spleen. Meanwhile the value of F can vary in the spleen depending on the physiological state of the CFU population, whereas in the bone marrow it is stable. Differences in the value of F for CFU obtained from different sources were demonstrated.

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FUNCTIONAL MORPHOLOGY OF THE ACCESSORY NEUROSECRETORY CELLS OF THE CAT HYPOTHALAMUS

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Accessory groups of neurosecretory cells were studied by staining serial paraffin sections of the hypothalamus by Gomori's method after stimulation of the supraoptic (SON) and postoptic (PON) nuclei, the preoptic region of the hypothalamus, the cervical sympathetic nerve (CSN) and afferent fibers of the vagus nerve in acute experiments on cats. Four paired accessory groups in the rostral hypothalamus were discovered (before the division of the chiasma into tracts); periventricular (along the walls of the third ventricle), preoptic (above the preoptic recess), parafornical (on both sides of the columns of the fornix), and fusiform (see: Byull. Éksp. Biol. Med., 1977, No. 2, p. 236). The fusiform group was found constantly in both control and experimental animals in all series of experiments. Stimulation induced an increase in synthesis of neurosecretory substance by its cells. In response to stimulation of SON and PON directly, and also of CSN and the vagus nerve, the direction of its reaction coincided with that in SON and PON, whereas to stimulation of the preoptic region of the hypothalamus activation of synthesis was observed against the background of an unchanged state of the neurosecretory nuclei by comparison with the control. Three other groups were found only during stimulation of the preoptic region. Accessory groups of cells can react in the same direction as the neurosecretory nuclei (mainly SON) or independently of them.

KEY WORDS: *neurosecretion; hypothalamic-hypophyseal neurosecretory system; stimulation of hypothalamus*

Steadily increasing attention has been paid in the recent literature to the neurosecretory centers. The study of serial sections through the hypothalamus has revealed accessory cells and groups in rats [7, 11], mice [3, 4], susliks [6], cats, dogs, and man [5]. They have been investigated in most detail in rats [11]. The workers cited describe the results of light- and electron-microscopic investigations of the morphological similarity between the accessory NSC and the NSC of the supraoptic nucleus (SON). However, their role in the neurosecretory process has not yet been completely explained.

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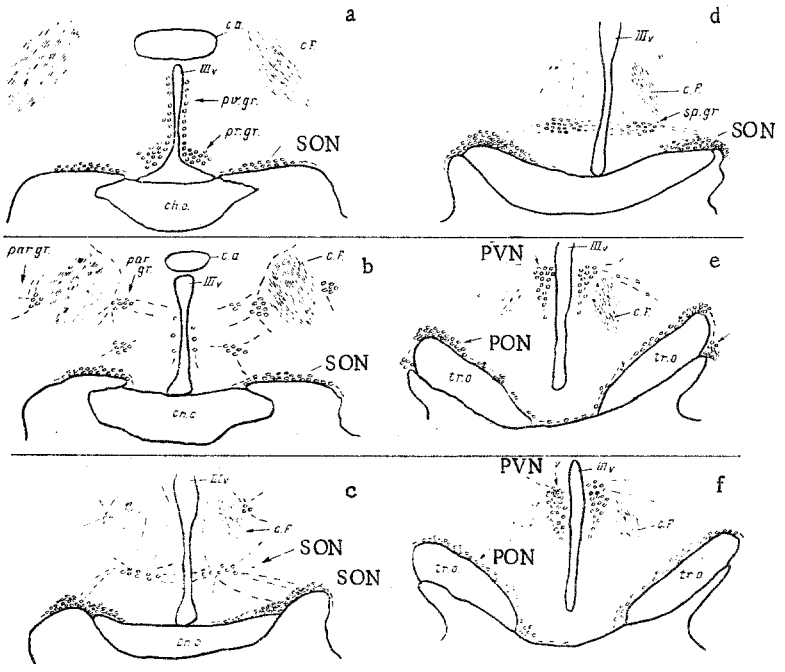

Fig. 1. Topography of neurosecretory cells and tracts in anterior hypothalamus of cat. Schemes based on atlas. Frontal sections at levels: a) A 14, b) A 13.5, c) A 13, d) A 12.5, e) A 12, f) A 11.5. Legend: c.a) anterior commissure; c.F.) column of fornix; ch.o.) optic chiasma; SON) supraoptic nucleus; pv.gr.) periventricular group; pr.gr.) preoptic group; par.gr.) parafornical group; sp.gr.) fusiform group; PON) postoptic nucleus; PVN) paraventricular nucleus; tr.o.) optic tract; IIIv) third ventricle.

