Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Self-Driven Jamming of Growing Microbial Populations CARL SCHRECK, MORGAN DELARUE, PAWEL GNEIWEK, OSKAR HALLATSCHEK, University of California, Berkeley — When cells grow in confined spaces, they assemble into dense populations that interact both chemically and physically. Although in recent years scientists have uncovered a previously hidden layer of mechanical regulation in mammalian tissues that impacts gene expression and development, little is known about the consequences of mechanical constraints on single-celled microbes. This is largely due to a lack of appropriate culturing techniques and accurate computational models. Using physically explicit computer models that are developed alongside microfluidic experiments, we address two fundamental questions: (1) what structures self-assemble in confined geometries due to the cell growth and division process? and (2) how do those structures and associated stresses feed back on to cell physiology? We find that microbial growth in confinement can lead to jamming, heterogeneous stress fields, and intermittent flow that in turn result in spatially and temporally heterogeneous physiological responses. With computer simulations, we further explore the differences between this 'active' flow that is driven internally by cell growth and 'inactive' flow, such as shear and hopper flow, that is driven externally.

Carl Schreck
University of California, Berkeley

Date submitted: 06 Nov 2015 Electronic form version 1.4