

## Master 2: *International Centre for Fundamental Physics*

### 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

10 rue Alice Domont et Léonie Duquet

75013 PARIS

Thesis possibility after internship: YES/NO

Funding: YES/NO

If YES, which type of funding:

#### **Physical constraints in muscle micro-tissues**

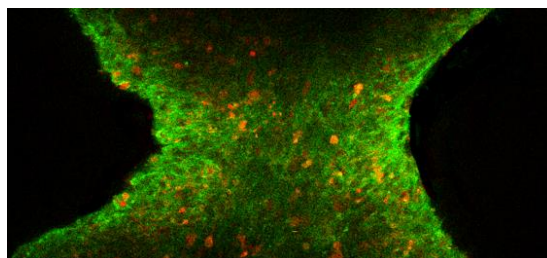
Cell-generated forces in tissues allow to contract, to stretch, to align and to organize biological tissues especially during muscle tissues formation. Muscles have indeed a fascinating multiscale architecture that promotes both their active and passive functions. The impact of physical constraints on muscle cell differentiation is consequently fundamental to understand muscle pathologies.

Over the past few years, we developed an original approach based on the use of magnetic nanoparticles [1,2,3,4]. 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 [5] or to drive cell fate [2].

We would like to investigate in artificial micro-tissues the interplay between mechanical, geometrical and electrical constraints on muscle cell differentiation. We will focus on myoblast precursors and mutants to unravel the role of the desmin in muscle architecture in relation with myopathies. The internship will be focus on the impact of geometrical parameters on cell

This project is a synergistic project that will be done in close collaboration with the research laboratory of Adaptive and Functional Biology in the University Paris Cité. It will use a variety of techniques including two-photon microscopy, mechanical manipulation, magnetic forces, cell and molecular biology.

The Laboratory Complex Systems (MSC-UMR7057) in Paris is a renowned interdisciplinary research center, with expertise both in life science, physics, chemistry and technology. Do not hesitate to contact us.



*Micro-tissues stretched between two micro-magnets*

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