

BIOMEDICAL ENGINEERING

2020-2021 ANNUAL REPORT





ABOVE: The Wong lab is a design-driven lab where we apply synthetic biology to engineer desired properties in mammalian cells, with application in understanding cellular design principles and developing cellular therapy.

2020-2021 ANNUAL REPORT

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ON THE COVER: From the lab of BME Assistant Professor Allyson Sgro, linking fluorescent proteins to the cytoskeleton of migrating human fibroblast cells allows scientists to understand how cells sense their surroundings and move in response. This can be useful for understanding processes like wound healing, at a cellular level.

2020-2021 - A YEAR LIKE NO OTHER

BU'S PANDEMIC RESPONSE

BU PUBLISHES PUBLIC HEALTH DATA FROM ITS 2020 COVID SURVEILLANCE EFFORTS



Above, One of BU's 5 sampling sites

By Kat J. McAlpine, *adapted from The Brink*

Living, working, and learning amidst a constant viral threat: Boston University leaders and scientists have written a case study documenting the lengths it took to safely reopen a residential university in one of the country's most bustling urban centers. The case study stands as a testament for what's possible in our new normal of living in the COVID-19 pandemic era, and as a potential roadmap for other institutions and corporations, weary of remote functioning, that seek a path to bring people back together in person. These case study results

"A year after the outbreak, science and technology have, indeed, proven to be the heroes."

- Dean Kenneth Lutchen's thoughts on the lessons learned from the pandemic

were published in the peer-reviewed journal *JAMA Network Open*.

Almost as soon as BU closed its doors, University leadership began building coronavirus response teams of its own—educators, scientists, engineers, clinicians, and laboratory technicians. BU developed its own high throughput PCR testing laboratory, to routinely test everyone on campus at least once a week. They implemented a hybrid learning model, called *Learn from Anywhere*, that would allow remote and in-person curriculum to blend as seamlessly as possible. They designed a computer simulation of BU's campus and community, modeling how the virus might spread through BU's network of people and testing out the impact of various proposed intervention strategies, should in-person classes and work resume. Then, bolstered by what the model predicted, they put a reopening plan into action.

The University fully reopened its campus in the fall of 2020, with minimal occurrence of COVID-19 transmission.



"There was buy-in from BU leadership from the start. [BU President Robert Brown] is an engineer. He wanted BU to develop solutions."

- Gloria Waters, BU's vice president and associate provost for research and a coauthor on the case study

At the start of the fall 2020 semester, BU reopened its doors to residential learning, a meticulously thought-out experiment in how University life could go on in spite of coronavirus. Through frequent testing, vigorous contact tracing, rapid isolation and quarantine, and a strong leadership structure to ensure rapid decision-making and adaption to emerging data, controlling the spread of SARS-CoV-2 on an urban campus was feasible despite worsening local transmission. BU's infrastructure played an important role in this—for leadership to buy into a reopening plan, for BU to have the right financial resources, and most importantly, for BU's intellectual resources to bring together the right expertise. ■



Each week, BU's Clinical Testing Lab processes roughly 30,000 coronavirus tests from asymptomatic BU students, faculty, and staff.

"The students really made this whole process work. They really brought their best selves to campus in the fall. They masked, they distanced, they tested, and on many occasions students have reached out to me to say how grateful they were to be back on campus."

- BME Professor Catherine Klapperich



BU implemented hybrid teaching in which all undergraduate and graduate students could attend classes in-person or remotely.



BME Department 2020-2021

Faculty

In fiscal year 2021 the BME Department added three new faculty, Assistant Professors Timothy O'Shea, Brianne Connizzo and Alexander Green. We also successfully recruited Dr. Erica Pratt as an Assistant Professor who will start January 1, 2022. At the end of FY 2021, the **BME Faculty numbered 39** making the department one of the largest in the country in terms of primary faculty.

Graduate Program

The BME PhD Program awarded 18 degrees in AY20-21, bringing our total PhD degrees awarded to 372 since the program began in 1991. 47 MS degrees were awarded, as well as 20 MEng degrees. Our graduate programs enrolled 229 students (166 PhD students; 2 MD/PhD; 38 MS; 23 MEng).

Graduate student recruitment: In the fall 2021 we matriculated 95 new graduate students (33 PhD, 27 MS, 22 MEng and 11 LEAP). Our applicant pool continues to be competitive with other top tier Biomedical Engineering Programs. In the 2020 - 2021 recruiting season we received **1,130 applications (PhD, MS and MEng)**.

Undergraduate Program

The BME Undergraduate Program awarded 138 Bachelor of Science degrees and enrolled 539 students in AY 20-21.

Research

In FY 2021 the BME faculty was awarded \$33,621,408 in extramural funds available for expenditure during the year. They expended \$30,097,487. This translates to about **\$961K per research active faculty member** in new funding and \$860K per research active faculty member in expenditures. The faculty submitted 165 research proposals for \$202M.

Our faculty is comprised of world renowned scientists and engineers who work across every scale of biology and in a wide spectrum of bioengineering subspecialties. Their research is driven by advancing fundamental understanding of biology and physiology in health and disease and then translating these principles to new technologies that impact the human condition and the practice of medicine. The research laboratories of the research active faculty members are listed on our web site (<http://www.bu.edu/bme/research/labs/>) and they also participate in **six interdisciplinary research centers** that are directed by BME faculty: Biomolecular Engineering Research Center (BMERC), Center for Innovation in Nanotechnology (BUNano), Biological Design Center (BDC), NSF Engineering Research Center in Cellular Metamaterials (CELL-MET), Precision Design Center (PDC), and Neurophotronics Center (NPC).



"BU BME faculty, students, and staff stepped up to create arguably the best internal, from-scratch, COVID-19 testing program in the country. Our debt to Profs. Cathie Klapperich and Doug Densmore, PhD student Lena Landaverde, and a host of others for keeping us safe cannot be repaid."

John A. White, BME Department Chair

BU BME 2020-2021

39 Primary Faculty

168 PhD Students

539 Undergraduates

84 Courses Taught

\$34 MILLION
Research Funding



ADMINISTRATION

CHAIR

Dr. John A. White

VICE CHAIR

Dr. Catherine Klapperich

ASSOCIATE CHAIR FOR GRADUATE PROGRAM

Dr. Mary Dunlop

ASSOCIATE CHAIR FOR UNDERGRADUATE PROGRAM

Dr. Irving Bigio

DIRECTOR OF PROFESSIONAL MASTERS PROGRAMS

Dr. Mario Cabodi

DIRECTOR OF PHD PROGRAM ADMISSIONS

Dr. Darren Roblyer

DIRECTOR FOR MASTERS PROGRAM ADMISSIONS

Dr. Kamal Sen

DIRECTOR

Matthew Barber

ASSISTANT DIRECTOR FOR ACADEMIC PROGRAMS

Christen Bailey

ASSISTANT DIRECTOR, FINANCE & ADMINISTRATION

Crystal Kelly

BME DEPARTMENT STAFF

ADMINISTRATIVE

Alexandria Gustin, *Administrative Assistant to the Chair*

Stephanie Johnson, *Senior Program Coordinator*

Inna Gerzon, *Senior Program Coordinator*

Lyn Markey, *Design and Communications*

Dr. Joshua Finkelstein, *Executive Director, BDC*

Lena Landaverde, *Assistant Director PDC*

ACADEMIC

Erin Phair, *Professional Masters Programs Administrator*

Mindy Hicks, *Undergraduate Program Administrator*

FINANCIAL

Lauren Daley, *Financial Administrator*

Fallon Fernandes, *Financial Manager*

Irene Orzechowski, *Financial Manager*

Laura Prusaitis, *Financial Manager*

Tara Sorrentino, *Financial Manager*

BU|BME HIGHLIGHTS Faculty Awards, Honors and Significant Events *Academic Year 2020-2021*


Professor Joyce Wong (BME, MSE), has been named president-elect of the **American Institute for Medical and Biological Engineering (AIMBE)**, one of the foremost biomedical engineering societies in the country. This honor recognizes her as a world-class leader and visionary for an organization of 50,000 members, one that includes the nation's most accomplished biomedical engineers, and boasts a strong track record of advocacy. Wong hopes to steer the organization toward victories on equality and diversity. Her twin goals are to leverage the power of biomedical engineering to address underfunded areas of research, such as sickle cell and kidney diseases, which disproportionately affect African Americans; and to open up the biomedical field itself to a range of perspectives and ideas.

Associate Professor Anna Devor has stepped up as Editor-in Chief of **Neurophotonics**, the open-access journal covering advances in optical technology applicable to the study of the brain, as well as their impact on basic and clinical neuroscience applications. "I am excited to carry on the mission of Neurophotonics to facilitate the continuous development, evolution, and broadest possible application of impactful photonics technologies in neuroscience," says Devor. "I am looking forward to publishing the best science, promoting the interdisciplinary and inclusive neurophotonics community, providing a platform for sharing and dissemination of technologies and data, offering an educational resource for neurophotonics students, and building awareness of the growing field of neuroethics."



Continuing a streak of honors for her ground-breaking research into the complex neural circuits that govern sleep, **Assistant Professor Laura Lewis** (BME) has been selected one of 22 early-career researchers to join the **Pew Scholars Program** in the Biomedical Sciences. She and her team hope to gain a deeper understanding of how sleep promotes brain health and why sleep is disrupted in neurological and psychiatric disorders. Recent awards for Lewis' impactful research include:

- Pew Scholars Program
- Sloan Research Fellowship
- 1907 Trailblazer Award
- Searle Scholars Program Grant
- McNight Endowment for Neuroscience
- Hariri Institute Junior Faculty Fellowship

Lena Landaverde (ENG'13,'17) is a 2021 **Perkins Award** winner. She was tasked with coordinating, building, and validating BU's Clinical Testing Lab for COVID-19, which processed 5000+ tests per day and enabled the BU campus to safely open this past year. Lena is assistant director of the College of Engineering's Precision Diagnostics Center.



BME alumna **Saniya Shah** was included on **Forbes 2021 "30 under 30" list**. Shah (ENG'16) and her colleagues invented Pilota, AI-powered software that predicts flight risks and helps users choose flights based on factors like safety and flexibility. The project landed them on the "30 under 30" list for consumer technology.

The annual list highlights the 600 "brightest young entrepreneurs, leaders, and stars" in industries ranging from venture capital to social media. Five BU alumni made the cut.

Forbes
30
UNDER 30



Optical Pioneer **Jerome Mertz** (BME, ECE, Physics) is **BU's Innovator of the Year**. Professor Mertz is a prolific inventor whose innovations have made leaps and bounds in microscopy. He holds six issued patents for technologies that have greatly advanced microscopic imaging quality and capabilities, more clearly illuminating for clinicians what is happening inside the human body.



Professor Joyce Wong (BME, MSE) was elected as a lifetime fellow of the **National Academy of Inventors** for her lab's innovations, with three issued patents in the last year alone.



The **American Association for the Advancement of Science** named **Professor Catherine Klapperich** as a 2021 fellow. She was awarded this honor for her contributions to the field of biomedical engineering, particularly the development of integrated microsystems for point-of-care diagnosis of disease for global and women's health.



BU BME Seminars 2020-21

Jina Ko, PhD Mass. General Hospital, Wyss Institute at Harvard
Next Generation Tools for Precision Medicine

Sergey Stavisky, PhD Stanford University
Intracortical Brain-Computer Interfaces From Fundamental Science and Engineering to Restoring Speech and Reach & Grasp

Erica Pratt, PhD University of Minnesota Twin Cities
Engineering Blood-Based Assays for Cancer

Robert Nims, PhD Washington University School of Medicine
Engineered Mechanogenetic Cartilage for Autonomous, Mechanically Activated Drug Delivery

Maria Coronel, PhD Georgia Institute of Technology
Engineering Synthetic Biomaterials for Islet Transplantation

Christopher M. Madl, PhD Stanford University
Harnessing Temporally Controlled Biophysical Cues to Direct Stem Cell Phenotype

Aaron Morris, PhD University of Michigan
Engineered Materials for Precision Immune Engineering

Shengxi Huang, PhD Pennsylvania State University
New Biosensing Paradigms Based on Designer Quantum Materials

Alexandra S. Piotrowski-Daspi, PhD Yale University
Designing Nanoparticles for Systemic Delivery in vivo to Enhance Therapeutic Effects in Key Tissues

Shachi Mittal, PhD University of Illinois at Urbana-Champaign
Optical and Chemical Profiling of Cancer using Artificial Intelligence for Next Generation Diagnosis

Kyoko Yoshida, PhD University of Virginia
The Mechanics Behind the Miracle of Life: Maternal Soft Tissue Growth and Remodeling

Alphonsus Ng, PhD Institute for Systems Biology, Seattle WA
Healthcare Democratization Using Microfluidics: Probing the Immune System in Blood

BME Distinguished Seminars

Christine E. Schmidt, PhD University of Florida
Engineering Advanced Materials for Neural Regeneration

Elaine Nsoesie, PhD BU School of Public Health
Data Science to Address Health Inequity



BU BME faculty continue to publish impactful research in top journals (*sampling*).

Darren Roblyer - NATURE COMMUNICATIONS
Shortwave-infrared meso-patterned imaging enables label-free mapping of tissue water and lipid content

Hadi Nia - SCIENCE
What are the physical hallmarks of cancer?

