MINI-SYMPOSIUM: MATERIALS FOR THE DIGITAL ENVIRONMENT

Talk 3 – Thursday, June 18, 2020, 5 p.m.

BIOELECTRONICS WITH NANOCARBONS - BRIDGING THE GAP BETWEEN THE DIGITAL WORLD AND THE SOFT AND SQUISHY WORLD

Prof. Dr. Itzhaq Cohen-Karni
Carnegie Mellon University, Pittsburgh, PA, USA

The interface between nanoscale electronic devices and biological systems enables interactions at length-scales natural to biology, maximizing communication between these two diverse yet complementary systems. Such nano-bio interfaces offer better sensitivity and spatial resolution as compared to conventional planar structures. We focus on developing a new class of nanoscale materials and novel strategies for the investigation of biological entities at multiple length scales, from the molecular level to complex cellular networks. Our highly flexible bottom-up nanomaterials synthesis capabilities allow us to form unique hybrid-nanomaterials that can be used in various input/output bioelectrical interfaces. For example, we have developed several bioelectrical platforms based on graphene, a two-dimensional (2D) atomically thin carbon allotrope. We have demonstrated recording of the electrical activity of excitable cells with graphene-based ultra-microelectrodes as small as the size as an axon ca. 2µm in size. Using graphene-based hybrid-nanomaterials, we have formed remote, non-genetic bioelectrical interfaces with excitable cells and modulated cellular and network activity with high precision and low needed power. We have also developed a breakthrough bioelectrical interface, a 3D self-rolled biosensor arrays (3D-SR-BAs) of either active field effect transistors or passive microelectrodes to measure both cardiac and neural spheroids electrophysiology in 3D. Our approach enables electrophysiological investigation and monitoring of the complex signal transduction in 3D cellular assemblies toward an organ-on-an-electronic-chip (organ-on-e-chip) platform for tissue maturation investigations and development of drugs for disease treatment. In summary, the exceptional synthetic control and flexible assembly of nanomaterials provide powerful tools for fundamental studies and applications in life science and open up the potential to seamlessly merge either nanomaterials-based platforms or unique nanosensor geometries and topologies with cells, fusing nonliving and living systems together.

KONTAKT

INM – Leibniz-Institut
für Neue Materialien gGmbH
Campus D2 2
66123 Saarbrücken
www.leibniz-inm.de

Christine Hartmann
Event Manager
christine.hartmann@leibniz-inm.de
Tel: 0681-9300-244
Fax: 0681-9300-233