PROPOSAL FOR M2 Internship AND / OR THESIS

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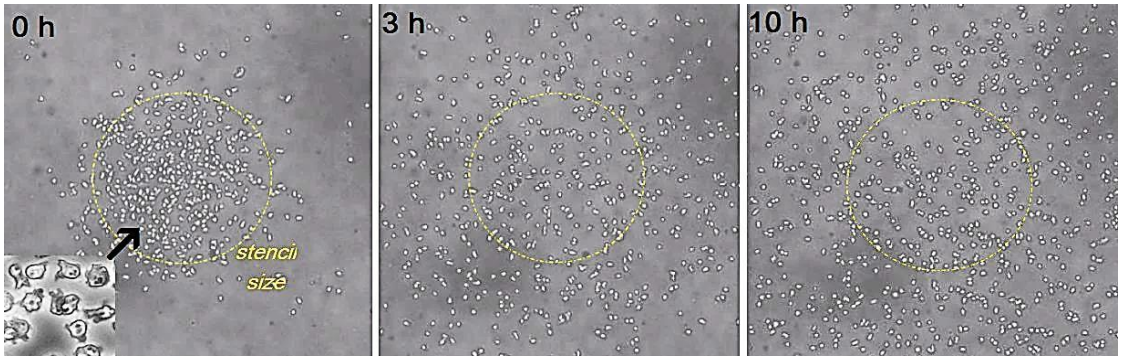
Doctoral school ID: ED 52, Physique et Astrophysique
Profil: Biophysicien, Physicien, Biologiste
Possibility to continue for PhD thesis: Yes
Possible financing : Allocation doctorale de Recherche des Ecoles Doctorales

Stage title: Role of contact interactions and secreted factors in the emergence of social behavior in the amoeba *Dictyostelium Discoideum*

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 (vegetative growth). However, when cells deplete their food source and begin to starve, they enter a developmental cycle: cells become polarized, express new proteins allowing cell to cell adhesion such as to form a motile multicellular organism. It was initially though that 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 secreted « quorum sensing factor» (QSF) that accumulates with time [1]. Using PDMS stencils (see figure), we analyzed how QSF would affect the behavior of micro-colonies of various cell density. We discovered that the initial, colony spreading is too fast to follow a simple diffusion equation[i] with a single diffusion coefficient. By measuring the cells motility parameters, we concluded that cells become temporarily more persistent upon their frequent collisions with each other. At longer time, the average cell speed is reduced upon conditioning by QSF[2].



The present internship is in the continuity of the previous PhD work [2]: **To analyze cell to cell communication in Dictyostelium through secreted factors (QSF) and upon collision.** For this, we are planning to continue our work to identify signaling pathways by comparing the behavior of various mutants as well as the effects of known signaling drugs using the same radial spreading geometry or using an homogenous 2D environment. We will then focus on statistical analysis of collision between two cells by confining them to follow trajectories to collide with various angles. We will also study these collisions at higher resolution, specially the organization of the actin cytoskeleton at the level of filopods using fluorescent microscopy as well as 4D traction force microscopy (xyzt)[3]. Model of population behaviors or particles dynamic will be developed in collaboration with theoreticians.

Key words: Motility, collective motility, cell signaling, active matter, micro-fabrication**.**

[i] Fisher-Kolmogorov-Petrovskii-Pishkunov (FKPP) voir par ex J.D. Murray. Mathematical Biology I: An Introduction. 2001)

[1] L. Gole, C. Rivière, Y. Hayakawa, J. P. Rieu (PLoS One, 2011)
[2] Joseph d'Alessandro PhD thesis at UCBL and article in preparation
[3] Delanoë-Ayari H, Rieu JP, Sano M. 4D traction force microscopy reveals asymmetric cortical forces in migrating Dictyostelium cells. *Phys Rev Lett.* **105** (2010) 248103