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Modelling finger-like pattern formation in a bacteria colony growing at an interface using dynamical self-consistent field theory

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Fascinating finger-like patterns are observed at the edge of *Pseudomonas aeruginosa* bacteria colonies that grow at the effectively two-dimensional interface between agar and glass. We study this pattern formation phenomenon by simulating a dynamical self-consistent field theory. The twitching bacteria are modelled as self-propelled rods pushing against the agar-glass adhesion force, represented as a bath of passive particles. We show that a perturbation to a flat interface between uniform agar and bacteria, which are aligned perpendicular to the interface, is unstable. Fingers emerge from the interface as regular regions of dense, polar-aligned rods that move along the finger axis. By introducing a random spatial variation into our model for the strength of the agar adhesion with the glass, we are able to produce more realistic irregular finger patterns, similar to those observed in experiment. We discuss the impact of various model parameters on the finger properties and propose an interpretation for some of the trends seen in these properties as the agar concentration is varied in experiment.

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