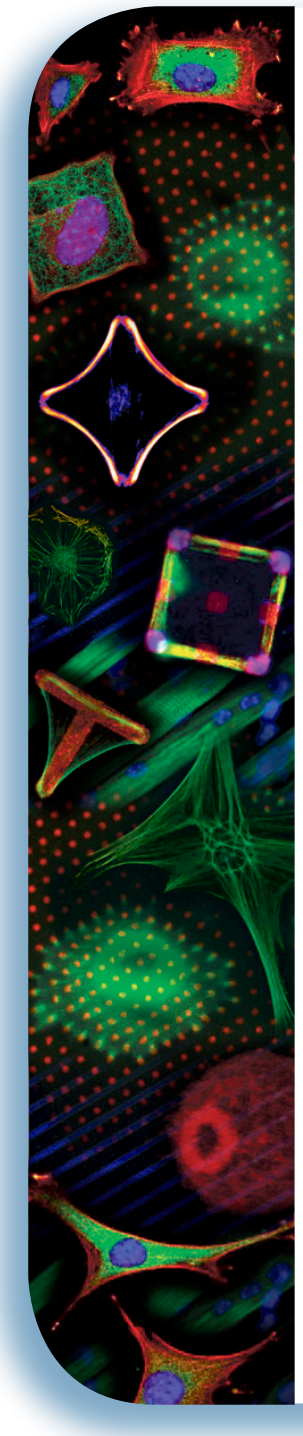

As part of our "Nano & Micro-envirmonments for Cell Biology" seminar series, we are delighted to invite you to attend this seminar to be given in english by :

Mathieu COPPEY

Laboratoire Kastler Brossel
Ecole normale supérieure, Paris

Thursday 10 October 2013
2pm

Magnetogenetic control of intracellular signaling

Amphithéâtre Gosse - Bât C
Locaux Grenoble INP
46 avenue Felix Viallet - 38000 GRENOBLE

nano SCIENCES FONDATION

Magnetogenetic control of intracellular signaling

The cell architecture and dynamics are controlled by a complex molecular circuitry able to process information from environmental cues in order to drive the cell into functional states accordingly. For instance, cells get polarized as they migrate or divide. To do so, they have to amplify local and transient signals into stable and system-level asymmetries. To understand how molecular events within the protein interaction network can be coordinated up to the emergence of cell functions there is a clear need for experimental approaches which allows perturbations of the signaling network at a spatial and temporal resolution sufficient to match the timing and extent of subcellular protein dynamics.

In this context, we developed a new "magnetogenetic" tool to locally probe and perturb signaling pathways inside living cells. In our approach, magnetic nanoparticles (MNPs) functionalized with active proteins are inserted in the cytosol of mammalian cells where they behave as solid signaling platforms. By exerting magnetic forces, MNPs are manipulated in the cytosol to position their signaling activity at different subcellular locations. We showed that MNPs of different sizes, from 50nm to 500nm in diameter, can be used to generate different patterns of spatial perturbation. We applied our approach to the Rho-GTPase signaling network which orchestrate cell polarity and migration. MNPs were functionalized with either the catalytic domain of guanine exchange factors (GEF) or the active GTPases. We demonstrated that the pathway linking Rac1 to actin polymerization is spatially restricted to the protrusive areas of the cell by manipulating TIAM1 particles at different subcellular locations while monitoring GTPase activation and actin polymerization.

nano SCIENCES FONDATION