LEHIGH UNIVERSITY | P.C. Rossin College of Engineering and Applied Science

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FALL 2022 Newsletter

Lehigh Bioengineering through the years

2002 LAUNCHED UNDERGRADUATE PROGRAM

2006 GRANTED FIRST BACHELOR'S DEGREES

2010 LAUNCHED GRADUATE PROGRAM

2011 GRANTED FIRST MASTER'S DEGREES

2014 GRANTED FIRST DOCTORAL DEGREES

2017 CONVERSION TO DEPARTMENT OF BIOENGINEERING

2018 COLLEGE OF HEALTH LAUNCHED

2020 ANAND RAMAMURTHI APPOINTED AS DEPARTMENT CHAIR

2022 HEALTH, SCIENCE & TECHNOLOGY RESEARCH HUBS OPENS

DEPARTMENT WELCOME

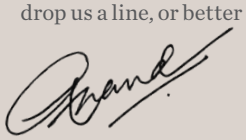
Twenty years! As we reflect, it is amazing to consider how technology has evolved in a generation, and Lehigh Bioengineering along with it. In 2002, when LU BioE was a fledgling undergraduate program, full color displays and camera integration were just making an entrance into cell phone technology. Fast forward to the present day - our research portfolio is rapidly morphing to include nex-gen biomedical technologies involving artificial intelligence, remote sensing, and mobile diagnostics! We have much to celebrate about our advancement over the years – creating a successful undergraduate program, building a strong graduate program, and evolving into a full-fledged department - growing in faculty and student numbers, diversifying our curricular programs, and increasing the scope, funding, and impact of our faculty and student research. Through it all, we have remained steadfast to our core values - our commitment to quality and rigor of bioengineering education and research and an emphatic focus on interdisciplinarity. Rather fitting isn't it, that we commemorated the start of our third decade with a move into the newest interdisciplinary research space on campus, the Health Sciences and Technology (HST) building. Highlighted in 'BioE in the HST,' the facility is designed to foster collaboration and innovation by bringing together multidisciplinary research expertise and resources in an open design space. The HST is a bold statement of Lehigh's foray into cutting-edge, health-related research, with Bioengineers at its helm!

In this issue of the newsletter, we introduce our two newest faculty members in the materials and therapies research space, Niels Holten-Andersen and Tomas Gonzalez-Fernandez. Highlighted are Niels's work on bioinspired materials – novel synthetic materials developed using design principles extracted from nature - for overcoming global challenges in energy, the environment and health, and Tomas' research into cell-instructive, 3D printable biomaterials for tissue repair applications. Importantly, both will be instrumental in the department's efforts to build interrelated themes of engineering innovation for health, and diversity, equity, and inclusion (DEI).

Also showcased in this issue are a sampling of exemplary, innovative student research as diverse as developing matrix reparative nanoth-erapeutics for vascular disease to glioblastoma organoid models and everything in between! And we proudly unveil our restructured Master of Science program in Bioengineering. Aimed to provide students practical and interdisciplinary skillsets to pursue promising, impactful careers in the biomedical arena, our MS program provides options for flexible, individualized curricula, experiential learning, and value-added features such as certificate programs in technical entrepreneurship or data analytics.

Read on to learn about Linxi (Poplar) Yang earning top honors at the David and Lorraine Freed Undergraduate Research Symposium and about our undergraduates who, this summer, returned to the international stage as BioE Global Social Impact Fellows. Join us in celebrating the BioE staff and faculty who won six of the fourteen 2022 Rossin College Awards, Prof. Lesley Chow who was awarded tenure and promoted to Associate Professor this year, and the many funding successes in the department this past year, including Prof. Yaling Liu who received a $1.5 million award from the NSF to develop a 'heterogeneous edge computing platform for real-time scientific machine learning.'

We have plenty of other successes we are eager to tell you about - publications, more grant awards, recognitions and student and alumni achievements. As always, we are eager to hear from you and engage. So, drop us a line, or better still, come visit us!



