Funded PhD project in Integrated Structural & Cell Biology in Grenoble, France (2024-2027)

Title of the PhD project: Tissuloid model for studying tissue self-organization

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Host laboratory: Biosciences and Bioengineering for health laboratory
Host team: Biomics
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Project summary:
Tissue formation is a highly regulated morphogenetic process, involving iterative interactions among cells and cell groups, guiding cellular differentiation and patterning on a large scale. This complex, yet not well-understood, emergent phenomenon enables individual cells to self-organize into intricate macroscopic structures. The dysfunction of tissue morphogenesis is implicated in various pathologies, including cancer. In our team, we are developing an original approach to create a pattern of macroscopic tissue-like structures, which we have named tissuloids, from single cell populations. This technology offers a unique opportunity to explore self-organization processes at every scale, from the micro (cell) to the macro (tissue) level.
As we embark on this new project to investigate the mechanisms of tissue morphogenesis and pathology, we are seeking a motivated PhD candidate to join us in unravelling the mysteries of tissue self-organization. In this role, you will tackle fundamental questions such as: How do the mechanical properties of the microenvironment influence cellular behaviour? How do changes at the cellular level manifest in tissue patterning? What role do emergent phenomena play in this complex process?

Preferred skills: We are seeking a motivated candidate with an M.Sc. in biology (biophysics), (bio)material engineering, (bio)mechanical engineering, or soft matter physics, who is eager to explore new fields. Background knowledge in cell biology is required, and experience in cell culture, cell imaging, and image analysis would be appreciated.

Student role: As part of our team, you will characterize the mechanical properties of extracellular matrices and cells, investigate the forces exerted by cells and cell assemblies, analyze the dynamics of tissuloid assembly, and decipher the mechanical and biochemical signals involved. You will utilize the newest technologies in 3D cell culture, mechanobiology, and imaging to make an impact in the fields of tissue engineering and translational research. You will collaborate closely with expert research teams at the BGE lab, the MINASEE team (at the LTM lab, https://ltmlab.fr/), and the Laboratoire d'Imagerie pour les Sciences du Vivant (at the CEA-Léti), benefiting from a rich multidisciplinary environment at the interface of biology and physics.

Keywords: self-organization, mechanobiology, morphogenesis, 3D cell cultures, tissue engineering, active matter, imaging

Relevant publications of the team:
1. Mittler et al., (2022) *J. Exp. Clin. Cancer Res.* DOI: 10.1186/s13046-022-02328-y.
2. Delanoë-Ayari H. & Nicolas A. (2022) *Phys Rev E.* DOI: 10.1103/PhysRevE.106.024411.
3. Tomba et al., (2022) *ACS Appl. Bio Mater.*, DOI: 10.1021/acsabm.1c01295.
4. Ghenim et al., (2021) *Sci. Rep.* DOI: 10.1038/s41598-020-79661-9.
5. Mittler et al., (2017) *Front. Oncol.* DOI: 10.3389/fonc.2017.00293.