

## 2021/2022 Internship proposal (M1/M2) + possible PhD project

**Institut Jacques Monod, Université de Paris, CNRS**

**Team :** Regulation of Actin Assembly Dynamics - [website](#)

**Headed by :** Guillaume Romet-Lemonne & Antoine Jégou

**Funding :** available in the team

**Contact information**

Guillaume Romet-Lemonne

[romet@ijm.fr](mailto:romet@ijm.fr)

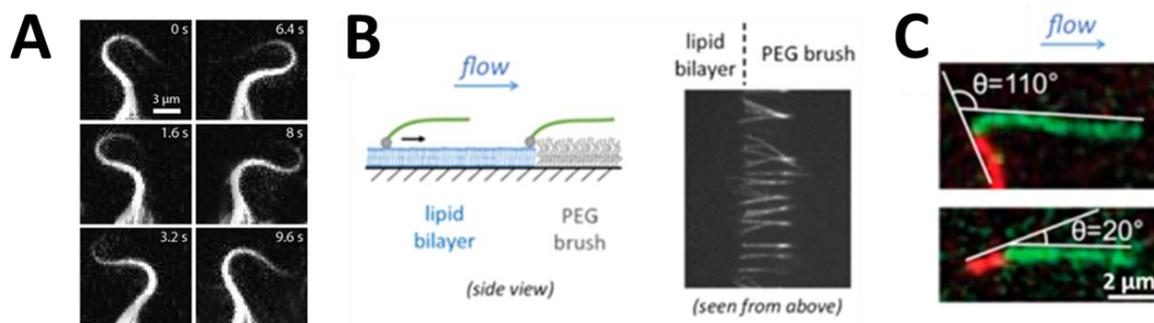
+33 1 57 27 80 13

### Molecular understanding of beating actin filament bundles

*Keywords: mechano-chemical coupling, cytoskeleton, molecular motors, microfluidics, microscopy*

In cells, the protein actin self-assembles into semi-flexible filaments. These filaments are organized in various networks, and can generate mechanical forces, either by polymerizing or thanks to molecular motors. Recently, the lab of our collaborator Pascal Martin (Institut Curie) has shown that actin filaments and motors could self-organize into bundles that oscillate, or 'beat', regularly (fig. A).

From a physics point of view, it is striking to see such a robust mechanical behavior emerge from a simple minimal system. From a biological perspective, understanding the molecular mechanisms behind this process will have implications for many cell functions.



**A.** Beating of a large bundle, containing tens of actin filaments and myosin motors. **B.** Building small bundles of 2-3 filaments using microfluidics and micropatterning (image on the right: fluorescence microscopy). **C.** Imposing a local curvature on single actin filaments (whose red segments are anchored to the surface), thanks to microfluidics.

**The objective of this project** is to understand how myosin motor activity is coupled to mechanical stress applied to the filaments in the bundle. To do so, we will build minimal bundles (fig. B) and apply mechanical stress, such as bending (fig. C), to individual filaments. The experiments will be done with purified proteins, using various techniques coupled to light microscopy: micropatterning, microfluidics, and optical traps.

We seek motivated and talented students with a background in physics, biophysics or biochemistry, and an interdisciplinary mindset. Candidates should be curious, and eager to discover original experimental approaches.

**Practical aspects:** Institut Jacques Monod is a major research center for fundamental biology in Paris. With its strong student community, it is a very dynamic and friendly working environment. The host team is internationally recognized in the cytoskeleton field. It is composed of physicists and biologists of different nationalities, who work *in vitro* using purified proteins and develop new experimental tools. Thanks to a joint ANR grant, the work will be carried out in collaboration with the lab of Pascal Martin (Institut Curie), who will focus on the mesoscopic scale and modeling.