

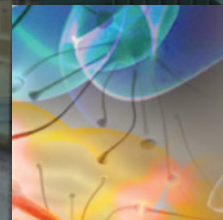
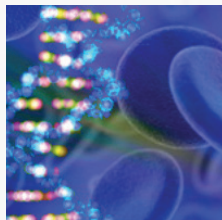
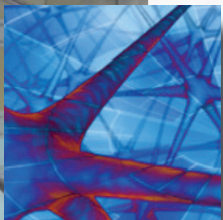
**FOURTH
CARNEGIE MELLON
FORUM ON
BIOMEDICAL
ENGINEERING**

September 17, 2021

Explore Frontiers in Biomedical Engineering!

The Carnegie Mellon Forum on Biomedical Engineering provides a platform for discussions and identification of grand challenges and frontiers in biomedical engineering research, education, and translation.

This year's forum will feature keynote talks from world-leading researchers, a DEI panel discussing current research and educational topics, and pre-recorded slide presentations covering the frontiers of biomedical engineering. The competition is open to students, postdocs or fellows who present their research in any area interfacing engineering with medicine and health.



Program

Friday, September 17 Carnegie Mellon Forum on Biomedical Engineering

Please register to gain access to the virtual meeting

09:00 – 09:05 AM	<p>Welcome Remarks</p> <p>William H. Sanders William D. and Nancy W. Strecker Dean College of Engineering Carnegie Mellon University</p>
09:05 – 09:20 AM	<p>Biomedical Engineering at Carnegie Mellon</p> <p>Keith Cook, PhD Professor and Interim Department Head of Biomedical Engineering Carnegie Mellon University</p> <p>Jana Kainerstorfer, PhD Associate Professor Biomedical Engineering Carnegie Mellon University</p>
09:20 – 09:50 AM	<p>Keynote: Following Nature's Lead: Designing Biomaterials for Nerve Injury</p> <p>Shelly Sakiyama-Elbert, PhD Fletcher Stuckey Pratt Chair in Engineering, Cockrell Family Chair for Departmental Leadership #1 Department of Biomedical Engineering The University of Texas at Austin</p> <p>Moderator: Adam Feinberg, PhD Arthur Hamerschlag Career Development Professor Biomedical Engineering and Materials Science & Engineering Carnegie Mellon University</p>
09:50 – 10:20 AM	<p>Keynote: Ex Vivo Lung Perfusion Business Case</p> <p>Richard Pietroski President of Lung Bioengineering United Therapeutics Corporation</p> <p>Moderator: Charlie Ren, PhD Assistant Professor Biomedical Engineering Carnegie Mellon University</p>
10:20 – 10:30	BREAK
10:30 – 11:00 AM	<p>Keynote: Skin-inspired Organic Bioelectronics</p> <p>Zhenan Bao, PhD K.K. Lee Professor and Chair of Chemical Engineering Professor of Chemistry, Materials Science and Engineering Stanford University</p> <p>Moderator: Christopher Bettinger, PhD Professor Biomedical Engineering and Materials Science & Engineering Carnegie Mellon University</p>

Program continued

11:00 – 11:30 AM

**Keynote: Non-Invasive Brain Imaging With Near-Infrared Light –
From Dolphins to Humans**

Jana Kainerstorfer, PhD

Associate Professor of Biomedical Engineering
Carnegie Mellon University

Moderator:

Sossena Wood, PhD

Special Faculty
Biomedical Engineering
Carnegie Mellon University

11:30 – 12:00 PM

**Keynote: Reconnecting the Hand and Arm to the Brain (ReHAB):
BCI Control of Upper Limb FES**

Robert Kirsch, PhD

Allen H. and Constance T. Ford Professor and Chair of Biomedical Engineering
Case Western Reserve University

Moderator:

Steve Chase, PhD

Professor
Biomedical Engineering and Carnegie Mellon Neuroscience Institute
Carnegie Mellon University

