BMC Neuroscience

Poster presentation

Open Access

A computational approach to dendritic spine motility with calcium signaling by the immersed boundary method with advection-electrodiffusion

Pilhwa Lee* and Charles S Peskin

Address: Courant Institute of Mathematical Sciences, New York University, New York, NY, USA

Email: Pilhwa Lee* - leep@cims.nyu.edu

* Corresponding author

from Sixteenth Annual Computational Neuroscience Meeting: CNS*2007
Toronto, Canada. 7–12 July 2007

Published: 6 July 2007

BMC Neuroscience 2007, **8**(Suppl 2):P95 doi:10.1186/1471-2202-8-S2-P95

Dendritic spines are small protrusions from the dendritic branches of neurons. Influenced by internal and external signals and forces, even adult spines are not static but dynamically move. In this paper, we consider actomyosin-based spine motility with calcium signaling. The simulation begins with influx of calcium ions through glutamate receptors. Calcium Induced Calcium Release (CICR) with IP_3 (inositol-1,4,5-trisphosphate) dynamics is also considered. The sensitivity of elasticity of actomyosin network is assumed to follow a Hill-type function of Ca^{2+} concentration. Several combinations in size of spine head and neck, physiology of Endoplasmic Reticulum (ER), and distribution of receptor/channels/exchangers are considered. Different functions of a spine as absorber, pumper and/or diffuser are observed. The computational framework used for these studies is the immersed boundary method with advection-electrodiffusion.