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INM-KOLLOQUIUM

"BIOMIMETIC AND BIOACTIVE COATINGS: FROM FUNDAMENTAL UNDERSTANDING TO PRE-CLINICAL APPLICATIONS"

Prof. Dr Catherine Picart
CEA/ Interdisciplinary Research Institute of Grenoble (IRIG),
Department of Health

Tuesday, December 17, 2019, 10:00 am

INM, Leibniz-Saal, Campus D2 5
Host: Prof. Dr. Aránzazu del Campo

In vivo, cells are surrounding by an extra-cellular matrix (ECM) which provide them with bioactive signals coming for the ECM proteins and growth factors. Presenting active biomolecules to cells in a spatially controlled manner to cells using biomaterials as carriers enable to mimic some aspects of the native ECM and to study cell signaling and tissue formation. Surface coatings made of biopolymers [1] can be engineered to trap the bone morphogenetic proteins and present the BMPs to cells at their ventral side. This matrix-bound presentation of growth factor to cells via a thin biomaterials enables to reveal so far hidden phenomena [2] [3]. This will be highlighted for bone morphogenetic proteins (BMPs) that induce bone tissue formation [2-4]. The spatial presentation of growth factors can be controlled at the cellular [5] and tissular scales [4.]. These surface coatings can also be used in vivo for the regeneration and bone defects [6]. In addition, recent developments using a liquid handling robot enables to use them for high throughput screening of cellular behaviors [7] in view of fundamental studies and cell therapies.

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INM-KOLLOQUIUM

"THERMORESPONSIVE TISSUE CULTURE SUBSTRATES AS A TOOL FOR THE ENGINEERING OF A VASCULAR BED"

Prof. Dr. Marie Weinhart
Freie Universität Berlin
Leibniz Universität Hannover

Tuesday, December 17, 2019, 11:00 am

INM, Leibniz-Saal, Campus D2 5
Host: Prof. Dr. Aránzazu del Campo

Cell sheet engineering as a scaffold-free approach towards in vitro engineered tissue represents a milestone in tissue engineering and regenerative medicine. In order to fabricate and harvest confluent cell sheets, we employ functional polyglycidyl ether coatings on cell culture substrates, that allow for cell adhesion, proliferation, and cell sheet detachment triggered by a thermal stimulus. The concomitant change in surface properties facilitates the relase of confluent cell sheets with their conserved extracellular matrix in a non-destructive manner in contrast to conventional enzyme-based cell harvesting methods. Confluent cell sheets of human endothelial cells (HUVEC), human aortic smooth muscle cells (HAoSMC), human dermal fibroblasts, human hepatocytes (HepaRGTM) and others are easily accessible with these coated surfaces. Cell sheets can be arranged with the help of cell adhesive polymers into 3D tissue models or tubular constructs that mimick human blood vessels. Our current scaffold-free approaches focus on the engineering of three-layered blood vessel constructs for subsequent maturation in a tissue bioreactor. On the long term we aim at a combination of the scaffold-free construction of perfusable medium sized artifical blood vessels with the self-assembly of endothelial cells into a stable microcapillary network for the generation of a perfusable vascular bed.

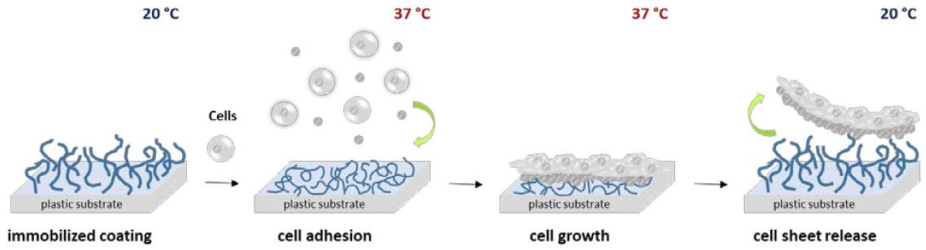

Fig. 1. Thermoresponsive coatings on polystyrene substrates for effective cell sheet fabrication.

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INM-KOLLOQUIUM

"INJECTABLE SYNTHETIC BUILDING BLOCKS TO REGENERATE SOFT ANISOTROPIC TISSUES"

Prof. Dr. Laura De Laporte
DWI – Leibniz Institute for Interactive Materials, RWTH University Aachen

Tuesday, December 17, 2019, 1:30 pm

INM, Leibniz-Saal, Campus D2 5
Host: Prof. Dr. Aránzazu del Campo

We apply polymeric molecular and nano- to micron-scale building blocks to assemble soft 3D biomaterials with anisotropic and dynamic properties. Microgels and fibers are produced by technologies based on fiber spinning, microfluidics, and in-mold polymerization. To arrange the building blocks in a spatially controlled manner, self-assembly mechanisms and assembly by external magnetic fields are employed. For example, the Anisogel technology offers a solution to regenerate sensitive tissues with an oriented architecture, which requires a low invasive therapy. It can be injected as a liquid and structured in situ in a controlled manner with defined biochemical, mechanical, and structural parameters. Magnetoceptive, anisometric microgels or short fibers are incorporated to create a unidirectional structure. Cells and nerves grow in a linear manner and the fibronectin produced by fibroblasts is aligned. Regenerated nerves are functional with spontaneous activity and electrical signals propagating along the anisotropy axis of the material. Another developed platform is a thermoresponsive hydrogel system, encapsulated with plasmonic gold-nanorods, which actuates by oscillating light. This system elucidates how rapid hydrogel beating leads to a reduction in cell migration, while enhancing focal adhesions, native production of extracellular matrix, and nuclear translocation of mechanosensitive proteins, depending on the amplitude and frequency of actuation.

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INM-KOLLOQUIUM

"SPATIOTEMPORAL CONTROL OVER ADHESIONS IN SYNTHETIC CELLS USING LIGHT"

Prof. Dr. Seraphine V. Wegner
Max Planck Institute for Polymer Research, Mainz
University of Münster

Tuesday, December 17, 2019, 2:30 pm

INM, Leibniz-Saal, Campus D2 5
Host: Prof. Dr. Aránzazu del Campo

Many functions in cells arise directly from the spatial and temporal regulation of cell-matrix and cell-cell interactions. In this talk, I will present strategies of how such spatiotemporal control over adhesions of synthetic and natural cells can be achieved with visible light (blue, green or red light). These light triggered and reversible interactions mimic the dynamics of interactions observed in biology, and allow modulating the interactions as desired without disturbing other processes in the cell. The photoswitchable adhesions allow us to self-assemble and self-sort cells into multicellular functional architectures with high precision, regulate their interactions with synthetic materials, program cell to cell communication and to study the underlying biology. Synthetic minimal cells, which reduce complexity and yet capture key features of natural cells, allow us to quantify and correlate cell behavior with molecular information. Further, complementary approaches pursued with synthetic minimal cells as well as bacterial and mammalian cells allow translating concepts between different systems and integration into hybrid structures. Overall, our work on one hand provides insight into underlying design principles of life and on the other hand allows addressing questions in cell biology as well as engineer new synthetic cell biology.

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