David Boas - SCIENCE ADVANCES
Single-shot 3D wide-field fluorescence imaging with a Computational Miniature Mesoscope

Bela Suki - NATURE COMMUNICATIONS
Modeling lung perfusion abnormalities to explain early COVID-19 hypoxemia

Tim O'Shea - NATURE COMMUNICATIONS
Foreign body responses in mouse central nervous system mimic natural wound responses and alter biomaterial functions

Laura Lewis - eLife
Blood Flow: Supplying the sleeping brain

Doug Densmore et al - NATURE COMMUNICATIONS
Machine learning enables design automation of microfluidic flow-focusing droplet generation

James Galagan et al - NATURE COMMUNICATIONS
A progesterone biosensor derived from microbial screening

Wilson Wong - NATURE COMMUNICATIONS
Scalable recombinase-based gene expression cascades

Ji-Xin Cheng, Wilson Wong, Mary J. Dunlop - NATURE COMMUNICATIONS
Microsecond fingerprint stimulated Raman spectroscopic imaging by ultrafast tuning and spatial-spectral learning

A. Fan, M. Cabodi, C. Klapperich, M. Grinstaff, A. Dennis & J. Galagan - NATURE COMMUNICATIONS
A progesterone biosensor derived from microbial screening

Wilson Wong - CELL
Synthetic biology in the clinic: engineering vaccines, diagnostics, and therapeutics

Laura Lewis - POPULAR SCIENCE
You get brainwashed whenever you go to sleep (and that's a good thing)

Mike Economo - NATURE NEUROSCIENCE
Attractor dynamics gate cortical information flow during decision-making

Mo Khalil - CELL
Here to stay: Writing lasting epigenetic memories

Muhammad Zaman - SCIENCE
Inclusion and equity through STEM training

Catherine Klapperich - ACS CENTRAL SCIENCE
Electrochemical Strategy for Low-Cost Viral Detection

Primary Faculty

**IRVING J. BIGIO**

**Professor, Biomedical Engineering;
Electrical and Computer Engineering; Physics; Medicine**
PhD, Physics, University of Michigan
Medical applications of optics, lasers and spectroscopy;
biomedical optics and biophotonics; biomolecular dynamics;
applied spectroscopy, especially to biomedical problems;
nonlinear optics; quantum electronics and laser physics.

**DAVID BOAS**

**Professor, Biomedical Engineering;
Electrical and Computer Engineering;
Director, Neurophotonics Center**
PhD, Physics, University of Pennsylvania
Neurophotonics; biomedical optics; functional near infrared
spectroscopy; microscopy methods; oxygen delivery and
consumption; neuro-vascular coupling; physiological modeling.

**CHRISTOPHER S. CHEN**

**Professor, Biomedical Engineering;
Director, Biological Design Center**
MD, Harvard University; PhD, Medical Engineering, MIT

My laboratory seeks to understand how cells interact with their environment, and to use this knowledge to control cell function. In particular, we are studying the cooperation between adhesive, mechanical and biochemical signaling in the regulation of angiogenesis and stem cell biology.

**JI-XIN CHENG**

**Professor, Biomedical Engineering;
Electrical and Computer Engineering; Chemistry; Physics;
Moustakas Chair Professor in Photonics and Optoelectronics**
PhD, Chemical Physics, University of Science and Technology of China
Molecular spectroscopic imaging technologies; label-free
microscopy; medical photonics; neurophotonics; cancer
metabolism; photonics for infectious diseases.

**BRIANNE CONNIZZO**

Assistant Professor, Biomedical Engineering
PhD, Bioengineering, University of Pennsylvania

Aging, orthopaedic and soft tissues, mechanobiology, multiscale biomechanics, extracellular matrix assembly and remodeling.

**EDWARD DAMIANO**

Professor, Biomedical Engineering
PhD, Applied Mechanics, RPI

Integrated cellular and extracellular biomechanics; biofluid dynamics; microhemofluidics; microcirculation; vestibular biomechanics; non-Newtonian rheology; closed-loop blood-glucose regulation.

**CHARLES DELISI**

**Metcalf Professor of Science and Engineering;
Dean Emeritus, College of Engineering**
PhD, Physics, New York University

Developing and applying computational/mathematical methods, and high throughput experimental methods for inferring the structure and function of protein networks.

**ALLISON M. DENNIS**

Assistant Professor, Biomedical Engineering
PhD, Bioengineering, Georgia Institute of Technology

Nanobiotechnology; fluorescent biosensing; fluorescence resonance energy transfer (FRET); quantum dot chemistry; fluorescence microscopy; single molecule sensing/imaging.

**ANNA DEVOR**

Associate Professor, Biomedical Engineering
PhD, Hebrew University of Jerusalem, Israel

Cellular and systems-level neuroscience, microscopy, physiological underpinning of noninvasive imaging.

**MARY DUNLOP**

Associate Professor, Biomedical Engineering
*PhD, Mechanical Engineering,
California Institute of Technology*

Understanding how microorganisms use feedback to respond to changes in their environment, studying naturally occurring examples of feedback to understand their implications for survival in changing conditions, and engineering novel, synthetic feedback control systems.

**MICHAEL ECONOMO**

Assistant Professor, Biomedical Engineering
PhD, Biomedical Engineering, Boston University

Systems neuroscience, motor control, long-range neural circuits, computational neuroscience, neurotechnology.

**SOLOMON EISENBERG**

**Professor, Biomedical Engineering;
Electrical and Computer Engineering;
Senior Associate Dean for Academic Programs,
College of Engineering**
ScD, Electrical Engineering, MIT

Electrically mediated phenomena in tissues and biopolymers; cartilage biomechanics; computational modeling of electric field distributions in the human thorax and heart during defibrillation; transcranial magnetic stimulation.

**JAMES GALAGAN**

**Professor, Biomedical Engineering;
Microbiology, BUSM**
PhD, Computational Neuroscience, MIT

Biosensor Development, Computational Biology, Systems Biology, Genomics.

**ALEXANDER GREEN**

Assistant Professor, Biomedical Engineering
PhD, Materials Science and Engineering, Northwestern University

Synthetic biology, nucleic acid nanotechnology, low-cost diagnostics, nanomaterials.

**MARK GRINSTAFF**

**Professor, Biomedical Engineering; Chemistry;
Director, Nanotechnology Innovation Center**
PhD, Chemistry, University of Illinois Urbana-Champaign

Biomaterials; tissue engineering; drug delivery; macromolecular chemistry and engineering, self-assembly; nanodevices.

**XUE HAN**

Associate Professor, Biomedical Engineering
PhD, Physiology, University of Wisconsin-Madison

Neurotechnology; optical neural modulation; optogenetics; neural prosthetics; neural network dynamics; brain rhythms; neurological and psychiatric diseases; cognition.

Primary Faculty Cont.



DIANE JOSEPH-MCCARTHY
Professor of the Practice,
Biomedical Engineering;
Executive Director, Bioengineering Technology & Entrepreneurship Center
PhD, Physical Chemistry, MIT
 Chemical Biology, Biophysics, Computational Science, Drug Discovery & Development.



SIMON KASIF
Professor, Biomedical Engineering
PhD, Computer Science, University of Maryland
 Genomic systems biology, P4 medicine, wellness and disease prevention, medical bioinformatics, artificial intelligence, machine learning, high performance systems, reproducibility and science informatics.



AHMAD (MO) KHALIL
Associate Professor, Biomedical Engineering;
Associate Director, Biological Design Center
PhD, Mechanical Engineering, MIT
 Synthetic & systems biology; gene regulation; protein aggregation; microbial communities; laboratory evolution.



CATHERINE KLAPPERICH
Professor and Vice Chair, Biomedical Engineering;
Director, Precision Diagnostics Center;
PhD, Mechanical Engineering, University of California, Berkeley
 Design of new molecular diagnostics and appropriate technologies for healthcare.



LAURA LEWIS
Assistant Professor, Biomedical Engineering;
PhD, Neuroscience, Massachusetts Institute of Technology
 Brain imaging; neural dynamics; computational neuroscience and signal processing; neural circuits underlying sleep and attention; decoding and predicting brain activity; neurovascular coupling; psychiatric and neurodegenerative disorders.



KENNETH R. LUTCHEN
Professor, Biomedical Engineering;
Dean, College of Engineering
PhD, Biomedical Engineering, Case Western
 Airway and lung tissue mechanics and ventilation; Computational modeling of structure-function relations in the lung; Mechanical ventilation; Integrated biomechanics of the lung; linear and nonlinear systems identification; blood-glucose regulation.



JEROME MERTZ
Professor, Biomedical Engineering; Physics
PhD, Physics, Université Paris VI and University of California, Santa Barbara
 Development and application of new optical microscopy techniques to biological imaging.



JOHN NGO
Assistant Professor, Biomedical Engineering
PhD, Biochemistry and Molecular Biophysics, California Institute of Technology
 Protein structure and engineering; molecular and cellular engineering; single-molecule biophysics; cell signaling; fluorescence and electron microscopy.



HADI T. NIA
Assistant Professor, Biomedical Engineering
PhD, Mechanical Engineering, MIT
 Tumor microenvironment; physical sciences of cancer; intravital imaging and animal models of cancer; mechanobiology and biomechanics.



TIMOTHY O'SHEA
Assistant Professor, Biomedical Engineering
PhD, Medical Engineering and Medical Physics, MIT
 Glia Engineering, Biomaterials, Neural Engineering, Spinal Cord Injury, Stroke, Glial neurobiology, regenerative medicine, cell transplantation.



DARREN ROBLYER
Associate Professor, Biomedical Engineering
Director of PhD Program Admissions
PhD, Bioengineering, Rice University
 Optical functional imaging; diffuse optics; near infrared spectroscopy; monitoring of emerging targeted and cytotoxic therapies in oncology; non-invasive monitoring of tumor metabolism.



KAMAL SEN
Associate Professor, Biomedical Engineering
Director of Master's Program Admissions
PhD, Physics, Brandeis University
 Electrophysiological recording of neural responses in auditory processing; theoretical methods to characterize neuronal encoding; computational models of natural sound processing.



ALLYSON SGRO
Assistant Professor, Biomedical Engineering
PhD, Chemistry, University of Washington
 Developing a quantitative and predictive understanding of how cells coordinate their behavior and organize themselves as part of collectives by directly controlling cellular behavior and signaling.



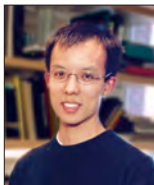
MICHAEL L. SMITH
Associate Professor, Biomedical Engineering
PhD, Biomedical Engineering, University of Virginia
 Cellular mechanotransduction through the extracellular matrix; fibronectin structural biology; and microfabricated surfaces for engineering cell function.



DIMITRIJE STAMENOVIĆ
Professor, Biomedical Engineering
PhD, Mechanics, University of Minnesota
 Respiratory mechanics; cell mechanics; rheology of soft tissues; mechanics of foam-like structures.



BÉLA SUKI
Professor, Biomedical Engineering
PhD, Biomechanics, Jozsef Attila University, Szeged (Hungary)
 Mechanical properties of living tissues; modeling the dynamic and nonlinear behavior of complex biological systems; pulmonary physiology.

Primary Faculty Cont.**JOE TIEN**

Associate Professor, Biomedical Engineering
PhD, Physics, Harvard University

Vascularization of biomaterials; quantitative physiology of engineered tissues; biomaterials for microsurgical applications; lymphatics; interstitial transport; inverse problems in vascular imaging.

**LUCIA M. VAINA**

Professor, Biomedical Engineering; Neurology
PhD, Mathematical Logic, Sorbonne; Doctorat d'Etat ès Sciences and in Médecine (MD PhD); Institut National Toulouse, France
 Behavioral, functional imaging (fMRI and MEG) and theoretical & computational approaches to study the neural basis and the plasticity of high-level visual functions in the human brain.

**SANDOR VAJDA**

Professor, Biomedical Engineering;
Director, Biomolecular Engineering Research Center
PhD, Chemistry, Hungarian Academy of Science

Scientific computing applied to problems in engineering, biochemistry, and biology, with focus on molecular mechanics, protein structure determination, protein-ligand interactions, docking, and drug design.

**JOHN WHITE**

Professor and Chair, Biomedical Engineering
PhD, Biomedical Engineering, Johns Hopkins University

Mechanisms of episodic memory; pathophysiology of epilepsy; computational neuroscience; design of real-time instrumentation; imaging of activity in neurons and astrocytes.

**JOYCE WONG**

Professor, Biomedical Engineering
PhD, Materials Science and Engineering, MIT
Program in Polymer Science and Technology, MIT

Biomaterials, tailoring cell-material interfaces for drug delivery and tissue engineering applications; direct, quantitative measurement of biological interactions.

**WILSON WONG**

Associate Professor, Biomedical Engineering
PhD, Chemical Engineering, UCLA

Synthetic and systems biology in immune cells.

**MUHAMMAD ZAMAN**

Professor, Biomedical Engineering
PhD, Physical Chemistry University of Chicago

Comprehensive and quantitative approaches to develop a multiscale understanding of cell-matrix interactions for fundamental biological and applied clinical research.

Lecturers

**OUSAMA M. A'AMAR**

Lecturer,
Biomedical Engineering
Ph.D., with Distinction, Electrical Engineering,
The National Polytechnic Institute of Lorraine (INPL), France
 EK131, EK210

**XIN BROWN**

Lecturer,
Biomedical Engineering;
Biointerface Technologies Facility Manager
PhD, Boston University School of Medicine
 BE209, BE605, BE726, BE727

**MARIO CABODI**

Senior Lecturer,
Biomedical Engineering
Director of Professional Master's Programs
PhD, Cornell University
 BE694, BE695

**ANDERSON (ICHUN) CHEN**

Lecturer,
Biomedical Engineering;
Micro Nano Imaging Facility Manager
PhD, Applied Physics, Stevens Institute of Technology
 BE517

**WYNTER J. DUNCANSON**

Lecturer,
Biomedical Engineering;
Assistant Dean of Outreach and Diversity
PhD, Biomedical Engineering,
Boston University
 BE465, BE466

**ANDY FAN**

Lecturer,
Biomedical Engineering
PhD, Electrical Engineering, MIT
 BE403, EK103, BE601, BE603, BE604, Mathematical
 Methods for Biomedical Engineering

**ALEKSANDRS ZOSULS**

Instructor,
Biomedical Engineering
BS, Biomedical Engineering, Boston University
 EK210, EK307, BE491, BE492

Research Faculty



ELIZABETH BARTOLAK-SUKI
Research Assistant Professor,
Biomedical Engineering
MD, General Medicine, Szent-Gyorgyi Medical School, Szeged, Hungary; DSc, Molecular Cell biology, Semmelweis Medical School, Budapest, Hungary
Inter/intracellular signaling and molecular/ medical pathology.



