

Numerical Modeling of Cell Populations Communicating via Diffusing Signal Molecules

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ABSTRACT

Cell-cell communication plays an important role in cellular systems exhibiting coordinated behavior at all levels, from bacterial colonies to the formation of tissue structures in complex organisms. Numerical models that accurately capture both the individual cellular dynamics and the interactions among the population are necessary in order to expand the reach of in-silico approaches in systems biology research. Due to the wide range of both temporal and spatial scales involved, an efficient simulation method is just as important. As a starting point for my PhD project aimed at the development of such a method, I focus on the case of bacterial communication via the diffusion of small signal molecules. Based on work by Danino and coworkers on a model system for quorum sensing, a signaling process that allows cells to coordinate expression of genes in a population, I aim to study the importance of explicitly representing spatial and stochastic effects in this kind of setting.