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Metabotropic and ionotropic glutamate receptors mediate the modulation of acetylcholine release at the frog neuromuscular junction

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Abstract

© 2016 Wiley Periodicals, Inc. There is some evidence that glutamate (Glu) acts as a signaling molecule at vertebrate neuromuscular junctions where acetylcholine (ACh) serves as a neurotransmitter. In this study, performed on the cutaneous pectoris muscle of the frog Rana ridibunda, Glu receptor mechanisms that modulate ACh release processes were analyzed. Electrophysiological experiments showed that Glu reduces both spontaneous and evoked quantal secretion of ACh and synchronizes its release in response to electrical stimulation. Quisqualate, an agonist of ionotropic α-amino-3-hydroxy-5-methyl-4-isoxazolepropionic receptors and metabotropic Group I mGlu receptors, also exerted Glu-like inhibitory effects on the secretion of ACh but had no effect on the kinetics of quantal release. Quisqualate's inhibitory effect did not occur when a blocker of Group I mGlu receptors (LY 367385) or an inhibitor of phospholipase C (U73122) was present. An increase in the degree of synchrony of ACh quantal release, such as that produced by Glu, was obtained after application of N-methy--D-aspartic acid (NMDA). The presence of Group I mGlu and NMDA receptors in the neuromuscula r synapse was confirmed by immunocytochemistry. Thus, the data suggest that both metabotropic Group I mGlu receptors and ionotropic NMDA receptors are present at the neuromuscular synapse of amphibians, and that the activation of these receptors initiates different mechanisms for the regulation of ACh release from motor nerve terminals. © 2016 Wiley Periodicals, Inc.

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Keywords

cholinergic synapse, metabotropic Glu receptors, neuromodulation, neurotransmitter release, NMDA receptor

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