DIMITRI BEGLOV
Research Assistant Professor,
Biomedical Engineering
PhD, Molecular Biophysics, Moscow Physical and Technical Institute
Computational chemistry and biology; protein structure and function; computational characterization and prediction of biomolecular interactions.



AARON COLBY
Research Assistant Professor,
Biomedical Engineering
PhD, Biomedical Engineering, Boston University
Developing novel delivery systems including nanoparticles and drug concentrating devices as tools for treating cancer.



JAMES J. COLLINS
Research Professor,
Biomedical Engineering
PhD, Mechanical Engineering, University of Oxford
Synthetic biology, systems biology, engineering gene networks.



AURELIE EDWARDS
Research Professor,
Biomedical Engineering
PhD, Chemical Engineering, MIT
Developing mathematical models of water and solute transport in the kidney, at different scales, to address physiological and pathological questions.



JEROEN EYCKMANS
Research Assistant Professor,
Biomedical Engineering
PhD, Medical Sciences, KU Leuven, Leuven, Belgium
Tissue repair and regeneration, wound healing biomechanics, biomimetic tissue-on-chip models, skeletal organoid biology, reverse tissue engineering, fibrosis.



FERNANDO FERNANDEZ
Research Assistant Professor,
Biomedical Engineering
PhD, Neuroscience, University of Calgary
Electrophysiology, biophysics and computational neuroscience; understanding the underlying mechanisms of neuronal electrical activity and its implications for synaptic integration and spike output modulation in cortical circuits.



ODED GHITZA
Research Professor,
Biomedical Engineering
PhD, Electrical Engineering, Tel Aviv Univ.
Formulation of cortical computation principles that underlie the speech decoding process and that are capable of predicting human performance in speech perception tasks.



DMYTRO KOZAKOV
Research Associate Professor,
Biomedical Engineering
PhD, Biomedical Engineering, Boston Univ.
Development of protein-protein and protein-ligand docking algorithms, fast and efficient scoring functions for screening large number of potential docked complexes, protein homology models suitable for docking.



NEŞE LORTLAR-ÜNLÜ, MD
Visiting Research Associate Professor,
Biomedical Engineering
MD, Hacettepe University, Ankara, Turkey
Optical characterization and nanophotonics.



BARBARA G. SHINN-CUNNINGHAM
Research Professor,
Biomedical Engineering
PhD, EE and Computer Science, MIT
Auditory neuroscience - binaural and spatial hearing.



BRIAN SNYDER
Research Professor,
Biomedical Engineering
MD and PhD, Biomechanics, University of Pennsylvania
Basic and applied research in musculoskeletal biomechanics, cellular processes, and gene expression.



THOMAS L. SZABO
Research Professor,
Biomedical Engineering
PhD, Physics, University of Bath, UK
Medical imaging, diagnostic ultrasound, tissue characterization, transduction, biomedical signal processing, wave propagation, nonlinear acoustics.



MERYEM YUCEL
Research Assistant Professor,
Biomedical Engineering
PhD, Biomedical Engineering, Boğaziçi University, Istanbul, Turkey
Functional neuroimaging (fNIRS, fMRI, EEG), fNIRS signal processing, cognitive neuroscience.



CHARLES CANTOR, PHD
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MALVIN C. TEICH, PHD
Professor Emeritus,
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Adjunct Faculty



HERNAN JARA, PHD
Adjunct Associate Professor,
Biomedical Engineering;
Associate Professor of
Radiology, BUSM



JOSEPH LEHÁR, PHD
Adjunct Research Professor,
Biomedical Engineering



AMIT MELLER, PHD
Adjunct Research Professor,
Biomedical Engineering



JULIO COLLADO VIDES, PHD
Adjunct Research Professor,
Biomedical Engineering



CHRISTINE MCBETH, PHD
Adjunct Research Assistant Professor,
Biomedical Engineering



JONATHAN ROSEN, PHD
Adjunct Professor,
Biomedical Engineering

Affiliated Faculty



MICHAEL ALBRO, PHD
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Mechanical Engineering



JEFFREY GAVORNIK, PHD
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Biology



ELISE F. MORGAN, PHD
Professor,
Mechanical Engineering



MARGRIT BETKE, PHD
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College and Grad School of Arts & Sciences,
Computer Science



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Pathology and Laboratory Medicine
BUSM



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Computer Engineering



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Mechanical Engineering;
Materials Science & Engineering;
Director, Photonics Center



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Sargent College,
Speech Language and Hearing Science



ELAINE O. NSOESIE, PHD
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School of Public Health



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Engineering; Mechanical Engineering;
Head, Div. of Materials Science & Engineering;
Director, CELL-MET Engineering Research Ctr.



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Physiology and Biophysics
BUSM



PIETER NOORDZIJ, MD
Professor,
Medicine
BUSM



DAVID CENTER, MD
Professor of Pulmonary Medicine,
Medicine, and Biochemistry;
Chief of Allergy, Pulmonary and Critical
Care Medicine
BUSM



MICHAEL HASSELMO, PHD
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Biology;
Director, Center for Systems
Neuroscience



GEORGE O'CONNOR, MD, MS
Professor,
Medicine
BUSM



**CHANDRAMOULI
CHANDRASEKARAN, PHD**
Assistant Professor,
Anatomy & Neurobiology; Psychological
and Brain Sciences; Center for Systems
Neuroscience



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Medicine
BUSM



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Electrical and
Computer Engineering



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Assistant Professor,
Biology



W. CLEMENT KARL, PHD
Professor,
Electrical and Computer Engineering



TYLER PERRACHIONE, PHD
Associate Professor,
Sargent College: Speech, Language &
Hearing Sciences



CHRISTOPHER CONNOR, MD, PHD
Assistant Professor,
Anesthesiology
BUSM



NANCY KOPELL, PHD
Professor,
Mathematics



STEVE RAMIREZ, PHD
Assistant Professor,
Psychological & Brain Sciences



QIANG CUI, PHD
Professor,
Chemistry



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Professor,
Medicine, BUSM
Director, Center for Regenerative
Medicine



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Assistant Professor,
Mechanical Engineering;
Materials Science & Engineering



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Electrical and
Computer Engineering



ANN MCKEE, MD
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Neurology & Pathology, BUSM



MICHELLE SANDER, PHD
Associate Professor,
Electrical and
Computer Engineering,
Materials Science & Engineering



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Professor,
Biology; Biochemistry;
Director, Center for Network Systems
Biology



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Professor,
Physics



BENJAMIN SCOTT, PHD
Assistant Professor,
Psychological and Brain Sciences



SHYAMSUNDER ERRAMILI, PHD
Professor,
Physics



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Associate Professor,
Biology

Affiliated Faculty Cont.



SATISH K. SINGH, MD
Associate Professor,
Gastroenterology
BUSM



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Professor,
Physics; Chemistry



CARA STEPP, PHD
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Sargent College, Speech, Language &
Hearing Science



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Anatomy; Neurobiology
BUSM



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Professor,
Electrical and Computer
Engineering



ARTURO VEGAS, PHD
Assistant Professor,
Chemistry



DAVID WAXMAN, PHD
Professor,
Biology; Bioinformatics; Medicine



ALICE WHITE, PHD
Professor and Chair,
Mechanical Engineering



JI YI, PHD
Assistant Professor,
Medicine
BUSM



**KATHERINE YANHANG
ZHANG, PHD**
Professor,
Mechanical Engineering



XIN ZHANG, PHD
Professor,
Mechanical Engineering; Electrical
and Computer Engineering;
Materials Science & Engineering

Postdocs

SENIOR POSTDOCTORAL ASSOCIATES

Afzal, Muhammad Imran (*Devor*)
Bono, Michael (*Klapperich*)

POSTDOCTORAL ASSOCIATES

Alnahhas, Razan (*Dunlop*)
Angstman, James (*Khalil*)
Bays, Jennifer (*Chen*)
Cheng, Xiaojun (*Boas*)
Chiesa, Guilio (*Khalil*)
Ching, Meining Carley (*Zaman*)
Chou, Kenny (*Sen*)
Drain, Allison (*Chen*)
Dutta, Palash (*Chen*)
Fomin-Thunmann, Natalie (*Devor*)
Frostig, Hadas (*Mertz*)
Gao, Yuanyua (*Boas*)
Herrmann, Jacob (*Suki*)
Jaswal, Rajneesh (*Galagan*)
Karrobi, Kavon (*Roblyer*)
Kim, Sudong (*Chen*)
Li, Huishan (*Wong W*)
Liang, Yong (*Wong W*)
Lowet, Eric (*Han*)
Lugagne, Jean-Baptiste (*Dunlop*)
Moussa, Hagar (*Khalil*)
Moya, Maria (*Economo*)
Ngo, Mai (*Chen*)
Parate, Kshama (*Galagan*)
Ravikumar, Arjun (*Khalil*)
Ricci-Tam, Chiara (*Sgro*)
Ristori, Tomasso (*Chen*)
Shaw, William (*Khalil*)
Sheng, Xiao (*Mertz*)
Shin, Jonghyeon (*Dunlop*)
Sundaram, Subramanian (*Chen*)
Teo, Jessica (*Chen*)
Weber, Timothy (*Mertz*)
Wong, Brandon (*Khalil*)
Xiao, Sheng (*Mertz*)
Hager, Emily (*Sgro*)
Applegate, Matthew (*Roblyer*)
Uroz, Marina (*Chen*)

Research Staff

SENIOR RESEARCH SCIENTISTS

Desai, Darash (*Zaman*)
Kim, Jae (*Vajda*)
Kilic, Kivilcim (*Devor*)
Tseng, Hua-an (*Han*)

RESEARCH SCIENTISTS

Buczek-Thomas, Joann (*Wong, J*)
Jiang, John (*Boas*)
Kondabolu, Krishnakanth (*Han*)
Zimmerman, Bernhard (*Boas*)

RESEARCH TECHNICIANS

Farzam, Parya (*Boas*)
Jadeja, Rohan (*Bigio*)
Kelleher-Tang, Laurie (*Chen*)
Kura, Sreekanth (*Boas*)
Morales, Christian (*J Wong*)
Charles, Roger (*Galagan*)
Cheung, Cyrus (*Han*)
Dubb, Jay (*Boas*)
Geib, Matthew (*Unlu*)
Lin, Wei (*Roblyer*)
Tucker, Stephen (*Boas*)
Williams, Stephanie (*Lewis*)
Diamandis, Zachary (*Lewis*)
Fuzail, Ahsan (*Zaman*)
Peters, Kevin (*Suki*)

External Research Funding

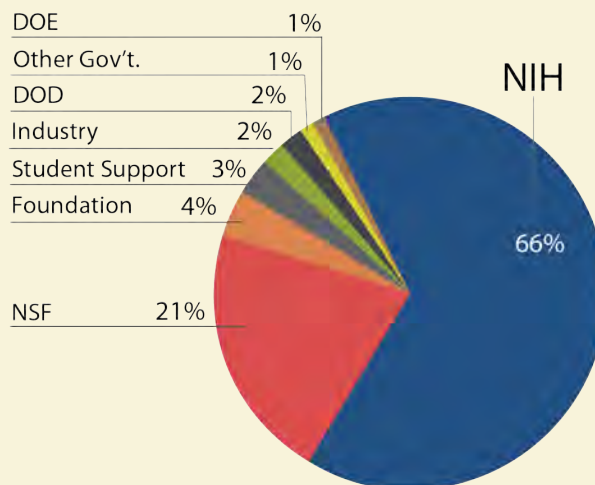
Boston University's Department of Biomedical Engineering

maintains a vibrant research program in its approximately 96,000 square feet of space on Boston University's Charles River Campus. We are comprised of **38 separate research laboratories**, and our faculty lead **6 research centers**.

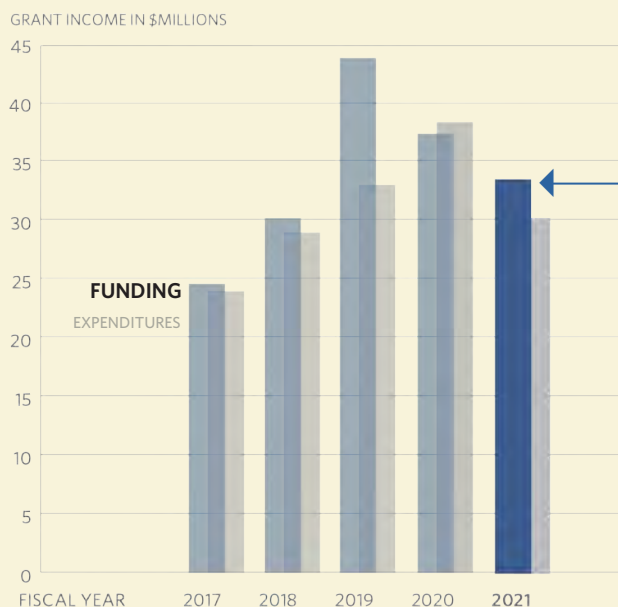
The research can be characterized by a combination of:

- Empirical and theoretical work with an attention to explicit mathematical models for the phenomena under study
- Intensive computer use for experimental and theoretical work
- A basic scientific flavor to the fundamental questions being asked
- An attention to the applications of improving health care, and a thorough understanding of the underlying physiological processes
- 4 Training Grants funding PhD students

BME Grant Funding by Agency



BME Faculty Annual Total Grant Funding



BME Faculty Research Funding

\$33,621,408 7/1/20 - 6/30/21

\$30,097,487 EXPENDITURES

99 new and continuing awards were funded.

