

Experimental and modeling investigation of the mechanism of synaptic vesicles recycling

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Abstract

Under the condition of microelectrode recording and fluorescence microscopy with dye FM 1-43 the research of exo-/endocytosis of synaptic vesicles in motor nerve terminals (NT) of frog cutaneous pectoris and white mice diaphragm muscles during high frequency stimulation (20 imp/s) was carried out. A mathematical modeling allowed us to conclude that the obtained experimental data can be explained in the following framework. Three pools of synaptic vesicles are involved in neurotransmitter release in the frog motor NT. Recovery of these pools is provided by endocytosis of two types: fast endocytosis with limited capacity and slow endocytosis. Fast-reconstructing vesicles refill the mobilization pool and slow endocytosis recovers the reserve pool. Our modeling investigation has revealed in frog NT independent recruiting of reserve and mobilization pools to the neurotransmitter secretion, i. e. this pools work concurrently. Experimental data, obtained on mice preparations, are well described with the framework of two-pools model including single type of endocytosis (fast endocytosis). © 2012 Pleiades Publishing, Ltd.

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Keywords

endocytosis, exocytosis, modeling, synaptic vesicles recycling