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DIFFERENTIAL LOCALIZATION OF A MALE AND A FEMALE HYPOTHALAMIC MATING CENTRE

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Implantation of testosterone propionate (TP) in the pre-optic-anterior hypothalamic region produced predominantly male, i.e. homosexual behaviour in female spayed rats. On the other hand, TP implants in the central hypothalamus induced mainly female behaviour, as did subcutaneous TP injections in these animals (Dörner, Döcke & Moustafa, 1968). Therefore, it was assumed that two different hypothalamic mating centres are responsible for the male and female mating activity. In the following study this hypothesis was reinvestigated by means of intra-hypothalamic implantations of oestradiol benzoate (OB) in rats.

Precise quantities of crystalline OB were implanted stereotaxically into the anterior or central hypothalamus of post-puberally spayed female rats of the Sprague-Dawley strain. The stereotaxic implantations were performed according to a method described recently (Döcke, Dörner & Voigt, 1968). OB was dissolved in alcohol, the solution was aspirated into calibrated glass capillary tubes, and the hormone was implanted after evaporation of the alcohol and recrystallization. The implants were introduced bilaterally anterior or posterior to the bregma according to the stereotaxic atlas of Szentágothai, Flerkó, Mess & Halász (1968) (A 0·5 for implantations in the anterior and P 2·5 in the central (middle) hypothalamus). After autopsy each hypothalamus was frozen, serially sectioned at 15 μ and stained with haematoxylin and eosin to verify the exact localization of the implants.

Tests for sexual behaviour were performed on Days 3, 5 and 7 following the implantation. In the mating tests each rat was exposed for 5 min to (1) a vigorous male, and (2) an oestrous female (Dörner, 1967). Animals with intrahypothalamic cholesterol implants or subcutaneous OB implants served as controls in order to compare the behavioural patterns. The rats of all groups were autopsied 8 days after implantation and the weights of their uteri were determined.

The following results were obtained (Table 1, Text-fig. 1):

(1) Implantation of 1 μg OB in the medial pre-optic-anterior hypothalamic region of spayed female rats elicited receptive female behaviour (lordosis reflex) in only one out of nine animals when exposed to active males. On the other hand, the majority of these rats showed some slight male behaviour (trials of mounting) when placed together with oestrous females.

Table 1

COMPARISON OF THE FEMALE (LORDOSIS REFLEXES) AND MALE (TRIALS OF MOUNTING) SEXUAL BEHAVIOUR AND OF UTERINE WEIGHTS BETWEEN DIFFERENT GROUPS OF SPAYED ADULT FEMALE RATS FOLLOWING INTRAHYPOTHALAMIC OR SUBCUTANEOUS IMPLANTATION OF OESTRADIOL BENZOATE (OB) OR CHOLESTEROL (VALUES OF χ^2, t AND P)