ANAND RAMAMURTHI

Welcome

NEW BIOENGINEERING FACULTY & STAFF

TOMAS GONZALEZ-FERNANDEZ
Joined Lehigh University's Department of Bioengineering in January 2022. Gonzalez-Fernandez's research is focused on the engineering of novel cell-instructive 3D printable biomaterials to advance towards the clinical translation of 3D bioprinting for the repair of musculoskeletal tissues.

QYSAR MAQBOOL
Completed his PhD in Chemistry from Indian Institute of Science Education and Research Bhopal and began work as a postdoctoral fellow in the Holten-Anderson research group in June.

PREETIKA KARNAL
A sticky tape enthusiast and a mean table tennis player! Preetika earned her PhD in Chemical and Biomolecular Engineering from Johns Hopkins University with Professor Joelle Frechette. At Lehigh University, she is working with Professor Anand Jagota to elucidate the effect of surface stress and roughness on adhesion of soft materials.

JARMAINE LOMAX
Joined the Bioengineering department after spending 5+ years in Lehigh's Iacocca Institute. Jay brings with him many years of experience from the BME department at Columbia University.

BIOENGINEERING MOVES TO A NEW HEALTH, SCIENCE, & TECHNOLOGY BUILDING

A CUTTING-EDGE FACILITY FOR HEALTH RESEARCH

Earlier this year, Lehigh's Bioengineering researchers moved into a state-of-the-art research facility. With its open floor plan integrating laboratory and public spaces, the new ***Health, Science and Technology (HST)*** building is a bold statement of the University's commitment to investing in both cutting-edge research AND human potential.

The HST is a physical manifestation of a "better together" ethos and is designed to break down physical boundaries to encourage faculty, staff, and students to interact, collaborate and innovate. Bioengineers have joined investigators from Material Science & Engineering, Chemical & Biomolecular Engineering, and the College of Health to pursue interdisciplinary, health-focused research.

"There are so many research resources, facilities, and equipment spread across our campuses," says ***Anand Ramamurthi***, Professor and Chair of the Department of Bioengineering. The HST brings these under one roof and gives all researchers immediate access to those with expertise outside their own." In the HST, Lehigh has invested in big equipment for X-ray photoelectron spectroscopy, low-energy ion scattering, fluorescence microscopy, and 3D bioprinting.

Driving the building's design, location, and selection of occupants, was the concept of creating "research neighborhoods," guided by two research themes, materials for energy and bio-health. Materials-, bio-, and health-related faculty are now located in the HST, adjacent to materials characterization, clean room, and chemistry facilities in nearby buildings.

Ramamurthi's research team, now based in the HST, creates nanotherapeutics and stem-cell-inspired approaches for the treatment of proteolytic tissue disorders such as aortic aneurysms and pelvic organ prolapse. His researchers now have access to the infrastructure needed for current investigations, and to facilities like a data visualization lab and high-speed computational resources that will enable Ramamurthi to expand his research footprint. Ramamurthi and his team are interested in using machine learning techniques to predict adverse blood vessel rupture outcomes. "While we are novices in these techniques," he says, "within HST, we'll be next to experts in these areas, to foster new connections."

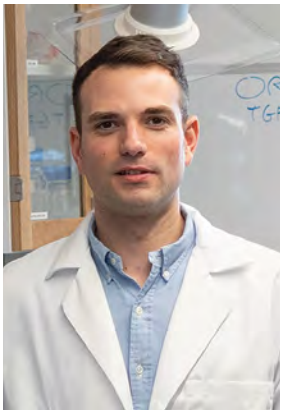
Anand Jagota, Professor and founding Chair of Bioengineering and Lehigh's Vice Provost for Research, also leads a variety of health-related projects in the HST, including virus adhesion to cells, the resuspension of virus-laden droplets from surfaces, and improving wound adhesives. Jagota says the spatial organization within HST allows for greater interaction, particularly among graduate students. Building those relationships and exploring new opportunities will be key to preparing students for the working world as they build networks and are empowered to explore new areas and lead new collaborations.

Simran Dayal, a fourth-year bioengineering PhD student advised by Ramamurthi, echoes this sentiment. "The open labs in HST allow me to get to know more people, and both impart and receive training on equipment. And with HST investing in bigger pieces of equipment, it's exciting to interact with people who know how to use them."