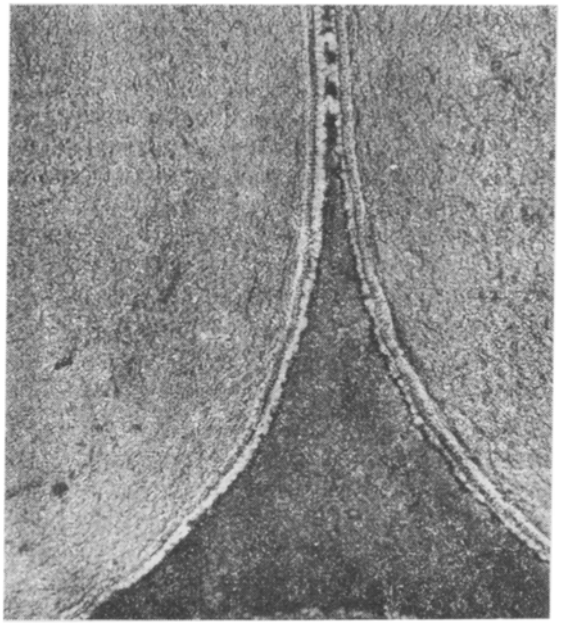

Fig. 2. Periventricular group of neurosecretory cells located along wall of third ventricle. Frontal section through hypothalamus A 14, magnification 42×. Stained with paraldehyde-fuchsin + azan.

TABLE 1. Diameter of Nucleoli (in ocular micrometer units) of Neurosecretory Cells after Stimulation of SON, PON, and Preoptic Region of Hypothalamus (M ± m)

Group	SON and PON		Fusiform group		PVN	
	left	right	left	right	left	right
Stimulation of SON and PON						
Experimental	42,6±1,0*	39,4±0,8	40,0±1,0*	37,2±0,9	35,1±1,0	34,7±1,1
Control	38,6±1,1	38,4±1,2	36,7±1,0	36,6±1,1	34,2±1,1	34,8±1,2
Stimulation of preoptic region						
Experimental	40,4±0,7	40,1±0,8	41,6±0,7* 40,5±1,1†	40,3±0,7* 39,9±0,9†	36,2±1,1	36,5±1,1
Control	39,7±0,8	39,6±0,9	37,1±0,5	37,2±0,8	35,5±0,8	36,1±0,9

Legend. *) Difference between right and left (stimulated) sides significant; difference from control significant ($P < 0.05$); †) combined data for periventricular, preoptic, and parafornical groups. Formations detectable only after stimulation and could not be found in control.

Some information on this probelm can be obtained by stimulating the "classical" neurosecretory nuclei, and this course was adopted in the investigation described below*.

EXPERIMENTAL METHOD

Experiments were carried out on cats weighing 3-3.5 kg under chloralose anesthesia. Unilateral stimulation of SON, the postoptic nucleus (PON) and the preoptic region of the hypothalamus (frontal sections A 12.5, A 11.5, and A 14 according to the stereotaxic atlas of Snider and Niemer [14]) was carried out with square pulses through unipolar nichrome electrodes. Control animals were subjected to all procedures except stimulation. Five experimental and two control animals took part in each series of experiments.

The animals were killed by air embolism and the hypothalamic region was fixed in Bouin's fluid. Serial frontal sections were stained by Gomori's method and counterstained with azan by Heidenhain's method. The diameter of the nucleoli of 100 NSC in each formation was measured separately for the stimulated (left) and intact sides. Mean values were compared by Student's t test.

EXPERIMENTAL RESULTS

The NSC in the cat are grouped into nuclei: SON, PON, and PVN, but other accessory groups also exist.

Four paired groups were discovered in the rostral part of the hypothalamus: a periventricular group arranged as bands in the walls of the third ventricle (Figs. 1a and 2), which is continuous with a more compact group lying a short distance from the dorsal walls of the preoptic recess — the preoptic group (Fig. 1a). These formations consisted of fusiform or round cells, fairly loosely packed. Their processes could be traced for a short distance within the groups themselves.

Small groups of NSC were found more caudally on both sides of the columns of the fornix — the parafornical group (Figs. 1b and 3). Some of the processes of cells, winding around the fornix, ran outside the anterior hypothalamus. The largest group of NSC not contained in the neurosecretory centers was a fusiform group (Fig. 1c, e), in which the number of cells was counted in hundreds. The functional morphology of this group during stimulation of SON was the subject of a previous communication [2].

During stimulation of both SON and PON the same results were obtained: increased synthesis and transport of neurosecretory substance (NSS) and liberation of neurohormones into systemic circulation. These processes were found only on the side of stimulation and they

*The state of SON, the paraventricular nuclei (PVN), and the posterior lobe of the pituitary (PLP) during stimulation of the cervical sympathetic nerve and afferent fibers of the vagus nerve was discussed in [1].

