Cerebellar inhibitory input to the inferior olive decreases electrical coupling and blocks subthreshold oscillations.

By elsec_admin
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By elsec_admin March 30, 2014


Abstract:

GABAergic projection neurons in the cerebellar nuclei (CN) innervate the inferior olive (IO) that in turn is the source of climbing fibers targeting Purkinje neurons in the cerebellar cortex. Anatomical evidence suggests that CN synapses modulate electrical coupling between IO neurons. In vivo studies indicate that they are also involved in controlling synchrony and rhythmicity of IO neurons. Here, we demonstrate using virally targeted channelrhodopsin in the cerebellar nucleo-olivary neurons that synaptic input can indeed modulate both the strength and symmetry of electrical coupling between IO neurons and alter network activity. Similar synaptic modifications of electrical coupling are likely to occur in other brain regions, where rapid modification of the spatiotemporal features of the coupled networks is needed to adequately respond to behavioral demands.

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