Center for Fluid Mechanics, Division of Applied Mathematics
Fluids, Thermal and Chemical Processes Group, School of Engineering
Joint Seminar Series

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The Coupling of Chemotaxis and Hydrodynamics in Suspensions of Micro-swimmers

Microorganisms are known to respond to a dissolved chemical substance by moving preferentially away or toward its source in a process called chemotaxis. We study such chemotactic responses at the population level when micro-swimmers are hydrodynamically coupled. We include in a recently developed kinetic model of motile suspension dynamics a chemotactic bias based on the known bacteria run-and-tumble phenomenon or a more general smooth turning. The chemical substance can be produced or consumed by the swimmers themselves, as well as be advected by the large-scale fluid flows created by their movement. The linear stability analysis of the system will be discussed, as well as the entropy analysis. Nonlinear dynamics are investigated using numerical simulation in two dimensions. We show examples of aggregation in pullers (front-actuated swimmers) and discuss how chemotaxis affects the mixing flows in pushers (rear-actuated swimmers).

Tuesday, February 22, 2011
Barus & Holley, Room 190
4:00pm