

another hamster, either male or female, was introduced into the cage of a female on heat. Pulses of 22–30 kHz were heard when the resident female nosed the stranger. This occurred both immediately on introduction and also later during the observation if the female on heat had maintained the rigid mating posture for several minutes without being mounted. Female hamsters are usually very aggressive towards intruders, so the ultrasonic signals may indicate willingness to mate.

In *Acomys* ultrasound at about 50 kHz was detected from a lactating female after her litter had been removed from the nest box.

Another situation in which ultrasound is produced has been found in *Apodemus sylvaticus*. Ultrasonic pulses at 70 kHz have been detected as animals emerged from the nest after the cage had been disturbed. When two pairs of animals were separately put into new cages, no ultrasound was detected immediately in either case, but after 3–5 min pulses were heard as the animals moved around their cages and stood upright on their hind legs. They were often detected while juveniles, 2–3 weeks old, were seen out of the nest and running round the cage in which they were born. It seems possible that in this species ultrasound has an exploratory or territorial function.

These observations in addition to those previously reported¹ show that, among myomorph rodents at least, ultrasound probably plays an important part in several different aspects of social behaviour.

I thank Professor D. R. Arthur for providing facilities for this work, which was carried out during the tenure of a Science Research Council studentship, and Dr J. D. Pye for advice and criticism. This research was supported by the Air Force Office of Scientific Research through the European Office of Aerospace Research, OAR, US Air Force, under a contract to Dr Pye.

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Received January 10, 1968.

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Growth Lines in the Larvae and Adults of Bivalve Molluscs

THE existence of growth lines on the shells of adult bivalve molluscs is well known, but little attention has been given to the significance of similar features in the larvae, although they appear in illustrations, such as those of Ranson¹.

In adults, growth lines are the outer edges of growth layers within the shell. The cyclic nature of these layers has been studied by Barker², who concluded that the five orders of layers represented growth cycles with periods of approximately 6 h, 24 h, 15 days, 6 months and 1 yr. He suggested that the layers result from periodical changes in temperature, salinity, tidal level and other environmental factors.

Larvae of the European oyster *Ostrea edulis*, when grown in the laboratory and when taken from the plankton, show a series of concentric rings on the shell. The rings are of two orders: major rings which seem to correspond in number to the number of days since the larva was released from the parent, and several minor rings between adjacent major rings. This arrangement is like that described by Barker for adult shells, with the larval major and minor rings corresponding, respectively, to the

fourth and fifth order rings of the adult. Both the fourth order adult ring and the major larval ring seem therefore to represent a 24 h rhythm. But in the larva, at least, the occurrence of rings does not seem to result from environmental changes. Typical rings were formed in larvae cultured at constant temperature and illumination, without mechanical disturbance. Furthermore, larvae taken from incubating females of the New Zealand species *Ostrea lutaria* Hutton and the Chilean species *O. chilensis* Philippi have growth rings which number twenty or more. It is significant that in both species the period of incubation is much longer than in *O. edulis*, and extends to about 20 days in *O. lutaria* according to Hollis³ and to 5–6 weeks in *O. chilensis* according to Walne⁴. The number of rings in these species also increases with the number of days of larval life, although the larva during incubation is possibly less subject to daily environmental changes than are the pelagic larvae of *O. edulis*. The larval lines may therefore result from an endogenous rhythm rather than an environmental one. If this is so in the larva, it may also be true of at least the daily (fourth order) lines of adult bivalves. Environmental factors may, of course, modify the expression of an endogenous rhythm.

Barker suggested "laboratory growth experiments and ecological investigations in order to test the hypothesis that growth layering reflects environmental periodicities", and I would add that the part played by endogenous rhythms should also be investigated.

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Received December 7, 1967.

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Female Copulatory Behaviour in Male and Androgenized Female Rats after Oestrogen/Amine Depletor Treatment

FEMALE sexual behaviour patterns are infrequent in adult castrated male rats unless very large doses of ovarian hormones are given^{1,2}. The age at which the rats are castrated is important^{3–5}. Male rats castrated later than 10 days of age and treated as adults with oestrogen in combination with progesterone displayed little feminine behaviour, but when castrated 1–5 days after birth the same hormone treatment caused more distinct female mating behaviour. Absence of androgen a short time after birth leads to behavioural feminization of the male rat.

Testosterone propionate administered neonatally to female rats abolished later feminine mating behaviour in the intact female, and oestrogen and progesterone activated sexual receptivity in ovariectomized rats^{6–7}.

Recent investigations suggest that in the female rat there are monoaminergic pathways which mediate inhibition of female mating behaviour. The oestrous behaviour activated by oestrogen and progesterone in spayed rats was inhibited by increased central nervous concentrations of monoamine^{8–10}, but amine depletors such as reserpine and tetrabenazine induced oestrous behaviour in rats treated with oestrogen even when there was no progesterone treatment, which is otherwise necessary for a response¹¹.

This work describes the extent to which female mating behaviour can be activated with oestrogen in combination with amine depletors in male rats castrated as adults, and in female rats treated neonatally with testosterone and spayed as adults.