Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

The role of near field interactions in the collective behaviour of model swimming micro-organisms TOBIAS LOCSEI, Cambridge University, TAKUJI ISHIKAWA, Tohoku University, TIM PEDLEY, Cambridge University — Experimentalists have reported that high concentration suspensions of swimming microorganisms exhibit collective behaviour, in the sense that each organism aligns its swimming direction with those of its near neighbours. Here, we present Stokesian dynamics simulations of swimming model micro-organisms (spherical 'squirmers'), which exhibit similar collective behaviour to what others have observed experimentally. Analysis of the simulations results reveals the following: (i) the collective behaviour is due to very close range (lubrication-regime) interactions between squirmers, (ii) the outcome of a close-range interaction between two squirmers is effectively deterministic, in that it is only weakly affected by the far-fields of the other squirmers, and (iii) the beginnings and ends of close-range interactions may be understood in terms of a 'suction' effect, in that two adjacent squirmers attract one another if the sum of the surface divergences of their surface velocities is positive at the point of nearest contact, and repel one another otherwise.

Tobias Locsei
Cambridge University

Date submitted: 03 Aug 2007 Electronic form version 1.4