

INTERNSHIP PROPOSAL

Laboratory name: MSC (Laboratoire Matière et Systèmes Complexes

CNRS identification code: UMR 7057

Internship director's surname: REFFAY

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Internship location: Laboratoire Matière et Systèmes Complexes

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75013 PARIS

Thesis possibility after internship: YES/NO

Funding: YES/NO

If YES, which type of funding:

Mechanics of tumor tissues across epithelial-mesenchymal transition

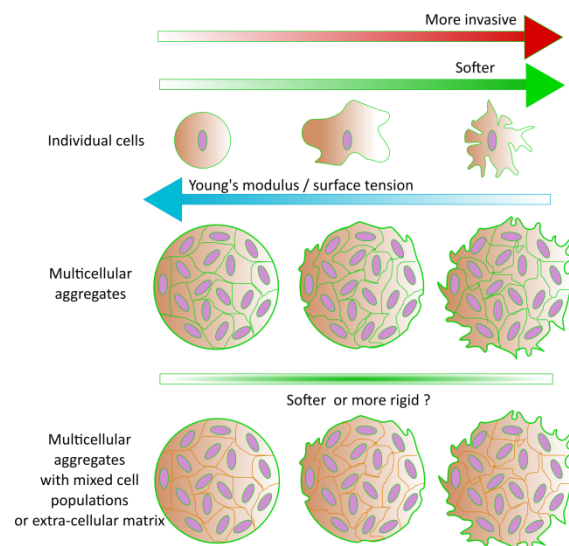
Primordial cell function such as cell division, migration and adhesion are deeply affected in tumorigenesis. All these processes are directly related to cell mechanics. From the past decades, these conclusions drive the emergence of studies on single tumor cells that reveal tumor cells softer than normal cells. Conversely, when detected by palpation, solid tumors are more rigid. We would like to explore this apparent paradox by looking at 3D model tissues and by measuring their mechanical properties.

Over the past few years, we developed an original approach based on the use of magnetic nanoparticles [1,2,3]. Magnetic nanoparticles penetrate inside cells to endow them with magnetic properties so that they can be remotely stimulated by a magnet. These magnetic properties are used to form multicellular aggregates of control size, shape and content and to deform them in order to access their mechanical properties.

We would like to investigate a model of breast tumor with unprecedented hybrid state of epithelial-mesenchymal transition (EMT). A first study demonstrates that surface tension of multicellular aggregates changed during EMT but how dynamical parameters are impacted is still unknown [4]. This project is part of a synergistic project in close collaboration with the research center of Saint-Antoine, on mechanobiology of tumoral cells at different scales (supracellular to tissue scale). It will use a variety of techniques including two-photon microscopy, mechanical manipulation, magnetic forces.

The Laboratory Complex Systems (MSC-UMR7057) in Paris is a renowned interdisciplinary research centre, with expertises both in life science, physics, chemistry and technology.

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[1] Mazuel F. et al. (2015) *Phys. Rev. Lett.* <https://doi.org/10.1103/PhysRevLett.114.098105>

[2] Du V. et al. (2017) *Nat. Comm.* <https://doi.org/10.1038/s41467-017-00543-2>

[3] Mary G. et al (2022) *Phys. Rev. E* <https://doi.org/10.1103/PhysRevE.105.054407>

[4] Nagle I. et al. (2022) *Frontiers in Cell and Dev. Biol.* <https://doi.org/10.3389/fcell.2022.926322>

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: YES/NO

Soft Matter and Biological Physics: YES/NO

Quantum Physics: YES/NO

Theoretical Physics: YES/NO