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Transient Electronics

John A. Rogers

Louis Simpson and Kimberly Querrey Professor of Materials Science and Engineering
McCormick School of Engineering
Northwestern University

Abstract: A remarkable feature of modern integrated circuit technology is its ability to operate in a stable fashion, with almost perfect reliability, without physical or chemical change. Recently developed classes of electronic materials create an opportunity to engineer the opposite outcome, in the form of 'transient' devices that dissolve, disintegrate, degrade or otherwise disappear at triggered times or with controlled rates. Water-soluble classes of transient electronic devices serve as the foundations for applications in zero-impact environmental monitors, 'green' consumer electronic gadgetry and bio-resorbable biomedical implants. This presentation describes the foundational concepts in materials science, electrical engineering and assembly processes for building bio/ecoresorbable electronics in a variety of formats and with a range of functions. Wireless sensors of intracranial temperature, pressure and electrophysiology designed for monitoring recovery from a traumatic brain injury, stimulators configured for accelerating neuroregeneration of an injured peripheral nerve and temporary pacemakers for minimizing risks after a cardiac surgery provide some system level examples.

Bio: Professor John A. Rogers obtained BA and BS degrees in chemistry and in physics from the University of Texas, Austin, in 1989. From MIT, he received SM degrees in physics and in chemistry in 1992 and the PhD degree in physical chemistry in 1995. From 1995 to 1997, Rogers was a Junior Fellow in the Harvard University Society of Fellows. He joined Bell Laboratories as a Member of Technical Staff in the Condensed Matter Physics Research Department in 1997, and served as Director of this department from the end of 2000 to 2002. He then spent thirteen years on the faculty at University of Illinois, most recently as the Swanlund Chair Professor and Director of the Seitz Materials Research Laboratory. In the Fall of 2016, he joined Northwestern University as the Louis Simpson and Kimberly Querrey Professor of Materials Science and Engineering, Biomedical Engineering and Medicine, with affiliate appointments in Mechanical Engineering, Electrical and Computer Engineering and Chemistry, where he is also Director of the recently endowed Querrey Simpson Institute for Bioelectronics. He has published more than 700 papers, is a co-inventor on more than 100 patents and he has co-founded several successful technology companies. His research has been recognized by many awards, including a MacArthur Fellowship (2009), the Lemelson-MIT Prize (2011), the Smithsonian Award for American Ingenuity in the Physical Sciences (2013), the MRS Medal (2018) and most recently the Benjamin Franklin Medal from the Franklin Institute (2019). He is a member of the National Academy of Engineering, the National Academy of Sciences, the National Academy of Medicine, the National Academy of Inventors and the American Academy of Arts and Sciences.