EFFECT OF TACTIVIN ON FORMATION OF CONDITIONED AND MANIFESTATION OF UNCONDITIONED AVOIDANCE REFLEXES IN AUGUST RATS

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UDC 612.821.014.46:615.361.-438].019:599.323.4

KEY WORDS: *tactivin, thymus, conditioned and unconditioned reflexes.*

In the last 10-15 years, a new scientific discipline, namely neuroimmunology, has been formed on the boundary between immunology and neurophysiology [1, 4, 6]. Within the confines of this discipline the mechanisms of interaction between the immune and nervous systems in phylogeny and ontogeny, and also the mutual influence of the process of formation of the immune response and changes in the neuropsychic status are being investigated [3]. The abundance of data gathered in this region is evidence that the immune and nervous systems do not simply interact with one another, but they are also integrated into a single entity, and as such they perform basic functions in the body [1-4].

Meanwhile, in investigations of connections, in both directions, between the immune and nervous systems, problems concerned with the action of factors from the lymphoid organs on functional characteristics of neuronal structures have been studied obviously insufficiently. Accordingly, the aim of this investigation was to study the possible role of tactivin (thymus humoral factor) as a modulator of the formation of conditioned and manifestation of unconditioned reflexes.

TABLE 1. Effect of Tactivin on Ability of August Rats to Learn Avoiding Electric Shock After Preliminary Acoustic Stimulation

Experiment				Contral			
№	total number of series	number of positive series	%	№	total number of series	number of positive series	%
1	30	14	47	1	30	5	17
2	30	13	43	2	30	1	3
3	30	6	20	3	30	10	33
4	30	5	17	4	30	2	7
5	30	9	30	5	30	12	40
6	30	8	27	6	30	6	20
7	30	9	30	7	30	4	13
8	30	14	47	8	30	9	30
9	30	3	10	9	30	2	7
10	30	5	17	10	30	6	20
		8,6	28,8			5,7	19,0

Notes. No. indicates serial number of animals; number of positive series, i.e., series in which avoidance was observed after acoustic stimulation (before electrical stimulation); voltage of electric current 35-45 V/15 sec, resting period 40 sec.

Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 113, No. 4, pp. 397-399, April, 1992. Original article submitted June 27, 1991.

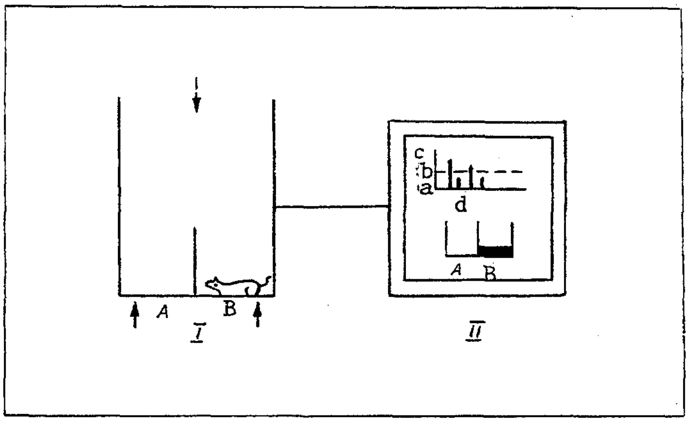

Fig. 1. Effect of tactivin on formation of conditioned and manifestation of unconditioned avoidance reflexes in response to electrical stimulation after preliminary application of acoustic stimulus in rats. I) Shuttlebox (with low partition in the middle). Floor of box made of wire mesh. A) Left side of box; B) right side of box. Arrow indicates electrical stimulation (voltage of 25-45 V applied alternately to a particular part of the box for 15 sec). Broken arrow indicates acoustic stimulus (applied before electrical stimulation for 5.5 sec). II) Screen of Iskra-226 microcomputer. A) Left side of shuttlebox; B) right side of shuttlebox. d) Abscissa) number of series (30 series to each animal); a-b) duration of application of acoustic stimulus (5 sec); b-c) duration of electrical stimulation (15 sec). Duration of rest period between series was 40 sec.

METHODS

Experiments were carried out on male August rats weighing 150-200 g. Tactivin (from Biomed, USSR) was injected intraperitoneally in a dose of 3 μg (volume 1.0 ml) for 5 days. Control animals received an equal volume of medium 199.

The animals were placed in a shuttlebox 20 min before the start of the experiment. The wire mesh floor of the box was connected to location detectors and to the control system of the electric current [7]. The experiments were controlled by an Iskra-226 microcomputer. On testing the unconditioned avoidance reflex the time spent by the animal running about in the nonelectrified part of the box after the beginning of application of an electric pulse 15 sec in duration and with an amplitude of 0.6-0.8 mA was recorded.

During avoidance conditioning the time spent by the animal running about after application of an acoustic stimulus lasting 5.5 sec was recorded. If 5 sec after the beginning of the conditioned stimulus the rat did not run into the neighboring compartment of the box, the unconditioned stimulus was applied. The training session consisted of 30 combinations of conditioned and unconditioned stimuli in the course of 45-60 min. The results of each experiment are shown in Table 1 and also in the form of diagrams (Fig. 1), and then processed with the aid of the nonparametric Wilcoxon—Mann—Whitney test.

RESULTS

Injection of tactivin into the rats led to a significant increase in the speed of formation of conditioned reflexes in the experimental animals compared with the controls (Table 1). For instance, in the group of experimental animals, the more rapid formation of the conditioned reflex (the animal running into the nonelectrified part of the box in response to application of the conditioned stimulus) took the form that avoidance on application of the acoustic stimulus was observed on average after only five combinations, but only after 10 combinations in the control group. On the whole, in the experimental group conditioned avoidance was exhibited in 29% of all tests, compared with only 19% of cases among the control group ($p < 0.05$).

Differences were found also in the parameters of the unconditioned avoidance reflex. In the experimental group, for instance, the average time of switching compartments was 3.2 sec compared with 3.5 sec in the control. The experimental and control groups also differed in the number of series in which the animals could not avoid electric shock at all (20 and 30, respectively, or three and five series to each animal from the above-mentioned groups).

Thus, a course of tactivin has a similar positive effect on formation of conditioned and unconditioned avoidance reflexes. This effect was manifested in the experimental animals as the more rapid formation of a conditioned reflex to sound, and also a decrease in the time of avoidance in response to electric shock, and a smaller number of unsuccessful series during testing of unconditioned avoidance than in the control. Some mechanisms of the effect of tactivin in these learning models can be discussed. First, tactivin may act on brain structures which are involved in conditioned reflex formation and in the realization of avoidance, through a change in their functional state. For example, we showed that intraperitoneal injection of tactivin leads to modulation of hippocampal electrical activity, reflected in a change in the parameters of evoked potentials [6]. The second hypothesis is connected with data on the antistressor action of tactivin [5], which is probably due to the presence of β-endorphin activity in its composition [2].

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