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THE INVOLVEMENT OF CA1, CA3 AND DENTATE GYRUS CELLS IN CARBACHOL-INDUCED OSCILLATIONS IN THE HIPPOCAMPAL SLICE. J.-M. Fellous* and T.J. Sejnowski. The Salk Institute. 10010 N. Torrey Pines Road, La Jolla, CA 92037.

Cholinergic projections from the septal nuclei affect the state of activity in the hippocampus. We studied the rhythms induced by carbachol, a muscarinic agonist, in an in vitro preparation. Perfusion of high concentrations (15-50 μM) of carbachol induced a spontaneous theta-like (4-10 Hz) AMPA-mediated network oscillations in the transversal rat hippocampal slice. Lower concentrations (1-10 μM) induced slow rhythmic delta-like discharges in the 0.2 to 2 Hz range. Intermediate concentrations (8-20 μM) produced irregular transient episodes of 50-80 Hz oscillations often intermixed with the two other rhythms.

Using simultaneous field and patch-clamp recording techniques, we examined the involvement of pyramidal and GABAergic cells in regions CA1, CA3 and dentate gyrus of the transversal hippocampal slice, and in the CA3 region of the longitudinal slice. Whereas interneurons fire more than one action potential at each cycles of the theta- or delta-like discharges, pyramidal cells usually fire at most once per cycle, and are active only during few cycles per theta-like episodes.

These findings suggest that the level of activity of the cholinergic inputs to the hippocampus may control the mixture of oscillatory rhythms observed in vivo. Supported by the Howard Hughes Medical Institute.