THE FRANKLIN INSTITUTE *Awards*

TEMPLE UNIVERSITY®

SOFT, BODY-INTEGRATED MICROSYSTEMS TECHNOLOGIES

Franklin Institute Symposium honoring Dr. John A. Rogers,
recipient of the 2019 Benjamin Franklin Metal in Materials Engineering

Dr. John Rogers is the Louis Simpson and Kimberly Querrey Professor of Materials Science and Engineering, professor of biomedical engineering, professor of neurological, and director of the Center for Bio-integrated Electronics at Northwestern University.
He is a member of the National Academy of Engineering, the National Academy of Sciences, and the American Academy of Arts and Sciences.

The 2019 Franklin Institute Laureate Symposium will be held at Temple University to honor Dr. John A. Rogers who received the Benjamin Franklin Medal in Materials Engineering for pioneering the engineering of flexible and stretchable electronic systems for e-health and exploratory neuroscience.

APRIL 10, 2019
9 AM – 12 PM
Walk Auditorium, Ritter Hall
Temple University
1301 Cecil B. Moore Ave.
Philadelphia, PA 19122

SPEAKERS:

JOHN A. ROGERS
Northwestern University

CANAN DAGDEVIREN
Massachusetts Institute of Technology

ROOZBEH GHAFFARI
Northwestern University

NANSHU LU
University of Texas, Austin

PRICE: Free and open to the public

REGISTRATION: https://events.temple.edu/the-2019-franklin-institute-laureate-symposium

CONTACT: Fei Ren, fei.ren@temple.edu, 215-204-9593

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THE FRANKLIN INSTITUTE AWARDS

For nearly two centuries, The Franklin Institute has honored pioneering achievements in science, engineering, and industry. As the oldest comprehensive science awards program in the United States, The Franklin Institute Awards celebrates Benjamin Franklin's legacy by honoring the Franklins of today. Through their remarkable contributions, our laureates inspire the Franklins of tomorrow.

Acknowledgements

This symposium is made possible by the generous support from the Franklin Institute, FS Investments, Robert M. and Mary Haythornthwaite Foundation, and Temple University College of Engineering and Department of Mechanical Engineering.

For 195 years, the Franklin Institute has honored the greatest minds in science, engineering, technology, and business. The Franklin Institute Awards are amongst the oldest and most prestigious comprehensive science awards in the world. Recognizing these brilliant men and women from around the world is one important way that the Institute preserves Benjamin Franklin's legacy. They are the Franklins of today; they will inspire the Franklins of tomorrow.

College of Engineering

Symposium Organizers
Jim S. Chen, Jie Yin, and Fei Ren
Department of Mechanical Engineering, Temple University

To learn more about this symposium and how to register this free event, scan the QR code on the left, or go to

https://events.temple.edu/the-2019-franklin-institute-laureate-symposium

THE FRANKLIN INSTITUTE Awards

Franklin Institute Laureate Symposium

Soft, Body-Integrated Microsystems Technologies

honoring

Dr. John A. Rogers

2019 Benjamin Franklin Medalist in Materials Engineering

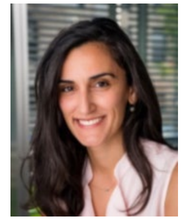
April 10, 2019
Walk Auditorium
Temple University
Philadelphia, PA, 19122

Program and Speakers

8:50 am – 9:10 am	Registration
9:10 am – 9:15 am	Opening Remarks by **Dr. Jayatri Das**, Chief Bioscientist, The Franklin Institute
9:15 am – 9:25 am	Welcome from College of Engineering, Temple University
9:25 am – 9:55 am	**Canan Dagdeviren**, Ph.D *Wearable and Implantable Devices 'On the Go'*
9:55 am – 10:25 am	**Roozbeh Ghaffari**, Ph.D *Soft, Skin-Interfaced Systems with Integrated Biosensors and Microfluidics from Feasibility to Commercialization*
10:25 am – 10:40 am	Coffee Break
10:40 am – 11:10 am	**Nanshu Lu**, Ph.D *Wireless Electronic Tattoos*
11:10 am – 12:00 pm	**John A. Rogers**, Ph.D *Some Thoughts on the Emergence of Soft, Body-Integrated Microsystems Technologies*

Dr. John Rogers is the Louis Simpson and Kimberly Querrey Professor of Materials Science and Engineering, professor of biomedical engineering, professor of neurological, and director of the Center for Bio-integrated Electronics at Northwestern University. He is a member of the National Academy of Engineering, the National Academy of Sciences, and the American Academy of Arts and Sciences. John is the recipient of 2019 Benjamin Franklin Medal in Materials Engineering for pioneering the engineering of flexible and stretchable electronic systems for e-health and exploratory neuroscience.

