
“Mathematical Modeling of Cell Volume Control and Electrolyte Balance”

Monday, April 1, 2024

Abstract:

Electrolyte and cell volume regulation is essential in physiological systems. Biophysical modeling in this area, however, has been relatively sparse. After a brief introduction to cell volume control and electrophysiology, I will discuss the classical pump-leak model of electrolyte and cell volume control. It will be shown that thermodynamic considerations lead to a new perspective of cell volume control. This classical model will then be generalized to a model with spatial extent (a system of partial differential equations) modeling cell-level electrodiffusive and osmotic phenomena. A simplified version of this model will then be applied to study osmosis-driven cell movement. I will also touch upon tissue-level models of ionic electrodiffusion and osmotic water flow which we have developed to study certain pathophysiology of the central nervous system.

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