Master 2 and PhD thesis project
Advisor: Cécile Sykes
Group « Biomimétisme du mouvement cellulaire »
UMR168, Institut Curie/CNRS/Paris 6
11, rue Pierre et Marie Curie
75231 Paris cedex 05
cecile.sykes@curie.fr
http://umr168.curie.fr/en/Sykes-group
tel : 33 (0)1 56 24 67 90

Subject 2 nucleus/cytoskeleton: **nucleus activity triggered by cytoskeletal forces:**

The cytoskeleton is the structure that ensures cell motility and cell shape changes, and also transmits forces throughout the cell. The cytoskeleton contains actin and microtubules, two types of filaments with different mechanical and dynamical properties. Those filaments are highly involved in various aspects of cell fate such as cell division and motility. The Sykes lab has a know-how in the reconstitution, with a minimal number of purified proteins, of actin dynamics and membrane shape changes. This thesis project aims at applying this knowledge to forces transmitted by the actin cytoskeleton to the nucleus.

Alternative to the whole cell approach, a reconstitution approach, using a minimal number of constituents, provides a controlled system to thoroughly study forces and nuclear shape changes. Purified nuclei will be placed in actin networks from purified proteins. Nuclear shape and content will be analyzed when actin networks are put under tension, either by spontaneous tension build up of the growing actin network, or by the addition of myosin motors.

Whereas the physics of actin networks are now well characterized, the mechanism of force transmission to the nucleus is not known. The use of reconstituted systems is a powerful method that has been developed by the host lab. Mechanical tensions within acto-myosin networks are sufficient to drive deformations of nuclear-like artificial objects, such as oil droplets and liposomes. By replacing these objects with real nuclei, and with the use of optically-tweezed actin coated beads, actin-patterned surfaces and contractile actin shells, we will assess the mechanics of nucleus-actin network contacts in a controlled way.

Tools available in the lab: optical imaging, microfluidics, optical tweezers, biochemistry, cell biology.