Two years postdoctoral position

Laboratoire Jean Perrin (LJP), Sorbonne University, Paris

Interplay between adhesion and contractility in actin networks

This ANR-funded project is carried out by a consortium composed of physicists from Laboratoire Jean Perrin (**Lea-Laetitia Pontani and Raphaël Voituriez, LJP, Institut de Biologie Paris Seine-IBPS, Sorbonne University**) and biologists from the Cytomorpholab (**Manuel Thery and Laurent Blanchoin, Institut Pierre-Gilles de Gennes -IPGG, Paris/ CEA, Grenoble**). This post-doc project will be implemented at LJP, with strong interactions with the neighboring pole of the Cytomorpholab at IPGG.

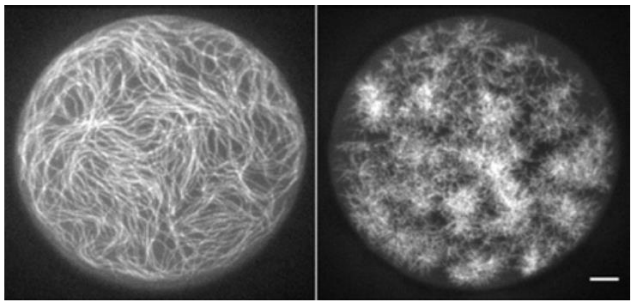
Context: Cells have the ability to change their shape to adapt to their environment. In response to an external signal, they have the capacity to move by reorganizing their internal architecture. This is possible because actin filaments in conjunction with molecular motor myosin are capable to exert or resist forces in a cellular environment. However, how actin assembly is coupled to contractility in a cell-sized compartment to sustain motility is not well-understood. In particular, in a cell-sized compartment the pool of components necessary to generate propulsive force is limited, so actin turnover must play an essential role to enable the movement to last over time. In addition, the inner contractile forces of actin must somehow be coupled to the environment via the surface of the object to generate a propulsive force.
The question of how this coupling is generated by actin dynamics, how the system polarizes upon symmetry breaking, and how effective it is, in other words - what are the main physical components of this force? - remains open. To tackle this question, we will use a bottom-up approach to decipher the coupling between contractility and adhesion to the environment.

Experimental approach: The candidate will reconstitute acto-myosin contractile networks from a minimal set of proteins that are already purified and routinely used within the consortium. These networks will be coupled to the surface through a membrane, which will itself be attached onto patterned adhesive substrates. The candidate will tune the strength of this coupling, i.e. the binding energy, to the surface. For instance, quasi-permanent bonds can be achieved between a streptavidin-coated surface and biotinylated lipids. Alternatively, the use of complementary DNA binders between the surface and the membrane allows for the control of the binding energy by simply tuning the length of the used DNA sequences. The candidate will study how this attachment to the surface tunes the dynamics and topology of the actin network atop of it.
The actin networks will be observed through spinning disc confocal microscopy and the collected data will be analyzed through custom image analysis tools. The data will be interpreted in the framework of an established collaboration with theorists of the consortium that are experts in the modeling of cell motility.

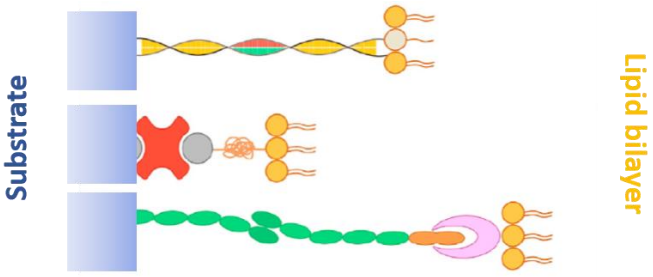
Candidate profile: We are looking for an enthusiastic young researcher (ideally who has recently obtained the PhD diploma, or about to), willing to join an interdisciplinary environment involving strong interactions between physicists and biologists. The experiments will mainly be carried out at LJP, with a preliminary transfer of skills from the IPGG (purified protein mix, surface patterns).

Requirements:
- PhD in biophysics/soft matter
- Skills in microfabrication
- Skills in microscopy (confocal, epifluorescence)
- Interest in interdisciplinary work

Additional beneficial skills:
- Skills in image analysis
- Skills in handling and purification of proteins



Actin network on diskshaped lipid micropatterns. Left, unbranched actin network. **Right**, branched actin network. Scale bar 10 µm.



Binding possibilities between the substrate and the lipid bilayer. Top, DNA thermoreversible interactions. **Middle,** biotin-streptavidin. **Bottom,** cadherin interactions.

The position is available from March 2024 onwards and will be funded by the ANR MOVING grant for 24 months. The fellow will receive full support to apply for further independent postdoctoral fellowships (EMBO, Marie Curie, FRM and others).
To apply, please send your CV including a list of your publications/preprints, a cover letter including the reasons why the position interests you, and two referees or more to:
- Léa Laetitia Pontani (IBPS, Laboratoire Jean Perrin): lea-laetitia.pontani@sorbonne-universite.fr