Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

The fidelity of adaptive phototaxis KNUT DRESCHER, IDAN TUVAL, RAYMOND GOLDSTEIN, DAMTP, University of Cambridge — Along the evolutionary path from single cells to multicellular organisms with a central nervous system are species of intermediate complexity which move in ways suggesting high-level coordination, yet have none. Instead, organisms within this category possess many autonomous cells which are endowed with programs that have evolved to achieve concerted responses to environmental stimuli. We examine the main features of the program underlying high-fidelity phototaxis in colonial algae which spin about a body-fixed axis as they swim. Using micromanipulation and particle image velocimetry of flagella-driven flows in *Volvox carteri*, we show that there is an adaptive response at the single-cell level that displays a pronounced maximum in its frequency dependence for periodic light signals. Moreover, the natural rotational frequency of the colony is tuned to match this optimal response. A hydrodynamic model of phototactic steering further shows that the phototactic ability decreases dramatically when the colony does not spin at its natural frequency, a result confirmed by phototaxis assays in which colony rotation was slowed by increasing the fluid viscosity.

Knut Drescher
DAMTP, University of Cambridge

Date submitted: 20 Nov 2009 Electronic form version 1.4