

**CA3 COMMISSURAL, BUT NOT MOSSY FIBER, SYNAPSES IN HIPPOCAMPUS EXHIBIT ASSOCIATIVE LONG-TERM POTENTIATION (LTP) USING RHYTHMICALLY COACTIVE INPUTS. S. Chattarji, P.K. Stanton, and T.J. Sejnowski. Dept. Biophysics, Johns Hopkins Univ., Baltimore, MD 21218.**

Long-term potentiation (LTP) is characterized by a persistent increase in synaptic efficacy following brief, high-frequency stimulation of afferent pathways in the hippocampus. There is evidence that weak excitatory inputs that do not exhibit LTP when stimulated alone do elicit LTP when coactivated with stronger inputs. Recent studies suggest that associative LTP can be induced in field CA1 of the hippocampus depending on the phase of rhythmically active inputs. The present study evaluates whether associative LTP can be induced using such rhythmically coactive inputs in field CA3, where mossy fiber synapses exhibit LTP not involving N-methyl-D-aspartate (NMDA) receptor activation.

Extracellular recordings were made in 400  $\mu$ m thick rat hippocampal slices in an interface recording chamber at 33 $^{\circ}$  C. Responses of CA3 pyramidal cell somata and apical dendrites were recorded following stimulation of the Commissural/Schaffer (COM) and mossy fiber (MF) afferents. Strong (potentiating) stimuli consisted of trains of 10 bursts of 5 pulses each at a frequency of 100 Hz, with an interburst interval of 200 msec. The weak stimulus, a train of single shocks at 5 Hz, was given either superimposed on the middle of each burst (in phase), or symmetrically between the bursts (out of phase).

A strong tetanus alone induced LTP at both COM and MF synapses, while weak inputs alone produced no change. When the COM side received a weak input in phase with a strong MF tetanus, associative LTP (>30 min) was induced at COM synapses. In contrast, a weak MF stimulus failed to elicit associative LTP when applied in phase with a strong COM input. Furthermore, when the COM side received a weak input out of phase with a strong MF train, a long-term depression (LTD) of COM evoked population spikes was observed. Thus, MF synapses, which lack NMDA receptors, do not exhibit associative LTP. (Supported by Naval Research Grant #N00014-88-K-0198)