Entrapment, escape, and diffusion of active particles in complex environments

The swimming kinematics and trajectories of microorganisms and active synthetic particles are altered by the presence of nearby boundaries, be they solid or deformable, and often in perplexing fashion. When an organism’s swimming dynamics vary near a boundary, a natural question arises: is the change in behavior fluid mechanical, biological, or perhaps mediated by other physical laws? We will explore the hydrodynamic interactions between active particles and nearby surfaces, which can result in entrapment or escape depending on the propulsive mechanism used by the swimming body and its size (through the strength of Brownian fluctuations). If the confining geometry is regular, the swimming dynamics can settle towards a stable periodic orbit or can be chaotic depending on the nature of the scattering dynamics. Yet more stunning effects are achieved by large suspensions of active particles swimming en masse when bounded by freely moving interfaces. Applications are envisioned in bioremediation and sorting of active particles or microorganisms, and the work may speak to the behavior of biofilms and motile suspensions in heterogeneous or porous environments.

Tuesday, Sept. 20, 2016
Lecture at 4:00 p.m.
Room 1610, Engineering Hall
Refreshments will be served at 3:45 p.m.