Abstract: Biological systems are mechanically soft, with complex, time-dependent 3D curvilinear shapes; modern electronic and microfluidic technologies are rigid, with simple, static 2D layouts. Eliminating these profound differences in properties will create vast opportunities in man-made systems that can intimately integrate into and onto the human body, for diagnostic, therapeutic or surgical function with important, unique capabilities in biomedical research and clinical healthcare. Over the last decade, a convergence of new concepts in materials science, mechanical engineering, electrical engineering and advanced manufacturing has led to the emergence of diverse, novel classes of 'biocompatible' electronic and microfluidic systems designed to interface to diverse locations across the human body. This talk describes the key ideas and enabling materials, with an emphasis on functional devices that take the form of (1) soft, thin membranes that laminate onto organ surfaces, (2) hair-like needle structures that penetrate into the depths of tissues, (3) bioresorbable, or 'transient', devices that disappear into the body on timescales matched to natural processes and (4) open, three dimensional network architectures that interface with biology across large volumes. Examples of clinically oriented activities built on the most mature of these technologies will be included.

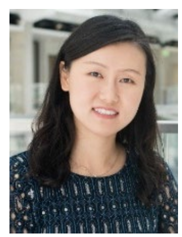


Dr. Canan Dagdeviren is the LG Career Development Professor of Media Arts and Sciences at MIT Media Lab, where she leads the *Conformable Decoders* research group. Dagdeviren's work has been featured in many media outlets, including *TIME*, *Washington Post*, *Smithsonian Magazine*, *Popular Mechanics*, CBS News, BBC News and *Physics World*.

Abstract: This talk will describe novel materials, mechanics and device designs for emerging classes of wearable health monitoring systems and implantable, minimally invasive medical devices. These include a variety of electrodes, sensors, and energy harvesting components, with promising applications in bio-integrated electronics, such as self-powered cardiac pacemakers, wearable blood pressure sensors, modulus sensor patches, and brain injectrodes. The devices can be twisted, folded, stretched/flexed and wrapped onto curvilinear surfaces or implanted without damage or significant alteration in operation. The fabrication strategies and design concepts can be applied to various biological substrates and geometries of interest, and thus have the potential to broadly bridge the gap that exists between rigid, boxy electronics and soft, curvy biology.

Dr. Roozbeh Ghaffari is the director of Translational Research and research associate professor of Biomedical Engineering at Northwestern University. His contributions in soft bioelectronics, micro/nano-scale systems, and neuroscience have been recognized with the Helen Carr Peake PhD Research Prize, the MIT100K Grand Prize, the Harvard Business School Social Enterprise Grand Prize, MIT Technology Review Magazine's Top 35 Innovators Under 35, IEEE Emerging Technology Award, and TEDx Gateway invited speaker.

Abstract: This talk will present an overview of recent advances in novel materials and system-level mechanics for fully-integrated epidermal electronics and soft microfluidic systems. These devices incorporate microfabricated arrays of sensors, microfluidic channels and biochemical assays, configured in ultrathin, stretchable formats for continuous monitoring of kinematics, cardiac signals, mechano-acoustics, and electro-chemical signals. Quantitative analyses of strain and performances under mechanical stresses highlight the utility of these systems in the clinic and at home. He will conclude with representative examples of soft/skin-interfaced systems that began as prototype demonstrations in groundbreaking research publications and which quickly matured to commercialized products.



Dr. Nanshu Lu is Temple Foundation Endowed Associate Professor at the University of Texas at Austin. She has been named 35 innovators under 35 by MIT Technology Review and has received NSF CAREER Award, multiple DOD Young Investigator Awards and 3M Non-Tenured Faculty Award.

Abstract: Over the past decade, stretchable high-performance inorganic electronics have emerged as a result of new structural designs and unique materials processes. Electronic tattoos (e-tattoos) represent a class of stretchable circuits, sensors, and stimulators that are ultrathin, ultrasoft and skin-conformable. This talk will introduce a dry and freeform "cut-and-paste" method to fabricate wireless e-tattoos. This method has been proved to work for thin film metals, polymers, ceramics, as well as 2D materials. Unique advantages of such e-tattoos enable them to be a mobile and disposable platform for continuous vital sign monitoring, human-robot interface, and personalized therapeutics. For wireless power and data transmission, NFC-enabled e-tattoos based on stretchable antenna and Bluetooth-enabled e-tattoos will be demonstrated. The concept of modular and reconfigurable e-tattoos will also be introduced.