Among other bioengineers (***Pashuck***, ***Cheng***), the HST is also home to our two newest bioengineering faculty members. Niels Holten-Andersen investigates bio-inspired synthetic materials for applications in energy, environment, and health and Tomas Gonzalez-Fernandez develops cell-instructive, 3D-printable biomaterials. Read more about them on pages 3-4.

THE ART OF BIOENGINEERING

BY: CHRIS QUIRK



For ***Tomas Gonzalez-Fernandez***, art runs in the family. His mother is an architect, and brought young Tomas on tours of architectural landmarks. When traveling today, he often brings a travel sketchbook for watercolor paintings. "I'm very passionate about architecture and I love admiring different architectural landmarks," he says. "I think it allows me to better visualize in 3D what I want when I'm working with biomaterials."

Gonzalez-Fernandez, assistant professor of bioengineering and a recent arrival at Lehigh, has an interest in art and architecture that dovetails with his thoughts on creativity in science, specifically bioengineering. "Just as in painting, you can use brushes or other utensils, for me the technology for tissue engineering is a 3D bioprinter or other automated fabrication technology," he says. "When you put the instruments together with the cells and the substrate materials we use, and get your intellect behind it, you can arrive at the final construction that recapitulates the native tissues in our bodies."

In the lab, Gonzalez-Fernandez uses novel bio-fabrication methods to repair and regenerate damaged tissues in vitro, with the goal of using the methods in clinical applications. "The stem cells and progenitor cells I start with are very naive. The challenge is to get them to differentiate into the particular cells that we need so that we can transplant into a patient," he says. Gonzalez-Fernandez engineers materials that instruct cells to achieve therapeutic goals. "The people that we want to help are patients who are suffering from diseases like arthritis or diabetes. They have bone fractures or cartilage defects, or skin ulcers that don't heal," he says. "So, I'm very interested in why that is, and in how to use those lessons to engineer material-based strategies for people who are suffering from those conditions"

To achieve that Gonzalez-Fernandez is forging partnerships with researchers at Lehigh's College of Health, as well as area medical centers. It's an approach that he applies to his teaching as well. "What is beautiful about our field is that we have to be experts in many things," says Gonzalez-Fernandez. "You need to know about material mechanics, chemistry, physiology, and you need to be in contact with clinicians to fully understand their needs. I want students to understand that you cannot just explore one thing or one area, and you have to engage with professionals who have different expertise."

Gonzalez-Fernandez also sees opportunities to work with population health experts at Lehigh to maximize healthcare resources. "What diseases have the most patients, and what diseases put the most burden on healthcare systems? I think identifying things like that is part of what we should be working on."

Unsurprisingly, Gonzalez-Fernandez has been taking some time to visit the many cultural institutions in nearby Philadelphia and New York City. "I love going to museums, like the Metropolitan Museum of Art, and trying out new restaurants," he says. "I grew up in a big city, and like the feeling of being surrounded by people."

But he's also enjoying life on campus, and the bucolic environs of the Lehigh Valley. "You really feel like in you're in a community here in Bethlehem, and the region has its own flavor."

MUSSEL MAN

THRIVING IN A CULTURE OF INTERDISCIPLINARY RESEARCH

BY: CHRIS QUIRK

Niels Holten-Andersen, newly arrived associate professor of bioengineering and materials science, was delighted with the—also new—Health, Science and Technology building he was assigned to. "It's not just because it's a pristine and appealing building, but because of the vision," he says. "It's in the heart of the campus, and first and foremost it feels like an open floor plan. The labs have transparent walls, and each PI has dedicated lab space, but you can see into other labs."

Holten-Andersen feels that the layout and design of the new HST building will promote collegiality, and the cross-pollination of ideas. "I'm excited about it. If you plant some seeds on a human level, not just on a scientific level, there will be good chemistry. That comes from people being in the space, and from trust that comes from working together and sharing ideas. I am looking forward to being part of a shared culture of discovery."

Holten-Andersen thrives on what he calls the culture of interdisciplinary research, and in his work, he explores the possibilities of using bio-inspired materials to find ways to take on energy, health and other challenges. After digging into molecular and cell biology, microbial genetics, and biomaterials, his recent focus has been creating visco-elastic materials, and tuning their viscosities and mechanical properties by adding different metallic ions into the mix. His work was inspired by his research on mussels. "Metal coordination chemistry is not new, but what we have discovered is that mussels infuse their holdfast fibers with certain metal ions, which give them more solid or liquid-like properties, depending on what you use," he says.

