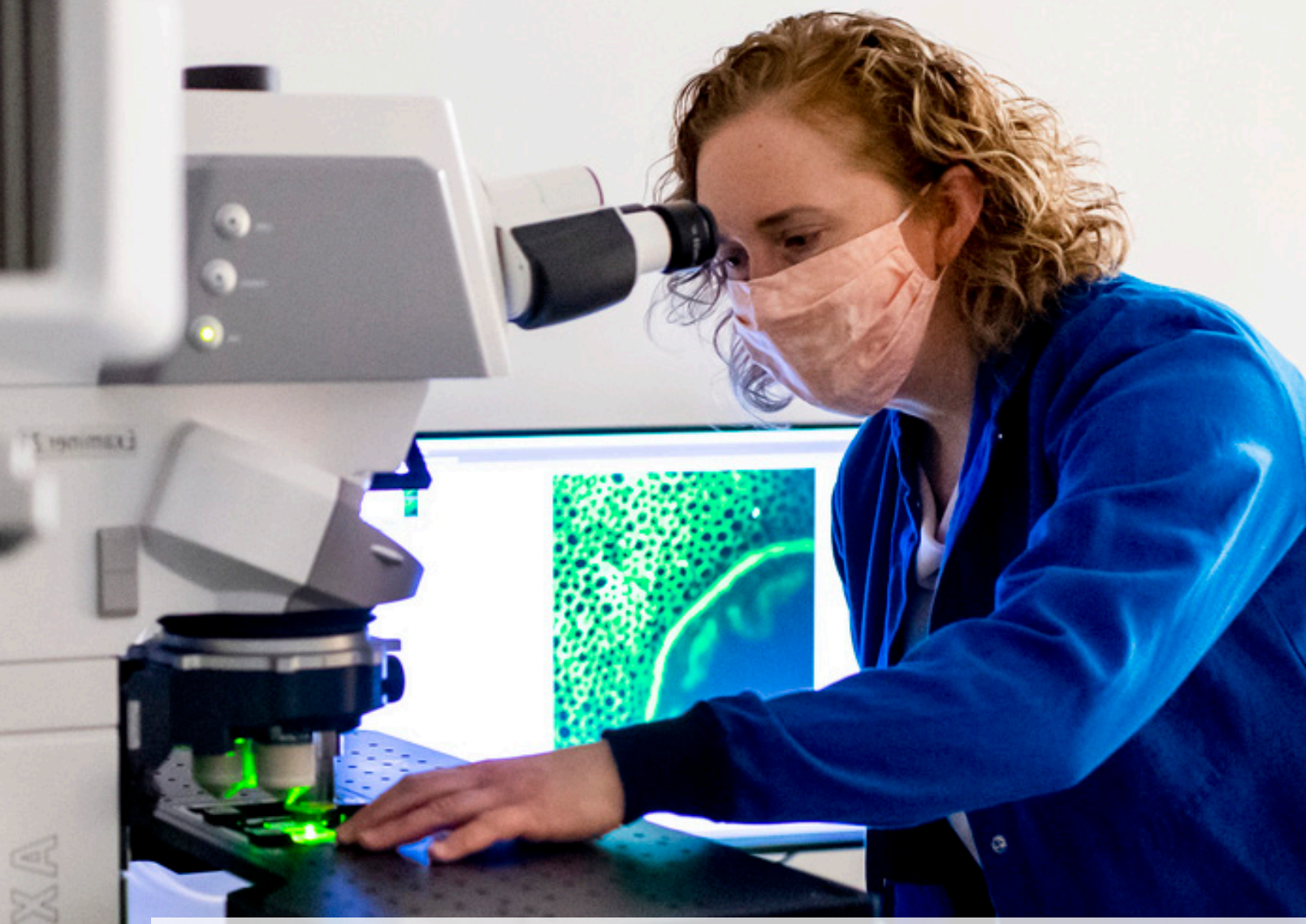
Northeastern University
College of Engineering



2020 | 2021

SCHOLARSHIP REPORT
BIOENGINEERING

NORTHEASTERN

We are a leader in experiential education and interdisciplinary research, focused on Engineering for Society

DEAR COLLEAGUES, FRIENDS, AND STUDENTS,

Bioengineering—engineering in a biological context—is generating some of the most exciting and impactful innovations of our times. The interface between engineered and biological systems place unique constraints on the design and implementation of devices, instruments, or implants. These constraints depend on the properties of the biological systems involved and the functionality that is being created. Our research into the fundamentals of cell and tissue engineering, biomedical imaging and signal processing, biomechanics, and computational and systems biology is providing a foundation on which innovative advances in medicine are being made. The coalescence of engineering and medicine is becoming one of the greatest intellectual adventures of the 21st century.

At Northeastern, students and faculty work together to combine classroom, research, and experiential learning in a vibrant bioengineering community that spans the entire University. With over 70 tenured/tenure-track and affiliated faculty, the Department of Bioengineering offers research that encompasses the entire breadth of biological and biomedical engineering.

