INFLUENCE OF BRAIN STEM STRUCTURES ON THE 
FORMATION OF THE DEFENSIVE BEHAVIOR OF ANIMALS

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The dependence of the dominant form of the defensive behavior of white male mongrel rats on the functional state of the brain stem inhibitory locomotor system has been studied in chronic experiments. It was established that the electrolytic destruction of the inhibitory zones of the cuneate nucleus of the midbrain, the medial parabrachial nucleus, the central and great nuclei of the raphe leads to the dominance of active defensive reactions in animals in confrontations with partners. The opposite effect is exerted by local injection of kainic acid into these regions of the brainstem. It is hypothesized that the functional state of the brain stem inhibitory locomotor system can exert a modulating influence on the formation of the defensive behavior of animals.

It is well known that the formation of defensive behavior can be accompanied by various types of emotional-expressive reactions. In a number of cases these reactions consist in active actions, including combat, attack, or avoidance; in other cases, in freezing, torpor, or passive endurance of the threatening actions [3, 13]. If the neurochemical mechanisms of the regulation of these types of emotional-expressive reactions and the morphological substrate participating in their formation at the level of the limbic system of the brain have been studied in considerable detail [2, 3], thus far there are insufficient data on the possible modulating influence of various areas of the brainstem. In particular little is known regarding the brainstem neurophysiological mechanisms participating in the formation of the passive defensive reactions to the surrounding situation. At the same time, there are certain data which make it possible to hypothesize that some areas of the brainstem may be involved in this form of behavior. Thus, the electrical stimulation of the medial nucleus of the raphe evokes behavioral reactions in the animals which are externally very similar to the fear reaction to threatening stimuli in situations in which avoiding them is impossible [16]. In our preceding investigations, similar cataleptiform reactions were observed with electrical stimulation of some areas of the cuneate nucleus of the midbrain, the medial parabrachial nucleus, the central and great nuclei of the raphe, which forms a unitary morphofunctional system participating in the regulation of the motor activity of animals [8, 9]. Despite the fact that these brainstem formations can provisionally be considered effector structures in the formation of motor expressive reactions, their participation in the regulation of higher nervous functions is highly significant due to the presence of developed bilateral connections with many rostral brain structures [5, 17].

The purpose of the present investigation was a study of the influence of the functional state of the brainstem structures which participate in the regulation of motor activity on the process of the formation of the defensive behavior of animals.

METHODS

The investigations were carried out on preliminarily selected white mongrel rats (male) weighing 250–300 g in chronic experimental conditions. In the process of selection the animals were divided into two groups (15 animals per group), into those predisposed and those not predisposed to catalepsy, based on a test of their maintenance of a forcibly imposed vertical posture [11]. The determination of the dominant form of defensive behavior was made by means of the simulation of aggression and emotional stress in animals taken in pairs of each group, with their attachment by the tail to the wall of the experimental chamber [14]. Pairs only of animals predisposed to active aggressive actions directed toward their partners were made up in a special series of experiments to elucidate the influences of local microinjections into brainstem inhibitory zones.
order to accelerate the process of confrontation between the animals, periodic threshold electrocutaneous stimulation of the tail was applied additionally to each of the animals, eliciting vocalization. Following the beginning of the confrontation, the duration of vertical defensive rearings and the time of the animals in the characteristic postures of dominance "from above" or complete subjection "on the back" [13] were recorded for 20 min. From 5 to 10 confrontations were carried out for each pair of animals before and after the local neurochemical or electrolytic influence on the structure of the brainstem.

From 3 to 5 bipolar Nichrome electrodes, with a diameter of the active tips of 100 μm and a distance between them of 50–100 μm, were attached, by means of steel fasteners and "Protacril-M" plastic, to the skull of each animals predisposed to passive defensive reactions, under ethaminal anesthesia (40–60 mg/kg, intraperitoneally). The electrodes were introduced into structures of the brain, the electrical stimulation of which, according to preliminary data, elicited inhibition of the motor activity of the animals: cuneate nucleus of the midbrain (bilaterally), the medial parabrachial nucleus (bilaterally), the central