The method makes it possible to generate quite different materials in a relatively straightforward fashion. "Whether you want a kind of sticky material that dissipates a lot of energy, like honey, a very stiff gel, or something with strong bonding qualities, you can mix metal ions in at particular ratios to achieve that," explains Holten-Andersen. "It's very powerful from a mechanical engineering standpoint."

Recently, Holten-Andersen has been experimenting with the elements in the lanthanide series, which can bestow optical and fluorescent properties to his materials. "If coordinated correctly, you will get emissions of different wavelengths depending on energy levels," he says. One possible use would be for responsive materials applied as exterior coatings that would emit different colors based on their state, with the added benefit that many of the chemistries involved are soluble in water. "Because they can function in aqueous environment, there could be biomedical or environmental applications for sensing pH, temperature or salinity, for example."

In his next endeavor, Holten-Andersen is taking on hard matter, and how biology produces durable materials. "If you look at how teeth grow, they start with a soft hydrogel, and then get loaded with inorganic particles. Somehow biology builds these protein scaffolds, a 3D template that has a spatial code that is ideal for mineralization," he explains. Holten-Andersen is investigating possibilities for substituting the calcium-based substances that typically mineralize hardened materials in nature, with various metal oxides. "Building these hardened and bio-inspired materials, with properties that are responsive to stimuli, could open the door to all kinds of fresh and interesting applications."

A COMMON GOAL: INCLUSIVE GROWTH OF LEHIGH BIOE

BY: CHRIS QUIRK

Kyani Jemmotte

In response to the need for greater equality in technological fields, the Department of Bioengineering has established a Diversity, Equity, and Inclusion (DEI) committee and tactical plan to ensure the department keeps moving forward on these important issues.

"We formed the Bioengineering DEI task force to implement a blueprint for growing our departmental efforts in fostering a welcoming and inclusive environment," said Anand Ramamurthi, Peter C. Rossin Endowed Professor and chair of the Department of Bioengineering. "It is vital that we ensure that all of our students, staff, and faculty are provided equitable opportunities to be vested in our educational mission and to derive benefit for their professional and personal growth."

The committee is comprised of students, faculty and administrative representatives, and is empowered to take concrete actions to meet the department's goals. "Our effort as a committee is to create an environment that is not only diverse, but welcoming to all students of different backgrounds," says Kyani Jemmotte, a junior in bioengineering and the undergraduate student representative on the council. "My responsibility is to ensure that whatever changes we implement will make a positive impact on the students of color on campus."

Committee member Tomas Gonzalez-Fernandez, assistant professor of bioengineering, agrees. "I'm interested in making things happen," he says. "Let's identify what will have an impact, create deliverables, and make sure we do them."

"The human sense of belonging, regardless of who we are or where we come from, is hugely important," says Niels Holten-Andersen, an associate professor of bioengineering who is also on the committee. "I think accountability, honesty and transparency on these matters is vital."

View the Department's current Diversity, Equity & Inclusion Tactical Plan at ***https://engineering.lehigh.edu/bioe/about/dei*** and look for updates on our planned deliverables for the 2022-23 academic year.

BIOE GRADUATE RESEARCH:
WHERE ENGINEERING INNOVATION IMPACTS HEALTH

Suraj Bastola

Md. Joynal Abedin (Faruky)

Caroline Ferguson

Natasha Hunt

FORGING A NON-INVASIVE PATH FOR REGENERATIVE REPAIR OF ABDOMINAL AORTIC ANEURYSMS

Suraj Bastola - BioE Doctoral Student

An abdominal aortic aneurysm (AAA) is a rupture-prone enlargement of the aorta that occurs due to chronic proteolytic degradation of the elastic matrix of the medial layer. Rupture of this enlarged area is nearly always fatal (>90% mortality rate in case of rupture). In the ***Ramamurthi Lab***, we are developing a novel, regenerative, nanotherapeutic platform to alleviate the naturally irreversible breakdown of structural elastic matrix in AAAs. The results are promising for our planned development of minimally-invasive, polymer-based nanotherapeutics incorporating sodium nitroprusside release for onsite regenerative repair of the AAA wall in-vivo. The proposed approach has the potential to slow or arrest AAA growth to the rupture stage, thus decreasing the need for risky surgery.