Our co-op program is working with companies across the sector to provide bioengineering students with cutting-edge opportunities within the Boston biotech industry and beyond. Career opportunities are rapidly expanding as the industry focuses on development of entirely new classes of products, instrumentation, and implants. The impact of these efforts on human health will be extraordinary.

This Scholarship Report provides a glimpse into the many activities of our faculty and the energy and breathe of their research. When you see stories that intrigue, entice, or excite, I hope you will take the time to further explore the details through our website, publications, and activities.

For more details, visit our website at BIOE.NORTHEASTERN.EDU.

Sincerely,

Lee Makowski, PhD
Department Chair
Bioengineering
l.makowski@northeastern.edu

QUICK FACTS BIOENGINEERING

780 **Students**
54% Students are Women

168 **Graduate Students**
Up 250% from 2015

8 Young Investigator Awards

8 Professional Society Fellowships

73 **TENURED/ TENURE-TRACK** including Affiliated

$20M **External Research Awards** (2019-2021)

Allen Distinguished Investigator
Nikolai Slavov, Associate Professor

National Academy Member
Herbert Levine, University Distinguished Professor

2021 National Science Foundation CAREER Award Recipient
Harikrishnan Parameswaran, Assistant Professor

Research Institute

Institute for Chemical Imaging of Living Systems
at Northeastern University

Directed by
Heather Clark, Professor Bioengineering, jointly appointed in Chemistry and Chemical Biology

QUICK FACTS COLLEGE OF ENGINEERING

With **200** tenured/tenure-track faculty and **17** multidisciplinary research centers and institutes with funding by eight federal agencies, the College of Engineering is a leader in experiential education and interdisciplinary research, with a focus on discovering solutions to global challenges to benefit society.

5 **Engineering Departments**

104 **YOUNG INVESTIGATOR** Awards

Including **58** NSF CAREER Awards, and **18** DOD Young Investigator Awards

84 **Professional Society Fellowships**

949 **Graduate Students**
Placed on Co-op (2020-2021)

TOTAL ENROLLMENT (Fall 2020)

7873
49.8% Graduate
50.2% Undergraduate

Enrollment Growth
(2015 to 2020)

52% MS
34% PhD
16% BS

RECENT FACULTY HIRES

AILEEN HUANG-SAAD
Associate Professor, Bioengineering, and Director of Life Science and Engineering Programs, the Roux Institute
PhD, John Hopkins School of Medicine, 1996
Scholarship focus: Entrepreneurship education microenvironments and their impact on the engagement of diverse populations, the influence of I-Corps on university ecosystems, and transforming BME education through instructional design

MINGYANG LU
Assistant Professor, Bioengineering
PhD, Baylor University, 2010
Scholarship focus: Computational systems biology, an integration of mathematical modeling and bioinformatics for studying gene regulatory networks, single cell genomics, epithelial-mesenchymal transition, coarse-graining, reverse engineering, machine learning, stochasticity and heterogeneity in gene expression

ELIZABETH LIBBY
Assistant Professor, Bioengineering
PhD, University of Pennsylvania, 2011
Scholarship focus: Synthetic biology, microbiology, biosensor development

RAIMOND WINSLOW
Professor, Bioengineering, and Director of Life Science and Medicine Research, the Roux Institute
PhD, John Hopkins School of Medicine, 1985
Scholarship focus: Computational modeling of the cardiac myocyte to understand the molecular basis of arrhythmias; machine learning in critical care medicine to identify those patients who require urgent care

FRANCISCO LOTH
Professor, Mechanical and Industrial Engineering, and Bioengineering
(joining January 2022)
PhD, Georgia Institute of Technology, 1993
Scholarship focus: Biological flows, experimental fluid mechanics, computational fluid mechanics, blood flow simulation, cerebrospinal fluid simulation, Chiari malformation, syringomyelia, medical image processing, magnetic resonance imaging

FACULTY BY RESEARCH AREAS

Biomechanics, Biotransport and MechanoBiology

Rouzbeh Amini
Ambika Bajpayee
Chiara Bellini
Guohao Dai
Jessica Oakes
Harikrishnan Parameswaran
Jeffery Ruberti
Sandra Shefelbine

Computational and Systems Biology

Anand Asthagiri
Chiara Bellini
Erel Levine
Herbert Levine
Elizabeth Libby
Mingyang Lu
Mona Minkara
Jessica Oakes
Nikolai Slavov
Eduardo Sontag
Raimond Winslow

Imaging, Instrumentation, and Signal Processing

Samuel Chung
Heather Clark
Qianqian Fang
Raymond Fu
Mark Niedre
Sara Rouhanifard
Mohammad Abbas Yaseen

