MAR10-2009-002663

Abstract for an Invited Paper
for the MAR10 Meeting of
the American Physical Society

Collective behavior of biological cells

PASCAL SILBERZAN, Institut Curie

Interacting biological cells can exhibit collective behaviors that our knowledge at the scale of the single cell cannot fully explain. These highly non-linear systems strongly depend on the boundary conditions on which microfabrication techniques offer a good control. A first example is given by chemotactic *Escherichia coli* bacteria swimming in liquid medium. These cells communicate by expressing soluble chemoattractants which gives rise to spatial concentration heterogeneities that can be evidenced particularly well in micro-geometries. In particular, when the bacteria are concentrated at the extremity of a microchannel, a concentration wave appears and propagates along the channel. We will discuss new results obtained on this system, in particular by studying closely the details of the trajectories of single bacteria. The situation with eukaryotic epithelial cells, although basically different, presents some formal similarities. By using microfabricated micro-stencils to trigger the collective migration, we observe long-range coordinated displacements well within the monolayer. In parallel, the edges of these migrating monolayers roughen drastically and exhibit a strong directional fingering where a "leader cell", that exhibits a clearly non-epithelial phenotype, leads the others. In these fingers, the velocity field, as well as the orientation and polarization of the cells align with the fingers but are described by different order parameters and kinetics. The exact role of the leader can be clarified by mapping the traction forces exerted by the cells using a microfabricated array of force sensors.