Modelling Protein Oscillations in *Myxococcus xanthus*

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Keywords: dynamical systems, reaction-diffusion equation, cell polarity.

Spatio-temporal oscillations of proteins in bacterial cells play an important role in fundamental biological processes. Motility of the rod-shaped bacterium *Myxococcus xanthus* is due to two motility systems: an A-motility system and a type-4 pili system [**?**]. Both motility systems depend on the correct localisation of regulatory proteins at the cell poles which set up a polarity (front-to-back) axis. The oscillatory motion of the individual cell results from dynamic inversion of the polarity axis due to a spatiotemporal oscillation of the regulatory proteins between the cell poles. A mathematical framework for a minimal macroscopic model is presented which produces self-sustained oscillations of the protein concentrations. The mathematical model is based on a reaction-diffusion system and is independent of external triggers. Necessary conditions on the reaction terms leading to oscillating solutions are derived theoretically. Several possible cases are studied based on different rates of interaction between the regulatory proteins. The interaction laws are then chosen according to mathematical analysis to produce different spatio-temporal oscillation patterns [**?**]. The different scenarios are numerically tested for robustness against parameter variation. Finally, possible extensions of the model will be addressed.

This is joint work with B. A. Schmitt, S. Dahlke, P. Lenz, L. Søgaard-Andersen. This work has been supported by the Centre for Synthetic Microbiology in Marburg, promoted by the LOEWE Excellence Program of the state of Hessen, Germany.

References

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