Rogers Research Group

We seek to understand and exploit interesting characteristics of 'soft' materials, such as polymers, liquid crystals, and biological tissues as well as hybrid combinations of them with unusual classes of micro/nanomaterials, in the form of ribbons, wires, membranes, tubes or related. Our aim is to control and induce novel electronic and photonic responses in these materials; we also develop new 'soft lithographic' and biomimetic approaches for patterning them and guiding their growth. This work combines fundamental studies with forward-looking engineering efforts in a way that promotes positive feedback between the two. Our current research focuses on soft materials for conformal electronics, nanophotonic structures, microfluidic devices, and microelectromechanical systems, all lately with an emphasis on bio-inspired and bio-integrated technologies. These efforts are highly multidisciplinary, and combine expertise from nearly every traditional field of technical study.

Professor John A. Rogers

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. During this time he also served as a founder and Director of Active Impulse Systems, a company that commercialized technologies developed during his PhD work. 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 currently holds a Swanlund Chair, the highest chaired position at the University of Illinois at Urbana/Champaign. He has a primary appointment in the Department of Materials Science and Engineering, with joint appointments in the Departments of Chemistry, Bioengineering, Mechanical Science and Engineering, and Electrical and Computer Engineering. He served as the Director of a Nanoscale Science and Engineering Center on nanomanufacturing, funded by the National Science Foundation, from 2009-2012. He is currently Director of the Seitz Materials Research Laboratory.

Rogers' research includes fundamental and applied aspects of nano and molecular scale fabrication as well as materials and patterning techniques for unusual electronic and photonic devices, with an emphasis on bio-integrated and bio-inspired systems. He has published more than 450 papers, and is an inventor on over 80 patents and patent applications, more than 50 of which are licensed or in active use by large companies and startups that he has co-founded. His research has been recognized with many awards including, most recently, the ETH Zurich Chemical Engineering Medal (2015), the A.C. Eringen Medal of the Society for Engineering Science (2014), the Smithsonian Award for American Ingenuity in the Physical Sciences (2013), the Robert Henry Thurston Award from the American Society of Mechanical Engineers (2013), the Mid-Career Researcher Award from the Materials Research Society (2013), the Lemelson-MIT Prize (2011), a MacArthur Fellowship from the John D. and Catherine T. MacArthur Foundation (2009), the George Smith Award from the IEEE (2009), the National Security Science and Engineering Faculty Fellowship from the Department of Defense (2008), the Daniel Drucker Eminent Faculty Award from the University of

Illinois (2007) and the Leo Hendrick Baekeland Award from the American Chemical Society (2007). Rogers is a member of the National Academy of Engineering (NAE; 2011), the National Academy of Sciences (NAS; 2015) and the American Academy of Arts and Sciences (AAAS; 2014), a Fellow of the Institute for Electrical and Electronics Engineers (IEEE; 2009), the American Physical Society (APS; 2006), the Materials Research Society (MRS; 2007), the American Association for the Advancement of Science (AAAS; 2008) and the National Academy of Inventors (NAI; 2013).

Rogers has also been named to many distinguished lectureships, including:

Dr R A Mashelkar Endowment Lecture, CSIR-NCL, 2015.

SNU-Dongjin Lectureship, Seoul National University, 2015.

Claritas Distinguished Speaker in Science, Susquehanna University, 2015.

Weissberger/Williams/Farid Lectureship, Kodak Research Labs, 2015.

Fowler Distinguished Lecture, Texas A&M University, 2015.

Inaugural Lecturer for the Institute for Materials Science, Los Alamos National Laboratory, 2015.

'Science at the Edge' Lecturer at Michigan State University, 2015.

College of Engineering Distinguished Lecturer at University Georgia, 2015.

Etter Memorial Lectureship at University of Minnesota, 2015.

Laufer Lectureship at University of Southern California, 2014.

Presidential Lectureship at Northeastern University, 2014.

College of Engineering Distinguished Speaker at University of Texas at Arlington, 2014.

Plenary Lecture, Annual Meeting of the American Association for the Advancement of Science, 2014.

Kavli Foundation Innovations in Chemistry Lecture, American Chemical Society, 2014.

Xingda Lectureship at Peking University, 2013.

Adams Lectureship at Purdue University, 2013.

Presidents Distinguished Lectureship at KAUST, 2013.

Bircher Lectureship at Vanderbilt University, 2013.

Deans Distinguished Lectureship at Northwestern University, 2013.

ET Distinguished Speaker at Applied Materials, 2012.

