Title: A model of Polarity for M. xanthus
Francesco Pancaldi
University of Notre Dame
fpancald@nd.edu

Abstract:
 Myxobacteria is a well known model organism to study cells polarity. However, the link between cell polarity, movement reversal, and division is still unclear [1,2]. Our project aim is to explain these connections through experimental data and computer simulations.
In order to provide significant biological assumptions on polarity in M. xanthus we are taking inspiration from the well-studied E. coli polarity (MinCDE system).
Our mathematical model consists of a system of coupled partial differential equations. These equations describe the distribution of RomR protein in two forms: an unbounded form that can diffuse in the cell body, and a bounded form that attaches to receptors positioned at the poles of the cell body. The receptors are activated or deactivated based on concentrations of proteins in an attractant-repellent type interaction.
These mechanisms mimic the periodic oscillations of the RomR seen during experiments. Simulations show higher RomR density at the cell lagging pole (tail) versus the other (head), reflecting the asymmetric patterns of RomR observed when new poles are formed during division [2]. These simulation results are comparatively similar to our experimental observation.

1. Wu, Y., Jiang, Y., Kaiser, D., and M. Alber [2009], Periodic reversal of direction allows Myxobacteria to swarm, Proc. Natl. Acad. Sci. USA 106 4 1222-1227 (featured in the Nature News, January 20th, 2009, doi:10.1038/news.2009.43).
2. Cameron W. Harvey, Chinedu S. Madukoma, Shant Mahserejian, Mark S. Alber and Joshua D. Shrout [2014], Cell Division Resets Polarity and Motility for the Bacterium Myxococcus xanthus, Journal of Bacteriology 196, 22, 3853-3861.