Abstract Submitted
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Enhancement of biomixing by swimming cells in 2D films[1] JERRY GOLLUB, HUSEYIN KURTULDU, Haverford College, JEFFREY GUASTO, Massachusetts Institute of Technology, KARL JOHNSON, Haverford College — Fluid mixing in active suspensions of microorganisms is important to ecological phenomena and shows surprising statistical behavior. We investigate the mixing produced by swimming unicellular algal cells (Chlamydomonas) in quasi-2D films by tracking the motions of cells and of microscopic passive tracer particles advected by the fluid. The reduced spatial dimension of the system leads to long-range flows and a surprisingly strong dependence of tracer transport on the swimmer concentration. The mean square displacements are well described by a stochastic Langevin model, with an effective diffusion coefficient D growing as the 3/2 power of the swimmer concentration, due to the interaction of tracer particles with multiple swimmers. We also discuss the anomalous probability distributions of tracer displacements, which become Gaussian at high concentration, but show strong power-law tails at low concentration.[2]

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[2]H. Kurtuldu et al., Proc. Nat. Acad. Sci. 108, 10391 (2011)

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