Molecular, Cell, and Tissue Engineering

Anand Asthagiri
Ambika Bajpayee
Samuel Chung
Guohao Dai
Michael Jaeggli
Carolyn W.T. Lee-Parsons
Jiahe Li
Elizabeth Libby
Lee Makowski
Mark Niedre
Harikrishnan Parameswaran
Sara Rouhanifard
Jeffrey Ruberti
Eduardo Sontag
Rebecca Willits

The Institute for Experiential AI at Northeastern University

Pioneering a Human-Centric Artificial Intelligence Research and Applications Hub

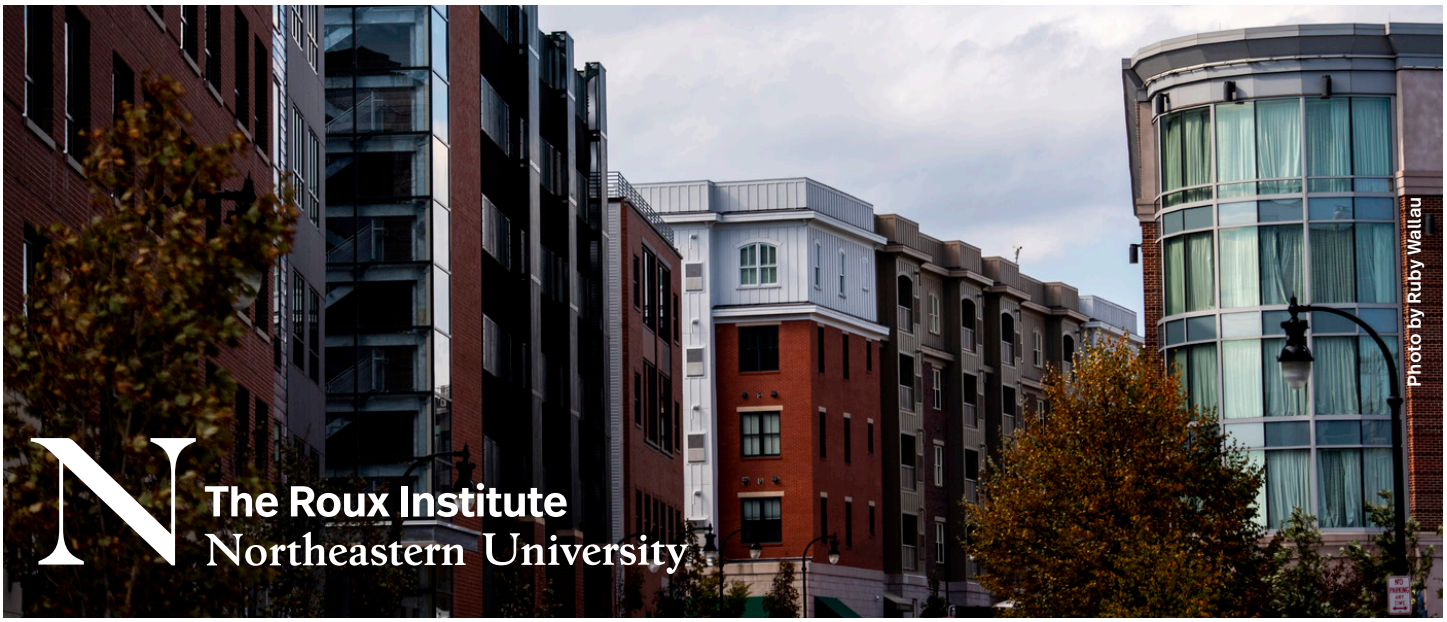
Northeastern University has allocated $50 million to the new Institute for Experiential AI, a pioneering research hub that places human skills and intelligence at the forefront of artificial intelligence applications. Leading experts in computer science, engineering, ethics, humanities, law, public policy, health, security, and sustainability will collaborate to develop applied human-centric AI solutions that tackle the world's toughest challenges.

The Institute for Experiential AI is university-wide, based out of the Roux Institute at Northeastern—a graduate education and research campus in Portland, Maine, born from a $100 million investment in the university by David and Barbara Roux (see page 5). Designed to educate generations of talent in the digital and life sciences sectors, the Roux Institute also acts as a driving force for sustained economic growth in Portland, the state of Maine, and northern New England.

"Northeastern has committed to building the top research institute in the world focused on Experiential AI," says founding Executive Director **Usama Fayyad**. "No one has claimed this space yet and I'm excited for our chance to lead this field."

To accelerate research and advance practical applications of AI in several domains, the Institute for Experiential AI is recruiting 30 new research and teaching faculty, data scientists, and postdoctoral fellows. In addition, faculty from colleges within the university such as the College of Engineering and Khoury College of Computer Sciences will conduct and collaborate on multidisciplinary research as part of the institute.

The Institute for Experiential AI will partner with industry, government, and academia to educate the next generation of AI professionals and lead efforts to create ethical and responsible human-centric AI. The institute also plans to be a prominent contributor to the global AI ecosystem and a key driver of experiential AI in New England through targeted activities in the region.



