Novel conducting polymer biointerfaces

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Conducting polymers (CPs) have been widely used as electroactive biointerfaces in applications such as electrically stimulated tissue engineering and stretchable organic bioelectronics. In this talk, we will present three different approaches to electroactive biointerfaces. The first approach overcomes the issue of poor solubility and processability of CP by functionalization of CPs with various moieties, in particular by grafting of CP backbones with polymeric side chains [1,2]. That enables modification of optoelectronic, chemical and mechanical properties of the CPs and their use as smart biointerfaces; e.g. responsive to various stimuli, intrinsically stretchable and self-healing. The second approach addresses the issue that electrodes are commonly 2D and as such cannot fully probe the actual 3D cell environment within tissues and organs. Our approach to overcome that is based on a precise fabrication of individually addressable, high aspect ratio, 3D CP-pillar microelectrode arrays by means of 'micro-extrusion printing'. Such 3D microelectrode arrays could be employed in a variety of applications, from biological sensing to recording and electrically stimulating cells and tissues [3], with the design of the arrays being easily adjustable to a particular application. The third approach is based on a design and fabrication, by electrospinning, of flexible, microporous, electrochemically switchable membranes. We demonstrate the use of such membranes for gene sensing and for fast, selective, non-destructive and efficient capture and subsequent release of extracellular vesicles (EVs) [4] and rare cells. In the later case, the membrane concentrates EVs and cells from large volumes of biological samples and into clean and small volumes of buffers, demonstrating a great promise for liquid biopsies.

References:

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