Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Modeling Light-Dependent Biofilm Morphology CHASE KERNAN, JEAN HUANG, REBECCA CHRISTIANSON, Franklin W. Olin College of Engineering — Bacterial aggregates on submerged substrates can produce complex biofilm morphologies that are subject to environmental and metabolic factors. We develop a reductionistic cellular automata model of these structures with the intent of guiding experimentation and explaining prior results. We focus on reproducing the columnar and "mushroom" phases of aerobic *R. palustris* and light-sensitive anaerobic *R. palustris*, respectively. This light sensitivity requires the novel inclusion of a characteristic light penetration depth in addition to surface tension and media penetration parameters. We quantitatively divide this parameter space into roughly four morphological phases—columnar, mushroom, uniform, and irregular—by examining the resultant convexity defect distribution, horizontal correlation, and coverage as a function of height. Finally, we both validate experimental evidence of these phases and suggest new parameter regimes to investigate empirically.

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Date submitted: 09 Nov 2012 Electronic form version 1.4