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LONG-TERM POTENTIATION (LTP) AND LONG-TERM DEPRESSION (LTD) IN INTERNEURONS WITHIN THE RAT HIPPOCAMPAL STRATUM RADIATUM.

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The application of tetanic stimuli at either 100 or 200 Hz has been shown to reliably induce LTP in CA1 pyramidal cells, while low-frequency (3 Hz) stimulation can induce LTD. In hippocampal interneurons however, the application of the 100 Hz stimuli has been reported to induce a LTD in interneurons located in the Stratum Radiatum (S.R.) of the CA1 region (McMahon and Kauer, 1995). Interneurons in the S.R. include a number of morphologically distinct neuronal types. These neurons receive input from a variety of afferent sources, and their axons terminate in distinct patterns within the hippocampal formation. In the present experiments, we examined the ability of both 100 and 200 Hz stimuli to alter excitatory synaptic transmission in interneurons located in the S.R. region. Whole cell recordings were made from visualized interneurons in slices obtained from 14-42 day old rats. Slices were maintained in physiological artificial cerebral spinal fluid (ACSF, 2.0 CaCl₂, and 1.3 MgCl₂) at 32-35 °C. All cells were filled with Biocytin (0.2-0.3%) for subsequent histological analysis. Tetani (100 pulses delivered at either 100 or 200Hz) were delivered twice, 20-30 seconds apart, through stimulating electrodes located 100-200 μm from the cell in the S.R. Application of the 100 Hz stimuli resulted in LTP in 15/19 cells tested ($54.8 \pm 13.2\%$, n=15) and a LTD in the remaining 4 cells ($-26.8 \pm 17.3\%$). The 200 Hz stimulation produced LTP in 6/8 cells tested ($120 \pm 56\%$, n=6) and LTD in the remaining two cells ($-16 \pm 9\%$, n=2). Low-frequency stimulation (3 Hz) produced LTD in 4/9 cells ($-35.4 \pm 8.3\%$), while the remaining cells exhibited LTP ($54.2 \pm 12.2\%$). These data suggest that hippocampal interneurons are capable of expressing both long-term potentiation and long-term depression. Possible correlates between cellular morphology and an interneuron's ability to sustain either LTP or LTD is under investigation. Supported by HHMI grant #528092.