Mathematical Model of Plasma Membrane Electrophysiology in a Single Pericyte Cell by Asad Mirza | Arash Moshkforoush | Nikolaos M. Tsoukias

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A mathematical model of a single pericyte cell was developed based on data available in literature. The model incorporates the dynamic behavior of 1) plasma membrane currents; 2) release and uptake of Ca2+ by the sarcoplasmic reticulum; 3) tracking of cytosolic Ca2+, K+, Na+, and Cl-; and 4) electrophysiological response due to norepinephrine (NE) stimulus. Current and voltage data attained from literature review was fitted to known equations for these channels. Coupled differential equations were then used along with these parameters to show the dynamic change of ion concentrations, membrane voltage, and gating variables. Validation was done using available literature data on NE and K+ stimulation. The proposed model predicted the depolarization and repolarization effects of NE and the increasing depolarization effects of increasing external K+ levels as reported in the literature. Further research for this model will aid in elucidating the underlying role of pericytes on arterial constriction/dilation, vasomotion, and in understanding their roles in disease states.