\$202 million in research proposals were submitted.

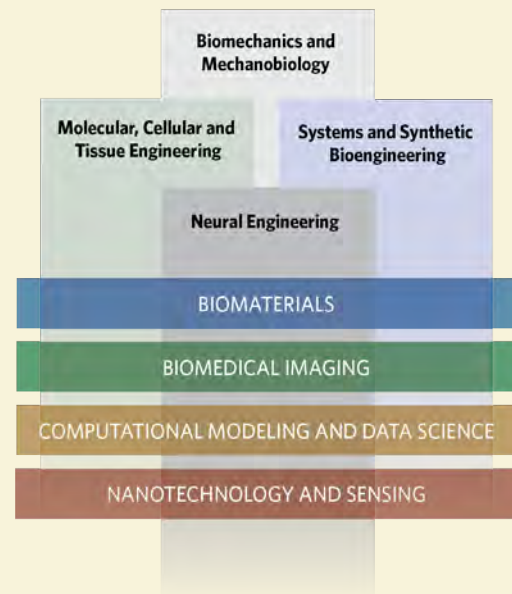
BU BME Research Areas

We have world leaders in these areas of research:

- Biomechanics and Mechanobiology
- Synthetic and Systems Bioengineering
- Molecular-Cellular-Tissue Engineering
- Neural Engineering

Using the enabling technologies:

- Biomaterials
- Biomedical Imaging
- Computation Modeling and Data Sciences
- Nanotechnology and Sensing



BU Research Centers

BU has seven interdisciplinary research centers that are directed by BME faculty:

BDC

Biological Design Center

To rigorously understand life's design principles and re-engineer them to revolutionize our approach to addressing critical challenges in human health and the environment

BMERC

Biomolecular Engineering Research Center

Developing and applying computational methods for the analysis and design of structures, functions, interactions, regulation and evolution of biological macromolecules

CELL-MET

NSF Engineering Research Center in Cellular Metamaterials

Developing tissue-engineering principles to create scalable, low-cost technologies for growing clinically significant cardiac tissues from cell-level building blocks

BUnano

Nanotechnology Innovation Center

Where nanomaterials intersect medicine and energy through collaborative interdisciplinary research

NPC

Neurophotonics Center

Advancing our understanding and treatment of brain disorders through advanced optical science and photonic systems

PDC

Precision Diagnostics Center

Discovery, design and development and clinical translation of technology for disease screening and monitoring, treatment management and health maintenance

NIH Awards

PI	Award Title	Prime Sponsor	\$ Amount
BAYS	NOTCH IN THE VASCULATURE	NHLBI	67446
BIGIO	VALIDATION OF LIGHT SCATTERING SPECTROSCOPY FOR INTRA-OPERATIVE MARGIN GUIDANCE DURING ORAL CANCER RESECTION	NIDCR (sub BMC)	186275
BOAS	ESTABLISHING AN FNIRS ECOSYSTEM FOR OPEN SOFTWARE-HARDWARE DISSEMINATION	NINDS	127433
BOAS	IMPROVING HUMAN FMRI THROUGH MODELING AND IMAGING MICROVASCULAR DYNAMICS	NIMH	113167
BOAS	THE IMPACT OF MICROVASCULAR (DYS)REGULATION ON CEREBRAL FLOW AND OXYGEN HETEROGENEITY	NINDS	1259589
BOAS	IMAGING AND ANALYSIS TECHNIQUES TO CONSTRUCT A CELL CENSUS ATLAS OF THE HUMAN BRAIN	NIMH (sub MGH)	583972
BOAS	TIME-GATED DIFFUSE CORRELATION SPECTROSCOPY FOR FUNCTIONAL IMAGING OF THE HUMAN BRAIN	NIBIB (sub MGH)	128285
BOAS	THE NEUROSCIENCE OF EVERYDAY WORLD- A NOVEL WEARABLE SYSTEM FOR CONTINUOUS MEASUREMENT OF BRAIN FUNCTION	NIBIB	1238194
CABODI	DEVELOPMENT OF A SEMI-QUANTITATIVE LIGATION-BASED ASSAY FOR HEPATITIS B	NIAID	206250
CHEN	LOCAL REGULATION OF ANGIOGENESIS BY MICROENVIRONMENT	NIBIB	363825
CHEN	MULTI-TISSUE PLATFORM FOR MODELING SYSTEMIC PATHOLOGIES	NIBIB (sub Wyss)	50426
CHEN	MICROENGINEERING THE DENTAL PULP VASCULAR MICROENVIRONMENT	NIDCR (sub Oregon HSU)	123750
CHEN	NOVEL STRATEGIES TO UNDERSTAND, PREDICT, AND PREVENT VASCULAR TOXICITY OF TARGETED CML THERAPIES	NHLBI (sub TUFTS)	200868
CHEN	DEFINING GENETIC ARCHITECTURE AND PATHWAYS OF DCM	NHLBI (sub Wyss)	29078
COLLADO-VIDES	A COMPREHENSIVE RESOURCE FOR ESCHERICHIA COLI GENOMIC DATA AND TOOLS	NIGMS	371703
CONNIZZO	AGING AND INFLAMMATION IN THE ETIOLOGY OF COMPRESSION-INDUCED TENDON DEGENERATION	NIA	317323
DENNIS	MULTIPLEXED IMAGING IN THE NEAR INFRARED WITH INDIUM PHOSPHIDE QUANTUM SHELLS	NIGMS	462000
DENNIS	BIODEGRADABLE AND BIOCOMPATIBLE SEMICONDUCTOR NANOPARTICLES FOR DEEP TISSUE IMAGING	NIGMS	206250
DEVOR	EFFECTS OF INTRINSIC AND DRUG-INDUCED NEUROMODULATION ON FUNCTIONAL BRAIN IMAGING	NIDA	808089
DEVOR	MICROSCOPIC FOUNDATION OF MULTIMODAL HUMAN IMAGING	NIMH	1231107
DEVOR	TRANSPARENT NEURAL INTERFACE FOR IN VIVO INTERROGATION OF HUMAN ORGANIDS	NEI	270342
DEVOR	UNDERSTANDING THE RELATIONSHIPS BETWEEN FUS-BBB OPENING, NEUROINFLAMMATION, AND THE NEUROVASCULAR RESPONSE	NIBIB (sub BWH)	112634
DUNLOP	CELL-TO-CELL HETEROGENEITY AND THE EMERGENCE OF ANTIBIOTIC RESISTANCE	NIAID	412193
DUNLOP	QUANTIFYING CLOSTRIDIODES DIFFICILE SINGLE-CELL GROWTH DYNAMICS USING TIME-LAPSE MICROSCOPY	NIAID (sub TUFTS)	31598
ECONOMO	REVERSE ENGINEERING THE BRAIN STEM CIRCUITS THAT GOVERN EXPLORATORY BEHAVIOR	NINDS (sub UCSD)	93075
EYCKMANS	DEVELOPMENT OF A WOUND-ON-CHIP MODEL TO STUDY STROMAL-EPITHELIAL INTERACTIONS DURING TISSUE REPAIR	NIBIB	206250
GREEN	MOLECULAR FUSES FOR REAL-TIME, LABEL-FREE, MULTIPLEXED IMAGING OF RNAs IN LIVING CELLS	NIGMS	738357
GRINSTAFF	TUMOR SPECIFIC DELIVERY OF VERTICILLIN A OVERCOMES EPIGENETIC SILENCING RESPONSIBLE FOR DRUG RESISTANCE	NCI	610821
GRINSTAFF	SUPERHYDROPHOBIC DRUG LOADED BUTTRESSES FOR PREVENTION OF LUNG TUMOR RECURRENCE	NCI	437722
GRINSTAFF	OPTIMIZATION OF NANOPARTICLE TUMOR-LOCALIZATION AND DRUG-LOADING FOR TREATING MESOTHELIOMA 1 R01 CA232056-01	NCI	568654
GRINSTAFF	A NOVEL APPROACH FOR REVERSAL OF AUTOPHAGIC DEFECTS USING LYSOSOME-TARGETED NANOPARTICLES	NIA (sub UCLA)	103125
GRINSTAFF	RELAXIN-2 AS A NOVEL PROTEIN THERAPEUTIC FOR THE TREATMENT OF SHOULDER ARTHROFIBROSIS	NIAMS	575973

NIH Awards Cont.

PI	Award Title	Prime Sponsor	\$ Amount
HAN	UNVEILING THE MECHANISMS OF ULTRASOUND NEUROMODULATION VIA SPATIALLY CONFINED STIMULATION AND TEMPORALLY RESOLVED RECORDING	NINDS	327370
HAN	VOLTAGE IMAGING ANALYSIS OF STRIATAL NETWORK DYNAMICS RELATED TO VOLUNTARY MOVEMENT AND PARKINSONS DISEASE	NINDS	382313
HAN	MULTIDIMENSIONAL OPTIMIZATION OF VOLTAGE INDICATORS FOR IN VIVO NEURAL ACTIVITY IMAGING	NIMH	707360
KHALIL	EPACE: AN AUTOMATED SYSTEM FOR HIGH-THROUGHPUT, CLOSED-LOOP CONTROL OF CONTINUOUS MOLECULAR EVOLUTION TO ENABLE NOVEL THERAPEUTICS	NIBIB	608022
KHALIL	SYNTHETIC TOOLKIT FOR PRECISION GENE EXPRESSION CONTROL AND SIGNAL PROCESSING IN MAMMALIAN CELLS	NIBIB	661543
KHALIL	BILLING AGREEMENT FOR CHARLES JO 07/06/2020 -07/05/202	NIAID (sub CHB)	14241
KLAPPERICH (Co-PI Smith & Cabodi)	FLIPPED BIOMEDICAL GRAND ROUNDS: CREATING A CLINICAL IMMERSION CLASSROOM	NIBIB	21600
LEWIS	IMAGING NEURAL DYNAMICS AT HIGH TEMPORAL RESOLUTION IN SLEEP AND SLEEP DEPRIVATION	NIMH	248292
LEWIS	DEVELOPMENT OF THE HUMAN DYNAMIC NEUROCHEMICAL CONNECTOME SCANNER	NIBIB (sub MGH)	12319
LEWIS	SLEEP-DEPENDENT MODULATION OF CEREBROSPINAL FLUID FLOW IN AGING AND ACROSS GENETIC RISK FOR ALZHEIMER'S DISEASE	NIA	700219
LEWIS	NEUROIMAGING THE IMPACT OF RESPIRATION AND RESPIRATORY-GATED NEUROMODULATION ON HUMAN GLYMPHATIC PHYSIOLOGY	NCCIH	689775
LEWIS	IMAGING NEUROVASCULAR PHYSIOLOGY IN PERSISTENT FATIGUE AFTER COVID-19	NINDS	468750
MERTZ	SPECKLE-FREE PHASE-CONTRAST ULTRASOUND IMAGING	NIGMS	206250
MERTZ	FAST, LARGE-SCALE NEURONAL IMAGING WITH MULTI-Z CONFOCAL MICROSCOPY	NIBIB	441004
MERTZ	MULTI-LAYER NEURONAL IMAGING WITH REVERBERATION MULTIPHOTON MICROSCOPY	NINDS	400516
NGO	INTEGRATIVE APPROACHES FOR PROBING CELL MECHANOTRANSDUCTION IN HEALTH AND DISEASE	NIMGS	753406
ROBLER	LABEL-FREE MEASUREMENT OF BLOOD LIPIDS WITH HYPERSPECTRAL SHORT-WAVE INFRARED SPATIAL FREQUENCY DOMAIN IMAGING TO IMPROVE CARDIOVASCULAR DISEASE RISK PREDICTION AND TREATMENT MONITORING	NIBIB	209212
SGRO	CONNECTING SINGLE-CELL SIGNALING DYNAMICS TO MULTICELLULAR DECISION MAKING	NIGMS	825000
SUKI	A MULTI-SCALE COMPUTATIONAL MODEL OF THE EXTRACELLULAR MATRIX OF THE LUNG	NHLBI	772568
TIEN	ENGINEERED INVASIVE HUMAN BREAST TUMORS WITH INTERGRATED CAPILLARIES AND LYMPHATICS	NCI	749968
WHITE	SYNCHRONIZATION IN NOISY, HETEROGENEOUS EXCITATORY/INHIBITORY NETWORKS	NINDS (sub LSU)	200091
WONG W	ADVANCED RECOMBINASE-BASED GENE EXPRESSION TECHNOLOGY IN MAMMALIAN CELLS	NIGMS	330000
WONG W	SIGNALS THAT ESTABLISH AND MAINTAIN HIV LATENCY	NIAID (sub BMC)	39978
WONG W	ADVANCED RECOMBINASE-BASED GENE EXPRESSION TECHNOLOGY IN MAMMALIAN CELLS	NIGMS	108667

