EFFECT OF HYPOTHALAMIC DE-AFFERENTATION ON INDUCTION OF PSEUDOPREGNANCY BY VAGINAL–CERVICAL STIMULATION IN THE RAT

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It is well known that mechanical or electrical stimulation of the uterine cervix activates the corpora lutea of the rat and induces pseudopregnancy as effectively as does mating with a vasectomized male (Everett, 1964). Evidence from recent studies on the effects of electrical stimulation of the hypothalamus (Everett & Quinn, 1966) and of hypothalamic lesions (Flerkö, 1960; McCann & Friedman, 1960) suggests that an important neurogenic component for the activation of the corpora lutea exists in the hypothalamus. Little is yet known, however, of the pathways whereby information is conveyed from the genitalia to the hypothalamus controlling the secretion of pituitary luteotrophic hormone (LH). In the present study, the surgical transection of neural connections to the hypothalamus (Halász & Pupp, 1965; Halász & Gorski, 1967) was employed to investigate the pathways by which the afferent nervous impulses from the vaginal–cervical region cause the secretion of LH influencing pseudopregnancy.

Surgery was performed under thiopental anaesthesia on Sprague-Dawley rats, weighing 250 to 270 g, according to the technique described by Halász & Gorski (1967). Since interruption of the anterior connection to the medial basal hypothalamus (MBH) causes anovulatory conditions (under which pseudopregnancy cannot be induced by vaginal–cervical stimulation without pre-treatment with gonadotrophins), only the dorsal, lateral and posterior connections to the MBH were interrupted, the MBH being left in neural contact with the anterior hypothalamus in all rats. This type of surgical transection (postero-bilateral de-afferentation, Text-fig. 1 A, B) has been reported not to interfere with ovulatory mechanisms (Halász & Gorski, 1967). From 30 days after the operation, vaginal smears were taken daily. Following completion of four normal cycles, the cervix was mechanically stimulated on the day of oestrus (4-day cycle) by tapping it rapidly (60 to 70 times) with a glass rod 2 to 3 mm in diameter. Four days later, a silk thread was placed in one of the uterine horns to test for a deciduoma reaction. Animals were killed 5 days after the traumatization. Each brain was removed and the precise localization of each de-afferentation was determined histologically. Only those animals in which the de-afferentation was verified histologically were incorporated in this report.

In nine rats, perfect postero-bilateral de-afferentation of the MBH was
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obtained. All of these rats showed di-oestrous vaginal smears continuously after the vaginal–cervical stimulation and, at autopsy, massive deciduoma responses were seen. Since the anterior neural afferents to the MBH from other parts of the CNS were interrupted in these rats, it was suggested that it was these afferents which were involved in the induction of pseudopregnancy. In order to clarify this, the effects of acute surgical transection of the anterior connections to the MBH (anterior de-afferentation, Text-fig. 1 C, D) on pseudopregnancy induction were investigated. Surgery was performed 4 to 5 hr before vaginal–cervical stimulation in eight rats which had already undergone postero-bilateral de-afferentation. In five of these rats, cornified vaginal smears appeared from 4 to 7 days after the stimulation of the uterine cervix and the placement of a silk thread in the uterine horn had failed to induce deciduoma response. In the remaining three rats, deciduoma formation occurred in spite of the anterior de-afferentation. It is possible that the neural elements responsible for the control of LH secretion in these rats were influenced by acute inflammatory injury of the anterior de-afferentation, since placing the Halász knife in the brain could affect the irritability of neurons or bundles. This assumption is in good agreement with the findings that mechanical lesions in the dorso-lateral anterior hypothalamus induced pseudopregnancy if the operation was performed on the day of oestrus (Flament-Durand & Desclin, 1964).

Hypothalamic de-afferentation in the rat

Electrophysiological studies have shown that impulses of cervical origin can be recognized in the anterior and lateral hypothalamus (Porter, Cavanaugh, Critchlow & Sawyer, 1957; Barraclough & Cross, 1963; Cross & Silver, 1965) and in the MBH (Marghaerita, Albritton, MacInnes, Hayward & Gorski, 1965; Ramirez, Komisaruk, Whitmoyer & Sawyer, 1967) by EEG recording. In the present study, postero-bilateral de-afferentation of the MBH failed to block the induction of pseudopregnancy. Subsequent acute anterior de-afferentation just before vaginal–cervical stimulation blocked it in most of the animals. It can be tentatively concluded that the ascending fibres related to the induction of pseudopregnancy in the rat converge on the anterior hypothalamus, and pass through the dorsal or lateral hypothalamus before forming connections with the MBH.

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REFERENCES