BUILDING A BETTER MODEL FOR GLIOBLASTOMA

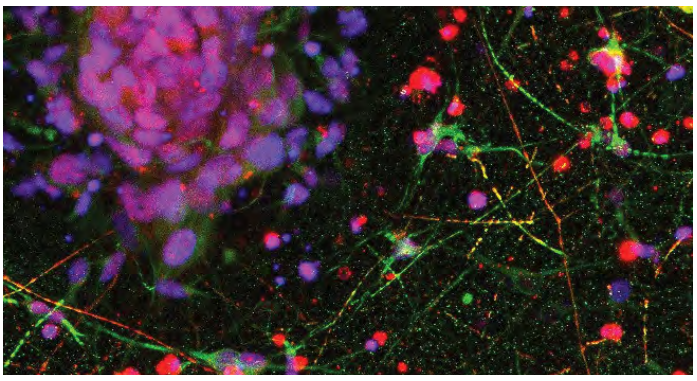
Md. Joynal Abedin (Faruky) - BioE Doctoral Student

The most malignant tumor of the central nervous system is glioblastoma (GBM). These tumors diffusely invade the brain, making resection surgery fruitless, and the prognosis very poor, with a median survival time of 15 months. Most current in-vitro models have limitations, and better models are necessary to translate GBM research to clinical applications. In the ***Berdichevsky Lab***, we've developed a novel, physiologically-relevant, in vitro model that mimics GBM invasion and GBM-associated modulation of neural activity. In this multicellular model, 3D, matrix-embedded GBM spheroids are generated from patient-derived GBM cells and primary rat brain host cells. The generation of this improved, functional, multicellular spheroid model for GBM offers the potential for new avenues of research on this aggressive form of cancer.

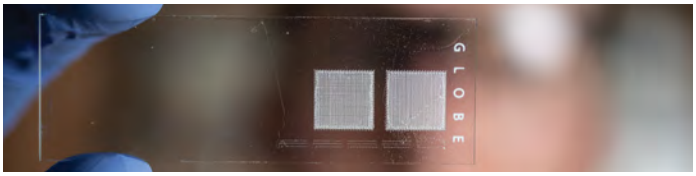
TACKLING DIFFICULT DIAGNOSTIC PROBLEMS

Caroline Ferguson - BioE Doctoral Student

Diagnostic technology traditionally relies on known thresholds of change - for example, a concentration of bound antibodies to darken a test line on COVID-19 tests. Incorporation of electrical sensing into diagnostic technology has the benefits of rapid analysis, large dataset collection, and applicability in a range of environments. In the ***Cheng Lab***, I leverage microfluidics, electrical sensing, and machine learning to address ambiguous thresholds. Using impedance spectra with hundreds of measurements, I go beyond traditional statistics, using machine learning to identify distinguishing features and develop predictive models that link cells to model disease classes. Current applications evaluate the detection of larger nuclei in cancer models and mitochondrial changes in chronic fatigue syndrome models. Combining system development and analysis to detect differences in subtly changing populations can help us tackle difficult diagnostic problems more effectively.



Abedin glioblastoma organoid



The "GOLDILOCKS" RATE OF SCAFFOLD DEGRADATION

Natasha Hunt - BioE Masters Student

Osteoarthritis and significant injuries to the bone/osteochondral interface often require invasive grafting procedures. With complicating issues such as donor site morbidity, supply, disease transmission, and mismatched geometries, synthetic degradable polymers are an attractive alternative. The ***Chow Lab*** utilizes modular, biodegradable polymers that can be 3D printed into implantable scaffolds for osteochondral tissue regeneration. I am enhancing the polymer platform by creating scaffold materials with linked, protease-sensitive peptides, designed to more efficiently degrade via cellular processes occurring in the regenerating tissue. Harnessing the same cellular proteases to make room in the extracellular matrix for the growing tissue and to simultaneously degrade the scaffold at the just-right, "Goldilocks" rate will be a major advance in scaffold design for regenerative tissue engineering.