Wulff Lectureship at M.I.T., 2012.

DB Robinson Distinguished Speaker at University of Alberta, 2012.

GT-COPE Lectureship at Georgia Institute of Technology, 2012.

Nyquist Lectureship at Yale University, 2011.

Judd Distinguished Lecturer at University of Utah, 2011.

ASU Distinguished Scholar and Lecturer at Arizona State University, 2011.

Rosenhow Lectureship at M.I.T., 2011.

Eastman Lectureship in Polymer Science, University of Akron, 2011.

Deans Distinguished Lectureship at Columbia University, 2010.

Nakamura Lectureship at University of California at Santa Barbara, 2010.

Chapman Lectureship (inaugural) at Rice University, 2009.

Zhongguancun Forum Lectureship, Chinese Academy of Sciences, 2007.

Dorn Lectureship at Northwestern University, 2007.

Xerox Distinguished Lectureship at Xerox Corporation, 2006.

Robert B. Woodward Scholar and Lectureship at Harvard University, 2001.

Highlights from 2014/2015 include the first:

- *mechanically driven self-assembly of 3D micro/nanostructures in device-grade silicon*
- *wireless, injectable optofluidic needles for in vivo pharmacology and optogentics*
- *epidermal piezoelectric systems for characterization of soft tissue biomechanics*
- *auricle-mounted electrodes for persistent brain-computer interfaces*
- *silk-based resorbable electronics for wireless infection abatement*

Highlights from 2013/2014 include the first:

- *soft, microfluidic assemblies of sensors, circuits and radios for the skin*
- *flexible devices for harvesting and storing electrical power from motions of the heart, lung and diaphragm*
- *3D electronic integumentary membranes for sensing, actuating across the entire epicardium*
- *quadruple junction solar cells and modules with world record efficiencies*
- *biodegradable batteries*

Highlights from 2012/2013 include the first:

- *physically transient forms of silicon electronics*

- *injectable, cellular-scale optoelectronics*
- *compound apposition, 'bug-eye' cameras*
- *strechable lithium ion batteries*
- *scalable routes to arrays of semiconducting carbon nanotubes*

Highlights from 2011/2012 include the first:

- *flexible electronics for high resolution mapping of brain function*
- *3D cavity-coupled plasmonic crystals*
- *electronically 'instrumented' sutures and surgical gloves*
- *wireless, implantable LEDs and sensors*
- *stretchable photovoltaics*

Highlights from 2010/2011 include the first:

- *'epidermal' electronics*
- *electronic 'eyeball' cameras with continuously adjustable zoom magnification*
- *microcell luminescent concentrator photovoltaics*
- *'cloak-scale' negative index metamaterials*
- *multi-functional electronic balloon catheters for interventional cardiology*

Highlights from 2009/2010 include the first:

- *multilayer, releasable epitaxy for photovoltaics, RF electronics and imaging*
- *first principles theory for aligned growth of carbon nanotube arrays*
- *bio-integrated electronics for high resolution cardiac EP mapping*
- *bio-resorbable devices for neural electrocorticography*
- *geometrically controlled adhesion in elastomers and use in deterministic assembly*

Highlights from 2008/2009 include the first:

- *printed microLED lighting systems and displays*
- *silicon-on-silk electronics for bioresorbable implants*
- *curvilinear electronics and paraboloid eye cameras*
- *high resolution, jet printed patterns of charge*
- *rubber-like silicon CMOS*

Highlights from 2007/2008 include the first:

- *electronic eye cameras*
- *stretchable silicon CMOS integrated circuits*
- *flexible, semi-transparent solar modules based on monocrystalline silicon*
- *flexible digital logic circuits based on SWNT thin films*
- *chemically synthesized, 2D carbon nanomaterials*

Highlights from 2006/2007 include the first:

- *observation and analysis of buckling mechanics in SWNTs*
- *quasi-3D plasmonics crystals for biosensing and imaging*

- *SWNT-based RF analog electronics, including the first all-nanotube transistor radios*
- *methods for electrohydrodynamic jet printing with sub-micron resolution*
- *routes to multilayer superstructures of aligned SWNTs*

Highlights from 2005/2006 include the first:

- *strechable form of single crystal silicon*
- *GHz flexible transistors on plastic substrates*
- *single-step two photon 3D nanofabrication technique*
- *lithographic method with molecular scale (~1 nm) resolution*
- *printing approach for 3D, heterogeneous integration*
- *method for growing high density, horizontally aligned SWNTs*