M2/PhD project

Laboratoire Physique des Cellules et Cancer
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Team: Biology-inspired Physics at MesoScales (https://institut-curie.org/teams/buguin_silberzan)
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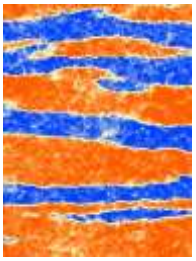
Direct measurement of cell-cell friction



Directed collective cell migration is central to morphogenesis, wound healing and cancer progression. Although the anisotropy of the microenvironment guides this migration in vivo, its impact on cell flow patterns remains unexplored. In a previous work, we have shown that subcellular microgrooves elicit a polar mode of collective migration in bidirectional "lanes" (see Figure where the color codes for the direction of migration – width of image is 2.5 mm), whose widths reach hundreds of micrometres. This directed form of flocking is explained by a hydrodynamic theory of active polar fluids and corresponding numerical simulations.

Interestingly, the velocity remains constant across a lane and the boundary between two antiparallel lanes is smaller than cell size, meaning that the shear experienced by the cells at these boundaries is very large.

In the present project, we propose to monitor the velocities of the cells in this laning phenomenon as the lanes reconfigure, to directly measure the friction between cells of the same type. Dedicated microfabricated setups will then be used for measuring the friction between two different cell types, and between cells and a wall bearing various moieties (adhesive, non-adhesives ...).

Recent relevant references of the group (selection)

- Lacroix M et al.: *Emergence of bidirectional cell laning from collective contact guidance.* Nature Physics **20**, (2024) 1324
- Sarkar T. et al.: *Crisscross multilayering of cell sheets,* PNAS Nexus, **2**, (2023), pgad034
- Yashunsky V et al : *Chiral Edge Currents in Nematic Cell Monolayers* Physical Review. *X* **12**, (2022), 041017.
- Duclos G et al.: *Spontaneous shear flow in confined cellular nematics*, Nature Physics. **14**, (2018), 728.
- Duclos G et al.: *Topological defects in confined populations of spindle-shaped cells.* Nature Physics **13**, (2017), 58.