INTEGRATION OF PEPTIDERGIC AND MUSCARINIC SYNAPTIC TRANSMISSION IN AMPHIBIAN SYMPATHETIC GANGLION NEURONS. T. J. Sejnowski and S. W. Kuffler†. Dept. of Neurobiology, Harvard Medical School, Boston, MA 02115.

Intracellular recording from paravertebral sympathetic ganglia of the bullfrog has established that in the large B neurons two slow excitatory postsynaptic potentials are produced by stimulating two different nerves: a muscarinic response lasting up to 1 min, which is mediated by acetylcholine, and a noncholinergic response lasting up to 10 min, which is mediated by a peptide resembling luteinizing hormone-releasing hormone (LHRH) (Jan, Jan & Kuffler, Proc. Nat. Acad. Sci. 76: 1501, 1979; 77: 5008, 1980).

Using a single-electrode voltage clamp, we have confirmed previous reports that a conductance decrease occurs in most ganglion cells near the resting potential during the peptidergic response to nerve stimulation or external application of LHRH. However, when a cell was clamped at hyperpolarized potentials, conductance increases often occurred during the response; in these ganglion cells the peak amplitude of the peptidergic current increased with hyperpolarization. Among the cells in which only a decrease in conductance occurred, it was possible in a few cases to reverse the polarity of the peptidergic current at a hyperpolarized potential. More than one mechanism may contribute to the generation of the peptidergic response.

Conductance decreases and conductance increases also occurred during the slow muscarinic responses. In the same cell the muscarinic and peptidergic responses had the same voltage dependence and were accompanied by the same conductance changes.

The similarity between the muscarinic and peptidergic responses, despite their different time courses, suggests that they are produced by similar mechanisms. Their interaction was examined to test whether the mechanisms are shared. When evoked together, their combined currents were generally less than the sum of the individual currents. Furthermore, during a prolonged saturating response to bethanechol, a muscarinic agonist, the response of a cell to LHRH was completely blocked, and conversely, a saturating response to LHRH completely blocked the effect of bethanechol. Since the muscarinic and peptidergic receptors are independently blocked by pharmacological agents, the interaction between the two responses occurs at a stage beyond activation of the receptors.

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