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New tools for self-organized pattern formation

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from BioSysBio 2007: Systems Biology, Bioinformatics and Synthetic Biology Manchester, UK. 11–13 January 2007

Published: 8 May 2007

BMC Systems Biology 2007, 1(Suppl 1):S10 doi:10.1186/1752-0509-1-S1-S10

This abstract is available from: <http://www.biomedcentral.com/1752-0509/1?issue=S1>

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Introduction

Multicellular organisms undergo self-organisation during development. Our aim was to engineer self-organised pattern formation in free-swimming bacteria cells by providing an artificial system for bi-directional communication. *E. coli* cells would be equipped with genes derived from independent quorum sensing systems from *P. aeruginosa* and *V. fischeri*. These systems enable communication between cell populations and can enable regulated switching between competing cell fates. The negotiation of cell fates within bacterial populations can be visualized precisely by the expression of different fluorescent proteins.

Experiments conducted and results obtained

Using *Escherichia coli* as a model system we have observed how differential cell motility can, in itself, lead to pattern formation. Adapting the experiments of Weiss et al. [1], we have studied the interactions between cell populations in swimming agar with genetically engineered sender and receiver cells. The sender cells express one of two acyl-homoserine lactone (AHL) synthases whereas the receiver cells are capable of responding to the generated AHL signal. Instead of using a differential response to AHL concentrations we employed cell motility as a way to define zones of response (see Figure 1 for an example). In particular we equipped highly motile strains such as *E. coli* MC1000 with AHL-mediated autoinducing systems based

on *Vibrio fischeri* luxI/luxR [2] and *Pseudomonas aeruginosa* lasI/lasR [3] cassettes. We had these auto-inducing cassettes synthesized and tested them as depicted. To obtain an enhanced response the coding sequences were codon optimized. (See Figure 2).

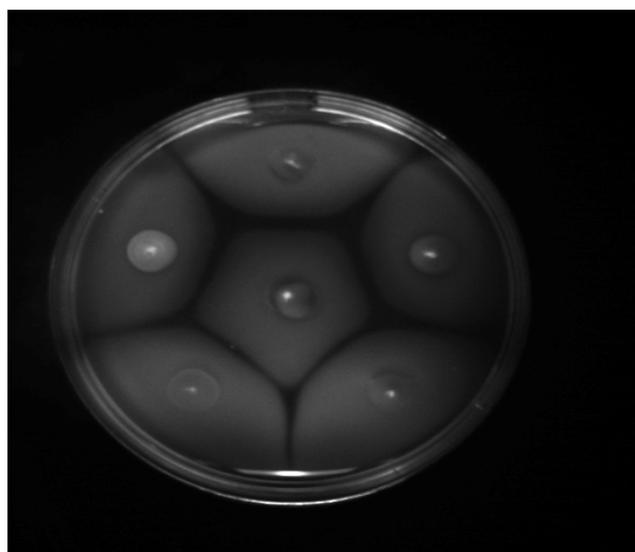


Figure 1
Zones of responses defined by cell motility

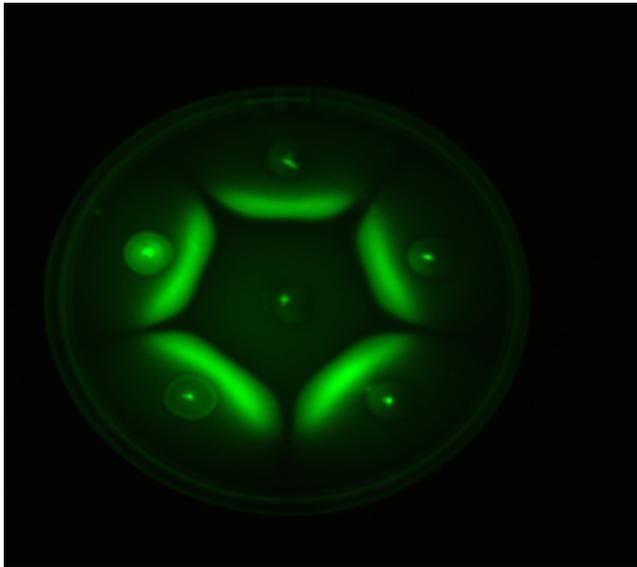


Figure 2
An enhanced response by codon optimization of the coding sequences

References

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3. Venturi V: **Regulation of quorum sensing in *Pseudomonas*.** *FEMS Microbiol Rev* 2006, **30(2)**:274-291.

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