Post-doctoral position in biophysics:
Mechanical characterization of actin gel by magnetic colloidal chaining

The actin protein is one of the major component of the cytoskeleton. Actin polymerizes into filaments which forms the cortex beneath the cell membrane. The polymerisation of actin also generates forces, a process used by the cell to move, change its shape, or divide. A large number of associated proteins interacts with actin to control the length of the filaments, accelarate the polymerisation and organise the filaments into bundles or dendritic arrays. More specifically the eukaryotic cells crawl on surface using the directed polymerisation of actin via the protein complex, Arp2/3 at the leading edge of the cell: the membrane is pushed forward by the polymerisation. Some pathogens, like Listeria, are able to recruit the actin of the host cells to assemble a “comet”. This comet is used by the pathogen to move inside the cytoplasm and from a cell to another. In vitro, such comet can be obtained from the growth of a gel at the surface of beads via a mix of purified actin associated protein.
This project aims to study the dynamics of actin polymerisation in a branched gel via a novel technique using magnetic colloids. Based on dipolar interactions that organise superparamagnetic beads in chain when a magnetic field is applied, this technique allows to apply well-controlled forces in the range of piconewtons to nanonewtons. Such forces are sufficient to deform an actin gel grown on the beads. We can thus study mechanical properties of actin gel. Compared to other existing techniques such as AFM (Chaudhuri *et al.* Nature 2007), we are here able to obtain easily very large statistics: each link between two beads gives an independent force distance curve, and hundreds of such characterisations can be made in one experiment.
The setup is now operational and is used to characterize mechanically actin gels whose growth have been stopped by a toxin. We want, with this postdoc, to adress the question of how the gel grows as the force on the gel increases, both in a spherical gel around a bead and after a comet has formed. We want to take advantage of the large statistics to collect data on the variation of force velocity relationship, when changing the geometry and the activity of the actin gel.

The post-doc project will take place in the laboratory of Physics and Mechanics of Heterogenous Media in the young Biophysics team. The laboratory is located in the center of Paris at ESPCI, a major teaching and research center hosting 17 international laboratories in physics, chemistry and biology. The laboratory is also associated to CNRS and the two main scientific universities of Paris (UPMC and Paris Diderot). The project is supported by the French *Agence Nationale pour la Recherche* (PIRIBIO program); its funding includes a postdoctoral fellowship of one year.
The candidate should have a background at the interface of Physics and Biology. Application of both experimental physicists and biologists will be considered.

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