12:00 – 1:00 PM

LUNCH BREAK

1:00 – 2:15 PM

BME Education Panel Discussion

Kelly Stevens, PhD

Assistant Professor in the Department of Bioengineering,
Department of Laboratory Medicine and Pathology,
University of Washington

Talk Title: Why Funding Black Scientists Will Help Us All

Stephani Page, PhD

ARC Network Community Engagement Manager, WEPAN - Women in Engineering
ProActive Network

Talk Title: Applying DEI as Frameworks For All You Do

Steven Abramowitch, PhD

Associate Professor in the Department of Bioengineering, Clinical and Translational
Science Institute, University of Pittsburgh

Talk Title: Growing Through Differences

Moderator:

Alaine Allen

Associate Dean for Diversity, Equity, and Inclusion
College of Engineering
Carnegie Mellon University

2:15 – 4:45 PM

Pre-recorded Slide Presentations

4:45 – 5:00 PM

Announcement of Awards

**Steven Abramowitch**

Professor
Department of Bioengineering
University of Pittsburgh

Steven D. Abramowitch is a Professor of bioengineering and William K. Whiteford faculty fellow at the University of Pittsburgh Swanson School of Engineering. He is nationally and internationally recognized as a leader for his work on biomechanics related to female pelvic health, generating more than \$10M in research funding and publishing more than 75 peer reviewed journal articles that have been collectively cited over 5500 times. Dr. Abramowitch has also received a number of accolades for his work focused on diversity, equity, and inclusion (DEI). He is the co-PI of two major NSF grants creating opportunities and changing environments to ensure the success of underrepresented and underserved students in Engineering at both the undergraduate and graduate levels. His STRIVE program has received the highest award at the University of Pittsburgh for work related to DEI. In addition, Dr. Abramowitch was recognized by the Biomedical Engineering Society with their highest award related to the DEI in 2019. Dr. Abramowitch received his BS (Applied Mathematics, 1998) and PhD (Bioengineering, 2004) degrees from the University of Pittsburgh. He joined the Department of Bioengineering at the University of Pittsburgh as a Research Assistant Professor in 2004 and was promoted to the rank of Assistant Professor in 2007, to the rank of Associate Professor (with Tenure) in 2015, and the rank of Professor in 2021. He was appointed as a William Kepler Whiteford Faculty Fellow in 2016.

**Dr. Zhenan Bao**

Professor and Chair
Department of Chemical Engineering
Stanford University

Zhenan Bao joined Stanford University in 2004. She is currently a K.K. Lee Professor in Chemical Engineering, and with courtesy appointments in Chemistry and Material Science and Engineering. She is the Department Chair of Chemical Engineering from 2018. She is a member of the National Academy of Engineering, the American Academy of Arts and Sciences and the National Academy of Inventors. She founded the Stanford Wearable Electronics Initiative (eWEAR) and is the current faculty director. She is also an affiliated faculty member of Precourt Institute, Woods Institute, ChEM-H and Bio-X. Professor Bao currently has more than 600 refereed publications and more than 65 US patents. She is Fellow of AAAS, ACS, MRS, SPIE, ACS POLY and ACS PMSE. She was a recipient of the MRS Mid-Career Award in 2021, ACS Central Science Disruptor and Innovator Prize in 2020, ACS Gibbs Medal in 2020, the Wilhelm Exner Medal from the Austrian Federal Minister of Science in 2018, the L'Oreal UNESCO Women in Science Award North America Laureate in 2017. She was awarded the ACS Applied Polymer Science Award in 2017, ACS Creative Polymer Chemistry Award in 2013 ACS Cope Scholar Award in 2011, and was selected by Phoenix TV, China as 2010 Most influential Chinese in the World-Science and Technology Category. She is a recipient of the Royal Society of Chemistry Beilby Medal and Prize in 2009, IUPAC Creativity in Applied Polymer Science Prize in 2008, American Chemical Society Team Innovation Award 2001, R&D 100 Award, and R&D Magazine Editors Choice Best of the Best new technology for 2001. She has been selected in 2002 by the American Chemical Society Women Chemists Committee as one of the twelve Outstanding Young Woman Scientist who is expected to make a substantial impact in chemistry during this century. She was also selected by MIT Technology Review magazine in 2003 as one of the top 100 young innovators for this century. She has been selected as one of the recipients of Stanford Terman Fellow and has been appointed as the Robert Noyce Faculty Scholar, Finmeccanica Faculty Scholar and David Filo and Jerry Yang Faculty Scholar.