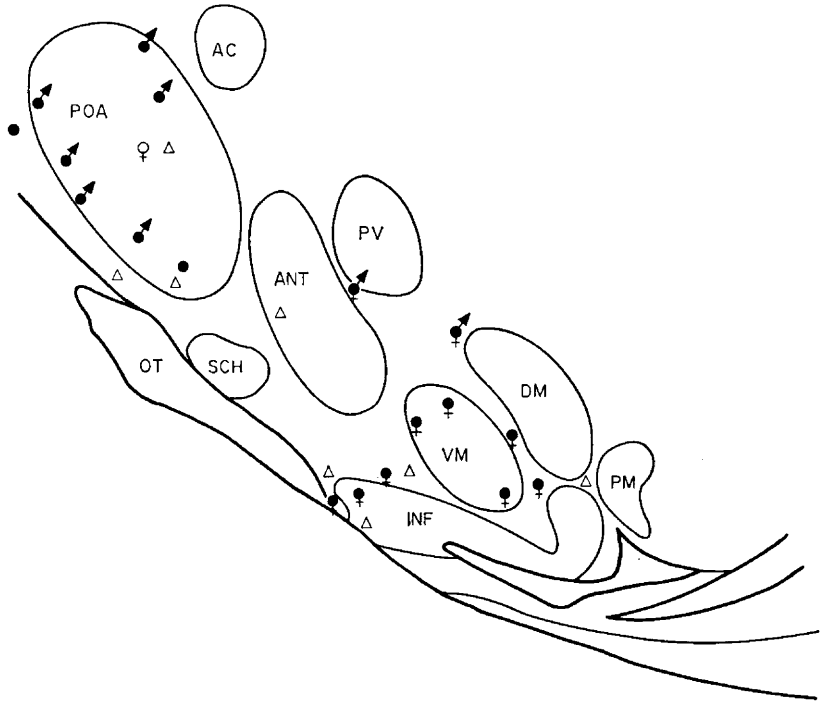
	Group	*No. of rats*	*Tests with positive ♀ and ♂ behaviour of total tests; uterine weights in mg*	*IV* Subcutaneous implantation of 2 μg OB	*III* Implantation of 1 μg cholesterol in the anterior or central hypothalamus	*II* Implantation of 1 μg OB in the central hypothalamus	*I* Implantation of 1 μg OB in the anterior hypothalamus
I	Implantation of 1 μg OB in the anterior hypothalamus	9	♀ 2 of 27 ♂ 12 of 27 143 ± 22·8*	$\chi^2 = 1{\cdot}4$; $P > 0{\cdot}05$ $\chi^2 = 5{\cdot}4$; $P < 0{\cdot}05$ $t = 1{\cdot}3$; $P > 0{\cdot}05$	$\chi^2 = 0{\cdot}4$; $P > 0{\cdot}05$ $\chi^2 = 11{\cdot}7$; $P < 0{\cdot}001$ $t = 7{\cdot}2$; $P < 0{\cdot}001$	$\chi^2 = 42{\cdot}2$; $P < 0{\cdot}001$ $\chi^2 = 6{\cdot}8$; $P < 0{\cdot}01$ $t = 0{\cdot}3$; $P > 0{\cdot}05$	—
II	Implantation of 1 μg OB in the central hypothalamus	10	♀ 29 of 30 ♂ 3 of 30 144 ± 20·1	$\chi^2 = 26{\cdot}0$; $P < 0{\cdot}001$ $\chi^2 = 0{\cdot}2$; $P > 0{\cdot}05$ $t = 1{\cdot}4$; $P > 0{\cdot}05$	$\chi^2 = 46{\cdot}4$; $P < 0{\cdot}001$ $\chi^2 = 1{\cdot}0$; $P > 0{\cdot}05$ $t = 8{\cdot}3$; $P < 0{\cdot}001$	—	$\chi^2 = 42{\cdot}2$; $P < 0{\cdot}001$ $\chi^2 = 6{\cdot}8$; $P < 0{\cdot}01$ $t = 0{\cdot}3$; $P > 0{\cdot}05$
III	Implantation of 1 μg cholesterol in the anterior or central hypothalamus	8	♀ 0 of 24 ♂ 0 of 24 70 ± 12·2	$\chi^2 = 4{\cdot}2$; $P < 0{\cdot}05$ $\chi^2 = 0{\cdot}6$; $P > 0{\cdot}05$ $t = 8{\cdot}2$; $P < 0{\cdot}001$	—	$\chi^2 = 46{\cdot}4$; $P > 0{\cdot}001$ $\chi^2 = 1{\cdot}0$; $P < 0{\cdot}05$ $t = 8{\cdot}3$; $P < 0{\cdot}001$	$\chi^2 = 0{\cdot}4$; $P > 0{\cdot}05$ $\chi^2 = 11{\cdot}7$; $P < 0{\cdot}001$ $t = 7{\cdot}2$; $P < 0{\cdot}001$
IV	Subcutaneous implantation of 2 μg OB	7	♀ 5 of 21 ♂ 2 of 21 159 ± 25·5	—	$\chi^2 = 4{\cdot}2$; $P < 0{\cdot}05$ $\chi^2 = 0{\cdot}6$; $P > 0{\cdot}05$ $t = 8{\cdot}2$; $P < 0{\cdot}001$	$\chi^2 = 26{\cdot}0$; $P < 0{\cdot}001$ $\chi^2 = 1{\cdot}2$; $P > 0{\cdot}05$ $t = 1{\cdot}4$; $P > 0{\cdot}05$	$\chi^2 = 1{\cdot}4$; $P > 0{\cdot}05$ $\chi^2 = 5{\cdot}4$; $P < 0{\cdot}05$ $t = 1{\cdot}3$; $P > 0{\cdot}05$

* Mean ± standard deviation.

(2) In contrast, implantation of 1 μg OB in the medial central hypothalamus resulted in distinct female behaviour in all postpuberally spayed female rats, whereas these implants were relatively ineffective concerning the male sexuality.

(3) Cholesterol implants that were localized in the anterior or central hypothalamus did not produce any effects on the sexual behaviour.

(4) Subcutaneous implantation of 2 μg OB caused sexual activity in only a minority of spayed female rats. Positive female (lordosis) and male tests (trials of mounting) were highly significantly less frequent in these animals than in



TEXT-FIG. 1. Parasagittal diagram of rat hypothalamus showing sites at which oestradiol implants were effective in elicitation of lordosis reflexes (♀) or trials of mounting (♂) in adult spayed females. Open triangles represent cholesterol implants. Abbreviations: AC, anterior commissure; ANT, anterior hypothalamic nucleus; DM, dorso-medial nucleus; INF, infundibular nucleus; OT, optic chiasma; PM, premamillary nucleus; POA, pre-optic area; PV, para-ventricular nucleus; SCH, suprachiasmatic nucleus; VM, ventro-medial nucleus.

those implanted with only half the s.c. dose of OB in the central or the anterior hypothalamus, respectively.

(5) The wet weights of the uteri of all animals with OB implants indicated a slight systemic action of the hormone without significant differences between the various experimental groups.

Since, on the other hand, significantly different behavioural reactions were seen in these groups, the results suggest that the site of the oestrogen application, and not the quantity of the hormone, was the important factor for elicitation of male or female mating activity in this study.

These findings are therefore consistent with our conclusion, drawn from recent experiments, which states that a male mating centre is localized in the anterior and a female one in the central hypothalamus of rats (Dörner, Döcke & Hinz, 1968; Dörner *et al.*, 1968). On the other hand, our results are in certain disagreement with those of Lisk (1962) who assumed that a centre for both male and female mating behaviour is situated in the medial pre-optic-anterior hypothalamic region. This author, however, did not implant precise quantities of oestrogen. Furthermore, the implants were not placed in the ventro-medial nucleus, a region that due to our findings revealed the greatest oestrogen responsiveness for the activation of female sexual behaviour.

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