Special Program in Applied Mathematics and Applied Mechanics

Application of Passive Cable Theory in Neuroscience

2014 - 04 - 30 (Wed.)
15:00 - 18:00
308, Mathematics Research Center Building (ori. New Math. Bldg.)

Passive cable theory, developed in the late 1950s by Rall and colleagues, provides a mathematical framework to describe the current flow and electrical characteristics of dendrites and axons by reducing these into equivalent cylinder models. The ability of a synapse, or its electrical voltage transient, to influence output can be analytically solved if one knows three basic parameters: the specific membrane resistance (Rm), intracellular core resistance (Ri) and membrane capacitance (Cm). These cable parameters, together with the specific cell geometry, determine the time course, spread and efficacy of current flow in neuronal dendrites. In this talk, I will first show how realistic multi-compartmental models are developed from experimental data. Next, I will demonstrate how models help interpret electrophysiological data but also make it possible to produce testable quantitative predictions, undoubtedly inspiring new experimental studies to gain further insight into the rules of synaptic integration in neuron.