

A PDE model of colonial formation by chemotactic bacteria

Masayasu Mimura

Meiji Institute for Advanced Study of Mathematical Sciences,
Meiji University
<http://home.mims.meiji.ac.jp/~mimura/index-e.html>

ABSTRACT

Over the past ten years, our understanding of how spatio-temporal patterns in far from equilibrium systems has been gradually deepened. Collaborative research of experimental and theoretical works have discovered the mechanism how complex patterns were generated in biological systems. It is emphasized that genetics does not always reveal the occurrence of such patterns and even simple systems may generate ordered as well as chaotic patterns in a self-organized way. As an example, Budrene and Berg observed complex but quite regulated colonial patterns of chemotactic bacteria of *E.coli.*, depending on initial concentration of nutrients ([1], [2]).

The aim of this talk is to understand the reason why such colonial patterns could be generated in a self-organization by using a macroscopic PDE model ([3], [4], [5]).

Keywords: colonial pattern formation, chemotactic mobility, self-organization.

REFERENCES

- [1] Budrene E. O and Berg, H. C.: Complex patterns formed by motile cells of *Escherichia coli.*, Nature **349** pp.630~633 (1991)
- [2] Budrene E. O and Berg, H. C.: Dynamics of formation of symmetrical patterns by chemotactic bacteria, Nature **376** pp. 49~53 (1995)
- [3] Aotani A., Mimura M. and Mollee T.: A model-aided understanding of spot pattern formation in chemotactic *E. coli* colonies, Japan J. Industrial and Applied Mathematics, 27, 5-22 (2010)
- [4] Celinski, R., Hilhorst D., Karch G. and Mimura M.: Mathematical properties of solutions to the model of formation of chemotactic *E. coli.* colonies, manuscript
- [5] Aotani A. and Mimura M.: Chevron patterns in chemotactic *E. coli.* colonies, in preparation