Expanding Research and Education with the Roux Institute at Northeastern

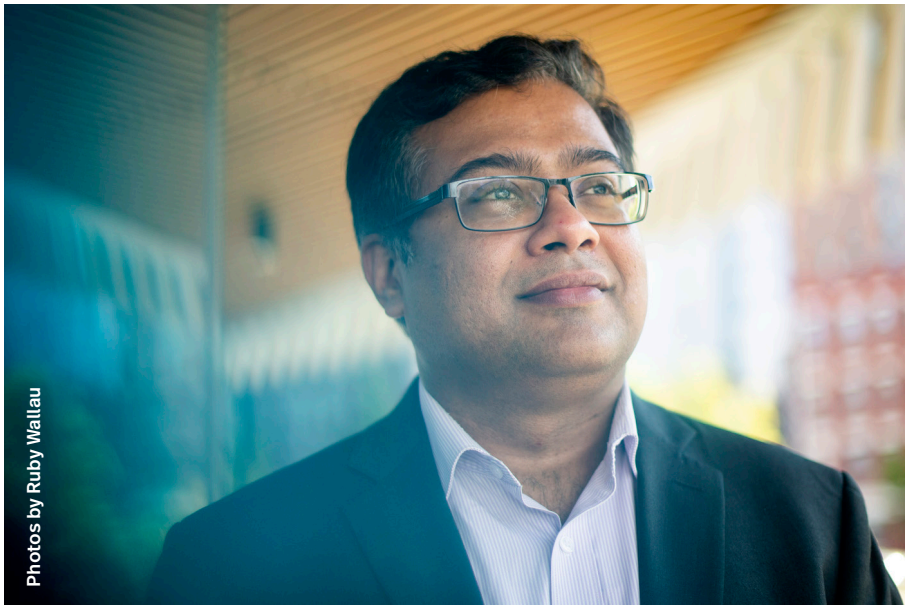
The Roux Institute at Northeastern University is a graduate education and research campus in Portland, Maine, made possible by a $100 million investment in the university from David and Barbara Roux in 2020. It is designed to transform Maine's economy by making it a hub for innovation in experiential artificial intelligence, digital engineering, advanced life sciences, and entrepreneurship. Its new model of graduate education and entrepreneurship is powered by Northeastern's experience forging industry partnerships. Currently, the Roux Institute has over 40 industry, academic, and civic partners.

With the Roux Institute's focus in AI and digital engineering, Northeastern's Institute for Experiential AI, led by Executive Director **Usama Fayyad**, will be based at the Roux Institute, and Professor **Jennifer Dy**, electrical and computer engineering, has been appointed director of experiential AI postdoc education there. New bioengineering faculty have joined as part of the Roux Institute's leadership team. Associate Professor **Aileen Huang-Saad** is director of life science and engineering programs, focused on developing interdisciplinary, experiential learning programs that will embed learners in the growing life sciences and engineering industries in Maine and at the Roux. Professor **Rai Winslow** is director of life sciences and medicine research. He will work at the leading edge of computational medicine, harnessing Big Data for predictive disease outcomes. Additionally, Professor **Jack Lesko**, mechanical and industrial engineering, jointly appointed in civil and environmental engineering, joins as director of engineering research. A materials researcher, he will focus on building deep industry collaborations. Also, Assistant Professor **Francesco Restuccia**, electrical and computer engineering, joined the Roux Institute to lead research conducted there as part of the Institute for the Wireless Internet of Things.

A research agreement was signed in May 2020 between the Roux Institute at Northeastern and the University of Maine as part of the mission to help build the Maine tech and life science economy with the power of Northeastern's research and learning enterprise in the areas of artificial intelligence, Earth and climate sciences, health and life sciences, manufacturing, and marine science. Seed funding was awarded to five collaborative research teams—including bioengineering, and electrical and computer engineering faculty. The one-year projects were selected from a pool of twenty-one applications through a rigorous review process and are the first funded as part of the collaborative research initiative established between the two universities. Each team was awarded $50,000, and they work together to pursue larger external funding programs through federal and private sponsors.

As part of this, **Jiahe Li**, assistant professor, bioengineering, is leading a project to develop a new, cost-effective, easily deployable ingredient to help create a stronger immune response in fish. He is working with PhD student **Xin Sun**, bioengineering, and University of Maine collaborators. **Mingyang Lu**, assistant professor, bioengineering, and **Ataur Katebi**, associate research scientist, bioengineering, in collaboration with University of Maine, are leading a project team to better understand the immune system's response to the Influenza A virus infection and develop an automated AI-based network modeling approach to find new antiviral therapeutic targets.

In October 2020, the Harold Alfond Foundation donated $100 million to the Roux Institute to provide financial aid for graduate-level students, funding for post-doctoral research, and support for co-ops with Maine employers. The Roux Institute will create additional research, entrepreneurship, education, and experiential learning opportunities for students and faculty across Northeastern's global network as it expands.