Awards from DOD

PI	Award Title	Prime Sponsor	\$ Amount
GALAGAN	BIOSENSORS FOR PHYSIOLOGICAL MONITORING FROM BACTERIAL MINING	DOD	170000
KHALIL	TECHNOLOGIES TO CONTROL, SURVEIL, AND COUNTER GENOME-EDITING NUCLEASES AND GENE DRIVES	DOD (sub MGH)	81408
KHALIL	EPIGENETICALLY PROGRAMMED BIOLOGICAL MATERIALS	DOD	576920

NSF Awards

PI	Award Title	Prime Sponsor	\$ Amount
CHEN (PI BISHOP)	NANOSYSTEMS ENGINEERING RESEARCH CENTER FOR DIRECTED MULTISCALE ASSEMBLY OF CELLULAR METAMATERIALS WITH NANOSCALE PRECISION: CELL-MET	NSF	5172386
CHEN	SCIENCE AND TECHNOLOGY CENTER FOR ENGINEERING MECHANO-BIOLOGY	NSF (sub UPENN)	160000
DUNLOP	SINGLE-CELL FEEDBACK, OPTOGENETICS, AND DEEP LEARNING TO CONTROL GENE EXPRESSION IN BACTERIA	NSF	820298
EYCKMANS	EAGER: (ST2) ENGINEERING BIOMATERIALS THAT INTEGRATE IN THE NATIVE ECM OF CELLS.	NSF	250000
HAN	COLLABORATIVE RESEARCH: DYNAMIC INTERACTIONS OF INDIVIDUAL NEURONS IN SUPPORTING HIPPOCAMPAL NETWORK OSCILLATIONS DURING BEHAVIOR	NSF	399231
ROBLER	EFRI CEE: OPTICALLY CONTROLLED LOCALIZED EPIGENETIC CHROMATIN REMODELING WITH PHOTOACTIVATABLE CRISPR-DCAS9	NSF (sub BIDMC)	122343
ZAMAN	D-1SN: TRACK 2: COLLABORATIVE RESEARCH: FINANCIAL NETWORK DISRUPTIONS IN ILLICIT AND COUNTERFEIT MEDICINES (FIND-M)	NSF	40000

Awards from Industry

PI	Award Title	Prime Sponsor	\$ Amount
BOAS	MONTE CARLO SIMULATIONS OF THE EFFECT OF NEURAL ACTIVATION AND VASCULAR DILATION ON THE DIFFUSE CORRELATION SPECTROSCOPY SIGNAL MEASURED NON-INVASIVELY IN THE HUMAN HEAD	FACEBOOK	10963
BOAS	FIBER-BASED LASER SPECKLE CONTRAST IMAGING	FACEBOOK	20066
BOAS	COMPARING LASER SPECKLE CONTRACT AND DIFFUSE CORRELATION SPECTROSCOPY MEASUREMENTS IN HUMAN BRAIN FUNCTION	FACEBOOK	336511
GRINSTAFF	BIOADHESIVE FORM IN PLACE PATCH DEVELOPMENT	BOSTON SCIENTIFIC	74931
KHALIL	AUTOMATED SEMI-CONTINUOUS EVOLUTION OF THERAPEUTIC BINDING PROTEINS AND BIOCONJUGATION ENZYMES	MERCK	94250
WONG W	ENGINEERING GENETIC LOGIC CIRCUITS IN MAMMALIAN CELLS TO ACCELERATE HIGH-THROUGHPUT DRUG SCREENING	NOVARTIS	37500
ZAMAN	APTAMER DEVELOPMENT FOR THE PHARMACHK PLATFORM	MERCK	163043
ZAMAN	2021 DCLC - DR. MUHAMMAD ZAMAN	HHMI	50000

Awards from Other Government Agencies

PI	Award Title	Prime Sponsor	\$ Amount
COLBURN	HOW THE BRAIN CREATES A SENSE OF AUDITORY SPACE	Australian Research Council (sub Macquarie U)	18721
GREEN	SYNTHETIC BIOLOGY THREATS: FIGHTING FIRE WITH FIRE	Public Works and Government Services Canada (sub TORONTO U)	47580
KHALIL	DRAPER TEAM FELIX PROPOSAL	ODNI (sub DRAPER)	150000

Awards from Foundations

PI	Award Title	Prime Sponsor	\$ Amount
CHEN	GEOMETRIC AND MECHANICAL PATTERNING OF HIERARCHICAL VASCULAR NETWORKS	UNITED STATES - ISRAEL BI-NATIONAL SCIENCE FOUNDATION	33,750
CHEN	ROCK2 LYMPHEDEMA VALIDATION PROJECT	WYSS INST	32836
ECONOMO	INVESTIGATING THE CONTROL OF MOVEMENTS BY SUBSPACES AND CELL TYPES IN THE MOUSE OROFACIAL SYSTEM	WHITEHALL FOUNDATION	75000
KHALIL	THE SODIUM CHANNEL AS A THERAPEUTIC TARGET FOR PREVENTION OF LETHAL CARDIAC ARRHYTHMIAS	FONDATION LEDUCQ (SUB BWH)	41409
LEWIS	SPI STEVENS: GLIAL MECHANISMS BY WHICH SLEEP PRESERVES COGNITIVE FUNCTION AND PLASTICITY IN AGING	SIMONS FOUNDATION	250000
LEWIS	HARVARD UNIVERSITY/MASSACHUSETTS INSTITUTE OF TECHNOLOGY JOINT RESEARCH GRANT PROGRAM IN BASIC NEUROSCIENCE	HARVARD COLLEGE	23487
LEWIS	INVESTIGATING SLEEP AND CEREBROSPINAL FLUID FLOW WAVES IN MAJOR DEPRESSION	1907 RESEARCH	100000
LEWIS	NEURAL DYNAMICS OF HUMAN SLEEP	AP SLOAN FOUNDATION	75000
O'SHEA	PROMOTING ASTROGLIAL MATURATION OF NPC GRAFTS IN SCI LESION CORES USING IMMUNOMODULATORY HYDROGELS	CH NELSON FOUNDATION	300000
SGRO	GREATER AS A WHOLE: BRIDGING INTRACELLULAR SIGNALING AND POPULATION BEHAVIORS IN COLLECTIVE SYSTEMS	BURROUGHS WELLCOME FUND	34597
SHAW	DECIPHERING GENETIC AND EPIGENETIC REGULATION IN EUKARYOTIC GENE CLUSTERS USING SYNTHETIC GENOMICS	EMBO	60000
ZAMAN	FELLOWSHIP IN QUALITY OF MEDICAL PRODUCTS AT BOSTON UNIVERSITY	UNITED STATES PHARMACOPEIAL CONVENTION	138759
ZAMAN	MEASURING AMR FOOTPRINT IN PAKISTAN	DAI	66581

Awards for Student Support

PI	Award Title	Prime Sponsor	\$ Amount
CHEN (Co-PI KHALIL)	SYNTHETIC BIOLOGY AND BIOTECHNOLOGY (SB2) PREDOCTORAL TRAINING PROGRAM	NIGMS	243814
EWOLDT	HYPERTROPHIC CARDIOMYOPATHY-INDUCED PARACRINE SIGNALING AND STROMAL ACTIVATION	NHLBI	46036
GRINSTAFF	TRANSLATIONAL RESEARCH IN BIOMATERIALS	NIBIB	197466
HOFFMANN	MECHANICALLY ACTIVE EXTRACELLULAR MATRIX FIBERS FOR TISSUE ENGINEERING APPLICATIONS	NHLBI	36727
LETENDRE	ADVANCED RECOMBINASE TECHNOLOGY FOR TISSUE ENGINEERING APPLICATIONS	NHLBI	35829
MOUNT	MECHANISTIC STUDY OF THE ROLE OF AUTISM SPECTRUM DISORDER RISK GENES IN HIPPOCAMPAL CA1 POPULATION DYNAMICS DURING LEARNING AND MEMORY	NIMH	37218
SHROFF	VOLTAGE IMAGING OF STRIATAL NEURON ACTIVITY DURING MOVEMENT AND REWARD	NINDS	37045
WHITE	TRAINING PROGRAM IN QUANTITATIVE BIOLOGY AND PHYSIOLOGY	NIGMS	350973

Awards from DOE

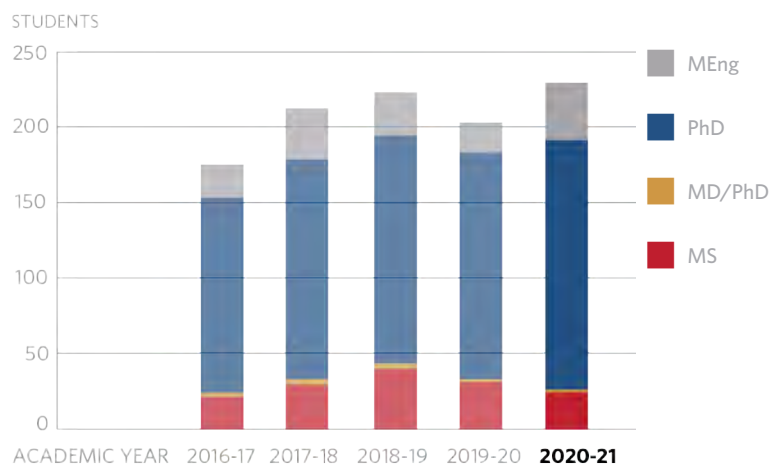
PI	Award Title	Prime Sponsor	\$ Amount
DUNLOP (Co-PI W WONG)	HIGH-THROUGHPUT CHEMICAL IMAGING FOR OPTIMIZING BIOFUEL SYNTHESIS USING SYNTHETIC BIOLOGY	DOE	494491

Graduate Enrollment

ENROLLMENT FOR AY 2020-2021

		LEAP	MS	MD/PhD	PhD	MEng	TOTAL
US	M	3	11	2	76	11	103
	F	8	10	0	46	11	75
INT'L	M	0	10	0	19	0	29
	F	1	7	0	25	1	34
TOTAL		12	38	2	166	23	241

GRADUATE PROGRAM POPULATION

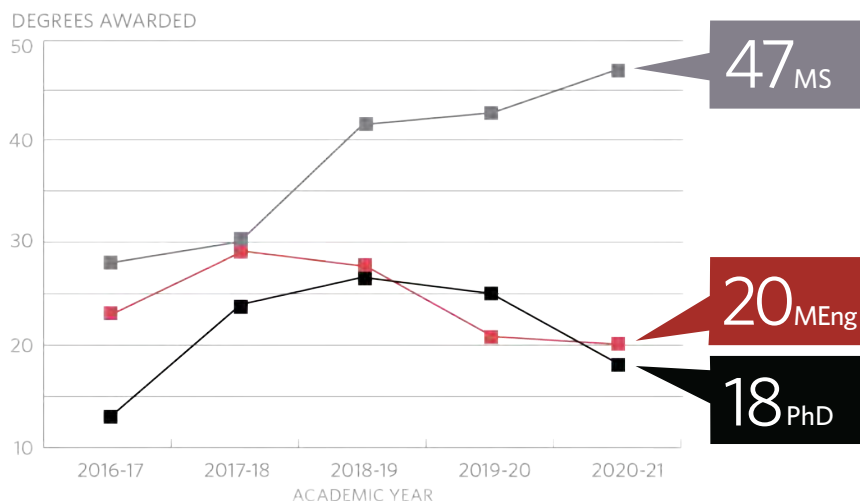


GRADUATE FUNDING AY 2020-2021

FELLOWSHIPS AND GRANTS	PhDs
Doctoral Research Fellowship	98
BME Distinguished Fellowship	31
NIH Quantitative Biology and Physiology T32 Training Grant	8
NIH Translational Research in Biomaterials T32 Training Grant	4
NIH Synthetic Biology and Biotechnology T32 Training Grant	4
NSF Graduate Research Fellowship	7
NIH F31 Fellowship	6
Dean's Fellowship	5
Kilachand Fellowship	3
MLK Fellowship	1
NSF Neurophotonics National Research Traineeship Program Fellowship	1
TOTAL	168

Graduate Degrees Awarded

DEGREES AWARDED



ADMISSION RESULTS FOR AY 2019-2020

		APPLICANTS					MATRICULANTS				
		LEAP	MEng	MS	PhD	TOTAL	LEAP	MEng	MS	PhD	TOTAL
US	M	11	40	47	161	259	0	11	7	16	34
	F	22	57	46	147	272	7	9	7	18	41
INT'L	M	3	34	92	148	277	0	0	1	5	6
	F	12	29	97	122	260	1	1	4	7	13
TOTAL		48	160	282	578	1068	8	21	19	46	94

ADMISSION RESULTS FOR AY 2020-2021

		APPLICANTS					MATRICULANTS				
		LEAP	MEng	MS	PhD	TOTAL	LEAP	MEng	MS	PhD	TOTAL
US	M	24	39	62	154	279	5	6	9	17	37
	F	12	58	67	180	317	7	13	10	9	39
INT'L	M	4	35	87	156	282	0	2	2	3	7
	F	5	33	80	134	252	1	1	6	4	12
TOTAL		45	165	296	624	1130	13	22	27	33	95

PHD Graduates

SEPTEMBER 25, 2020

David Bedig Bernstein
(Daniel Segre, PhD Advisor)
"Probabilistic Metabolic Modeling of Microbial Communities"

Samuel Garrett Brown
(Jason Ritt and John White, PhD Co-Advisors)
"Experimental Demonstration of Single Neuron Specificity during Underactuated Neurocontrol"

Andrew R. Brughera
(Kamal Sen and David McAlpine, PhD Co-Advisors)
"Sensitivity to Interaural Time Differences across Sound Frequency: Models of Auditory-Brainstem Neurons"

Chenguang Peng
(Tyronne Porter, PhD Advisor)
"Phase Shift Nanoemulsions Facilitated Transcranial High Intensity Focused Ultrasound Ablation"

