Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Macroscopic dynamics of biological cells interacting via chemotaxis and direct contact[1] PAVEL LUSHNIKOV, Department of Mathematics and Statistics, University of New Mexico — A connection is established between discrete stochastic model describing microscopic motion of fluctuating cells, and macroscopic equations describing dynamics of cellular density. Cells move towards chemical gradient (process called chemotaxis) with their shapes randomly fluctuating. Nonlinear diffusion equation is derived from microscopic dynamics in dimensions one and two using excluded volume approach. Nonlinear diffusion coefficient depends on cellular volume fraction and it is demonstrated to prevent collapse of cellular density. A very good agreement is shown between Monte Carlo simulations of the microscopic Cellular Potts Model and numerical solutions of the macroscopic equations for relatively large cellular volume fractions about 0.3. Combination of microscopic and macroscopic models were used to simulate growth of structures similar to early vascular networks.

[1]Support is provided by NSF grants DMS 0719895 and DMS 0807131

Pavel Lushnikov
Department of Mathematics and Statistics, University of New Mexico

Date submitted: 20 Nov 2009 Electronic form version 1.4