

Modelling bacterial communities as emerging systems of communication

Pongor S, Venturi V

International Centre for Genetic Engineering and Biotechnology,
34012 Trieste, Italy

Motivation

Members of swarming bacterial communities compete for nutrients but cooperate in terms of molecular signals and other 'public goods' in order to form communities capable of crossing barriers as well as following exogenous cues.

Methods

Community formation can be modelled in two or three dimensions with randomly moving agents emitting diffusible signals described with a system of reaction diffusion equations. The emission of signals is under control of two genes represented as threshold based switches.

Results

The movement of the agents can be described as an emerging activation zone, in which nutrients and signals are present in sufficient quantities, and swarming is the spontaneous displacement of this high cell-density zone towards nutrients and/or exogenous signals. The cells of this community form a system of entities interacting via the sensing of the diffusible signals. The model correctly predicts the qualitative behavior of various cell types in conquering new habitats. In particular, the kinetics and stability of the agent communities corresponds to the in vivo colony formation of wild type and engineered bacterial cells and provides predictions on the role of cooperation in crossing barriers.

Contact : pongor@icgeb.org