David Christopher Sloas
(John Ngo, PhD Advisor)
"Engineering Mechanotransduction in Mammalian Cells Using the Notch Receptor"

Jennifer Michele Vojtech
(Cara Stepp, PhD Advisor)
"Acoustic and Videoendoscopic Techniques to Improve Voice Assessment via Relative Fundamental Frequency"

JANUARY 25, 2021

Mingfu Chen
(Mark Grinstaff, PhD Advisor)
"Development of Enzymatic and Transcription Factor-Based Biosensors"

Christine Nykyforchyn Goldfarb
(David Waxman, PhD Advisor)
"Sex-Biased and Xenobiotic-Responsive Long Non-Coding RNAs in Mouse Liver: Sub-Cellular Localization, Liver Cell-Type Specificity, and Knockdown by Epigenetic Reprogramming"

Divya V. Israni
(Mo Khalil, PhD Advisor)
"Advanced Gene Expression Control in Therapeutic Human Cells Using Synthetic Transcriptional Programs"

Ariel Marie Langevin
(Mary Dunlop, PhD Advisor)
"Dynamics and Evolution of Efflux Pump-Mediated Antibiotic Resistance"

Saundria Michelle Moed
(Muhammad Zaman, PhD Advisor)
"Integrated Electrochemical Device to Screen for Liver Function at the Point-of-Care"

Jiaxi Song
(Mark Grinstaff, PhD Advisor)
"Harnessing the Power of Light in Nanopore Sensing and Biomedical 3D Printing Applications"

Jean Marc Fan Chung Tsang Min Ching
(Jerome Mertz, PhD Advisor)
"Techniques for Single-Shot Volumetric Fluorescence Imaging"

MAY 16, 2021

Ali Lashkaripour
(Doug Densmore, PhD Advisor)
"Rapid Prototyping, Performance Characterization, and Design Automation of Droplet-Based Microfluidic Devices"

Raeef Eric Istfan
(Darren Roblyer, PhD Advisor)
"Frequency-Domain Diffuse Optical Spectroscopy for Cardiovascular and Respiratory Applications"

Ryan Emily Peace Miller
(John Ngo, PhD Advisor)
"Engineering Light-Inducible Molecular Tools from Fluorophore-Binding Photoactivatable Domains"

Elliot Parker Tague
(John Ngo, PhD Advisor)
"Engineering Novel Chemosensory Proteins to Respond to Antiviral Drugs"

Marjon Zamani
(Cathie Klapperich, PhD Advisor)
"Affordable Technologies for Point-of-Care Diagnostics"

MENG Graduates

JANUARY 25, 2021

Natasha Leshea McMasters Erika Yoon

MAY 16, 2021

Pankaj Agarwal
Caryn Clark
Herrick Fernandes
Eric Richard Haas
Reed C. Jones
Tanner Christian Knabe
Claire Elizabeth Kraft
Alexandra Marker Onsi
Anthony Joseph Pandolfo
Sai Anirudh Papineni
Kyle Michael Puleo
Jay Shah
Yashaswee Tamrakar
Eric J. Ton
Julia Michelle Towne
Natalia Villarreal
Joseph Wagner
Kyu Bi Yang

MS Graduates

SEPTEMBER 25, 2020

Nathan Blanke
(Irving Bigio, PhD Advisor)
"Quantitative Birefringence Microscopy for Imaging the Structural Integrity of Myelin in the CNS"

Ting-Ya Chang
(David Waxman, PhD Advisor)
"Identification of CAR-Responsive Active Enhancers at DNase-I Hypersensitive Sites by Massively Parallel Reporter Assay in TCPOBOP-Exposed Mouse Liver"

Matti David Tyrr Groll
(Cara Stepp, PhD Advisor)
"The Quantitative Assessment of Laryngeal Physiology"

June Hua
(Steve Colburn, MS Mentored Project Advisor)
"Local Impedance Changes during RF Delivery"

Matthew Herbert Ning
(Kamal Sen, PhD Advisor)
"Decoding Spatial Attention in the Cocktail Party Problem with EEG and fNIRS"

Jian Carlo Nocon
(Kamal Sen, PhD Advisor)
"Using Optogenetics and Behavioral Paradigms to Examine Modulation and Spatial Tuning in the Cocktail Party Problem"

Christian A. Ortiz
(Allison Dennis, MS Mentored Project Advisor)
"Statistical Analysis of CIS Toxicity"

Samuel Scott Spink
(Darren Roblyer, PhD Advisor)
"Paced Breathing Hemodynamics in Breast Tumors Measured with a High Optode-Density Wearable Diffuse Optical Probe"

Rajendranath R. Selagamsetty

Nathan Tague
(Mary Dunlop, PhD Advisor)
"Dynamic Post-Translational Control for Metabolic Engineering"

Yuying Tan
(Ji-Xin Cheng, PhD Advisor)
"Uncovering Metabolic Signature of Cisplatin-Resistant Ovarian Cancer"

Jiarui Yang
(David Boas, PhD Advisor)
"Serial Sectioning Block-face Imaging of Post-Mortem Human Brain"

Zhiyu Zhang

MS with Practice

Rui Liu
(Ji-Xin Cheng, MS Mentored Project Advisor)
"Understanding the Fatty Acid Metabolism During Cancer EMT"

JANUARY 25, 2021

Mark Samuel Aronson
(Allyson Sgro, PhD Advisor)
"Bridging Intracellular Signaling and Multicellular Development Programs in Bacillus subtilis Biofilms"

Vinson Chu
(Hadi Nia, MS Mentored Project Advisor)
"Measurement and Actuation of Mechanical Stresses in Fibrotic Tumors"

Yoseph Warren Dance
(Joe Tien, PhD Advisor)
"Engineering of a Three-Dimensional Breast Tumor-on-a-Chip to Investigate How Adipose Tissue Affects the Early Stages of Breast Cancer Metastasis"

Jocelyn M. Davee
(Joyce Wong, MS Mentored Project Advisor)
"PFAS Exposure in Reproductive-Aged Women across Race and Ethnicity from the National Health and Nutrition Examination Survey (NHANES)"

Alexander James Gray
(Irving Bigio, MS Thesis Advisor)
"Design and Implementation of a Miniaturized Elastic Scattering Spectroscopy (mESS) System with Scanning Modality for Oral Cancer Deep Margins Assessment"

Krishna Dutta Harpanahalli
(John Ngo, MS Mentored Project Advisor)
"Intracellular Application of dNS3"

Tanya Jain
(Bela Suki, MS Mentored Project Advisor)
"High Throughput Biomechanical Tissue Stretching Device"

Chuqiao Huyan
(Allyson Sgro, PhD Advisor)
"Interrogating Signaling Dynamics that Coordinate Cell Behaviors in Multicellular Model Systems"

Colin Kunze
(Mo Khalil, PhD Advisor)
"Engineering Durable Synthetic Epigenetic Memory Circuits"

Yueying Lao
(Diane Joseph-McCarthy, MS Mentored Project Advisor)
"Intranasal Formulation/Device Modeling Project"

David Glenwood Lee
(Jerry Cheng, PhD Advisor)
"The Role of Perirhinal Cortex in

Learning and Memory for Freely Behaving and Head-Fixed Mice”

Chi-Chen Lin

(Chuanhua Duan and Cathie Klapperich, MS Mentored Project Co-Advisors)
“Detection of Ultra-Low Concentration of Nanoparticles Using Electrokinetic Trapping”

Christine Casserly McKee

(Joyce Wong, MS Thesis Advisor)
“Tissue Engineered Pediatric Patches: Bioprinting Structured Collagen to Mimic the Mechanical Properties of Native Blood Vessels”

Kevin Raymond Peters

(Bela Suki, MS Mentored Project Advisor)
“Biomechanical Factors in Glycolytic Dynamics”

Tina Le Ta

(Xue Han, MS Mentored Project Advisor)
“Targeting Specific Neurons through Different Viral Constructs”

Eryn L. Weiser

(Mo Khalil, MS Mentored Project Advisor)
“Strategies for Detecting and Responding to Protein Aggregation in vivo”

Evana Baiyu Zhou

(Irving Bigio and Vipul Chitalia, MS Mentored Project Co-Advisors)
“Developing a Novel Technique to Quantify and Predict Kidney Fibrosis”

Xuedong Zhu

(Michelle Sander, PhD Advisor)
“Pulsed Infrared Light for Modulating Neuromuscular Activity”

MAY 16 2021

Deeya Burman

(Mary Dunlop, MS Mentored Project Advisor)
“Design, Build, and Test of Escherichia coli Strains Engineered to Produce Free Fatty Acids”

Catherine Covert Eberman

(Hadi Nia, MS Thesis Advisor)
“Design and Fabrication of an Optically Transparent Ribcage to Enable Ex-Vivo Whole Lung Imaging”

Jourdan Ewoldt

(Chris Chen, PhD Advisor)
“Hypertrophic Cardiomyopathy-Induced Paracrine Signaling and Stromal Activation”

Usman Ghani

(Sandor Vajda, PhD Advisor)
“Investigating the Effect of ECM Concentration on Metastasis Using a 3D in vitro Model and Using Docking to Evaluate Predicted Protein Complex Stability”

Catherine Anne Gormley

(Joyce Wong, PhD Advisor)
“Targeted Microbubbles as

Ultrasound Contrast Agents for Monitoring Post-Surgical Abdominal Adhesions”

Maria Margaret Iennaco

(David Boas, MS Thesis Advisor)
“The Effect of Photobiomodulation on Cerebral Blood Flow”

Karim Khaled Abdelhamid Mohamed Ismail

(Cara Lewis and Elise Morgan, MS Thesis Co-Advisors)
“Hip Joint Forces in Individuals with Femoroacetabular Impingement Syndrome”

Patrick T. Lally

(James Galagan, PhD Advisor)
“Generating and Mining Binding-Based Transcription Regulatory Networks”

David Patrick McIntyre

(Doug Densmore, PhD Advisor)
“Machine-Guided Droplet Microfluidic Screening Platforms for Synthetic Biology”

Samhita Murthy

(Bela Suki, MS Thesis Advisor)
“Predicting Changes in Lung Structure and Function during Emphysema Progression Through Network Modeling Methods”

Menna Yamany Siddiqui

(Wilson Wong, PhD Advisor)
“CAR T-Cell Therapy for the Prevention of Allograft Rejection”

Yuan Yin

Ziwen Yuan

(Bela Suki, MS Thesis Advisor)
“Consistent Spring Representation of Emphysematous Lung from CT Images”

Chengqian Zhou

(Xue Han, MS Thesis Advisor)
“Development of Semi-Automatic Data Analysis Algorithms to Examine the Influence of Sensory Stimuli on Locomotion and Striatal Neural Activities in Rodent Models”

MS with Practice

Meenakshi Agarwal

(Mark Grinstaff and Madhu Hariharan, MS Mentored Project Co-Advisors)
“Designing High Quality Oral Soluble Films Using DepoFilmTM Technology”

GRADUATE STUDENT AWARDS AND FELLOWSHIPS

12th International Seminar on Speech Production Student Scholarship: **Matti Groll**

2020 Annual QBP/SB2/TRB Symposium – Best Oral Presentation Award: **Cam Condylis**

2020 Annual QBP/SB2/TRB Symposium – Best Poster Presentation Awards: **Alison Lanzi, Menna Siddiqui**

2020 BME Student Paper of the Year Award: **Ali Lashkaripour**

2020 BME TA of the Year Award: **Rebecca Mount**

2021 ENG Masters Societal Impact Award: **Christine McKee**

BU Ignition Award: **Uros Kuzmanovic**

Dean's Fellowships: **Jessie Anderson, Ben Bremer, Isabella Darke, Ariane Garrett, Emma Stowe**

Distinguished BME Fellowships: **Sarah Adams, Honour Adewumi, Anthony Aggouras, Baarbod Ashenagar, Aviva Borison, Morgan Cambareri, Nicole Carr, Jaehoon Choi, Rohan Deshpande, Eric DuBois, Ben Fitzsimmons, Scott Gaines, Delaney Gray, Gabrielle Grifno, Joseph Hall, Linda Henry, Timothy Josephson, Sophia Kuipa, Quan Le, Jiayi Li, Chang Liu, Sebastian Naranjo, Anna Novoseltseva, Amish Patel, Yifan Peng, Chinmayee Prabhu Dessai, Cara Ravasio, Nicole Rinaldi, James Robson, Diana Suciu, Songyang Wang, Tian Wang**

F31 Fellowships: **Cam Condylis, Jourdan Ewoldt, Gwen Hoffmann, Justin Letendre, Rebecca Mount, Sanaya Shroff**

Kilachand Fellowships: **Eric Bressler, Cristian Coriano-Ortiz, Jing Zhang**

M2D2 \$200K Challenge Prize Winner: **Uros Kuzmanovic**

MassChallenge Finalist: **Uros Kuzmanovic**

MLK Fellowship: **Joshua Dupaty**

NIH Quantitative Biology and Physiology T32 Fellowships: **Diana Arguijo Mendoza, Sydney Bailes, Marcus Blackburn, Christopher Kuffner, Joshua Levitt, Carolyn Marar, Dev Mehrotra, Max Rozenblum**

NIH Synthetic Biology and Biotechnology T32 Fellowships: **Noshin Nawar, Adam Sanford, Menna Siddiqui, Ezira Yimer Wolle**

NIH Translational Research in Biomaterials T32 Fellowships: **Danny Carbonero, Christian DeMoya, Alanna Farrell, Samantha Fletcher**

NSF Graduate Research Fellowships: **Danyal Bhutto, Caroline Blassick, Emma Bortz, Carlos Gomez, Joshua Kays, Alison Lanzi, Alex Marzilli**

