DIURNAL RHYTHMS IN THE NEST-BUILDING
BEHAVIOUR OF FEMALE MICE

by

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(With 5 Figures)
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INTRODUCTION

Diurnal rhythms in the behaviour of mice and other species, both in the wild and in the laboratory, are well documented (for reviews see Aschoff, 1963; Hinde, 1970). Mice are nocturnal in natural environments (e.g. Crowcroft, 1966); and laboratory studies have shown that locomotor activity, as measured by running wheels and activity cages, is bimodally distributed, with a major peak just after dusk and a somewhat smaller one just before dawn (Aschoff, 1951, 1960; Tribukait, 1956; Wiepkema, 1966). Feeding behaviour of mice is also subject to a marked diurnal rhythm (Anliker & Mayer, 1956; Larsson & Strom, 1957; Wiepkema, de Ruiter & Reddingius, 1966).

The purpose of the present study was to extend knowledge of diurnal rhythms in this species to another behaviour, namely nest-building. Van Oortmerssen (1971) reports that mice make and repair their nests just before dawn, in preparation for the following day's sleep, but the source of this information is not given. In support of this claim, Van Oortmerssen found that if mice maintained on a reversed light schedule were given access to nest material just before light onset, the intensity of nesting behaviour was greater than if material was made available just after light offset. However since the animals had had no previous experience of the test situation, and were allowed only a single 5 min exposure to nest material, the behaviour which was observed may have been related more to exploration of the novel

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stimulus than to nest-building. The possibility of diurnal variation in nest-building therefore required further investigation, using a technique which did not interfere with the animal's daily routine. Recently developed procedures for delivering nest material automatically as reinforcement for the performance of an operant response (Jansen et al., 1969; Oley & Slotnick, 1970; Roper, 1973a, 1973b) are well suited to such a task, since they allow the behaviour to be selectively monitored with a high degree of accuracy, whilst leaving the animal relatively unconstrained.

EXPERIMENT 1

METHODS

a. Subjects.

Subjects were five nulliparous female mice of strain RAP (albino), obtained from the Department of Genetics, University of Cambridge. They were littermates, aged 12 to 14 weeks at the start of testing, and weighing from 25.4 to 29.1 gm.

b. Apparatus.

Each animal lived throughout the experiment in a two-compartment metal cage, consisting of a feeding compartment (28 × 22 × 20 cm), and a nest-box (12 × 22 × 20 cm), linked by a circular doorway (see Fig. 1). The front walls of both compartments were glass, so that the animal was observable. Food pellets and water were continuously available in the feeding compartment.

An operant panel, on which were mounted a paper dispenser and a response key (Campden Instruments Ltd), could be attached to the rear wall of the feeding compartment. The response key was 2.5 cm in diameter and centred 3.0 cm above the cage floor, and was back-illuminated by a green light. The paper dispenser enabled strips of paper (10 cm long × 1.25 cm wide) to be unwound into the cage from a continuous reel, by means of an electric motor. The paper appeared through a slot in the panel located 1.5 cm above the floor and 6.0 cm from the response key, and each strip had to be nibbled off by the animal.

Each experimental cage was housed in a sound-attenuating chamber in a sound-proof room, maintained at 23°C ± 1/2°, and continuously flooded with white noise of intensity 75dB. Subjects were maintained on a LD 12:12 light cycle, with light onset at 13.00 hrs. Each chamber was individually illuminated by a 15W white bulb during the light period, and by a 15W red bulb during the dark period.

Operant responses and delivery of paper were automatically programmed and recorded by means of electronic and electro-magnetic apparatus located outside the experimental room.

c. Procedure.

Subjects were placed in their experimental environments 14 days before the start of testing, and were provided with nests of newspaper strips. They were then trained to key-press for paper by the method of shaping successively closer approximations to the desired response (Ferster & Skinner, 1957). Shaping sessions lasted for two hours daily, and occupied the last two hours of the 12 hour dark period. Nests were removed two hours prior to the session. Delivery of each paper strip was accompanied by offset of the key-light for 0.75 sec, which was the length of time necessary for the strip to be unwound into the cage.

After shaping, which took from three to eight sessions, subjects were allowed access to the operant panel for two hours per day for a further five days, to ensure that