Faculté des Sciences
Aix*Marseille Université

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FORMULAIRE STAGE Recherche-M2 BBSG
(période de stage : du 5 janvier 2016 au 3 juillet 2016)

High-Speed Atomic Force Microscopy (HS-AFM): Imaging of protein-protein and protein-membrane interactions at high spatio-temporal resolution

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Descriptif du stage :

Atomic force microscopy (AFM) is the type of scanning probe microscopy that is probably best adapted for imaging biological samples in physiological conditions with submolecular lateral and vertical resolution. In addition, AFM is a method of choice to study the mechanical unfolding of proteins or for cellular force spectroscopy. The advent of high-speed atomic force microscopy (HS-AFM, [1]), about 10 years ago, has provided unprecedented insights into the dynamics of membrane proteins and molecular machines from the single-molecule to the cellular level [2,3,4,5]. HS-AFM imaging at nanometer-resolution and sub-second frame rate opens novel research fields depicting dynamic events at the single bio-molecule level. As such, HS-AFM is complementary to other structural and cellular biology techniques.
Membrane-mediated protein-protein and protein-lipid interactions, membrane protein localization, and related dynamics, modulate membrane protein function. So far membrane structure and dynamics could not be studied altogether lacking the technique that analyses unlabeled proteins at submolecular lateral and high temporal resolution. In this M2-project, the student will be trained in the use high-speed atomic force microscopy (HS-AFM) to characterize the movements, interactions and actions of membrane associated proteins in real-time. The project comprises at about equal weight HS-AFM operation (physics) and sample production and preparation (biology). Another important aspect is represented by image data analysis.

[1] T. Ando, et al., Proceedings of the National Academy of Sciences 98, 12468 (2001)
[2] I. Casuso, et al., Nature Nanotechnology, 7, 525 (2012)
[3] A. Colom, et al., Journal of Molecular Biology, 423, 249 (2012)
[4] A. Colom, et al., Nature Communications, DOI:10.1038/ncomms3155 (2013)
[5] F. Rico, et al., Science, 342, 741 (2013)