

Interfacing with the Brain using Organic Electronics

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One of the most important scientific and technological frontiers of our time lies in the interface between electronics and the human brain. Interfacing the most advanced human engineering endeavor with nature's most refined creation promises to help elucidate aspects of the brain's working mechanism and deliver new tools for diagnosis and treatment of a host of pathologies including epilepsy and Parkinson's disease. It also represents a unique opportunity for industry: Medical electronics is the fastest-growing segment of the semiconductor industry. Current solutions, however, are limited by the materials that are brought in contact with the tissue and transduce signals across the biotic/abiotic interface. The field of organic electronics has made available materials with a unique combination of attractive properties, including mechanical flexibility, mixed ionic/electronic conduction, enhanced biocompatibility, and capability for drug delivery. I will present examples of organic-based devices for recording and stimulation of brain activity, highlighting the connection between materials properties and device performance. I will show that organic electronic materials provide unparalleled opportunities to design devices that improve our understanding of brain physiology and pathology, and can be used to deliver new therapies.

Professor George Malliaras is the Head of the Department of Bioelectronics of the Ecole Nationale Supérieure des Mines de Saint-Étienne (France). He received a BS in Physics from the Aristotle University (Greece) in 1991, and a PhD in Mathematics and Physical Sciences, cum laude, from the University of Groningen (the Netherlands) in 1995. After a two year postdoc at the IBM Almaden Research Center (California), he joined the faculty in the Department of Materials Science and Engineering at Cornell University (New York). From 2006 to 2009 he served as the Lester B. Knight Director of the Cornell NanoScale Science & Technology Facility. His research on organic electronics and bioelectronics has been recognized with awards from the New York Academy of Sciences, the US National Science Foundation, and DuPont. He is a Fellow of the Royal Society of Chemistry.