

## DISTRIBUTION OF CATECHOLAMINES IN THE MEDIAN EMINENCE OF RATS AFTER ADRENALECTOMY

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The distribution of adrenergic and peptidergic fibers in the eminentia medialis of the tuber cinereum of rats was studied 3 weeks after bilateral adrenalectomy. An increase in the intensity of fluorescence in the outer zone of the eminentia medialis and an increase in the number of strongly fluorescent bodies of the neurons in the arcuate nucleus were found. Numerous nerve fibers with bright green fluorescence could be seen in the inner zone. In the outer zone, many peptidergic nerve fibers appeared. Differences in the response to adrenalectomy in the rostral, middle, and caudal zones of the eminentia medialis are described.

**KEY WORDS:** eminentia medialis; adrenalectomy; catecholamines; peptidergic fibers; arcuate nucleus.

The participation of peptide neurohormones (releasing hormones) in the control of ACTH secretion is confirmed by the appearance of neurosecretory fibers, running toward capillaries, after adrenalectomy in the outer zone of the eminentia medialis (EM) [7, 10]. Conflicting views are held on the role of hypothalamic catecholamines (CA) in the regulation of ACTH secretion [1, 5, 6, 11, 14, 16, 17].

The most widely held hypothesis is that CA inhibit ACTH secretion [13]. However, a chronic lowering of the brain CA level leads to a decrease in the plasma corticosterone concentration [15]. The decrease in the dopamine concentration in the middle portion of EM in rats after adrenalectomy suggests a role of dopamine in the hypothalamic regulation of ACTH secretion [11]. It is also claimed that the inhibitory effect of CA on ACTH secretion is mediated through central serotonergic neurons [3, 14]. In vitro, CA increased the serotonin concentration in the hypothalamus [19]. In the outer zone of EM, terminals of serotonergic neurons have been identified [9].

The object of this investigation was to determine the response of the adrenergic structures of EM on adrenalectomy and their subsequent relations with peptidergic Gomori-positive fibers.

### EXPERIMENTAL METHOD

Experiments were carried out on noninbred sexually mature male albino rats weighing 150-200 g. Material was taken 3 weeks after bilateral adrenalectomy (14 rats). Rats with poorly developed accessory interrenal tissue, as shown by their response to water loading, were taken for investigation. Ten rats undergoing a mock operation served as the control. CA were detected histochemically by a fluorescence method [12]. Fluorescence was studied in the ML-2 microscope. Neighboring sections were stained with paraldehyde-fuchsin by the Gomori-Gabe method and counterstained with light green.

### EXPERIMENTAL RESULTS AND DISCUSSION

Three weeks after adrenalectomy multiple thin Gomori-positive fibers, branching from the hypothalamo-hypophyseal tract and running perpendicularly to it toward the capillaries, could be seen in the outer

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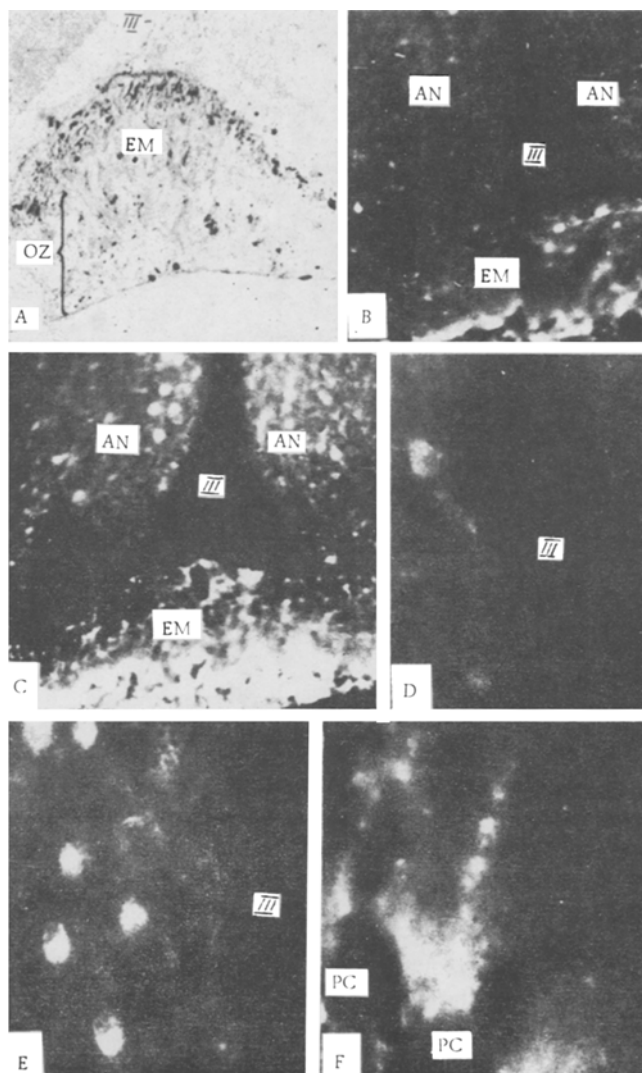


