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Antidromically-Conditioned E-S Potentiation is not Blocked by GABA_A Inhibitors. Lee W. Campbell*, Jennifer M. Jester, Terrence J. Sejnowski. Computational Neurobiology Laboratory, Salk Institute, La Jolla, CA

Long-term potentiation (LTP) of the population spike in excess of that predicted by increase in the slope of the field excitatory post-synaptic potential (EPSP) has been described as a component of theta-burst LTP (Exp Brain Res 79:633-641). An increase in the ratio of excitation to inhibition, a reduction of tonic inhibition, and a decrease in spike threshold are thought to contribute to this EPSP-to-spike (E-S) potentiation. Associative LTP using antidromic stimulation as the conditioning stimulus produces a stable increase in the population spike amplitude, but no change in the slope of the EPSP (Soc Neuro Abstr 17:533.15). Do changes in tonic or synaptic inhibition underlie the associative form of E-S potentiation as they are thought to do in theta-burst E-S potentiation?

The EPSP and population spike were recorded from the CA1 layer of rat hippocampal slices. The antidromic conditioning stimulus was 50 bursts of 5 pulses at 100 Hz with an interburst interval of 200 ms delivered to the alveus. The Schaffer-collateral pathway was stimulated once per burst. In some slices the GABA_A blockers picrotoxin (10 μ M) and/or bicuculline (10 μ M) were added to the bath prior to testing. When paired together, the antidromic and orthodromic stimuli produced a potentiation of the population spike, even in the presence of the GABA_A blockers (138% \pm 16.7; mean \pm s.e.m). In contrast, the E-S potentiation component of theta-burst LTP is blocked by GABA_A inhibitors.

Intracellular recordings from the CA1 layer reveal an increase in excitability following associative E-S potentiation. Paired t-tests suggest that a depolarization of the resting membrane potential (RMP) accounts for the increased excitability (ctrl -63.7 \pm 0.326 mV, 15 min. post tetanus -61.2 mV \pm 0.438; mean RMP \pm s.e.m, $P = 0.04$, $F_1 = 9.08$). Spike threshold, input resistance, and time constant of the membrane were not effected by associative E-S potentiation.