Keith Cook

Professor and Interim Department Head
Department of Biomedical Engineering
Carnegie Mellon University

Dr. Cook is a Professor and Interim Department Head of Biomedical Engineering at Carnegie Mellon University, where he also serves as the Director of the Bioengineered Organs Initiative. Dr. Cook's research focuses on the application of biomedical engineering to the treatment of lung disease. His primary research focus is the development of permanent replacement lungs for destination therapy. This work extends into many different research areas, including computational modeling and device design, development of novel biomaterials and new drug approaches to reduce blood coagulation within these devices, and in-vitro and in-vivo biomaterials and artificial lung testing. His research also focuses on lung biofabrication, right ventricular function modeling, and pulmonary drug delivery using perfluorocarbon emulsions. Dr. Cook is a fellow of the American Institute for Medical and Biological Engineering (AIMBE).



Jana Kainerstorfer

Associate Professor
Department of Biomedical Engineering
Carnegie Mellon University

Jana Kainerstorfer is an Associate Professor of Biomedical Engineering at Carnegie Mellon University and holds courtesy appointments in the Neuroscience Institute and Electrical & Computer Engineering. Her lab's research is focused on developing noninvasive optical imaging methods for disease detection and/or treatment monitoring, with an emphasis on diffuse optical imaging. She serves on program committees at national and international conferences (including the SPIE Photonics West as well as OSA Topical Meetings) and served as Program Chair for the OSA Biophotonics Congress: Optical Tomography and Spectroscopy in 2020. She further is an associate editor for Journal of Biomedical Optics (SPIE), served as associated editor for IEEE Transactions on Biomedical Engineering, as a guest editor for Opportunities in Neurophotonics in APL Photonics, and as editor for the Virtual Journal of Biomedical Optics (a journal of the Optical Society of America). She got elected as a senior member of the Optical Society of America. Her research has been funded by AHA, NIH, ONR, DARPA, and the Air Force, including the NIH R21 Trailblazer as well as AHA Scientist Development Grant.



Robert Kirsch

Allen H. and Constance T. Ford Professor and Chair
Department of Biomedical Engineering
Case Western Reserve University

Dr. Robert F. Kirsch is the Allen H. and Constance T. Ford Professor and Chair of Biomedical Engineering at Case Western Reserve University and the Executive Director of the Department of Veterans Affairs Rehabilitation Research and Development Service “Center for Functional Electrical Stimulation”. He is the Principal Investigator of the Case-Coulter Translational Research partnership, a Fellow of the American Institute for Medical and Biological Engineering (AIMBE), the Chair of the national BME Council of Chairs (2017), the co-Director of a NIBIB T32 training grant, and a member of advisory boards for a number of biomedical engineering departments, research centers, and training grants across the US and internationally. His research focuses on the restoration of arm movements to individuals with complete paralysis of arm muscles due to spinal cord injury or other neurological disorders using functional electrical stimulation (FES), as well as high performance user command interfaces such as brain computer interfaces and advanced prosthetic user interfaces. He received a BS in electrical engineering (University of Cincinnati) and the MS and Ph.D. in biomedical engineering (Northwestern University), and completed post-doctoral research (McGill University).



