THE EVOCATION OF OESTRUS IN THE CUIS, *GALEA MUSTELOIDES*

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In a recent paper, Rood & Weir (1970) suggested that oestrus in *Galea musteloides* was induced by the male. Modification of oestrus by the male is known to occur in mice (Whitten, 1956) and in voles (Richmond & Conaway, 1969). Female mice in small groups will show regular oestrous cycles in the absence of a male, and in *Mus* (Marsden & Bronson, 1964) and *Microtus ochrogaster* (Richmond & Conaway, 1969), proximity of the male and exposure of the females to male excreta are sufficient stimuli to initiate oestrus. Richmond & Conaway (1969) have shown that in the prairie vole, change of cage type or social grouping can cause the female to respond but exposure to the male or his excreta is the best stimulus to induce oestrus. Similar factors do not appear to be effective in *Galea* and the following data are those on which this statement, and those in Rood & Weir (1970), are based.

Two colonies of Argentine cuis were used; one was established in 1967 and the other in 1970. Pertinent observations on females in the first colony are presented in Text-fig. 1. Initially, five cuis were isolated from males to observe the periodicity of spontaneous oestrous cycles which were detected by perforation of the vaginal closure membrane. Three of these five were kept in a group (Text-fig. 1a) and the other two were caged alone (Text-fig. 1b). Only two periods of oestrus (in one animal) occurred during the isolation but all the females responded as soon as a male was reintroduced. Further tests were made using animals isolated from birth and females of known fecundity which were separated from the male before parturition. Nine of these cuis (Text-fig. 1c) were kept in the presence of a male but contact was not allowed. Three females were placed together in a cage adjoining that of the male so that the animals could see and smell each other. The other six females were housed in a large cage and the male was shut off in a run which was strung from the roof (see Weir, 1967). Thus, the females could not only see and smell the male, but were also exposed to his urine and faeces as they fell through the cage to the litter tray. Only two spontaneous oestrous periods (in two cuis) were observed in this group and, as in the other females (Text-fig. 1a, b and c; Table 1), oestrus occurred soon after introduction of the male into the same cage.

In the second colony, two males and fifteen females were kept for 8 weeks in small cages in pairs or trios, the two males constituting a pair; only one vaginal opening occurred. The cuis were then set up in two large floor pens with one male in each; within 5 days, eleven of the females had come into oestrus. One female showed vaginal opening on the 11th day and two others subsequently

TEXT-FIG. 1. Diagrammatic representation of the occurrence of oestrus in cuis (*Galea musteloides*) when males are excluded and reintroduced. (a) Three females isolated together; (b) two females kept singly; (c) nine females exposed to the sight and smell of a male; (d) other isolated females. The start of each line represents the time when the male was removed; B, born; O, vaginal opening; K, killed; D, died, usually from fighting; L, littered; P, pregnancy; ↓, introduction of intact male; V, introduction of vasectomized male.

had oestrous cycles. One cuis died with the vagina still imperforate 3 weeks after the introduction.

Of the thirty-eight females that were isolated from males, six (13%) had spontaneous periods of oestrus. In the two females which had two periods of

TABLE 1
INTERVAL TO ONSET OF OESTRUS AFTER INTRODUCTION OF THE MALE

	Interval between contact and oestrus (days)											Total
	1	2	3	4	5	6	8	9	11	20	>20	
No. of cuis coming into oestrus	4	11	5	4	5	1	1	1	1	1	3	37

PLATE 1

FIG. 1. Photograph of the neck area of an adult male cuis showing the two bare patches of skin; an hypertrophied sebaceous gland underlies the most anterior patch. The dark spots on the gland are hair follicles.

(Facing p. 406)

PLATE 2

oestrus, the intervals were 12 and 27 days and these are within the range reported by Rood & Weir (1970) for random cycles. In Text-fig. 1(d), the last record is that of a female placed with a vasectomized male. A fertile male was substituted just after vaginal closure and the next oestrus and conception occurred 9 days later. It was not possible to do more tests with the vasectomized male or with other females as the colonies were not large enough to maintain themselves if too many females were kept from breeding for considerable periods of time. No environmental factors other than contact with the male, such as changes from cages to pens and *vice versa* (Richmond & Conaway, 1969), were observed to affect oestrus.

The data presented above provide good evidence of the need for a male to be in the same cage as the female for the almost immediate induction of oestrus (Table 1). This implies that physical contact is necessary, and observations on cuis in the wild, (Rood 1970) and in the laboratory (Weir, unpublished) show that the species has a type of behaviour pattern known as a 'chin-rump follow' whereby the male chases the female with his chin on her rump. The intensity of chin-rump following increases as the female approaches oestrus (Rood, 1970). Examination of the chin of *Galea* revealed two areas of bare skin (Pl. 1, Fig. 1). The anterior one is raised from the surface as a thick pad about 1.0×1.5 cm and has a glandular appearance. Histological preparation of this area shows that it contains a discrete holocrine gland (Pl. 2, Figs. 2 to 5). The gland is present in both sexes but no information is yet available on its detailed anatomy and histochemistry at different stages of life and reproduction. A similar gland is not present under the other patch of bare skin.

Group-isolated females chin-rump follow each other but vaginal opening does not ensue, therefore it seems that it is not the behaviour pattern alone which is effective. The experiment with female groups exposed to the smell of a male show that it is not the behaviour pattern plus the smell of the male that is important. Physical contact of the sexes is necessary and animals have now been isolated for testing with a male from which the chin gland has been removed. It is very unlikely that the secretion of the gland is effective by inunction, and there is no sign of any specialized areas of skin on the back. *Galea* do not groom frequently and no increase in grooming has been observed after chin-rump following. Ingestion seems to be the most likely means of operation, although a skin gland secretion acting as a 'primer' rather than as a 'signalling' pheromone would be unique (Bronson, 1968).

Whatever the mechanism of action, it seems that the *Galea* female has a basic ovarian rhythm (shown by the periodicity of random oestrous cycles and

EXPLANATION OF PLATE 2

FIG. 2. Section through the chin gland of a 30-day-old male cuis showing extensive development of sebaceous gland acini. $\times 48$.

FIG. 3. Section through the chin gland of an adult female, at the same magnification as the male gland shown in Fig. 2. Acinar and total gland development is much less than in the younger male. $\times 48$.

FIG. 4. High power of gland shown in Fig. 2; the gland is clearly holocrine and the acini appear active. $\times 190$.

FIG. 5. High power of gland shown in Fig. 3; activity of the acini is minimal. It can be seen in this figure that the secretion reaches the exterior by passage along hair follicles. $\times 190$.

those with a vasectomized male) which is not manifested as an oestrous vaginal opening unless a male is present. The short interval between introduction of the male and the onset of oestrus indicates that the presence of a male can override the inherent rhythm. A detailed study is being made of the ovaries (Rowlands & Weir, in preparation) to investigate how this might be achieved and whether ovulation, as well as oestrus, is induced in this species.

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