NSF Graduate Research Fellowship – Honorable Mention: **Brett Tingley**

NSF Neurophotonics National Research Traineeship Program Fellowships: **Erin Landry, Xinwen Zhu**

Raymond H. Stetson Scholarship in Phonetics and Speech Production, Acoustical Society of America - Honorable Mention: **Hasini Weerathunge**

Society for Lab Automation & Screening Graduate Fellowship: **David McIntyre**

Undergraduate Enrollment

ENROLLMENT FOR AY 2020-2021

539 STUDENTS

in the BME program

33%

of the College of Engineering

	BME Department			All College of Engineering		
	F	M	TOTAL	F	M	TOTAL
FRESHMAN	57	61	118	105	216	321
SOPHOMORE	71	69	140	132	267	399
JUNIOR	60	75	135	126	317	443
SENIOR	72	74	146	155	294	449
TOTAL	260	279	539	518	1094	1612

COLLEGE OF ENGINEERING SELECTIVITY FOR AY 2020-2021

45% INCREASE

in selectivity over 8 years

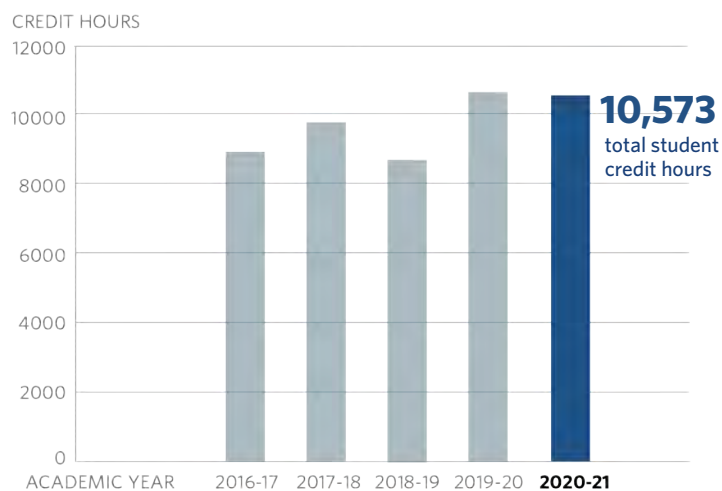


BME TEACHING HISTORY - AY 2020-2021

84 COURSES TAUGHT

39 PRIMARY FACULTY

\$34 MILLION
in research funding



Undergraduate Degrees Awarded

BS DEGREES BREAKDOWN - AY 2020-2021

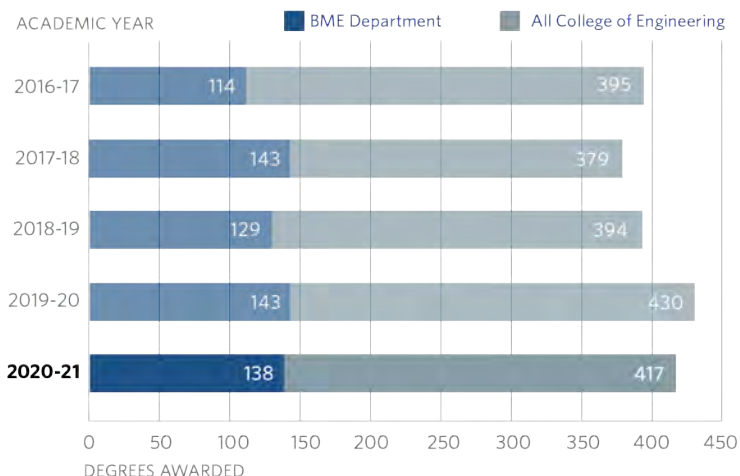
The Department awarded

138

BACHELOR OF SCIENCE
DEGREES

33%

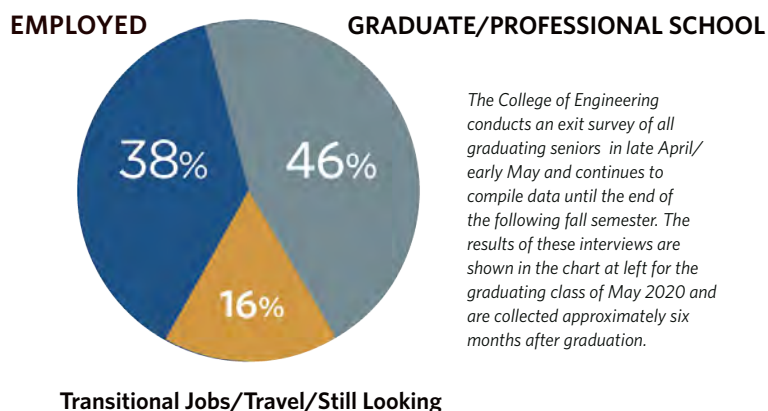
of all the BS degrees awarded by
the College of Engineering.



TRACKING ALUMNI

POST GRADUATION PLANS - 2019-2020 BME GRADUATES

84% EMPLOYED
or ENROLLED IN
GRADUATE SCHOOL
of 2019-2020 graduates



The College of Engineering conducts an exit survey of all graduating seniors in late April/early May and continues to compile data until the end of the following fall semester. The results of these interviews are shown in the chart at left for the graduating class of May 2020 and are collected approximately six months after graduation.

ENGMEDIC

ENGMEDIC

The ENGMEDIC program is an early selection program that leads to a BS in Engineering and an MD from the Medical School. This program is offered and administrated in collaboration with our School of Medicine and is designed to train biomedical engineers who have the MD as their ultimate degree objective. ENGMEDIC admits to the School of Medicine a small number of highly qualified students who have completed two years of the premedical option of the biomedical engineering curriculum. The program is not designed to accelerate the engineering or the medical training but rather to effect a better transition from undergraduate engineering study to graduate medical training. The BS in Biomedical Engineering is normally earned after 4 years of undergraduate study and the MD after an additional 4 years of study at the Boston University Medical School.

Undergraduate Student Awards

In 2021, several of the BME seniors were recognized for achievements and contributions to the Boston University community and BME profession.

Adam M. Miller Memorial Award:	Awarded by the Biomedical Engineering Department to the graduating senior who has best advanced the reputation and prestige of the department through his/her involvement in department, college, university, professional activities, or organizations, as well as through the academic and senior project programs. This year the award was presented to Aditya Jain .
Ging S. Lee Community Service Award:	Presented to one or more seniors at the College of Engineering who have made outstanding contributions in the area of community service. This year's award winner was Phoebe Ato .
Earle and Mildred Bailey Memorial Award:	Presented to graduating seniors in the College of Engineering to recognize outstanding scholarship and service to the college. This year the award was presented to Leen Arnaout and Deema Abdel-Meguid .
Engineering Alumni Association Student Leader Award:	Presented to seniors who have made outstanding contributions to the College and University through their involvement in activities and organizations. The 2 award winners this year are Meghan Griffin and Pooja Chainani .
Undergraduate Student Service Award:	This year's award winners included 2 BME seniors: Georgia Vachon and Ekaterina Murzin .
Outstanding Senior Project Award:	First Place in the Department's 2021 Outstanding Senior Design Project Award went to Leen Arnaout and Meghan Griffin for their project "A Wearable Solution for Treating Apnea of Prematurity through Application of Physical Stimuli", under the supervision of Bela Suki and Dean Zeldich.
Student Advisor Award:	Among the ENG winners for outstanding assistance in advising this year, the following BME seniors were recognized: Leen Arnaout, Anisha Butaney, Pooja Chainani, Reece Huff, Aditya Jain, Molly McGowan, Shivani Merchia, Ekaterina Murzin, Aneka Pradhan, Lesbeth Roque, Akhila Sonti, Govinda Thomas .

Undergraduate Student Organizations

Boston University Student Chapter of the Biomedical Engineering Society

The purpose of the Biomedical Engineering Society is: "To promote the increase of biomedical engineering knowledge and its utilization." The student chapter at Boston University works towards this goal in all of its activities. The Biomedical Engineering Society provides a focus for community building among BME students with activities which strengthen their understanding of and interest in Biomedical Engineering. The Society provides students with literature, field trips, films and guest lectures, which provide them with a "resource center" concerning such vital areas as career opportunities and graduate study in Biomedical Engineering.

BMES Officers AY 2020-2021

President – Grace Hinds '21

Vice President – Ruchita Jain '21

Treasurer – Jack Cardini '21

Communications Chair – Rishi Vaidya '22

Events Chair – Lesbeth Roque '21

Public Relations Chair – Prinjali Kalyan '23



Alpha Eta Mu Beta Biomedical Engineering Honor Society

Alpha Eta Mu Beta is the honor society for Biomedical Engineering. The society promotes an understanding of the profession and recognizes and encourages excellence within the field. The purpose of the society is to bring into closer union and to mark in an outstanding manner those biomedical engineers who have manifested a deep interest and marked ability in their chosen life work so as to promote an understanding of their profession and to develop its members professionally.

AEMB Officers AY 2020-2021

President – Peyton Tierney '21

Vice President – Anna Geraghty '21

Secretary – Rachel Allen '21



Undergraduate Research Activities

Fellows from the **Distinguished Summer Research Fellowship program (DSRF)** spend the summer engaged in a transformative research experience under the guidance of a faculty member. The program provides students with \$10,000 per summer to cover housing, living expenses, and research expenses such as supplies, books, and related travel. Fellows must work full time in the lab of an engineering faculty member for at least 10 weeks.

College of Engineering undergraduates engaged in faculty-mentored full-time research experiences during the summer may apply for the **Remote Research Summer (RRS)** program. RRS participants will receive 10 or 12 weeks of housing in a Boston University residence hall OR up to \$2750 towards off-campus housing costs (reimbursement is for actual cost of housing). To be eligible, students must receive a weekly stipend from an engineering faculty mentor to participate in full-time research during the summer (summer courses are not allowed).

The College of Engineering **Supplemental Undergraduate Research Funds (SURF)** program encourages faculty to involve undergraduates in their research programs during the academic year by providing matching funds for undergraduate students who are working on faculty-sponsored research. Requests for SURF funds are made by individual students when they have found positions in faculty labs.

The **Undergraduate Research Opportunities Program (UROP)** is a University-wide academic program which promotes participation by Boston University undergraduates in faculty-mentored research across all disciplines and throughout the calendar year.

DSRF Summer 2020

Deema Abdel-Meguid
Pallavi Balivada
Lordean Gustinvil
Rachel Honigsberg
Reece Huff
Aditya Jain
Harin Lee
Juncheng Zhang

RRS Summer 2020

Rachel Allen
Leen Arnaout
Jeonghoon Choi
Stepan Demidkin
Keyi Han
Emma Hartman
Gabriela Hernandez
Grace Hinds
Aksel Laudon
Artemis Margaronis
Amartya Naik
Maia Shwartz
Rockwell Tang
Aliya Tazhibayeva
Samuel Zhou

SURF Summer 2020

Rachell Allen
Leen Arnaout
Jeonghoon Choi
Peter Crary
Keyi Han
Emma Hartman
Gabriela Hernandez
Grace Hinds
Casey Spillane
Yaopu Wang
Samuel Zhou

SURF Fall 2020

Christian Arthur
Nicole Chen
Jodee Frias
Lordean Gustinvil
Keyi Han
Olivia Lewallen
Cullen Paulisick
Beatrice Tacugue
Zenia Valdiviezo
Alexandra Van Waes
Jessica Weber
Yujia Zhang
Brian Zhou

SURF Spring 2021

Christian Arthur
Jodee Frias
Lordean Gustinvil
Geroge Katsarakis
Olivia Lewallen
Artemis Margaronis
Beatrice Tacugue
Rockwell Tang
Ksenija Tasich
Juan Luis Ugarte Nunez
Zenia Valdivienzo
Alexandra Van Waes
Jessica Weber
Brian Zhou

UROP Fall 2020

Jack Cardini
Pooja Chainani
Austin Luong
Stefan Lutschg
Juncheng Zhang
Brian Zhou
Deema Abdel-Meguid
Layth Amra
Phillip Baik
Rana Boustany
Jorge Casas
Lordean Gustinvil
Elizabeth Hanchar
Rachel Honigsberg
Zhuoying Huang
Reece Huff
Jonathan Jordanides
Prinjali Kalyan
Harin Lee
Kairav Maniar
Amartya Naik
Logan O'Connor
Cullen Paulisick
Kirk Pierce
Sanjeev Rampam
Cedric Salame
Rahul Varki
Moriah White
Yujia Zhang
Samuel Zhou

UROP Spring 2021

Rana Boustany
Jack Cardini
Tyler Crawford
Emma Golden
Lordean Gustinvil
Rachel Honigsberg
Zhuoying Huang
Ruchita Jain
Michaela Johnson
Jonathan Jordanides
Emre Karabay
Harin Lee
Stefan Lutschg
Amartya Naik
Maria Alexandra
Parada Rodriguez
Kirk Pierce
Sanjeev Rampam
Cedric Salame
Akhial Sonti
Moriah White
Brian Zhou

UROP Summer 2021

Shirin Bakre
Gabriela Berniac
Elisa Cordeiro Lopes
Delaney Dow
Soumaya Fayie
Jodee Frias
Melissa Gillis
Emily Hill
Veronica Hui
Brandon Kao
Connor Kim
Aksel Laudon
Harin Lee
Yuke Li
Miguel Mazumder
Mackenzie Obenreder
Nicole Ostrovsky
Felicia Pinto
Laura Raiff
Cedric Salame
Medha Shekhar
Zachary Silfen
William Swift

Biomedical Engineering **Senior Design Projects** 2021

The Senior Design Project Experience

Every BME senior is required to develop a project proposal with an individual faculty member, local area scientific mentor, or even a bioengineering corporate technical advisor (with a BME faculty co-supervisor). The project is then carried out with the guidance of the student's technical advisor. This brings together elements of engineering science and engineering design. In coordination with the technical work, this course includes experience in planning, establishing priorities and formal training in technical communication including proposal, abstract, progress reports and oral and written presentations of the final work. In conjunction

with the BME Department's Visiting Committee, we have additional lectures from our industry partners to expose the students to elements of entrepreneurship, business plans, intellectual property, marketing, and clinical regulatory issues. The project continues over the full academic year and culminates in a Senior Design Project Conference that is attended by students, faculty, and representatives from BME industry, hospitals and other academic institutions. A record of the project presentations is followed by a listing of participating companies.