Hari Parameswaran, assistant professor, bioengineering

NSF CAREER Award for Better Treatment of Asthma

Harikrishnan Parameswaran, assistant professor, bioengineering, received a $602K National Science Foundation CAREER Award for "Elucidating the Role of Collective Cell-Matrix Interactions in the Mechanobiology of Airway Narrowing." He seeks to understand how the smooth muscle detects inhaled irritants and generates force at the cellular level to develop better treatment for people with asthma.

Any organ in the human body that requires constriction—such as the airways or blood vessels—is lined with smooth muscle that aids in its contraction. In asthmatics, the smooth muscle lining the airways undergoes exaggerated constriction in response to a small amount of inhaled irritants, making it difficult to breathe. The exact mechanisms that lead to this behavior are unknown, making effective and universal medical treatment difficult.

In the airway, human smooth muscle cells are supported by a complex scaffold of proteins called the extracellular matrix. This extracellular matrix undergoes substantial changes in asthma. Parameswaran's research discovered that when smooth muscle cells from healthy human donors are placed on a synthetic substrate mimicking diseased tissue, even a tiny dose of an irritant molecule is perceived as a high dose and causes an increased contraction response.

However, the most curious finding is that this abnormal reaction doesn't occur in single smooth muscle cells, but only with a group of cells—meaning the cells are somehow communicating and responding to inhaled irritants as a collective.

"When inhaled irritant molecules bind to the smooth muscle, the smooth muscle cells communicate with each other using calcium waves," says Parameswaran. "These calcium waves are frequency modulated—just like those used in radio communications—and, together like a committee, these cells decide the amount of inhaled irritant molecules. This method of sensing inhaled irritants is fundamentally different from what is currently known. It brings up the intriguing possibility that the individual smooth muscle cell might not be at fault in asthma. Instead, the problem might be in how these cells talk to each other in an asthmatic airway."

"The idea that the extracellular matrix may have a role in regulating smooth muscle cells is new and exciting," says Parameswaran. "If we're able to understand better how the underlying matrix modulates intercellular communication, we may be able to learn more about what drives the disease of asthma and develop methods to target the cause and not the symptoms of this disease."

Faculty Highlights

Professor **Heather Clark**, bioengineering, jointly appointed in chemistry and chemical biology, and director of Northeastern University's Institute for the Chemical Imaging of Living Systems, has been named a **2021 AIMBE Fellow**. She was nominated, reviewed, and elected by peers and members of the College of Fellows for the development of nanoscale optical probes for chemical imaging within live cellular and tissue environments.

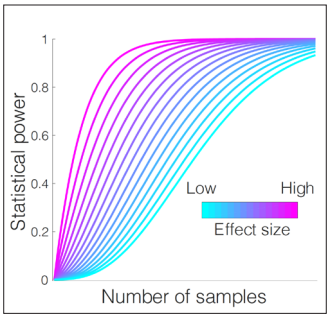
Assistant Professor **Ambika Bajpayee's** research was published on the **cover of the Biomaterials Science Emerging Investigator Issue 2021** of the journal *Biomaterials Science*. The paper, titled "Milk Exosomes with Enhanced Mucus Penetrability for Oral Delivery of siRNA," was in collaboration with Sanofi. Key authors in addition to Bajpayee, include first author Matt Warren, E'21, and Chenzhen Zhang, PhD'24, and Armin Vedadghavami, PhD'21–all working in the Bajpayee Lab.

Research from Assistant Professors **Sidi A. Bencherif**, chemical engineering, and **Ambika Bajpayee**, bioengineering, on "Hyaluronic Acid-Based Shape-Memory Cryogel Scaffolds for Focal Cartilage Defect Repair" was featured on the **cover of the June 2021 *Tissue Engineering Part A* journal**.

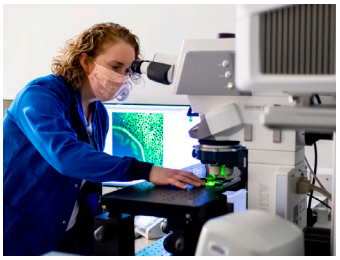
Lee Makowski, professor and chair of the Department of Bioengineering, along with his student **Will Olson-Sidford**, E'22, bioengineering, and a collaborator John Weisel from University of Pennsylvania, **published a perspective article in the journal *Virus*** titled, "Biological and Clinical Consequences of Integrin Binding via a Rogue RGD Motif in the SARS CoV-2 Spike Protein." The article puts forth a hypothesis on the most dangerous aspects of COVID-19. It is well known that the virus enters cells of the respiratory tract by binding to a cell surface receptor known as ACE2. But the viral spike protein has evolved a structural motif that is used by many human viruses as a key to enter cells using a different class of receptors known as integrins. Integrins are present in virtually all organs of the body and control many cellular signaling pathways. Viral dysregulation of these pathways has the potential for triggering uncontrolled clotting disorders and disruption and damage to lung tissue and other organs including the heart and kidneys–disruption commonly seen in the most severe COVID-19 cases. Makowski and his colleagues make the case that their hypothesis needs to be tested since a better understanding of the origin of severe symptoms will greatly aid the development of strategies that could mitigate the worst aspects of severe COVID-19.

