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ASSOCIATIVE LONG-TERM POTENTIATION IN THE HIPPOCAMPUS USING ANTIDROMIC STIMULATION AS THE CONDITIONING TETANUS. J. M. Jester and T. J. Sejnowski, Computational Neurobiology Laboratory, Salk Institute, La Jolla, CA 92037.

Associative long-term potentiation (LTP) is a long-lasting increase in synaptic response produced when a stimulus insufficient to cause LTP is paired with a conditioning tetanus. In area CA1 of the hippocampus, associative LTP is mediated by depolarization of the post-synaptic membrane which relieves the Mg^{++} block of the N-methyl-D-aspartate (NMDA) type of glutamate receptor. Can antidromically-elicited action potentials in the soma of CA1 pyramidal neurons depolarize the post-synaptic membrane in dendrites enough to prime the NMDA receptor?

Extracellular field potentials were recorded from 400 µm thick slices of rat hippocampus. The orthodromic test stimulus site (TEST) was in stratum radiatum of CA1 and the antidromic stimuls site (ANTI) was in the alveus. The ANTI site received a train of 50 bursts of 5 pulses at 100 hz with an inter-burst interval of 200 msec. The TEST site received 50 shocks at 5 Hz so that the shocks arrived simultaneous with the bursts to ANTI.

The conditioning stimulation to ANTI when given alone did not produce a change in either population spike or EPSP of the test site (0.0 $\pm$ 3.9%, n=6 PS, -5.4 $\pm$ 9.6%, n=5 EPSP), nor did the 5 hz stimulation to TEST (-2.5 $\pm$ 6.3%, n=11, PS and 0.6 $\pm$ 2.7%, n=11, EPSP); however, when the ortho- and antidromic stimulations were paired an increase in the population spike was observed (+24.0 $\pm$ 9.4%, n=5) which lasted at least 30 minutes. Application of 2-amino-5-phosphonovalerate (AP5) reversibly blocked this associative LTP. Thus, antidromically stimulated action potentials may invade the apical dendrites of CA1 hippocampal pyramidal cells and provide the depolarization necessary for associative LTP.