2021 Project Presentations

NEUROSCIENCE, NANOSCIENCE & CELL/TISSUE ENGINEERING

Neural Engineering

Virtual Reality System for Investigating Spatial Navigation Encoding in Mice

Sam Zhou, Keyi Han

A Discriminative Model for the Assessment of Vocal Hyperfunction Using Acoustic Features During Voicing Onset and Offset

Austin Luong, Phillip Baik

An Integrated Sensory Environment for In Vivo Imaging of Neuronal Activity

Michael Beazule, William Willigrod, Isabel Sanchez

Examination of Hippocampal CA1 Population Dynamics During Extinction Learning using Healthy and Autism Spectrum Disorder Mouse Models

Yujia Zhang, Peiying Liu

NEUROSCIENCE, NANOSCIENCE & CELL/TISSUE ENGINEERING

Cell and Tissue Engineering

Uterus-on-a-Chip for Interrogation of Trophoblast Behavior in Preeclampsia

Deema Abdel-Meguid, Anna Howard, Arthan Bhatt, Aditya Jain

Developing a Midbrain Organoid-on-a-Chip for Live Cell Imaging and Parkinson's Disease Modeling

Maria Parada Rodriguez, Eugenia Angelopoulos, Victoria Lara-Aguilar

3D Bioprinting of Realistic Adventitia Tissue Structures Assessed via Multiphoton Microscopy

Tharin Durongkapitaya, Antoine Baize, Nelson Chan, Jake Kenny

Exploring Atomic Force Microscopy for Applications in Targeted Cell Therapy

Emma Golden, Akhila Sonti, Michaela Johnson, Ruchita Jain

In Vitro System to Model Cell Interactions of CNS Injury Lesion Compartments

Anagha Arvind, Guadalupe Garcia, Sangsoo Lee, Mihir Mehta, Mahir Shajin

The Senior Design Project

NEUROSCIENCE, NANOSCENCE & CELL/TISSUE ENGINEERING

Nanoscience

A Coral Stress Biosensor

Savanah Garcia, Moriah White, Daron Hamparian

Convergence Approach to Nanoparticle-Based Biomonitoring of Per- and Polyfluoroalkyl Substances (PFAS)

Peyton Tierney, Evan Dann, Sarah Pham, Anarghya Murthy

Optical Pressure Sensor Utilizing Quantum Dot Embedded Polymers

Jorge Paolo Casas, Thomas Quinn, Kirk Pierce

Small Molecule Concentration Analysis via Fluorescent Comparison of Quantum Dots in a Black Box Device

Nicole Leon Vargas, Maia Shwarts, Luiza Damotta, Anisha Butaney

BIOMECHANICS, BIOMATERIALS & SYNTHETIC BIOLOGY

Biomechanics 1

High-Frequency Atomic Force Microscope (AFM)-Based Nanorheology System with Imaging Capacity

Zhuoying Huang, Zach Lam (MechE)

Effects of Substrate Stiffness on Actin Network and Nucleus Size in Human Airway Smooth Muscle Cells

Grace Hinds, Kairav Maniar

Lightweight Intelligent Foot Tracker & Trainer (L.I.F.T.T.)

Janice Noh, Sean Jang (MechE)

Characterizing Tendinopathy Mechanobiology in an In-situ Setting

Priyan Pathirana, Rachel Honigsberg

BIOMECHANICS, BIOMATERIALS & SYNTHETIC BIOLOGY

Biomechanics 2

Mechanical Loading Bioreactor for Real-Time Imaging of Mouse Flexor Tendon Explants

Alan Shain, Felix Litvak, Cong Zheng, Jack Jordanides, Amartya Naik

Designing a Hemiarthroplasty Implant for Massive Rotator Cuff Tear Patients

Danielle Fakler, Pooja Chainani

Simulating Age-Related Bone Loss and Disc Degeneration in Human Lumbar Spine Segments for Study of Vertebral Fractures

Reece Huff, Jae Ahn

Assessment of Tendon Tear Progression Ex-Vivo

Avery Allen (MechE), Dominic Ascitto, Stepan Demidkin

BIOMECHANICS, BIOMATERIALS & SYNTHETIC BIOLOGY

Synthetic/Systems Biology & Biomaterials

Optimization of Closed-Loop Optogenetic Feedback Control

Cullen Paulisick, Jeremy Johnson, Joshua Singh, Ronak Shah, Kailyn Tran

Automated Metabolic Monitoring of Bioreactor

Nathaniel Fullam, Samuel Tomp, Evan Donovan

Soft Endoscopic Catheter Simulator

Liyang Zhu, Ziyu Yang

Device for Controlling Optogenetic Stimulation for Cell Cultures Using Real-Time Feedback

Vrushali Joshi, Michelle Nam, Alexandra O'Connor

Using AI to Determine the Genome-Wide Likelihood of Splicing

Yi Chieh Lin, Nawar Rasul

The Senior Design Project

PRECISION MEDICINE

Wearables & Augmented Reality

A Wearable Solution for Treating Apnea of Prematurity through Application of Physical Stimuli

Leen Arnaout, Meghan Griffin

Wearable SWIR Optical Probe for Measuring Lipid and Water Composition for Hemodialysis Volume Status Assessment

Megan Freeman, Grace Bag, Huiru Huang

Reimagining Clinical Rounds During COVID-19 and Beyond: Augmented Reality for a Contactless Approach

Darien Figueroa, Nick Simone, Marifer Hernandez, Alejandra Beltran, Marietta Perez

Investigating Physiological Effects of Lifestyle During COVID-19 Pandemic Using Wearable Devices

Kathleen Rice, Tiffany Henry, Anna Geraghty, Rana Boustany

PRECISION MEDICINE

Devices & Apps

Detection of Degraded and Counterfeit Antimalarial Drugs with Optical Spectroscopy

Ketan Gupta, Rahul Varki

Improving Vocalization through Games: Speech Therapy Application for Children with Autism

Rachel Allen, Ali Dubois, Kathryn Scheerer

Developing an Automated Microfluidic System for Sample Application on Biosensors

Shivani Merchia, Brian Kendrick

Cognitive Test App for Alzheimer's and Dementia

Justin Harlan, Danyal Qureshi, Michael Song, Peter Martinez, Nadezhda Tarasova

Characterization of Novel Biomicroscopy Technique for Clinically Relevant Bioassays

Lordean Gustinivil, Sapan Gupta, Qian Xu

PRECISION MEDICINE

Data Science, Computation & Diagnostics

In Silico Prototyping for an Intranasally Administered Agent for COVID-19 Prophylaxis and Treatment

Phoebe Ato, Nogaye Ka, Pallavi Balivada

Predictive Algorithm for Presence of Post-Adenotonsillectomy Complications

Komal Kango, Muhammad Amirul Adli bin Ramli

Engineering ACE2 Binding Peptides and Peptidomimetics to Block Interaction with SARS-CoV-2 Spike Protein

Stephanie Haug, Ethan Chan, Sina Analoui, Justin Moy

Proposed Design and Implementation of a Biobank for the Storage of COVID-19 Samples

Elena Sanchez, Sophia Brocoum, Julia Nothaft, Gabriela Hernandez

Projects Previously Presented

Attachable Intraoral Camera for Dental Handpieces

Kassidy Green, Nicolai Olesen, Lesbeth Roque, Govinda Thomas, Ho (Jessica) Wang

New Insights into the Down Syndrome-Related Brain Cells Phenotypes Studied in iPS-Derived Oligocortical Spheroids

Jack Cardini, Aneka Pradhan, Sanjeev Rampam

Sensor Performance Comparison

Nir Shukrun, Georgia Vachon, Molly McGowan, Prachi Kholwadwala, Rebecca Turi

Prototyping an Artificial Anterior Cruciate Ligament (ACL) using Embedded 3D Bioprinting

Logan O'Connor, Rahul Herur, Leighton Marcovici, John Trovato

The Senior Design Project

Participating Companies

3M	Codman Neuro, Johnson & Johnson	Lux Research
Accenture Life Sciences	Colorado Nepal Alliance,	Mankato National Instruments
Advanced Instruments, Inc.	Dept. of Veterans Affairs	Massachusetts Eye and Ear Infirmary
Advanced Silicon Group	Columbia University,	Massachusetts General Hospital
Ajax Biomedica	College of Physicians and Surgeons	Massachusetts Institute of Technology
AltraBio	Comprehensive Health Management Inc.	Medtronic, Inc.
Altran	ConforMIS, Inc.	METI
Applied Medical Resources	Consult and Design	Minnesota State University
ArQule, Inc.	Covidien	MIT/Koch Institute
Atrium Medical	CSA Medical	Motility Biomedical, Inc.
Avedro, Inc.	Cynosure	nanoView Diagnostics , Inc.
Banyan Life Sciences LLC	Davison	Navinet
BD Advanced Diabetes Care	Davol - C.R. Bard, Inc.	Neuroptix Corporation
BD Medical	Decision Resources	New Health Sciences
Beta Bionics	DEKA Research and Development	Novartis Institutes for BioMedical Research
Beth Israel Deaconess Medical Center	Corporation	NuOrtho Surgical, Inc.
Biotronik	DePuy Spine, Inc.	Olympus Surgical Technologies America
BioTrove, Inc.	DocBox, Inc.	Optasia Medical, Inc.
Bioventus LLC	Draeger Medical Systems, Inc.	Oregon Health & Science University
Bitome	Draper	O'Shea Getz PC
Boston Engineering	Eastman Kodak Company	Parexel
Boston Medical Center,	Eaton-Peabody Laboratory	Perceptive Informatics PerkinElmer
Dept. of Anesthesiology	Elm Electrical & Automation	Pfizer Biotherapeutics
Boston Medical Center,	EndoCore	Philips Healthcare
Dept. of Clinical Engineering	Enumeral Biomedical Holdings, Inc.	Philips Ultrasound
Boston Medical Center,	Essex Orthopedics & Optima Sports	Praxis Advisors LLC
Dept. of Orthopedic Surgery	Medicine	Pulmatrix, Inc.
Boston Scientific	Fellers Snider et al.	Raytheon
Boston University School of Management	Ferrotec Corporation	Regeneron Pharmaceuticals
Boston University School of Medicine	Fluidform	Respiratory Motion, Inc.
Boston University School of Medicine,	Foundation Medicine	Rtangent
Dept. of Pharmacology	Fractal Therapeutics	Sanofi
Boston University School of Public Health	Fraunhofer USA-CMI	Sapient
Boston University, Dept. of Athletic Training	GE Healthcare	Schepens Eye Research Institute
and Physical Therapy	Gems Sensors	Schneider Electric
Boston University, Dept. of Biochemistry	Genzyme Corporation	Shire Pharmaceuticals
Boston University, Dept. of Biology	GlobalData Healthcare	Solace Therapeutics, Inc.
Boston University,	Goodyear-Veyance Technologies, Inc.	SoundMedicine
Dept. of Biology (Neuroscience)	Grant Street Group	SQZ Biotechnologies
Boston University,	Harvard Business School	St. Jude Medical
Dept. of Mechanical Engineering	Harvard Medical School	Teleflex Medical
Boston University,	Harvard University	Ten15Ventures
Dept. of Physiological and Brain Sciences	Harvard-MIT Division of Health Sciences	Toxikon Corporation
Boston University,	and Technology	Tufts University
Dept. of Physiology and Biophysics	HeartWare, Inc.	UMASS
Boston University,	Higher Order Technologies, LLC	Universidad de Valencia
Dept. of Speech, Language and Hearing Sciences	Hologic	University of Texas at Austin
Brandeis University	Hypertherm	University of Wisconsin-Madison
Brigham and Women's Hospital	Iandiorio Teska & Coleman	US Army Institute of Environmental Medicine
Bright Cloud International Corp	IDEXX Laboratories	USA Research Institute of Environmental
Broad Institute	Image Stream Medical	Medicine
Bruker Daltonics	ImagiRation	VA Boston Healthcare System
CAE Healthcare	Instrumentation Labs, Inc.	Vantage Management Group Verbal Care
CBS Local	Integra LifeSciences	Vertex Pharmaceuticals
Center for Global Health and Development	Ironwood Pharmaceuticals	Veterans Administration
Charles Stark Draper Laboratory	iWorx Systems, Inc.	Visus Technologies
Children's Hospital Boston	Jana Care Inc.	Worcester Polytechnic Institute
CIMIT	Janssen Pharmaceutical, Johnson & Johnson	Wyss Institute for Biologically Inspired
CKD Associates	JH Technologies	Engineering
Clark & Elbing LLP	Johnson & Johnson	Xcellerex
Cleveland Clinic	Lahey Hospital and Medical Center	Youpling Corp.
	Legionarius	



Department of Biomedical Engineering

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Annual Report 2020-2021

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This report provides a description of the instructional and research activities of the Department of Biomedical Engineering at Boston University during the 2020-2021 academic year.

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