INHIBITORY GLUTAMATE RECEPTORS IN SPIDER PERIPHERAL MECHANOSENSORY NEURONS

Panek Izabela*, Meisner Shannon* and Torkkeli Päivi H.
Dept. Physiology and Biophysics, Dalhousie University, Halifax, NS, B3H 1X5, Canada

Peripherally located parts of mechanosensory neurons in the spider *Cupiennius salei* receive extensive efferent innervation. The majority of the efferent fibers were immunoreactive to GABA, but glutamate and octopamine immunoreactive fibers were also found. The sensory neurons were inhibited by GABA and muscimol, agonists of ionotropic GABA receptors, but octopamine increased their sensitivity to mechanical stimuli. Here we show that mechanosensory neurons innervating the spider lyriform slit sensilla are inhibited by glutamate, via mechanisms similar to the GABAergic inhibition described before. Both GABA and glutamate depolarized the neurons, and this effect was blocked by the Cl^- channel blocker picrotoxin. Glutamate induced depolarization reversed at more hyperpolarized membrane potential (~-50 mV) than the GABA or muscimol induced depolarization (~-30 mV). Like the ionotropic GABA receptors, invertebrate inhibitory glutamate receptors (IGluRs) gate Cl^- channels, but some of these channels are also permeable to K^+. Cloned IGluR subunits share high sequence identity and similarity with vertebrate glycine receptors. In the spider mechanosensory neurons, glutamate was not as potent an inhibitor of electrically induced action potentials as GABA. However, glutamate was equally potent in inhibiting mechanically versus electrically induced action potentials, and it also slightly reduced the amplitude of mechanically activated current. In contrast, GABA has only been shown to inhibit axonal excitability. Three antibodies against different sequences of cloned *Drosophila* IGluR subunit, GluClα, specifically labeled the dendrites, somata and axons of the spider mechanosensory neurons. Western blot analysis of crude and immunoprecipitated spider tissue extracts revealed expected ~50 kDa bands with the same antibodies. Some immunoreactivity was also present in the efferent neurons. However, blocking of efferent activity with Ni^{2+} had no effect on the glutamate response of the sensory neurons. These results show that IGluRs are expressed in all parts of the spider mechanosensory neurons and that they can modulate the neuron's response to mechanical stimuli before it is conveyed to the soma or axon.

Supported by the CIHR to PHT and a NATO Science fellowship to IP