THE NERVE FIBRES CONTROLLING THE GONADOTROPIC ACTIVITY OF THE HYPOPHYSIS OF RANA TEMPORARIA

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With 13 Figures in the Text

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Introduction

The mechanism of regulation of the gonadotropic activity of the pars distalis of the hypophysis remains largely unknown. The hypothalamus plays an important role in it (ÅHREN 1962, FORTIER 1963; JÖRGENSEN and LARSEN 1963a; RINNÉ 1960; SZENTAGOThAI et al. 1962). In our experiments the relations between the hypothalamus and the gonadotropic function of the hypophysis were studied in Rana temporaria. The effect of total extirpation of the magnocellular neurosecretory preoptic nuclei on the seasonal development of the gonads, on the secondary sexual characters and on reproduction were already described in previous papers (DIERICKX 1963a, 1963b). In this paper the results of total and permanent interruption of all nervous pathways to the median eminence and hypophysis, without interfering with the portal vascular supply, are described.

Material and Methods

The data of following adult female specimens of Rana temporaria were used:

1. Group Tr. This group consists of twenty seven animals in which a complete interruption of all nervous pathways to the median eminence and hypophysis, without interfering with the normal blood supply of the hypophysis, was performed. The animals were operated from June, 26, 1963 till July, 6, 1963. They were killed October, 34, 1963, three months after operation.

2. Group KTr. Twenty five intact animals were kept in the same conditions as the operated ones. They served as controls. They were killed October, 3--9, 1963.

3. Group P. This group consists of normal outdoor controls killed in May, 2, 1963 (six animals), July, 6, 1963 (six animals) and October, 7, 1963 (7 animals). Of these animals only the weight of the gonads and the diameter of the oviducts and largest eggs are considered here (Figs. 4--6).

Previous experiments, performed in 1961 and 1962, showed that sham operated animals were not necessary (DIERICKX 1963b).

All animals had a minimum length of 69 mm and a minimum feeding index of 4.5 at the moment they were killed. Feeding index = \( \frac{\text{Total body weight (g)} - \text{weight of ovaries (g)}}{\text{Lenght (cm)}} \).

The animals of group Tr were operated under ether anesthesia and with the aid of a Zeiss binocular technoscope. They were fixed in dorsal position with open mouth. With the aid of a dental drill, the base of the skull was opened in front of the area of the infundibulum lying apical to the median eminence. Local removal of the cartilage. The manipulations that followed were done with a very fine metal needle, the top of which was slightly incurvated. The operation consisted in the destruction and removal of all nerve fibres running in the infundibular wall towards the median eminence and the hypophysis. On the other hand,
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The normal vascularisation of the median eminence and of the hypophysis was left intact. The operation was complicated by the fact that, in the operative area, the arachnoidea joins the pia mater, so that there is no sub-arachnoidal space and the small arterial vessels, supplying the median eminence and hypophysis, lie directly on the nervous tissue that has to be removed. To remove the nervous elements, the top of the needle was inserted directly in the cavity of the infundibulum. With the curved top of the needle, the ependyma and the nervous tissue were completely destroyed in a more or less extensive area (Fig. 1). The major part of the destroyed nervous tissue was removed through openings made in the pia-arachnoidea between the afferent blood vessels of the median eminence. These blood vessels, with the

Fig. 1. Sketch of the ventral hypothalamo-hypophysial region of Rana. In the hatched area, at operation, all nervous tissue was removed, without interfering with the hypophysial portal vascular supply.

immediately surrounding pia-arachnoidea, and the median eminence were left intact. These remaining blood vessels made it impossible to place a barrier in the operative area to prevent the eventual regeneration of the interrupted nerve fibres. Therefore it was necessary to destroy these fibres over a relatively large area. Bleeding could be avoided. After operation, the blood circulation in the median eminence and in the pars distalis was controlled. Then, the opening in the skull was closed by replacing the piece of cartilage removed. The opening in the mucosa of the mouth was closed by simply adjusting the two borders of the incision. Total recovery followed after a few days. For the post-operative care of the animals we refer to another paper (Dierickx 1964). The animals remained in good nutritional condition (Fig. 2). They were killed by decapitation. In three operated animals, before they were killed, the portal vascular supply of the hypophysis was controlled again and found to be normal. In the other animals the portal vascular system of the pars distalis was checked after they were killed. The organs were immediately fixed (Bouin-Hollande + 10 percent of a saturated watery solution of sublimate) for two days. The fixed pieces were embedded in paraffin. Serial sagittal sections (5 micron) of the brains and hypophysis. Staining methods: standardized aldehyde-fuchsin (GABE)-hemalum-orange G and standardized P. A. S.-hemalum-orange G.

The weight of the ovaries was determined with a precision of 0.01 g. The diameter of the eggs was measured with a Wild ocular micrometer (precision 0.05 mm). The oviducts were measured with a precision of 0.5 mm.