Recent Advances in Network Electrophysiology Using Multi-Electrode Arrays
Tuesday, October 26, 2004, 5:30 pm – 8:30 pm
Convention Center, Room 3, San Diego, CA

Long-Term Depression (LTD) in Organotypic Hippocampal Slices Grown on Multielectrode Arrays.

Natalia Bastrikova and Serena Dudek
Laboratory of Neurobiology, National Institute of Environmental Health Sciences, NIH, Research Triangle Park, NC 27709, USA

One of the features of neuronal development is the elimination of synapses during a critical period of postnatal life. A question remaining unclear is whether or not synaptic weakening in the form of long-term depression (LTD) is required prior to synapse elimination. In order to address this problem, we cultured hippocampal slices on electrode arrays (MED 64, Panasonic) capable of stimulating and recording from the same electrode of the 64 available over the course of several days.
Because stimulation frequencies that are effective at generating LTD induction in acute hippocampal slices were found to be ineffective in freely moving animals, the first step in our experiments was to test several frequencies for their LTD inducing ability. Young organotypic slices (10DIV) were studied with 900 pulses delivered at 0.5, 1, 2, 3 and 5Hz.
Neither depression nor potentiation was observed following a stimulus application at 0.5 or 1Hz, while 5Hz stimulation resulted in only short-term depression with the response amplitude returning to baseline within 5-7 min. Stimulation at 2 Hz and 3 Hz induced significant LTD (20 and 34%, respectively) that was sustained for greater than 24 hours. Furthermore, a second application of 900 pulses resulted in further LTD or, sometimes, in the loss of response. The NMDA receptor antagonist D-amino-5-phosphonopentanoic acid (D-APV, 50muM) completely blocked this form of LTD. Thus, young organotypic slices (10DIV) maintain the ability to express NMDA receptor-dependent LTD, but the frequency-response curve is shifted rightward to higher frequencies when compared to acute slices.
Future studies using confocal microscopy and gene gun transfection will directly examine whether LTD-inducing stimulation results in synapse elimination.