Institut Jacques Monod
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POST-DOC POSITION (18 MONTHS)

Stimuli-responsive surfaces patterned at the nanometer scale to control cell adhesion

The aim of the project is to develop and characterize new patterned surfaces exhibiting both nano and micro structuration. Our strategy is to combine the thermoresponsive PLL-g-PNIPAM copolymer that allows functionalization of surfaces with biomolecules and control of its accessibility at the micrometer scale, with block copolymer micelle nanolithography [1-2], which enables the organization of well-defined biofunctionalized gold nanoparticles in a quasi-hexagonal pattern with particle spacings below 100 nm, a range that is hardly accessible by standard lithographic techniques.

As a proof of concept, we plan to use these nano-templates to study the interplay between integrins and cadherins [3-4], two families of adhesion receptors that are involved in important biological processes, such as cell migration, cell proliferation, cell differentiation, cell survival and the regulation of gene expression [5]. To do so, the gold nanoparticles will be functionalized with E-cadherin extracellular domains separated by a background of thermoswitchable PNIPAM polymers functionalized with RGD peptide fragments specific to integrins. By varying E-cadherin extracellular domain functionalized gold nanoparticles density and controlling in time the access to RGD fragments, we will be able to monitor the cadherin-based adhesion behavior of individual cells as a function of integrin activity.

The postdoc will be based at the Jacques Monod Institute UMR7592 CNRS/University Paris Diderot, under the supervision of Philippe Girard, and the work will be in close collaboration with Emmanuelle Marie, ENS Paris. The postdoc will be integrated to the team of “Mechanotransduction : from cell surface to nucleus” directed by Nicolas Borghi. The postdoc duration is 18 months, start date negotiable from October 2018.

The candidate should have a PhD (or have it completed before the start of the position), in biology or in soft matter physics with a strong interest in biology.

If you are interested please send us a CV and a short email motivating your interest in the position to Philippe Girard: **philippe.girard@ijm.fr**

[1] Arnold, E. A. Cavalcanti-Adam, R. Glass, J. Blümmel, W. Eck, M. Kantlehner, H. Kessler,and J. P. Spatz, Activation of Integrin Function by Nanopatterned Adhesive Interfaces. ChemPhysChem 2004, 5, 383–388.
[2] J. A. Deeg, I. Louban, D. Aydin, C. Selhuber-Unkel, H. Kessler, and J. P. Spatz, Impact of Local versus Global Ligand Density on Cellular Adhesion. Nano Lett. 2011, 11, 1469–1476.
[3] J. de Rooij, A. Kerstens, G. Danuser, M. A. Schwartz, and C. M. Waterman-Storer, Integrin-dependent actomyosin contraction regulates epithelial cell scattering, J. Cell Biol., 2005, 171, 153-164.
[4] H. Yano, Y. Mazaki, K. Kurokawa, S. K. Hanks, M. Matsuda, and H. Sabe, Roles played by a subset of integrin signaling molecules in cadherin-based cell–cell adhesion, J. Cell Biol., 2004, 166, 283-295.
[5] S. E. La Flamme (Editor), A. P. Kowalczyk (Editor), Cell Junctions: Adhesion, Development and Disease, 2008, Wiley-VCH, ISBN: 978-3-527-62210-8.