Assistant Professor **Mingyang Lu**, bioengineering, and University Distinguished Professor **Herbert Levine**, physics, jointly appointed in bioengineering, in collaboration with the University of Texas at Dallas, were awarded a **$1.4 million National Science Foundation grant** for "Genome Editing Approaches to Unravel MicroRNA Roles in Stochastic Multistable Networks." One of the fundamental questions in biology is to understand the roles of the gene regulatory networks driving cellular decisions. MicroRNAs (miRNAs) are small RNA molecules that bind to the mRNA of target genes, acting as regulators of gene expression. Previous studies have demonstrated the critical roles of miRNAs in a variety of biological processes such as cell growth and cell differentiation. However, what is still not well-understood concerns possible synergistic effects from multiple miRNA molecules targeting different binding sites of the same mRNA and concerns how miRNA interactions operate within a complex gene regulatory network. To address these issues, an interdisciplinary platform that combines genome editing, live-cell imaging, and mathematical modeling will be developed in this project.

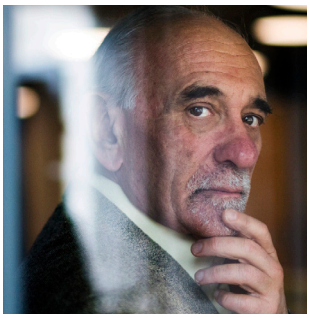
Faculty Highlights



Associate Professor **Nikolai Slavov**, bioengineering, published a perspective article in ***Nature Biotechnology*** titled "Increasing proteomics throughput" highlighting new mass-spectrometry technologies transcending limitations in the throughput of proteomics and opening the stage for many exciting applications.

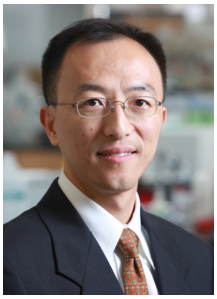


Professor **Heather Clark**, bioengineering, jointly appointed in chemistry, and director of the Institute for the Chemical Imaging of Living Systems, and James Monaghan, associate professor of biology, along with colleagues at Northeastern and researchers from the University of California, San Francisco, developed a DNA-based nanosensor that detects a specific neurotransmitter, acetylcholine, as it's released and picked up by target cells in living animals. The new type of nanosensor allows scientists to image communication between the brain and the body in real-time. They published their findings in the journal ***Proceedings of the National Academy of Sciences***.



University Distinguished Professor **Eduardo Sontag**, electrical and computer engineering, jointly appointed in bioengineering, was awarded a **$750K grant from the Air Force Office of Scientific Research**, titled "Network Motifs and Responses of Nonlinear Systems." The award will support his research into the mathematical foundations of biomolecular feedback control and signal processing. The project aims to explain how responses to external stimuli provide information regarding the internal structure of synthetic and natural cellular networks, elucidating the behavior of natural systems as well as helping to improve feedback control in engineered systems.

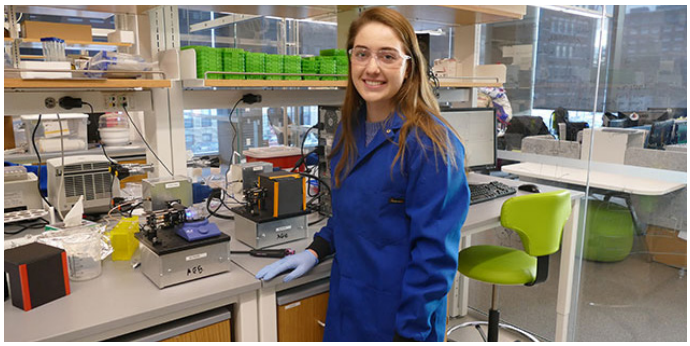
Professor **Mark Niedre**, bioengineering, and University Distinguished Professor **Mansoor Amiji**, pharmaceutical sciences and chemical engineering, received a **$400K grant from the National Cancer Institute and National Institutes of Health**, titled "Fluorescence Molecular In Vivo Liquid Biopsy of Circulating Tumor Cells." The project will develop new technology to optically detect and count circulating tumor cells directly in the body without having to draw blood. Metastasis is responsible for the majority of cancer-related deaths and is often mediated by dissemination of tumor cells via the blood system. The project hopes to lead to the ability to detect cancer earlier, opening up a range of treatment.



