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CORTICAL PROJECTIONS TO THE THALAMIC RETICULAR NUCLEUS MAY CONTROL THE SPATIOTEMPORAL COHERENCE OF SPINDLE AND EPILEPTIC OSCILLATIONS. A. Destexhe*, D. Contreras, T.J. Sejnowski‡ and M. Steriade. Department of Physiology, Laval University, Québec, CANADA G1K 7P4; ‡ Computational Neurobiology Laboratory, The Salk Institute, PO Box 85800, San Diego, CA 92186, USA.

Recent experiments revealed a powerful effect of the cortex in synchronizing thalamic oscillations into very coherent spatiotemporal patterns. We investigated possible network mechanisms underlying the control of thalamic and cortical oscillations using computer models. The intrinsic properties of thalamic and cortical cells were modeled using voltage-dependent currents described by Hodgkin-Huxley type of kinetics, and synaptic currents were modeled by kinetic models for AMPA, $GABA_A$ and $GABA_B$ receptors. We successfully modeled the following electrophysiological observations *in vivo* and *in vitro*: (a) without cortex, thalamic networks displayed spindle sequences with few simultaneity and propagating properties; (b) in the presence of the cortex, spindle oscillations were nearly simultaneous due to extended thalamo-cortical and cortico-thalamic projections; (c) if cortical discharges were tuned down by increased intracortical inhibition, the spatiotemporal coherence of spindle waves was decreased; (*d*) decreased cortical inhibition led to stronger cortical discharges that could force the intact thalamic circuitry into ~3 Hz oscillations due to the particular properties of $GABA_B$ receptors; in this case, all cells displayed prolonged discharges similar to some type of epileptic patterns. The model suggests that cortical cells have a powerful influence on recruiting thalamic-generated oscillations primarily via their projections to the reticular nucleus. Through this mechanism, cortical discharges have a decisive impact in controlling the type and spatiotemporal pattern of oscillations generated in the thalamus. Supported by MRC of Canada, FRSQ, the Savoy Foundation and the Howard Hughes Medical Institute.