Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

3D Gyrotactic Bioconvection Simulations NICHOLAS HILL, University of Glasgow, SAKTIPADA GHORAI, Indian Institute of Technology, Kanpur — We introduce a new code for solving the continuum equations for gyrotactic bioconvection [1] in *three spatial dimensions* to study pattern formation in suspensions of swimming micro-organisms such as the single-celled alga, *Clamydomonas nivalis*. The governing equations consist of Navier–Stokes equations for an incompressible fluid coupled with a micro-organism conservation equation. These equations are solved efficiently using a semi-implicit second-order accurate conservative finite-difference method. The structure and stability of a three-dimensional plume in a deep chamber with stress-free sidewalls are investigated. The solutions are compared with previous studies on two-dimensional [2] and axisymmetric bioconvection [3]. The evolution of the plumes is rich and varied, with quasi-steady states giving way to varicose and then meandering modes. 1. Pedley, T.J., Hill, N.A. & Kessler, J.O., 1988. The growth of bioconvection patterns in a uniform suspension of gyrotactic microorganisms. J. Fluid Mech. **195**, 223—238. 2. Ghorai, S. & Hill, N.A., 2000. Wavelengths of gyrotactic plumes in bioconvection. Bull. Math. Biol. **62**, 429—450. 3. Ghorai, S. & Hill, N.A., 2002. Axisymmetric bioconvection in a cylinder. J. Theor. Biol. **219**, 137—152.

Nicholas Hill
University of Glasgow

Date submitted: 04 Aug 2006 Electronic form version 1.4