Universität Basel

Research Project

Visualizing mechanotransduction in space and time with a mechano-optical microscope COST

Third-party funded project

Project title Visualizing mechanotransduction in space and time with a mechano-optical microscope COST
Principal Investigator(s) Lim, Roderick ;
Organisation / Research unit
Departement Biozentrum / Nanobiology Argovia (Lim)
Department
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Departement Biozentrum / Nanobiology Argovia (Lim)
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Cells sense and respond to their surroundings using a complex interplay of mechanical forces and biochemical interactions. Mechanical forces that impinge on the cell are transduced from membrane receptors to the extracellular matrix and into the nucleus as one mechanically coupled system. This process activates essential mechanoresponsive transcription factors (MTFs) that are imported into the cell nucleus to modulate gene expression. Although the force-transducing mechanisms are generally understood, little is known as to how mechanical loading and deformation can impact on the ability for a cell to selectively deliver MTFs into the nucleus. This proceeds through highly selective channels in the nuclear envelope known as nuclear pore complexes (NPCs). In part, this work is technically challenging because of the crosstalk between mechanical and biochemical attributes that act simultaneously in space and time. Here, we will develop a correlative multimodal imaging method (CMI) known as the Mechano-Optical Microscope (MOM) that synchronizes atomic force microscope and spinning disk confocal microscope data acquisition within a single integrated platform. In doing so, the MOM will provide both mechanical and biochemical views of biological functionality in live cells. This includes quantitative, multidimensional information with respect to force-induced changes to cell morphology, the localization of subcellular structures, intra-cellular diffusion (e.g., NCT), and the dynamic responses of key molecules of interest, to name a few.

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