

Seminar



Multiscale Topological Design of Biological Interfaces to Novel Nanomaterials

Dr. Tzahi Cohen-Karni

May 30, 2018 | 12:00 - 1:30pm | Scott Hall 6142

Seminar abstract

We focus on developing hybrid-nanomaterials and novel strategies for the multiscale electrical investigation from the molecular level to complex cellular networks. Recently, we have demonstrated highly controlled synthesis of 3D out-of-plane single- to few-layer fuzzy graphene (3DFG) on a Si nanowire (SiNW) mesh template. By varying graphene growth conditions, we control the size, density, and electrical properties of the NW templated 3DFG (NT-3DFG). This flexible synthesis inspires formation of complex hybrid-nanomaterials with tailored electrical properties to be used in bioelectrical interfaces. Currently, we target the limits of cell-nanodevices interfaces using nanosensor based array assembled in 3D with subcellular spatial resolution ($<5\mu\text{m}$) and μsec temporal resolution. Our approach enables simultaneous multiplexed electrical measurements to directly monitor the development of electrical activities of microscale tissues (ca. $100\text{-}400\mu\text{m}$) which are engineered from induced pluripotent stem cell (iPS) or embryonic stem cell derived cardiomyocytes. Last, we have developed a unique transparent graphene-based electrical platform that enables concurrent electrical and optical investigation of ES-derived cardiomyocytes' intracellular processes and intercellular communication. In summary, the exceptional synthetic control and flexible assembly of nanomaterials provide powerful tools for fundamental studies and applications in life science, toward seamlessly merge either nanomaterials-based platforms or unique nanosensor geometries and topologies with cells, fusing nonliving and living systems together.

Speaker bio

Tzahi Cohen-Karni is an assistant professor at the department of biomedical engineering in Carnegie Mellon University, Pittsburgh PA USA. He received both his B.Sc. degree in Materials Engineering and the B.A. degree in Chemistry from the Technion Israel Institute of Technology, Haifa, Israel, in 2004. His M.Sc. degree in Chemistry from Weizmann Institute of Science, Rehovot, Israel, in 2006 and his Ph.D. in Applied Physics from the School of Engineering and Applied Sciences, Harvard University, Cambridge MA, USA, in 2011. He was a Juvenile Diabetes Research Foundation (JDRF) Postdoctoral Fellow at the Massachusetts Institute of Technology and Boston Children's Hospital at the labs of Robert Langer and Daniel S. Kohane from 2011 to 2013. Dr. Cohen-Karni received the Gold Graduate Student Award from the Materials Research Society in 2009, and received the 2012 International Union of Pure and Applied Chemistry Young Chemist Award. In 2014, he was awarded the Charles E. Kaufman Foundation Young Investigator Research Award. In 2016, Dr. Cohen-Karni was awarded the NSF CAREER Award. In 2017, Dr. Cohen-Kari was awarded the Cellular and Molecular Bioengineering Rising Star Award, The Office of Naval Research Young Investigator Award and The George Tallman Ladd Research Award.

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