ON THE RELATIONS BETWEEN THE HYPOTHALAMUS AND THE ANTERIOR PITUITARY IN RANA TEMPORARIA

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With 7 Figures in the Text

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The relations between hypothalamus and anterior pituitary remain a point under discussion. With the exception of Drager (1953) and Metuzals (1954), no important uninterrupted nervous connections between the two systems were described. On the other hand, in many animal species and in man (Popa and Fielding 1930, Green and Harris 1947, 1949, Green 1951) a portal system between the median eminence and the anterior pituitary has been described. Hence the idea that this portal system would make a humoral mediator between hypothalamus and anterior pituitary. The mode of action of this humoral mechanism still remains in suspense. Does the hypothalamus influence the anterior pituitary (Harris 1944, Green and Harris 1947, 1949) or does the contrary occur (Spatz 1951, 1954, 1958)?

In the last few years the conception of Spatz who accepts an influence of the anterior pituitary on the hypothalamus has found less and less support. There are more and more data for the thesis of Harris who thinks that the hypothalamic nuclei influence the anterior pituitary. We tried to approach this problem in Rana temporaria.

The histology of the hypothalamo-hypophyseal system was fully described by Hild (1951). Our study is based upon the works of Green (1947, 1951) as far as the vascularisation of the hypophysis and its environment is concerned.

Green has demonstrated that there exists in Rana a well developed venous portal system between the area of the median eminence and the anterior pituitary. According to Diepen (1952) and Dawson (1952), it is possible to distinguish in Rana two areas on the level of the median eminence viz. 1. an inner subependymal zone and 2. an outer zone, which has a very well developed vascular system and where the primary capillary network of the venous portal system is situated. According to Dawson (1952), in the inner zone, the neurosecretory fibres of the tractus hypothalamo-hypophyseus run more or less directly cephalo-caudal towards the infundibular process (posterior lobe). On the contrary, in the outer zone, many neurosecretory fibres end around the capillaries of the venous system. According to Dawson, this last arrangement would be a fact in favour of a possible release of neurosecretory material through the endings of the nerve fibres of the tract to the blood of these capillaries. The neurosecretory material would, in this way, reach the anterior pituitary and influence it. Hitherto, in Rana, this neurosecretory material has never clearly been shown in the outer zone of the median eminence. Analogical observations as those done by Dawson in Rana, were also done, among others, by Benoit and Assenmacher (1953, 1955), Assen-
Hypothalamus and anterior pituitary in Rana


Material and methods

The material consists of 240 test animals. During two years the brains of ten animals were prepared every month. The animals were beheaded. The diencephalon with the hypophyseal system was immediately prepared and fixed in Bouin during 5 to 7 days. The fixed pieces were embedded in paraffin. From the pieces were made horizontal, transversal and longitudinal serial sections of 5 micron. Staining methods: Hemalum-erythrosin; Gomori's chrome-alum hematoxylin method and the Halmi's aldehyd-fuchsin method. We have to mention that, for the observations described here, the Gomori-method is much less suitable, and that the Halmi staining, on the contrary, seemed to be much more appropriate. For this reason our results are chiefly based on observations done by the latter method. Every month the temperature of the surroundings in which the animals lived was noted. We have to mention that the test animals from December 1958 were put during three days in surroundings where the temperature (18° Celsius) was notably higher than the temperature outside (5° C).

The quantity of neurosecretory material was controlled in the median eminence of the different series of test animals. In the absence of an objective method, we determined the quantity of neurosecretory material by estimation on the successive slides. The results of this method are certainly influenced by subjective factors. We tried to make them objective, as much as possible, by means of a large number of observations.

Observations

In agreement with the data of Diepen (1952) and Dawson (1952) we observed in the material, which we examined, that the median eminence really consists of two areas, viz. 1. an inner subependymal zone and 2. an outer zone. The inner zone contains bundles of fibres whose direction is chiefly cephalo-caudal towards the posterior lobe of the hypophysis. In the more elaborate and much more vascularized outer zone many neurosecretory fibres end around the capillaries of the portal system. On some sections we could clearly observe that those fibres originate from the hypothalamo-hypophyseal tract and that, on the level of the median eminence, they separate, and turn towards the outer zone of the median eminence.

Here we want to draw attention to the fact that the area which, in Rana, corresponds with the infundibulum in mammals is very well developed. It is large and contains an extensive infundibular recess. The median eminence forms the caudal part of the ventral wall of this recess, whereas the posterior pituitary consists in a thickening of the dorso-caudal part of the wall of this cavity.

We particularly observed a striking resemblance between the general histological structure of the outer zone of the median eminence with this of a posterior pituitary containing few neurosecretory material. In the Halmi sections this resemblance is so striking that, on superficial examination, it is easy to mistake