Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Biofilm growth: a lattice Monte Carlo model YUGUO TAO, GARY SLATER, University of Ottawa — Biofilms are complex colonies of bacteria that grow in contact with a wall, often in the presence of a flow. In the current work, biofilm growth is investigated using a new two-dimensional lattice Monte Carlo algorithm based on the Bond-Fluctuation Algorithm (BFA). One of the distinguishing characteristics of biofilms, the synthesis and physical properties of the extracellular polymeric substance (EPS) in which the cells are embedded, is explicitly taken into account. Cells are modelled as autonomous closed loops with well-defined mechanical and thermodynamic properties, while the EPS is modelled as flexible polymeric chains. This BFA model allows us to add biologically relevant features such as: the uptake of nutrients; cell growth, division and death; the production of EPS; cell maintenance and hibernation; the generation of waste and the impact of toxic molecules; cell mutation and evolution; cell motility. By tuning the structural, interactional and morphologic parameters of the model, the cell shapes as well as the growth and maturation of various types of biofilm colonies can be controlled.

Yuguo Tao
University of Ottawa

Date submitted: 18 Nov 2010 Electronic form version 1.4