Abstract Submitted
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Stability of a Random Walk Model for Fruiting Body Aggregation in M. xanthus[1] G.C. MCKENZIE-SMITH, Bowdoin College, H.B. SCHÜTTLER, C. COTTER, L. SHIMKETS, University of Georgia — Myxococcus xanthus exhibits the social starvation behavior of aggregation into a fruiting body containing myxospores able to survive harsh conditions. During fruiting body aggregation, individual bacteria follow random walk paths determined by randomly selected runtimes, turning angles, and speeds. We have simulated this behavior in terms of a continuous-time random walk (CTRW) model, re-formulated as a system of integral equations, describing the angle-resolved cell density, R(r, t, θ), at position r and cell orientation angle θ at time t, and angle-integrated ambient cell density ρ(r, t). By way of a linear stability analysis, we investigated whether a uniform cell density R_0 will be unstable for a small non-uniform density perturbation δR(r, t, θ). Such instability indicates aggregate formation, whereas stability indicates absence of aggregation. We show that a broadening of CTRW distributions of the random speed and/or random runtimes strongly favors aggregation. We also show that, in the limit of slowly-varying (long-wavelength) density perturbations, the time-dependent linear density response can be approximated by a drift-diffusion model for which we calculate diffusion and drift coefficients as functions of the CTRW model parameters.

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Grace C. McKenzie-Smith
Bowdoin College

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