Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Chemotactic Self-Organization of Bacteria in Three-Dimensions
YEVGENIY KALININ, DAVID GRACIAS, Chemical and Biomolecular Engineering, Johns Hopkins University — Self-assembly with cellular building blocks represents an important yet relatively unexplored area of research. In this talk, we describe the self-assembly of motile cells using three-dimensional (3D) patterns of chemical (such as chemoattractants) that guide cellular and organization. These 3D chemical patterns are created when chemicals are released via diffusion from lithographically patterned self-assembled polyhedral containers. We show that a number of conceptually different strategies can be utilized for chemical patterns creation. In one such strategy, the overall shape of the container can be chosen to closely match the desired 3D spatial profile. As a part of a different strategy, we discuss how the chemical patterns can be engineered by specific placement of pores on the polyhedral containers. Combining these two strategies allows chemicals to be released in a variety of spatial patterns. To demonstrate applicability of our concept to in vitro organization of living cells in specific 3D geometries, we describe chemotactic self-organization of E. coli bacteria in a variety of well-defined shapes and space curves. We link the parameters that characterize the patterns of cells and the patterns of chemicals and describe how one can engineer the spatial shape of the multicellular constructs.

David Gracias
Chemical and Biomolecular Engineering, Johns Hopkins University

Date submitted: 11 Nov 2011 Electronic form version 1.4