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Effect of increased membrane conductance on response properties of spinal motoneurons

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The pattern of action potential generation in spinal motoneurons depends on synaptic input and intrinsic response properties. Synaptic activity of premotor network not only directly excites, inhibits and modulates the neuron, but it may also contribute by shunting intrinsic properties. During spinal network activity motoneurons receive massive balanced synaptic excitation and inhibition [1], therefore their membrane conductance dramatically increase [2]. This can substantially decrease an influence of intrinsic properties of motoneurons.

It is straightforward to expect that shunting inhibition will increase the rheobase of the neuron, and therefore decrease the number of spikes when stimulated with depolarising current pulse. However, it is not trivial to predict how increased membrane conductance will influence the gain of motoneuron and the threshold for action potential generation.

This issue was investigated by intracellular recordings from adult turtle spinal motoneurons. Membrane conductance was pharmacologically increased by extracellular application of muscimol, GABAA receptor agonist.

Our findings suggest that membrane conductance increased up to 50% does not affect the threshold for action potential generation and causes a subtractive rather than divisive action on the gain of motoneurons.

[1] Berg RW, et. al *Science* (2007), 315(5810):390-3.

[2] Alaburda A, et. al. *J. Neurosci* (2005), 25(27):6316-21.