Abstract Submitted
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Fingering instabilities in bacterial community phototaxis RITWIKA VPS, University of California, Merced, ROSANNA MAN WAH CHAU, Institute of Medical Biology, Singapore; Stanford University, California, KERWYN CASEY HUANG, Stanford University, California, AJAY GOPINATHAN, University of California, Merced — Synechocystis sp PCC 6803 is a phototactic cyanobacterium that moves directionally in response to a light source. During phototaxis, these bacterial communities show emergent spatial organisation resulting in the formation of finger-like projections at the propagating front. In this study, we propose an analytical model that elucidates the underlying physical mechanisms which give rise to these spatial patterns. We describe the migrating front during phototaxis as a one-dimensional curve by considering the effects of phototactic bias, diffusion and surface tension. By considering the propagating front as composed of perturbations to a flat solution and using linear stability analysis, we predict a critical bias above which the finger-like projections appear as instabilities. We also predict the wavelengths of the fastest growing mode and the critical mode above which the instabilities disappear. We validate our predictions through comparisons to experimental data obtained by analysing images of phototaxis in Synechocystis communities. Our model also predicts the observed loss of instabilities in taxd1 mutants (cells with inactive TaxD1, an important photoreceptor in finger formation), by considering diffusion in mutually perpendicular directions and a lower, negative bias.

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