Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Studying the Transition to Multicellular Life by Altering a Chemical Signaling Channel CARL FRANCK, KAYVON DAIE, Cornell University — The starvation response of the eukaryotic microbial system Dictyostelium discoideum has continued to provide opportunities to explore the transition from solitary to collective life. Specifically, one observes a change of behavior from random to synchronized cellular motion reflecting successful long-ranged chemical signaling that leads to aggregation. In the typical experimental universe life goes on upon a flat substrate underneath an ocean of liquid media through which these chemical signals pass. In our observations of starvation development we have uniquely exploited the possibilities afforded by varying the depth of this signaling channel over an interesting range: from essentially infinitely thick (mm's of depth) to an extremely thin wetting layer (below 1 micron). We also examine the development system over a wide range of surface density: from almost a full monolayer to a few percent areal coverage. Our key observation is a striking reduction of the time from the beginning of starvation to the onset of synchronized movement when we reduce the aqueous overlayer thickness to the thinnest values. We provide an interpretation for our observations by combining an exact solution to the diffusive transport problem with a rough dynamical theory for multiagent synchronization. This work was supported by the NIH (P01 GM078586).

Carl Franck
Cornell University

Date submitted: 21 Nov 2008 Electronic form version 1.4