

Abstract of Presentation

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Research interest: (URL: ishiilab.jp) Models of neuronal morphogenesis, Decision making, Bayesian statistics	
Presentation Title: <u>Models and simulations of neural morphodynamics</u>	
Abstract : Neuronal morphology should be an information processing basis of neurons. During development, neurons acquire their morphology to work as information processing elements. Even in a uniform environment, they produce single axons from multiple neurites in a stable manner. First, we introduce a computational model of this symmetry-breaking phenomenon, neuronal polarization. After establishing the single-axon structure, the axon is guided by extra-cellular guidance molecules, so as to appropriately perform neuronal wiring. However, this axon guidance is an extremely complicated phenomenon; it shows bidirectionality, attraction and repulsion, depending on the status of intracellular calcium signaling. To know the mechanism underlying this calcium-dependent bidirectionality, we introduce a computational model of intracellular biophysics in the axon guidance. During the guidance, actin filaments in a neuronal growth cone are dynamically regulated by extracellular guidance molecules, which produce driving force of the axon; this dynamic cytoskeleton is also involved in cellular chemotaxis. Then, we introduce a multi-physical model of cellular chemotaxis and show its large-scale simulations. Our simulation model includes actin filament dynamics, membrane, and intracellular signaling related to cytoskeleton regulation. Through simulations of cellular chemotaxis and invasion, we observe the cell dynamically changes its morphology to appropriately adapt to the surrounding environment.	