Atomic force microscopy and fluidic force microscopy to investigate cell mechanics and cell-biomaterial interactions

Livia Angeloni[1,2] - [1]Department of Biomedical Engineering, Eindhoven University of Technology, Eindhoven, The Netherlands; [2]Institute for Complex Molecular Systems (ICMS), Eindhoven University of Technology, Eindhoven, The Netherlands.

Understanding the causal relationships between cell mechanics and biological function is emerging as an essential need in the biomaterials field. Using physical cues, *e.g.*, surface topography and mechanical properties, to tune the functional cell behavior is a potentially powerful strategy for designing novel cell instructive medical implants. [1] However, the cell's mechanical response to physical stimuli has been poorly studied, and the mechanotransduction mechanisms that elicit the cell's biological function are still largely unknown, limiting the rational design of such cell instructive implants.

Here, we will discuss the use of different atomic force microscopy (AFM) and fluidic force microscopy (FluidFM) techniques to quantify the mechanical parameters of live cells interacting with biomaterials with different physical cues, intending to elucidate the mechanical mechanisms governing the cell response to the physical environment. The focus will be on the quantification of morphology, elastic and viscoelastic properties, adhesion forces, and cytoskeleton organization of preosteoblasts and macrophages, fundamental cells playing a critical role in the osteointegration of orthopedic implants and the orchestration of the immune response [1-2].

[1] M. Nouri-Goushki et al., ACS Appl. Mater. Interfaces 13 (29), 33767-33781 (2021).
[2] L. Angeloni, et al., Small 19, 2204662 (2023).