Title: Model for Myxococcus xanthus Polarity, Reversal, and Division

Shant Mehserejian
University of Notre Dame
smahsere@nd.edu

Abstract

The connection between cell division and other cellular processes is a very important biological problem which is currently poorly understood. The characteristic well-studied motility features of the rod shaped myxobacteria make them a model organism for studying polarity selection [1,2]. A mathematical model is presented in the form of a system of coupled partial differential equations to describe dynamic distribution of the RomR protein in two states: an unbounded state diffusing through the cell body, and a bounded state attached to receptors located at the poles of the cell body. The receptor activation/deactivation is controlled by an attractant-repellent like system in order to represent the periodic oscillations of the RomR seen during cell reversal events. Simulations demonstrate accumulation of more RomR at one cell pole versus the other, providing possible mechanism of formation of asymmetric patterns of RomR observed when new poles are formed during cell division [2]. Detailed in vivo experimental data is used to develop and calibrate the model and to test predictions obtained from simulations. The experiments involve tracking the concentration of RomR protein in gfp-labeled M. xanthus using high temporal resolution fluorescent microscopy, and high frequency analysis.

Keywords: Computational model, PDEs, polarity, cell division, fluorescent microscopy

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