THE LEHIGH BIOENGINEERING MS DEGREE: IT'S RIGHT FOR YOU!

Lehigh's Master of Science program in Bioengineering will provide you the skillsets to pursue promising careers in challenging industry sectors where you can make an impact! Students in the 30-credit degree program can focus their studies in one of three concentrations: **(1) Biomaterials**, for students interested in biological and biomimetic materials, as well as their characteristics and applications in tissue engineering & regenerative medicine, nanomedicine and drug delivery; **(2) Bioengineering Product Development**, for students interested in the design, development, regulation, and/or commercialization of medical products, including pharmaceuticals and medical devices; or **(3) Biocomputations and Biomedical Analytics,** for students interested in the rapidly growing field of computational data sciences, as applied to biotechnology, biological systems, and biopharmaceutical development. Alternately, students also may pursue a more generalized Master of Science in Bioengineering, with individualized curricular guidance. Based on your future career goals, interests, and time commitment, you can pursue a 12 month, coursework-only or research project option, or a longer research thesis-requiring degree. Whatever your goals, we will help you build a personalized curriculum that is right for you!

MASTER OF SCIENCE PROGRAMS IN BIOENGINEERING

CAREER-FOCUSED
Gain a competitive edge in biomedical industry sectors

- Robust Technical Curriculum
- Real-World Experiences
- Professional Development & Networking Opportunities
- Enhanced Career Preparedness

INTERDISCIPLINARY
Learn and work at the intersection of disciplines

- Cross-Disciplinary Career Skills
- Certificate Programs in Technical Entrepreneurship, Data Science and More
- Immersive & Collaborative Projects/ Research

PERSONALIZED
Build a program that works for you

- Full- or Part-Time Study
- In-Person and Hybrid Learnings
- Thesis/Project/Coursework Options
- Flexible Curriculum & Individualized Advising

RESOURCE-RICH
Chart your future with Lehigh's many assets

- World Class Faculty
- State of the Art Facilities & Collaborative Resources
- Baker Institute for Entrepreneurship, Creativity & Innovation.
- 85,000-Strong Lehigh Alumni Network

VALUE-ADDED
Invest in your future & achieve your goals

- In-Depth Technical Knowledge
- Expanded Career Options
- Increased Leadership, Management & Earning Power Opportunities
- High Return on Investment

2022 FUNDING AWARDS

Professor **ANAND JAGOTA** (BioE/ChBE) is the principal investigator on a multidisciplinary proposal that was recently funded by NSF. Jagota is joined by Lehigh colleagues and Co-PIs, Profs. Matthias Falk (BioS), **XUANHONG CHENG** (BioE/MSE), Paolo Bocchini (CEE), and Jessecae Marsh (Psych; HMS) receiving a nearly $1million, 18-month, PIPP Phase I grant titled "*Dynamics of Pandemic Spread and Prevention in Indigenous Communities*."

Professor **TOMMY PASHUCK** (BioE) was awarded nearly $609K in funding for two grants, one from the National Institutes of Health (NIH) and the second from the National Science Foundation (NSF). The 3-year NIH award, "*Designing Technologies to Visualize Protease Activity in Cancer Models*," is focused on improving understanding of cancer progression and treatments. The 3-year NSF grant, "*Controlling Non-Specific Peptide Degradation in Hydrogels*" focuses on providing a better understanding of how cells degrade biomaterials in order to improve model tissue systems and regenerative therapies.

Professor **YALING LIU** (BioE/MEM) was awarded a $434K NIH 3 year grant titled "*An Affordable and Versatile Two-Dimensional Cell Isolation and Tracking Platform Based on Image Machine Learning and Maskless Photolithography Single Cell Encapsulation*"

Professor **LESLEY CHOW** (BioE/MSE) received the 2022 3M Non-Tenured Faculty Award along with $15Kto support her research developing polymeric biomaterials with tunable biochemical and physical properties. Recipients of this award are nominated by 3M researchers and selected for their outstanding research and leadership.

