HHS Public Access

Author manuscript

Adv Mater. Author manuscript; available in PMC 2015 December 17.

Published in final edited form as:

Adv Mater. 2015 December ; 27(46): 7492. doi:10.1002/adma.201504783.

Organic Bioelectronic Materials and Devices

George Malliaras and

Department of Bioelectronics, École Nationale Supérieure des Mines, 880, Route de Mimet, 13541 Gardanne, France

Mohammad Reza Abidian

Department of Biomedical Engineering, The University of Houston, 3715 Cullen Blvd, Room 2020, Houston, TX 77204, USA

Mohammad Reza Abidian: mabidian@uh.edu

This is a special issue dedicated to the emerging field of organic bioelectronics. Bridging the interface between biology and electronics necessitates advances in materials, which, in turn, enable better performing devices or entirely new device concepts. Existing bioelectronic devices utilize conventional materials, such as metals, that are not intrinsically compatible with biological systems and do not efficiently convert ionic signals in the biological environment to/from electronic signals. The structural and functional similarity of organic materials to biological ones suggests many applications of the former to neural interfaces, drug delivery, tissue engineering, diagnostics, etc. This interdisciplinary effort has rapidly grown over the last few years with the development of devices that take advantage of the unique features of organics including: (1) their “soft” mechanical properties that mimic those of biological structures; (2) their mixed electronic/ionic conductivity that promotes efficient signal transduction; (3) their transparency that allows the simultaneous use of optical analysis techniques; (4) their facile functionalization by proteins and biomolecules to tune biological properties; and (5) their cost-effective synthesis on a variety of scales.

This issue highlights some applications of organic electronics to bioelectronics, while at the same time bringing to the foreground some important implications for the design of materials and devices. Papers include applications in neural prosthesis, diagnostics based on flexible substrates, devices and circuits based on biomolecules, as well as some fundamental properties and new materials for the biotic/abiotic interface. We hope that you will enjoy reading this issue, whether you are a newcomer to the field or a seasoned veteran!

Acknowledgments

The authors would like to acknowledge support from the National Institutes of Health R01 NS087224.

Biographies

Professor George Malliaras received a Ph.D. in mathematics and physical sciences from the University of Groningen (The Netherlands) in 1995. After postdoctoral research at the

Correspondence to: Mohammad Reza Abidian, mabidian@uh.edu.

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. He subsequently moved to the École Nationale Supérieure des Mines de Saint-Étienne (France), where he chairs the Department of Bioelectronics. His research is focused on organic electronics and bioelectronics.

Professor Mohammad Reza Abidian received his Ph.D. in Biomedical Engineering from the University of Michigan in 2007. After he completed his postdoctoral research in the Center for Neural Communication Technology at the University of Michigan he joined the department of Biomedical Engineering at Pennsylvania State University in 2010. He is currently Associate Professor of Biomedical Engineering Department at the University of Houston. His current research interests include: organic electronics and bioelectronic materials and devices for smart, targeted drug delivery to brain tumors, conducting polymers for axonal regeneration and neurochemical detection.