometer. We are greatly indebted to Professor Kazimierz Zielinski for a critical review of the manuscript. Synthetic scotophobin was obtained from Professor George Ungar. This investigation was supported by Project 10.4.1.01 of the Polish Academy of Sciences.

REFERENCES


Accepted 11 September 1977

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