Professor **YU ZHANG** (BioE) received a nearly $150K, 3 year grant from the Alzheimer's Association titled "*Identifying Neural Circuits Vulnerable During Alzheimer's Progression*"

Professors **TOMMY PASHUCK** (BioE) and **LESLEY CHOW** (BioE/MSE) received a $60K 1 year Collaborative Research Opportunity (CORE) grant from Lehigh to support their collaboration with researchers from Johns Hopkins University to developing 'smart' scaffolds for craniofacial regeneration.

Professor **LESLEY CHOW** (BioE/MSE) received a $359K, 2 year NIH grant titled, "*Engineering Spatiotemporal Osteochondral Tissue Formation with Tunable 3D-Printed Scaffolds*" in collaboration with Dr. Gregory Carolan (Department of Orthopedic Surgery, St. Luke's University Health Network). This funding supports the development of 3D-printed scaffolds functionalized with biomimetic peptides to direct native-like osteochondral tissue regeneration.

Professor **YALING LIU** (BioE/MEM) received a 3 year grant for nearly $1.5M from NSF titled, "*Development of Heterogeneous Edge Computing Platform for Real-Time Scientific Machine Learning*."

2022 PUBLICATION SPOTLIGHT

Lehigh Bioengineering faculty members, post-docs and students co-authored more than **50** publications that were accepted for print in the last year. Some of the notable ones are listed below. (Names in **BOLD** are current Lehigh BioE faculty or current/former Lehigh BioE students)

BERDICHEVSKY, Y. 2022 Neuron-neuron Attraction Shapes Morphology and Activity of Tissue Engineered Brain Constructs *Neural Regeneration Research* **17** (12), 2655

CHANDRASEKAR, S., Kuipa, S., Vargas, A., Ignatova, T., Rotkin, SV., **JEDLICKA, S**. 2022 Cell Cycle-dependent Endocytosis of DNA-wrapped Single-Walled Carbon Nanotubes by Neural Progenitor Cells. *Biophysical Reports* **2**

DAHAL, S., **DAYAL, S.**, Androjna, C., Peterson, J., **RAMAMURTHI, A**. 2022 Adult Mesenchymal Stem Cells and Derivatives in Improved Elastin Homeostasis in a Rat Model of Abdominal Aortic Aneurysms. *Stem Cells Translational Medicine*, **11**

GONZALEZ-FERNANDEZ, T., Tenorio, A., Saiz, A., Leach J. 2022 Engineered Cell-Secreted Extracellular Matrix Modulates Cell Spheroid Mechanosensing and Amplifies Their Response to Inductive Cues for the Formation of Mineralized Tissues. *Advanced Healthcare Materials* **11**

MCMILLAN, K., **CORR, S.**, Manko, K., **FERYO, M.**, **SHAH, N.**, **CAFFREY, R.**, **HERZ L**. 2022 Acceptability of Nutritious Children's Foods in Development for Markets in Sierra Leone *African Journal of Food, Agriculture, Nutrition, and Development*, (in press)

Kim, M., Chen, C., Wang, P., Mulvey, J., Yang, Y., Wun, C., Antman-Passig,M., Luo, H., Cho, S., Long-Roche, K., Ramanathan, L., **JAGOTA, A.**, Zheng, M., Wang, Y., Heller, D. 2022 Detection of Ovarian Cancer via the Spectral Fingerprinting of Quantum-defect-modified Carbon Nanotubes in Serum by Machine Learning. *Nature Biomedical Engineering* **6**

LEVIN, M., Spiro, R., Jain, H., Falk, M., 2022 Effects of Titanium Implant Surface Topology on Bone Cell Attachment and Proliferation in vitro. *Dovepress: Medical Devices and Research* **15**

LIU, Y., Li, S., **LIU, Y.** 2022 Machine Learning-Driven Multiobjective Optimization: An Opportunity of Microfluidic Platforms Applied in Cancer Research. *Cells* **11**

Loureiro, J., Miguel, S.P., **SEABRA, I.J.**, Ribeiro, M.P., Coutinho, P. 2022 Single-step Self Assembly of Zein-Honey-Chitosan Nanoparticles for Hydrophilic Drug Incorporation by Flash Nanoprecipitation. *Pharmaceutics* **14** (5)

