GDR 3070 : Physique de la cellule au tissu

Combination of micropatterning and magneto-active substrates for local mechanical stimulation of single cells

Sadequa SULTANA[1,2], Cécile M. Bidan[3,4], Mario Fratzl[5,6,7], Philippe Moreau[3,4], Irène Wang[3,4], Martial Balland[3,4], Nora M. Dempsey[5,6], Thibaut Devillers[5,6], Thomas Boudou[3,4], Aurélie Dupont[3,4]

1 CNRS, LMGP, F-38000 Grenoble, France , 2 Univ. Grenoble Alpes, LMGP, F-38000 Grenoble, France, 3 Univ. Grenoble Alpes, LIPHY, F-38000 Grenoble, France, 4 CNRS, LIPHY, F-38000 Grenoble, France, 5 Univ. Grenoble Alpes, Inst. NEEL, F-38042 Grenoble, France, 6 CNRS, Inst. NEEL, F-38042 Grenoble, France, 7 Univ. Grenoble Alpes, CNRS, Grenoble INP, G2Elab, F-38000 Grenoble, France

Cells can sense and respond to their physical environment by translating a mechanical cue into an intracellular biochemical signal[1]. Yet, how a cell senses local mechanical stimulations is still under investigation. The cellular response to an external mechanical stimulation has been studied with various static and dynamic systems, so far limited to global deformations[2,3] or to local stimulation through discrete substrates[4,5].

Here we aimed at generating fibronectin micropatterns on very soft (20 kPa) polydimethylsiloxane (PDMS) substrates containing magnetic micro-pillars. We introduced a novel technique for patterning fibronectin on soft and sticky PDMS by using polypropylene sheet as an intermediary step before directly curing PDMS on top of it.

To mechanically stimulate the obtained single cells, we used electro-magnets to move the embedded magnetic micropillars which in consequence locally deformed the PDMS substrate. We characterized the magnetically-induced surface stress and the resulting cell shape and forces. The combination of our micropatterning approach with magneto-active substrates thus represent a new tool to study mechanotransduction in single cells, and complement existing techniques by exerting a local and dynamic stimulation through a continuous soft substrate.

References:

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