Life Sciences Seminar

3D nanostructured platforms for in vitro biomedical applications

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Host:

In recent years, 3D nano and micro-fabricated platforms have been used for multiple in vitro biomedical applications. In particular, 3D conductive nano and microstructures can be used as sensing elements of biological phenomena revealed as voltage or current changes, such as action potentials as well as outgrowth topological cues. Traditional devices are planar, and a cleft between cells and device typically forms, affecting the recorded/stimulating signal quality. Devices with protruding 3D nanostructures have been proven to be tightly connected to in vitro populations of electrogenic cells, showing better signal recording/stimulating performances than planar devices(1-6).
Here, I will show surface 3D modifications of metal-based materials as well as conductive polymers for cell-chip coupling. First, I will present an innovative technique based on correlative scanning electron microscopy (SEM) and focused ion beam (FIB) spatially controlled sectioning to resolve cellular ultrastructures at the cell-chip interface with 10 nm resolution applicable to any organic/inorganic material interacting with individual adherent cells. The understanding of the contact area between cells and nanoelectrodes represents the first step for an optimal design of chip-based devices. In fact, I will show that 3D nanopillar-like electrodes induce the cell membrane to wrap more tightly than in case of planar electrodes. Taking advantage of this intimate contact, one can use nanoelectrodes to apply an electrical pulse for opening a pore at the plasma membrane such that the nanoelectrode can gain intracellular access without cell s death. In this case, multi-site non-invasive investigations of intracellular processes can be successfully carried out.

Wednesday, February 15, 2017 08:45am - 09:45am
Mondi Seminar Room 3, Central Building

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