Stephani Page

ARC Network Community Engagement Manager,
WEPAN - Women in Engineering ProActive Network

Stephani Page is a STEM equity and community engagement professional who has over 15 years of biological and biomedical academic research experience. She earned her doctorate in Biochemistry and Biophysics from the School of Medicine at the University of North Carolina at Chapel Hill. Dr. Page is a proud HBCU graduate of North Carolina A&T State University with a bachelors and masters in Chemical Engineering and Biology, respectively. She has been recognized as a researcher by the American Society for Biochemistry and Molecular Biology, the Biophysical Society, and the American Heart Association. Dr. Page has been committed to diversity, equity, and inclusion in the academy and STEM. She is the creator of the #BLACKandSTEM community which has a social media following of nearly 19,000. Over the years, she has contributed to several major efforts to improve the scientific workforce and education through experiences such as serving on the NIH’s working group for the Next Generation Researchers Initiative and contributing a commissioned paper for the National Academies of Sciences, Engineering, and Medicine’s (NASEM) report on Mentoring in STEM (the additional ‘M’ stands for medicine). Dr. Page currently serves as the community engagement manager for the ADVANCE Resource and Coordination (ARC) Network, an NSF-ADVANCE funded STEM equity brain trust.



Richard Pietroski

President of Lung Bioengineering
United Therapeutics Corporation

For nearly four decades Mr. Pietroski's life has been dedicated to the successful analysis, development and improvement of the organ donation and transplantation system across the globe. Through a vast number of appointments, his experience transcends the full scope of the deceased donor procurement and transplant process, and is balanced with national committee leadership work, legislative and regulatory policy development, administrative oversight of \$60+ Million budgets, multiple clinical foot-print building projects as large as 75K ft², and recognition of international and multicultural positions related to altruistic deceased organ donation. His commitment to succeed is underscored in his personal benefit of becoming a tissue allograft recipient to rebuild a failed shoulder and his 20-year old son becoming a donor.



Shelly Sakiyama-Elbert

Professor and Chair
Department of Biomedical Engineering
The University of Texas at Austin

Dr. Sakiyama-Elbert's lab is interested in developing new bioactive scaffolds for tissue engineering. These scaffolds contain bioactive signals that include signals for cell-type specific adhesion and migration, growth factors to promote cell proliferation and differentiation. Her lab's goal is to make materials that can sense cell-derived signals during regeneration and respond by providing biological signals to enhance tissue regeneration.

Growth factors are potent protein drugs that are powerful regulators of biological function. Their presence in tissues is highly regulated in both time and space. The ability to tightly regulate the release of growth factors is essential in the development of tissue engineering scaffolds. The Sakiyama-Elbert Laboratory is using combinatorial methods to design novel materials for affinity-based protein delivery. They are currently testing the ability of these bioactive drug delivery systems to promote nerve regeneration in both peripheral nerve and spinal cord injury models in collaboration with clinical faculty. They are also using these drug delivery systems in combination with neural progenitor cells to understand the role of specific populations of neurons in regeneration after injury.



Kelly Stevens

Assistant Professor

Department of Bioengineering, Department of Laboratory Medicine and Pathology
University of Washington

Kelly Stevens is an Assistant Professor in the Departments of Bioengineering and Pathology at the University of Washington. Kelly received a B.S. in Biomedical Engineering from the University of Wisconsin-Madison, a Ph.D. in Bioengineering from the University of Washington, and postdoctoral training at Massachusetts Institute of Technology. Her work bridges several facets of regenerative medicine, including pluripotent stem cell biology, transplantation, tissue engineering, and micro/nanofabrication. In particular, she has made several seminal contributions in the development of complex multicellular tissues for organ repair, with increasing focus on enhancing tissue function, microvascularization, and organization. Some examples include the construction of functional scaffold-free cardiac tissue from pluripotent stem cells, the subsequent 'pre-vascularization' of these tissues using the intrinsic capacity of microvascular cells to self-organize, and the geometric control of multicellular patterning for optimal parenchymal function and microvascular ingrowth after implantation.