Associate Professor **Guohao Dai** (PI), bioengineering, Assistant Professor **Ryan Koppes** (PI), chemical engineering, and Associate Professor **Abigail Koppes** (co-PI), chemical engineering, were awarded a **$430K National Institutes of Health grant from the National Institute of Neurological Disorders and Stroke** for "Bioengineer a Humanized Autonomic Neurovascular Innervation on a Chip" to improve clinical outcomes of vein grafts. The incomplete adaptation of vein grafts to arterial hemodynamics may be the primary reason of vein graft failure. One of the missing links in the vein graft is the lack of innervation, whereas arteries are closely associated with the sympathetic/parasympathetic nerves. A recent study in embryonic development suggested that sympathetic innervation is critical for the proper development of arteries through releasing sympathetic neurotransmitters, raising the possibility that providing innervation to the vein graft may facilitate the better switch of vein to artery, thus potentially leading to better clinical outcomes. To explore this possibility, the research will examine autonomic neural derived signals on the arterialization of vascular endothelial cells (ECs) and their impact on smooth muscle cells (SMC) phenotypes, by establishing a novel humanized vascular innervation model on a microphysiological chip.

Learn more about our accomplished faculty

Student Highlights



Alumna **Erica Wagner**, E'20, bioengineering, and **Nathanial Silvia**, PhD'24, bioengineering, received **National Science Foundation Graduate Research Fellowships**. The NSFGRF program recognizes and supports outstanding graduate students who are pursuing full-time research-based master's and doctoral degrees in science, technology, engineering, and mathematics (STEM) or in STEM education.

Laura Bilal, E'21, and **Meghan Quon**, E'22, bioengineering, were third place **winners of the 2020 Husky Startup Challenge** of Northeastern's Entrepreneurs Club, taking home $1,000 in funding to pursue their venture, Klip Tech. Their invention offers an app connected to a rechargeable device that clips onto clothing and can be activated with either one or two clicks in situations where the wearer may be in some form of distress and unable to quickly access their phone. They are now furthering its development working with Generate, the College of Engineering's student-run product development studio that is part of the Sherman Center for Engineering Entrepreneurship Education.

Emily Man, E'19, ME'19, bioengineering, and **Valeria Martinuzzi**, ME'18, bioengineering, were first-place winners in the Young Alumnae Graduate Award category of Northeastern's inaugural 2021 Women Who Empower Innovator Awards for Entrepreneurship for their work on Venova Technologies, which is developing a novel, hormone-free contraceptive device for women.


BIOROB 2020
BIOMEDICAL ROBOTICS & BIOMECHATRONICS

The winner of the "Best Student Paper Award" is

Dynamic Primitives Facilitate Manipulating a Whip

Moses C. Noh, Aleksei Krotov, Marta Russo, Dagmar Sternad and Neville Hogan

MIT, NorthEastern University

Congratulations!!

Aleksei Krotov, PhD'24, bioengineering, received a **Best Student Paper Award** at the 8th IEEE Biomedical Robotics and Biomechatronics Conference.

During the COVID-19 pandemic, **Caitlynn Tov**, E'21, bioengineering, conducted research in the laboratory of MIT Assistant Professor Giovanni Traverso at Brigham and Women's Hospital while on co-op, working on the **TEAL Bio face mask**. The mask is made of a clear silicone rubber material with removable filters and is equally as effective as the N95 mask. When the filters are removed the mask can be sterilized and new, clean filters are put in which allows the mask to be reused. Tov assisted in the design elements of the mask by analyzing face scans with the goal of optimizing the fit and comfortability of the mask. She was also involved in the clinical trials. For all her contributions, Tov was listed as an **author/contributor in two papers and three patents** for the TEAL Bio face mask.

Michael Stahl, PhD'21

BIOENGINEERING

Advised by Octavia Camps, Professor of Electrical and Computer Engineering

After earning his undergraduate degree in biomedical engineering from Boston University, Michael Stahl joined Northeastern University's College of Engineering to pursue his master's in computer engineering with a concentration in digital signal processing. As a master's student, he studied the effectiveness of a psychophysical procedure to detect hearing loss. Upon graduating in 2004, Stahl entered the workforce, spending the next 8 years as a senior research engineering and project manager at Convergent Engineering, Inc. and Xhale Diagnostics Inc., developing medical diagnostics for breathing pathologies. He returned to Northeastern to pursue a PhD in Bioengineering. Stahl, who is legally blind, was excited to use his engineering skills to help the visually impaired. His research, in collaboration with Schepens Eye Research Institute in the Ophthalmology department at Harvard Medical School, developed a wearable, hands-free electronic travel aid (ETA) for the blind and visually impaired based on structured light principles. The device detects tripping hazards by analyzing laser light projected in front of the user and can be used in day and night conditions. The National Eye Institute awarded Stahl an F31 fellowship to pursue this research. He additionally won funding from Edmund Optics, Barrington, New Jersey, as well as a grant from the Stiftelsen Promobilia Foundation, Stockholm, Sweden, to construct a prototype and measure its impact on safe and effective travel for people with visual impairments. Stahl plans to continue research in low vision rehabilitation—specifically focused on increasing independent and safe travel—and to productize and market the electronic travel aid developed during this PhD dissertation.

