466.4

IN VIVO, IN VITRO AND COMPUTATIONAL ANALYSIS OF DENDRITIC CURRENTS IN THALAMIC RETICULAR NEURONS.

T.J. Sejnowski*, A. Destexhe, D. Contreras†, M. Steriade† and J.R. Huguenard‡

The Salk Institute, Computational Neurobiology Laboratory, PO Box 85800, San Diego, CA 92186, USA; † Laboratory of Neurophysiology, Laval University, Quebec, CANADA G1K 7P4; ‡ Department of Neurology and Neurological Sciences, Stanford University Medical Center, Stanford CA 94305, USA.

Thalamic reticular (RE) neurons are involved in the genesis of synchronized thalamocortical oscillations, which depend *in part on their complex* bursting properties. We have investigated the intrinsic bursting properties of RE cells using computational models based on morphological and electrophysiological data. Simulations of a reconstructed RE cell were compared directly to the recordings from the same cell, which allowed precise values for the passive parameters to be obtained. Voltage-clamp data were obtained on the low-threshold calcium current (I_{T_s}) in acutely dissociated RE cells which lack most of their dendrites. Simulations based on a cell with truncated dendrites and Hodgkin-Huxley kinetics reproduced these recordings *with a relatively low density of* I_{T_s}. *In intact* RE cells, high densities of I_{T_s} in distal dendrites were required to generate the higher amplitudes of the current seen experimentally, as well as the typical properties of the burst of RE cells. More importantly, we found that, because of dendritic I_{T_s}, synaptic bombardment in the dendrites had a strong impact on the genesis of the burst, and could generate the typical burst responses of RE cells *in vivo*. These findings suggest that synaptic integration on the dendrites of RE cells is significantly influenced by dendritic calcium currents. In addition, we were able to simulate the same behavior in simpler models with as few as three compartments, provided there was a high density of I_{T_s} in the dendrites. These experiments provide firm evidence for resolving the difference observed in the intrinsic bursting properties of RE cells *in vivo* and *in vitro*, on the basis of dendritic calcium currents.