【**Seminar**】Deciphering the spatiotemporal and mechanical regulation of integrin and actin cytoskeleton at the nanoscale by Prof. Grégory Giannone

Date-Time:
Friday, September 19, 2025 - 14:00 to 15:00

Location: Seminar room E48, Lab 4

Description:

Title: Deciphering the spatiotemporal and mechanical regulation of integrin and actin cytoskeleton at the nanoscale

Speaker: Prof. Grégory Giannone
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https://www.iins.u-bordeaux.fr/GIANNONE#pub

Summary:

How adhesive and cytoskeletal assemblies integrate with mechanical forces to shape cells is a fundamental question. We developed super-resolution and single-molecule tracking approaches to study integrin adhesions and actin networks. On rigid 2D substrates, we identified molecular events driving integrin activation and actin polymerization in migrating cells. We now extend this to: (1) softer, confined 3D multicellular environments and (2) molecular mechanosensing in cells using a custom stretching device compatible with super-resolution microscopy. These approaches revealed that actin-driven membrane nanotopographies shape stable integrin-based muscle attachments during Drosophila development, and that the axonal spectrin–actin membrane periodic skeleton functions as a mechanosensitive scaffold that reversibly reorganizes under mechanical stimuli.

Bio:

Grégory Giannone is a cell biologist studying integrin- and actin-based cell migration and mechanobiology. During his PhD at the University Louis Pasteur of Strasbourg (1997-2001), Grégory Giannone studied the correlation between intracellular calcium oscillations and integrin-dependent adhesion site disassembly. During his postdoctoral training at Columbia University, New York (2001-2005) in the laboratory of Michael Sheetz, he demonstrated the periodic nature of cell protrusion and studied mechanotransduction during cell motility. He started as a CNRS researcher in 2005 in the group of Daniel Choquet. To step towards higher spatial and temporal resolution, from the micron-scale coordination of subcellular structures to the nanometer-scale coordination of proteins, he developed projects based on super-resolution imaging and innovative single protein tracking methods. Since 2011, he has been a group leader at the Institute for Interdisciplinary Neurosciences (IINS), Bordeaux, France.

The goal of his group is to decipher at the molecular level the spatiotemporal and mechanical processes which control the architecture and dynamics of motile structures, mainly in the context of cell migration by studying integrin-based adhesions and the actin-based lamellipodium, but also in the context of neuronal structural plasticity by studying the actin cytoskeleton in dendritic spines and axons. To reach this molecular understanding, his group has developed over the last ten years new strategies to study adhesive and cytoskeletal structures at the molecular level using super-resolution microscopy and single protein tracking. They have unraveled key molecular events leading to: integrin activation and mechanosensing in healthy and cancer cells; actin assembly in dendritic spines and in lamellipodia. These studies at the nanoscale have revealed, within macromolecular complexes, the correlation between protein molecular dynamics and functions and how physical and mechanical parameters control protein organization, dynamics, and functions.