L3 or M1 Internship in Cell Biophysics (2018)

Design of Cell Sorter and Cell Collider to understand Collective Cell Migration

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Collective cell migration is important in many physio-pathological processes like embryo development, immune response, wound healing or cancer progression. When cell density is maximum (confluence), cells move as convective viscous liquid. When cell density is very low, cells perform random walks eventually biased by chemical interactions (chemotaxis). However, the mechanisms of the emergence of collective migration are not well known especially at intermediate density. How cells tend to escape, to self-align or aggregate each other?

Dictyostelium is a unicellular amoeba used as simple model organism to investigate coordinated cell movements and emergence of social behavior. As long as nutrients are present, *Dictyostelium* cells multiply as unicellular amoebae. It was initially though that such vegetative cells were dividing and moving randomly, without interacting much with each other. We have recently showed that the parameters defining cell migration (speed, persistence time, polarization) are regulated by a chemical secreted « quorum sensing factor» (QSF) that accumulates with time [1]. Using PDMS stencils (see figure A), we also found that in addition to chemical factors, cell-cell collision modify cell speed and persistence[2].

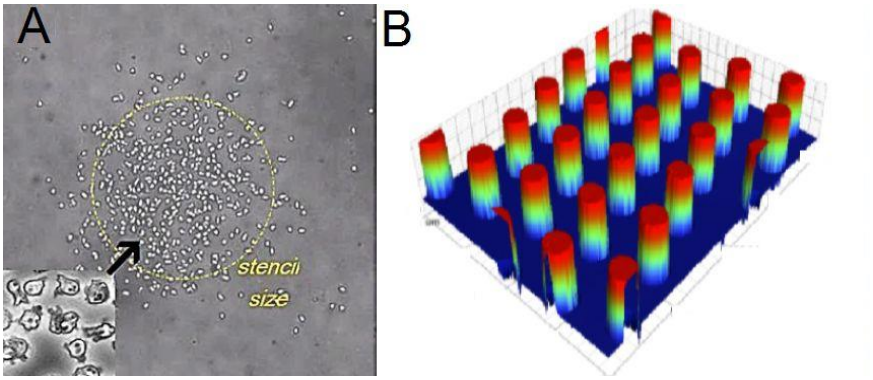

Figure. A) Spreading assay with an initial colony of 320 µm diameter made with a PDMS microstencil (yellow dotted circle) with about 300 *Dictyostelium* cells. **B)** 3d view of the cell sorter (100µm pillars)

The present internship aims to improve an existing cell sorter allowing to screen rapidly over 10^7 cells for rare mutants displaying high motility characteristics (mutants are already available in the laboratory). Cells are plated at the bottom of a pillar forest and climb up toward an insert lying above the pillars that can collect fast cells (see Fig. B). **We will also design a cell collider** to investigate in more details than with the spreading 2D geometry (Fig; A) the statistics of speed and direction after a single collision between two cells coming from two different microfluidic channels.

Key words: Motility, collective motility, microdevice design and fabrication in a clean room, confocal microscopy**.**

[1] Gole, Rivière, Hayakawa, Rieu (PLoS One, 2011)
[2] d'Alessandro, Rieu, Anjard, Rivière et al. Nature Physics, 2017 (**doi 10.1038/nphys4180**)