BAYER: EVOLVING RADIOLOGY IMAGE ACQUISITION

Bayer has been committed to radiology for more than 80 years and continues to partner with radiologists to guide diagnostic care. Bayer's legacy in Radiology dates back to 1930 with the launch of one of the first contrast agents. Included in our comprehensive portfolio are products that improve automation, provide unparalleled support, and services that may help maximize uptime.

As a trusted collaborator, Bayer provides radiologists with a portfolio of diagnostic imaging products and services to support the Radiology workflow and engages collaboratively with original equipment manufacturers (OEMs) of diagnostic imaging scanners and healthcare IT partners.

Our comprehensive and continually evolving portfolio includes medical devices, contrast media, integrated dose-management software (radiation dose and contrast dose), and equipment service across a broad range of modalities, including CT, MR, PET, and Interventional Angiography. We offer customer solutions to help healthcare teams meet challenging needs of today's radiology environment.

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CMU BME Research Areas:

- Biomaterials & Nanotechnology
- Cardiopulmonary Engineering
- Cell & Tissue Engineering
- Computational Biomedical Engineering
- Medical Devices & Robotics
- Neural Engineering

BME Academic Programs at CMU

Graduate Programs Overview

Ph.D. Program

The Ph.D. program is designed to nurture the next generation of leaders in biomedical engineering for the university and industry. Flexible degree requirements allow the student to balance breadth and depth, and to develop a research plan best suited to his/her career goal.

Ph.D. students start thesis research soon after matriculation. A rigorous review system monitors the progress to facilitate timely completion in 4-5 years for students without an M.S. degree, and in as short as 3 years for students with a relevant M.S. degree. All Ph.D. students are supported with full financial aid that covers tuition and stipend. The Department also participates in a joint M.D.-Ph.D. Program with the University of Pittsburgh School of Medicine.

M.S. Program

The M.S. program, built upon the interdisciplinary, collaborative culture of Carnegie Mellon University, provides an ideal opportunity for career advancement in biomedical engineering or transitions from other disciplines into biomedical engineering.

The large degree of flexibility and a wide choice of research advisors allow M.S. education to be tailored according to the student's professional goals, from R&D in biotechnology, healthcare, to university faculty.

Students may choose between the traditional Research-Option M.S. program and the accelerated Practicum-Option M.S. program. If choosing the practicum option, a practicum course can provide opportunities for clinical exposure at local hospitals. It may also be combined with programs in Engineering & Technology Innovation Management to form a dual M.S. program. M.S. Students wishing to enter Carnegie Mellon's Ph.D. program in Biomedical Engineering must reapply and compete with the general pool of Ph.D. applicants.

M.S. Program students may choose between the traditional **Research-Option** and the accelerated **Practicum-Option**.

Undergraduate Programs Overview

Major in Biomedical Engineering

Biomedical engineering education at Carnegie Mellon University reflects the belief that a top biomedical engineer must be deeply trained in both a traditional engineering practice and biomedical sciences. The unique



additional major program leverages extensive collaborations with sister departments in the College of Engineering and with major medical institutions in Pittsburgh. This collaborative approach, combined with a rigorous engineering education, confers unique depth and breadth to the education of Biomedical Engineering graduates.

Minor in Biomedical Engineering

The minor program is designed for engineering students who desire exposure to biomedical engineering but may not have the time to pursue the Biomedical Engineering additional major. The program is open to students of all colleges and is popular among science majors. In conjunction with other relevant courses, the program may provide a sufficient background for jobs or graduate studies in biomedical engineering. Students interested in a medical career may also find this program helpful.

The Department of Biomedical Engineering offers world class interdisciplinary research and teaching. Our training programs expand students' opportunities in academia, industry, healthcare, and entrepreneurship, while encouraging the innovation of world-changing technologies both at CMU and in your later career.

**Organized by Carnegie Mellon
Biomedical Engineering Department**



**BIOMEDICAL
ENGINEERING**

Carnegie Mellon University

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