Kerry Eller, E'21, bioengineering, is a recipient of the 2021 Harold D. Hodgkinson Award and the 2020 Truman Scholarship. During her time at Northeastern, she gained an interdisciplinary, experiential education, and studied, researched, and worked in four countries.

Work in Four Countries Prepares for a Global Career

It might seem unusual that Kerry Eller, E'21, bioengineering with a minor in political science, discovered her passion for bioengineering during a month-long Dialogue of Civilizations to the United Nations in Geneva, Switzerland. After all, it was an international relations program with courses on disarmament and international law.

But in addition to her classes, Eller conducted independent research for a paper on global engineering.

"My paper was on the policy initiatives needed to create the infrastructure for bioengineering in low-income countries," she says. "That's what sparked my interest in the field."

While at the United Nations, Eller also had an opportunity to talk with diplomats from around the world about the role scientists play in shaping international policy initiatives.

"I want to help create low-cost medical devices that are designed specifically for use in low-income countries," she says. "But I want to do more than just the technical side of engineering. I also want to be involved in the interventions that make engineering in low-and-middle income countries possible. I'm interested in how engineering, politics, and global health interact."

In addition to Switzerland, Eller pursued her global engineering interests in Ethiopia, Uganda, and Chili.

She went to Ethiopia as a member of the student club Innovators for Global Health, a trip that planted the seed for her senior capstone project in which she and five other students are designing a low-cost wireless pulse oximeter with telemetry to replace the constantly failing equipment at St. Paul's Hospital in Ethiopia.

She also traveled to Uganda as a member of the Northeastern chapter of the Global Med student organization to help female leaders of a grassroots organization improve water sanitation in their rural villages.

"I like the grassroots model of Global Med," says Eller. "Their philosophy is the people who live there should identify their needs while we provide the financial resources to help them meet those needs autonomously. We're there to support them, not tell them what we think is best for them."

For professional experience, Keller self-designed her co-op in Chile at the Universidad del Desarrollo, working on two primary projects—a mosquito trap to track vector-borne diseases as they spread, and a wearable pesticide monitor to gauge the exposure of agricultural workers to harmful chemicals.

The challenge was that no one at the university was well-versed in the paper-based diagnostics that were to be used in the mosquito trap. "That was my assignment, and so they expected me to become the expert and figure it out," she recalls. "So, I had to do a ton of research. I had to educate myself in a hurry about immunobiology."

She also had to quickly improve her rudimentary Spanish, since neither her host family nor the university researchers spoke fluent English.

"I knew what I was getting into," she says. "I purposefully threw myself into the deep end to force myself to learn."

After graduation, Eller is pursuing a PhD in bioengineering at Duke University, which will be partially funded by the prestigious Truman Scholarship she won in 2020. She is also the recipient of the Harold D. Hodgkinson Award for academic and experiential excellence, one of Northeastern's highest honors for graduating seniors.

Once she completes her doctorate, she plans to devote the early portion of her career to designing low-cost medical devices, then transition into a leadership role where she can influence policies that help low-income countries develop bioengineering capacity of their own.

"I plan to work from a ground-up perspective during the first portion of my career and from the top down in the second portion," she says.

LVX
VERITAS
VIRTVS

Northeastern
College of Engineering

With over 195 tenured/tenure-track faculty, 17 multidisciplinary research centers and institutes, and funding by eight federal agencies, the College of Engineering is a leader in experiential education and interdisciplinary research, with a focus on discovering solutions to global challenges to benefit society.

Northeastern University

Founded in 1898, Northeastern is a global research university and the recognized leader in experience-powered lifelong learning. Our world-renowned experiential approach empowers our students, faculty, alumni, and partners to create impact far beyond the confines of discipline, degree, and campus.

Our locations—in Boston; the Massachusetts communities of Burlington and Nahant; Charlotte, North Carolina; London; Portland, Maine; San Francisco; Seattle; Silicon Valley; Toronto; and Vancouver—are nodes in our growing global university system. Through this network, we expand opportunities for flexible, student-centered learning and collaborative, solutions-focused research.

Northeastern's comprehensive array of undergraduate and graduate programs—in on-campus, online, and hybrid formats—lead to degrees through the doctorate in nine colleges and schools. Among these, we offer more than 140 multidisciplinary majors and degrees designed to prepare students for purposeful lives and careers.

DEPARTMENT OF BIOENGINEERING

Northeastern University
206 Interdisciplinary Science
and Engineering Complex
805 Columbus Avenue
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bioe.northeastern.edu
coe.northeastern.edu

COVER IMAGE

Heather Clark, a professor in the departments of bioengineering and chemistry, works at the Institute for the Chemical Imaging of Living Systems (ICILS) in the Interdisciplinary Science and Engineering Complex. Clark, who is director of ICILS, helped develop a nanosensor that can image communication between the brain and the body.