EFFECT OF TESTOSTERONE ON SPONTANEOUS UNIT ACTIVITY OF THE HYPOTHALAMIC ARCUATE NUCLEI

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The hypothalamus is the central component of the apparatus for neurohumoral control of the male gonads. On the basis of much evidence obtained by the use of special radioimmune, radiomorphological, and morphometric methods of investigation, testosterone-reactive cells have been shown to be widely represented in the preoptic, anterior, and basal parts of the hypothalamus [9-11]. The zone of localization of cells producing gonad releasing agents is confined to the parvocellular nuclei of the median eminence [1, 3, 12]. The results of electrophysiological investigations [5, 13, 14] have not succeeded in reducing the mechanism of hypothalamic control of the testes to a common denominator, which is absolutely essential both for pathogenetic correction of hormonal disturbances and for the deepening of our ideas on hypothalamo–hypophyseal regulation of activity of the endocrine glands as a whole.

This paper describes an investigation of unit activity in the parvocellular arcuate nuclei of the hypothalamus in response to artificial elevation of the androgen concentration *in vivo*.

EXPERIMENTAL METHOD

Experiments were carried out on eight sexually mature male albino rats weighing 150-160 g, immobilized with tubocurarine. Unit activity was recorded in the hypothalamic arcuate nuclei extracellularly by means of stereotaxically implanted [8] glass microelectrodes (diameter of tip 4-5 μ), filled with 3 M NaCl solution (resistance not more than 1 MΩ). Unit activity was recorded with the FOR-2 camera from the screen of an S1-18 oscilloscope. After spontaneous activity of all neurons encountered during passage of the microelectrode through the nucleus had been recorded, the animal was given an intramuscular injection of an oily solution of testosterone propionate (30 mg/kg). The microelectrode was then passed again through the arcuate nuclei after 30 min and 1, 2, and 3 h, and all neurons encountered were recorded. For each experiment separately and for all the experiments together, the mean frequency of activity was calculated before and at the above times after administration of testosterone. The significance of differences was estimated by Student's t test [4]. Control experiments were carried out on four rats each of which received an intramuscular injection of 0.05 ml of peach oil. At the end of each experiment, the location of the microelectrode track in the zone of the arcuate nuclei was verified morphologically. The investigation was carried out at one of the electrophysiological units of the Research Institute of Neurocybernetics, Rostov University*. Activity of 390 neurons was recorded in the main series of experiments and of 200 neurons in the control series.

EXPERIMENTAL RESULTS

Before administration of testosterone the mean spontaneous firing rate was 7±1 spikes/sec, roughly the same as that observed in neurons of the ventromedial and posterior regions of the rat and rabbit hypothalamus [2, 7]. The mean firing rate fell a little to 6±1 spikes/sec 30 min after injection of the hormone. A statistically significant decrease in firing rate was observed 1 h after injection of the hormone, the same as the time taken for a physiologically significant level of concentration of the hormone to be reached in target cells from an exog-

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TABLE 1. Change in Firing Rate of Neurons of Hypothalamic Arcuate Nuclei in Response to Injection of Testosterone Propionate (principal series) and of Peach Oil (control series)

Series of experiments	Time of recording				
	before injection	30 min after	1h after	2h after	3h after
Principal	7±1 (n=126)	6±0,5 (n=96)	4±1 (n=54)	5±0,5 (n=66)	5±0,5 (n=48)
P	>0,05	<0,5	<0,01	<0,01	<0,05
Control	7±1 (n=45)	7±0,5 (n=38)	7±0,5 (n=37)	7±0,5 (n=42)	6±0,5 (n=38)

Legend. Number of neurons shown in parentheses.

enous source [6]. A tendency toward the formation of bursts of spikes will be noted, a fact which correlates well with the synchronization of global hypothalamic electrical activity described in some investigations after injection of androgens.

As Table 1 shows, unit activity was statistically significantly reduced 1 h after injection of testosterone propionate, but after 3 h it was a little increased, although it did not return (in absolute values) to its initial level. This change in spontaneous activity was not a response to nociceptive stimulation, as is proved by the stability of the spike discharge of neurons in the control series, but it can be regarded as a response of neurons of the arcuate nucleus, evidently connected with the mechanism of weakening of the tonic influence of gonad-regulating structures of the hypothalamus on the male gonads.

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