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ABSTRACT

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Abstracts

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S2.140. Changes in the electrical characteristics of identified neurons in the terrestrial snail as a result of the development of a conditioned situational reflex and reconsolidation of memory for this reflex

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A plethora of experimental data indicate that cellular processes associated with learning are caused by long-term modifications in the efficiency of synaptic transmission and changes in the endogenous properties of the neuron and its membrane [1,2,3]. For a long time, the change in the efficiency of synaptic transmission was recognized as the main learning mechanism until later evidence of non-synaptic mechanisms appeared. Within the framework of such ideas, there is a sufficient number of studies of cellular learning mechanisms [4,5]. Therefore, in many works, studies have been carried out to establish a link between the outcomes of behavioral learning and the excitability of neurons and the electrical characteristics of the membrane [1,2,4,5]. Previously, we have shown membrane correlates (changes in the membrane and threshold potentials of premotor interneurons) for conditioned defensive reflexes of tapping on the shell and aversion to food [2,4,6]. Therefore, the question arose whether such changes are possible during the development of other types of conditioned reflexes. To do this, we studied the possible correlation of the development of a conditioned situational reflex [7], and the reconsolidation of its memory to the dynamics of changes in the electrical characteristics of the premotor interneurons of the defensive behavior LPa3 and RPa3 as well as the serotonin-containing neurons Pd2 & Pd4 of the pedal ganglion, which modulate this reflex in the terrestrial snail,. Therefore, we studied the changes in the membrane and threshold potentials of the premotor interneurons LPa3 and RPa3 of the terrestrial snail after the development of a conditioned defensive reflex to the situation and memory reconsolidation of this reflex.
The experiments were carried out using the mollusc Helix lucorum. In all animals, a situational conditioned reflex was developed according to the contextual paradigm "on the ball" where the animals were rigidly fixed to the shell. Before elaborating the conditioned reflex and after training, the amplitude of the defensive reaction was tested as an indicator of the formed long-term memory. Behavioral responses were tested in two environments (contexts): 1) on a ball (i.e., under standard learning conditions), 2) on a flat surface. In some snails, after the development of a conditioned reflex to the environment, long-term memory of the learning environment was reconsolidated [7]. For the study of reconsolidation, a "reminder" of the learning environment was introduced. The results showed that the membrane potential in neurons LPa3 and RPa3 decreases significantly (about 5 mV) after training. No significant further changes were found in the membrane potential after the reminder (initiation of reconsolidation relative to its post-training level). The threshold potential of these neurons decreased after training and remained unchanged after the reminder. At the same time, after the reminder, the membrane and threshold potentials significantly decrease relative to the initial level (before training). All in all, these neurons can participate in the process of reconsolidation of the situational reflex.
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S2.141. Changes in the process of endocytosis of synaptic vesicles in various types of muscle mice after hindlimb unloading

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Functional unloading of skeletal musculature (immobilization, bed rest, space flight) leads to atrophy, which mechanisms are well studied. Condition of motoneurons, innervating this muscles and launching muscle contraction process, is less studied. Action potential propagation along motoneuron axon provides transmission of excitation from the motor nerve ending to postsynaptic membrane of the muscle fiber by activation of acetylcholine receptors with mediator – acetylcholine. Previously shown, that levels of non-quantum secretion of acetylcholine change, and quantum induced and spontaneous secretion, in rats are changed after antiorthostatic suspension of the hind limbs (support unloading model according to the Morey-Holton method). The intensity of the quantum release of the mediator can be regulated both by exo- and endocytosis. In this work, we analyzed the processes of endocytosis of synaptic vesicles in the nerve endings of muscles of different functional types in mice after 30 days of support unloading (antiorthostatic rear limb suspension (AOS) according to the Morey-Holton method). The experiments were carried out on isolated neuromuscular preparations m. Diaphragma (mixed muscle), m. Soleus (slow muscle), m. EDL (m. extensor digitorum longus fast muscle) of laboratory white mice. The processes of endocytosis of synaptic vesicles were studied using a fluorescent marker FM 1-43 (3μM), which reversibly binds to the presynaptic membrane and during endocytosis of synaptic vesicles is inside the nerve terminal ("loading" of the terminal). An indicator of endocytosis and loading of the fluorescent dye into synaptic vesicles was the appearance of brightly glowing spots inside the nerve ending. The intensity and duration of stimulation of the nerve stump depended on the type of muscle: m. Diaphragma 50 imp/s in 1 minute, m. Soleus – 1 imp/s 5 sec and 10 imp/s 10 sec, m. EDL – 60 sec by hyperpotassic Krebs solution. In the control group of mice with high-frequency stimulation of the motor nerve of the phrenic muscle, the luminescence intensity was 87 r.u. ± 3 r.u. (n=14). In the group of animals after AOS, the terminal luminescence intensity was 75 ±