Fig. 1. Eminentia medialis (EM) and arcuate nucleus (AN) of rats in control and 3 weeks after bilateral adrenalectomy. III) Infundibulum of third ventricle. A) Fibers with Gomori-positive material located in outer zone of EM of an adrenalectomized rat. B-E) Fluorescence of CA in EM of control (B) and adrenalectomized (C) rats. Some increase in intensity of fluorescence in outer zone. Number of bodies of neurons with intensive fluorescence (C, E) is increased in AN compared with the control (B, D). F) Aminergic fiber with varicosities on capillaries of primary plexus (PC) in outer zone of EM in a rat after adrenalectomy. A) Stained with paraldehyde-fuchsin, 125  $\times$ ; B-F) by Falck-Hillarp fluorescence method (120  $\times$ ).

zone of EM (Fig. 1A). Only solitary fibers of this type, distributed uniformly in frontal sections, could be seen in the outer zone of EM in the control; their number increased from the rostral portion of EM toward the caudal.

After adrenalectomy a somewhat higher intensity of fluorescence was observed in the outer zone of EM in the region of the junction between the rostral and middle portions compared with the control (Fig. 1B, C); this is probably evidence of an increase in the dopamine content in that region. Thin fibrils with varicosities and bright green fluorescence, also running toward the capillaries of the outer zone of EM, were more numerous than in the control (Fig. 1F). The nature of these fibrils is uncertain.

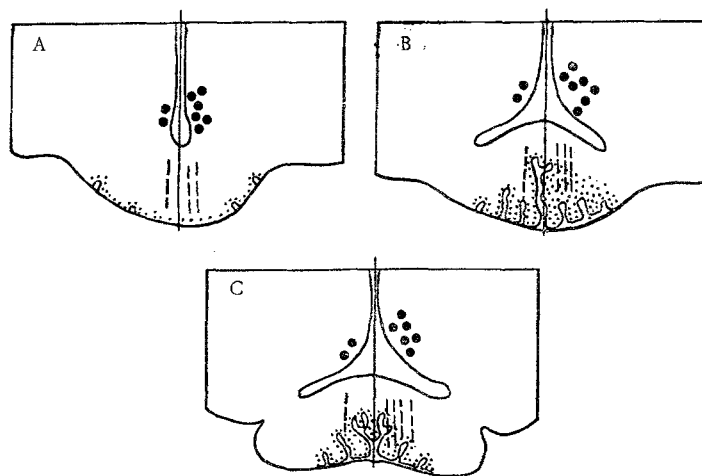


Fig. 2. Diagram showing rostral (A), middle (B), and caudal (C) portions of EM of tuber cinereum of the rat hypothalamus in control (left) and 3 weeks after adrenalectomy (right). Large dots show bodies of neurons containing CA in AN; broken line represents Gomori-positive fibers in outer zone of EM; small dots show fluorescence of CA around capillaries in outer zone of EM.

In the inner zone of all parts of EM clearly outlined nerve fibers with small or large varicosities and strong green fluorescence could be seen after adrenalectomy. These fibers, which have been described previously [11], could be traced for a considerable distance. Most of them followed the course of the hypothalamo-hypophyseal tract and were concentrated near the deep loops of the EM capillaries, but others ran ventrally toward the capillaries of the outer zone. Particularly large varicosities ( $2-4\ \mu$ ) were seen both in the zone of the hypothalamo-hypophyseal tract and at the boundary with the cavity of the infundibulum. The character and arrangement of these fibers suggest that they are noradrenergic.

Under normal conditions only solitary, weakly fluorescent perikarya of dopaminergic neurons can be seen in the arcuate nucleus (AN) of rats (Fig. 1B, D). The number of these perikarya in the dorsal part of AN and the intensity of their fluorescence were considerably increased 3 weeks after adrenalectomy (Fig. 1C, E). A similar picture was observed by Smith and Fink after hypophysectomy [18]. The bodies of these neurons can be seen in AN at the junction between the rostral and middle portions of EM and also at the level of the middle and caudal portions of EM (Fig. 2).

The varied character of changes in the different parts of EM after adrenalectomy evidently points to functional heterogeneity of these different portions. The maximal number of Gomori-positive fibers observed in the outer zone of the caudal portion of EM is in agreement with the results of electron-microscopic investigations [2] but differs somewhat from the observations of Bock [10]. It is the caudal portion of EM that is important for the supply of corticotropin releasing hormone into the portal system of the anterior pituitary [20].

The results of these experiments indicate an accumulation of both Gomori-positive neurosecretion and CA in EM and an increase in the CA content in the neuron bodies of AN. It is difficult to say what functional changes reflect these phenomena, and what is primary and what secondary in this reaction. However, the definite increase in the content of both CA and Gomori-positive neurosecretion in a certain portion of EM can be taken to support the views of those workers who accept that CA is supplied, together with peptide releasing hormones, into the portal system in order to regulate ACTH synthesis (or secretion) [8, 13] and to confirm A. L. Polenov's concept of the dual control of the tropic functions of the adenohypophysis [4].

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