



Effects of Serotonin Receptor Antagonist Methiothepin on Membrane Potential of Premotor Interneurons of Naïve and Learned Snails

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Abstract

It was shown that the application of methiothepin, the antagonist of serotonin (5-HT) receptors, caused a decrease in the membrane potential of the high-threshold premotor interneurons LPa3 and RPa3 of the intact snails and its increase to the previous level after the subsequent application of 5-HT in vitro. The application of methiothepin also led to a decrease in the membrane potential of these neurons, but the subsequent application of 5-HT did not lead to the return of the membrane potential to the previous level in animals trained in defensive reflex. It can be assumed that conditioning of the defensive reflex causes a state change of the 5-HT receptor system of premotor interneurons of defensive behavior.

Keywords Serotonin · Methiothepin · Identified neurons · Membrane and threshold potentials · Learning · Snail

1 Introduction

There are a large number of studies that demonstrate the necessity of serotonin (5-HT) for the elaboration of the defensive reflexes conditioning in mollusks [1–3]. The concept about the important role of extrasynaptic transmission of 5-HT in the mechanisms of memory in mollusks is recently developing [4, 5]. The modulatory neurons of the pedal ganglion of the

terrestrial snails are responsible for those modulations [6, 7]. It has been shown that the electrophysiological correlates of plasticity can be reproduced by the application of 5-HT in the solution, washing the central nervous system [8–14]. One of the sites for 5-HT action may be the 5-HT receptors. So, it was shown that the methiothepin (MET), an antagonist of the 5-HT receptors, prevented posttetanic potentiation caused by acetylcholine-evoked current in premotor interneurons and behavioral sensitization in snails [15]. It was also found that the mianserin, another antagonist of the 5-HT receptors, blocked two forms of the defensive behavior of *Lymnaea*, caused by unconditioned stimulus (extract of the cray-fish tissue). The methysergide, also antagonist of 5-HT receptors, disrupted the formation of long-term memory after training [16]. On the soma of snails, premotor interneurons, which are the object of our study, were found only the 5-HT receptors, inhibited by MET (possibly of first type 5-HT receptors) [15, 17]. The aim of present work was the study of the changes of excitability of premotor interneurons in response to sequential applications of MET (antagonist of serotonin receptors) and 5-HT in preparations of naive and trained snails.

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2 Methods

The terrestrial snails *Helix lucorum* were used in experiments. The animals were kept in active state in a glass terrarium, in a humid atmosphere, at room temperature, with an excess of