Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Hydrodynamics and control of microbial locomotion JORN DUNKEL, MIT, VASILY KANTSLER, MARCO POLIN, University of Warwick, HUGO WIOLAND, RAYMOND GOLDSTEIN, University of Cambridge — Interactions between swimming cells, surfaces and fluid flow are essential to many microbiological processes, from the formation of biofilms to the fertilization of human egg cells. Yet, relatively little remains known quantitatively about the physical mechanisms that govern the response of bacteria, algae and sperm cells to flow velocity gradients and solid surfaces. A better understanding of cell-surface and cell-flow interactions promises new biological insights and may advance microfluidic techniques for controlling microbial and sperm locomotion, with potential applications in diagnostics and therapeutic protein synthesis. Here, we report new experimental measurements that quantify surface interactions of bacteria, unicellular green algae and mammalian spermatozoa. These experiments show that the subtle interplay of hydrodynamics and surface interactions can stabilize collective bacterial motion, that direct ciliary contact interactions dominate surface scattering of eukaryotic biflagellate algae, and that rheotaxis combined with steric surface interactions provides a robust long-range navigation mechanism for sperm cells.

Jorn Dunkel
MIT

Date submitted: 01 Nov 2013 Electronic form version 1.4