

2012 PHYS 7654 Basic Training in Condensed Matter Theory
2012 PHYS 7683 Physics of Bio-locomotion
Module on Physics of Organisms
Jane Wang

Homeworks (due 1/28 5pm, Clark 517)

The first two problems are tied to our discussions of physics of chemoreception (read [Berg and Purcell 1977 paper](#))

1. Can a cell in a medium of uniform concentrations increase its material intake by swimming?

2. The motion of the cell will generate an apparent spatial gradient. Calculate this spatial gradient.

The next two problems are related the propulsion in Stokes flow (zero Reynolds number). Read [Purcell 1977 paper](#) and Watch [Taylor's video](#).

3. Purcell's swimmer

Determine the swimming direction of Purcell's three-links swimmer (Fig.~7 in Purcell's paper, attached), and explain what breaks the time reversal symmetry.

4. Reversibility of a solid ring in a Taylor-Couette Flow at zero Reynolds number

Show that a solid ring is reversible in a shear flow at zero Reynolds number. That is, if the motion of the boundary, in this case, the inner cylinder, is reversed completely, the position and the orientation of the ring also reverses. The experimental demo of this is in the video of G.I. Taylor's lecture on low Reynolds numbers.