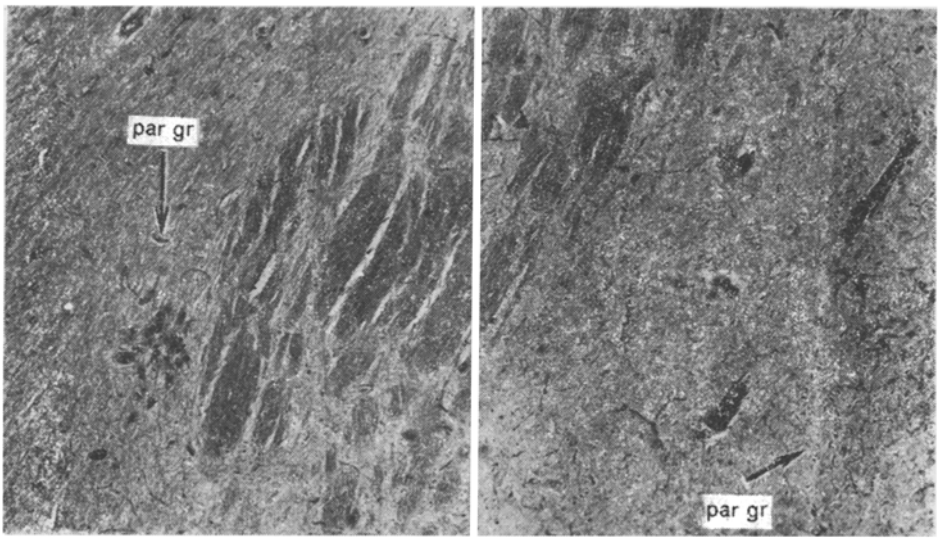

Fig. 3. Parafornical group of cells. Arranged on both sides of column of fornix. Frontal section through hypothalamus at level A 13.5. Stained with paraldehyde-fuchsin by Gomori–Gabe method; 200×.

involved SON, PON, and the fusiform group; PVN were indistinguishable from the control (Table 1). In their cell compositions and the dimensions of their nucleoli, SON and PON did not differ from each other and both were activated regardless of in which the electrode was located.

In response to stimulation of the cervical sympathetic nerve (CSN) and afferents of the vagus nerve, the fusiform group was revealed in both the control and the experimental animals. In the first case the direction of its resection corresponded to that in SON. Stimulation of the vagus led to activation of all neurosecretory formation. Stimulation of the hypothalamic preoptic region caused no changes in the neurosecretory nuclei. They were indistinguishable from those in the control (Table 1). Processes of synthesis of NSS were activated in the fusiform group. It was only during stimulation of this type that the periventricular, preoptic, and parafornical groups could be found. They could not be found in the control. However, with reference to all parameters the NSC of the three groups were identical with cells of the fusiform group (Table 1), and it may be that they constitute a single formation.

On the basis of the results of these experiments a somewhat wider view can be obtained of the role of the accessory cells. In series with stimulation of SON, PON, and CSN, during selective activation of the neurosecretory formation the fusiform group can be regarded as an "accessory SON," but it responds independently to stimulation of the preoptic region.

If Gomori's method is used the accessory cells and groups are by no means invariably revealed. It can tentatively be suggested that they can be found in the section only after the active accumulation of NSS in their perikarya; however, if the more sensitive immunoperoxidase technique is used, they are revealed constantly [8, 9, 13, 16] and they give a reaction for vasopressin, oxytocin, and both neurophysins. In the inactive state, when neurohormones and neurophysins exist as precursors [12, 15], they probably react with antiserum but cannot be detected by oxidation, as is used in Gomori's method.

It can be concluded from the results of these experiments, together with data in the literature, that the peptidergic hypothalamic-hypophyseal neurosecretory system is not confined to SON, PON, and PVN, the axons of whose cells terminate in the median eminence and PLP. This system is much wider and includes a large number of NSC (both single and forming groups) within the anterior hypothalamus and also NSC lying outside it [10].

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HISTOTOPOGRAPHY OF SOME METABOLIC PROCESSES IN THE HEART

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The localization of the principal metabolic processes in the heart of untrained, trained, and overtrained rats in a state of relative rest and in untrained rats exposed to single and repeated physical exertion was investigated histochemically. Processes of glycogenolysis and glycolysis in the myocardium were found to be more active in the subendocardial layers, whereas oxidation of fatty acids and ketone bodies was more active in the subepicardial layers. The reverse relationships were found in the myocardium of trained and overtrained rats. The role of the subepicardial layers of the myocardium in the maintenance of cardiac function in response to a sharp increase in the intensity of its activity is demonstrated.
KEY WORDS: *myocardium; metabolic pathways; topography; physical exertion.*

After many years of histochemical investigation of the heart it has been concluded that different parts of the myocardium differ in the intensity and direction of their metabolism [3, 4]. Various enzyme processes and their substrates have been shown to be located principally in the subepicardial or subendocardial zones of the myocardium [2, 7, 8]. However, no systematic study of the topography of the principal metabolic processes in the heart in different functional states has hitherto been undertaken. This was the object of the present investigation, which was based on the assumption that this approach could shed some light on the fine mechanisms of adaptation of the heart to the conditions of its activity.

EXPERIMENTAL METHOD

Male Wistar rats weighing 180-200 g were studied. All the physical loads consisted of swimming in water at 30°C by the animal carrying a weight amounting to 2.5% of its body weight. Animals exposed to physical exertion once only were decapitated in the "running in" period (the first 7 min of swimming), the period of stationary work (90 min) and the period of fatigue (the time of sacrifice was determined individually within the period from 180 to 240 min of swimming). In the rest period the rats were decapitated 24 and 48 h after the end of exertion. Some animals were subjected to repeated exertion after a rest of 24 and 48 h, and they were decapitated at the same stages of the second exertion as during the first.

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