“Talking to Cells: Surface Topography as a Tool to Optimize Biomaterials”

Wednesday – August 31, 2016 – 11:00 a.m.
EPFL – room SV1717

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Abstract

Topographical cues have been shown to influence cell fate dramatically [1]. This phenomenon opens new opportunities to design the interaction between biomaterials and biological tissues in a predictable manner. Unfortunately, the exact mechanism of topographical control of cell behavior remains largely unknown. We have therefore established a high throughput screening platform of surface topography (the TopoChip), which consists of 2176 unique surfaces that are reproduced in an arrayed fashion on polymers using microfabrication techniques [2]. The 2176 topographical features were randomly selected from an in silico library of more than 150 million of topographies, which were based on combinations of simple geometric elements such as circles, triangles and rectangles. After cell seeding, we use quantitative high content imaging and machine learning algorithms to characterize the response of the cells to the thousands of different surfaces and learn more about the relation between surface topography and cell response. Previously, we have demonstrated that these surfaces significantly affect cell shape, including the roundness and size of the nucleus, as well as the perimeter and orientation of the cells [3]. Moreover, we have shown that these topographies can also be used to modulate the ALP expression in human mesenchymal stromal cells, as well as pluripotency in human induced pluripotent stem (iPS) cells. In the future, we intend to further extend this data driven platform for materials design to test other biomaterial’s characteristics as well as to develop advanced computational techniques to enhance our fundamental understanding of cell-biomaterial interactions.

[1] Bettinger et. al., 2009, Angewandte Chemie, 48.30

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