CALCIUM-BASED NEGATIVE FEEDBACK ON SENSORY TRANSDUCTION IN SPIDER MECHANORECEPTORS

Andrew S. French, Ulli Höger, Shannon Meisner and Päivi H. Torkkeli
Department of Physiology and Biophysics, Dalhousie University, Halifax, Canada

The compound slit sense organ VS-3 in the patella of the spider, Cupiennius salei, consists of 7-8 cuticular slits, each innervated by a pair of bipolar mechanosensory neurons. VS-3 neurons are accessible to intracellular recording and mechanical stimulation in the periphery, where mechanotransduction occurs. During mechanical stimulation, Ca2+ enters VS-3 neurons via voltage activated Ca2+ channels when they are opened by action potentials. We used a Ca2+ sensitive fluorescent dye (Oregon Green BAPTA-1) to show that intracellular [Ca2+] rises with a similar time course in all peripheral regions of VS-3 neurons following individual action potentials. An antibody against Ca2+ channels showed that they are located in the same regions.

Intracellular Ca2+ levels were raised experimentally by releasing intracellular caged Ca2+ (NP-EGTA) using UV illumination. Increased [Ca2+] reduced the receptor potential amplitude produced by mechanical stimulation of the slits. Single-electrode voltage clamp recording showed that receptor current was reduced with a similar time course to receptor potential. These experiments indicate that one function of the [Ca2+] increase during action potential firing in VS-3 sensory neurons is to provide negative feedback control of neuronal sensitivity.

Canadian Institutes of Health Research
Nova Scotia Health Research Foundation
Dalhousie Medical Research Foundation.