Abstract View

AN ELECTRODIFFUSION MODEL FOR ION MOTION IN DENDRITIC SPINES

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A computational model for electrodiffusion is important for calculating membrane potentials as well as computing ionic concentrations. This is especially true in small compartments, such as dendritic spines on pyramidal cells, where cable models of electrical conduction fail. Preliminary results are presented from a realistic computer model of calcium dynamics and signal transduction. The algorithm uses MCell, a program that uses highly optimized Monte Carlo algorithms to track the stochastic behavior of discrete molecules coupled to a finite-volume method where evaluation of the electric profiles take place. A three-dimensional finite-volume grid will be constructed using NWGrid, a computational package used for mesh generation. The Nernst-Planck equation was solved to study the motion of ions in an electric field, incorporating experimental electrophysiological data to model the voltage-dependent ion channels. The ultimate goal was to study the function and importance of a variety of signaling pathways in dendrites.
Support Contributed By: Sloan-Swartz Foundation for Theoretical Neurobiology, NIH P01 NS044306, NIH R01 GM068630

Citation:C.L. Lopreore, T.M. Bartol, T.J. Sejnowski. AN ELECTRODIFFUSION MODEL FOR ION MOTION IN DENDRITIC SPINES Program No. 849.11. 2004 Abstract Viewer/Itinerary Planner. Washington, DC: Society for Neuroscience, 2004. Online.