RIVERA GONZALEZ, X., **YAZDANPARAST TAFTI, S.**, Dragovich, M., **ZHANG, X**. 2022 Biophysical Properties of Endothelial Mechanotransduction Mediated by Glycocalyx. *The FASEB Journal* **36**

THAMPI, S., **DAHAL, S.**, **BASTOLA, S.**, **DAYAL, S.**, **YAU, J.**, **RAMAMURTHI, A.** 2022 Stem Cell Based Approaches to Modulate the Matrix Milieu in Vascular Disorders. *Frontiers in Cardiovascular Medicine* **1499**

Wang, Y., Nguyen, K., **ISMAIL, E.**, Donoghue, L., Giridharan, G., Sthu, P., **CHENG, X.** 2022 Effect of Pulsatility on Shear-induced Extensional Behavior of Von Willebrand Factor, *Artificial Organs* **46** (5)

WU, Y., **ZHOU, Y.**, **LIU, Y.** 2022 An Adaptable Vessel-on-a-Chip Platform for Investigating Metastatic Transport in Bloodstream. *Analytical Chemistry* (in press)

Wu, H., Khripin, C., **JAGOTA, A.**, Hui, C.Y. 2022 Enhancement of Hydrodynamic Friction by Periodic Variation of Contact Stiffness *Extreme Mechanics Letters* **54**

YAZDANPARAST TAFTI, S., **RIVERA GONZALEZ, X.**, **ZHANG, X.** 2022 Effects of Viral Infection on Endothelial Activation and Barrier Function. *The FASEB Journal* **36**

ZHAO, K., **DUKA, B.**, Xie, H., Oathes, D.J., Calhoun, V., **ZHANG, Y.** 2022 A Dynamic Graph Convolutional Neural Network Framework Reveals New Insights into Connectome Dysfunctions in ADHD. *NeuroImage* **246**

WE'D LOVE TO HEAR MORE FROM YOU!

Send your news to inbioe@lehigh.edu, or visit our home page, lehigh.edu/bioe and scroll down to our news update link!

FACULTY

NOTABLES AND MEDIA MENTIONS

ANAND JAGOTA, professor of bioengineering and chemical and biomolecular engineering, has been named Lehigh's Vice Provost for Research. Jagota's research interests span multiple disciplines and are focused on biomaterials, interfacial mechanical properties of soft materials, biomechanics, and nanobiotechnology. He has authored three book chapters and more than 150 refereed journal articles. One recent project, a collaboration between Jagota and researchers at Lehigh, Memorial Sloan Kettering Cancer Center, Weill Cornell Medicine, the University of Maryland, and the National Institute of Standards and Technology, explores a new approach to detecting ovarian cancer. Other projects have included exploration of the biomechanics of Ebola virus attachment to host cells and new mechanisms to improve the effectiveness of vehicle tires. Jagota has also collaborated with a team of researchers to create a reversible superglue-like material inspired by snail mucus. His work has been funded by the National Science Foundation (NSF), the National Institutes of Health (NIH) and the U.S. Department of Energy (DOE).

Six BioE faculty and staff members were among those recognized at the Rossin College's annual awards ceremony. Garnering six of the fourteen awards were Prof. **XUANHONG CHENG** (BioE/MSE) – *Experiential Learning Excellence*, Professor **LESLEY CHOW** (BioE/MSE) – *Interdisciplinary Research Excellence*, Prof **ANAND JAGOTA** (BioE/ChBE) – *Interdisciplinary Research Excellence*, Prof **INES SEABRA** (BioE) – *Richard P. Vinci Award for Educational Excellence*, **GWEN HUGHES** – *Excellence in Graduate Student Support*, and **WILL XIA** – *Experiential Learning Excellence*.

LESLEY CHOW (BioE/MSE) was awarded tenure and promoted to Associate Professor by Lehigh's Board of Trustees. Chow also was named a 2022 PMSE Young Investigator Awardee by the American Chemical Society Division of Polymeric Materials: Science and Engineering.

GRADUATE

GRADUATE STUDENT NEWS

Congratulations to **SWETHA CHANDRASEKAR** and **PAULA CAMACHO SIERRA** for | successfully defending their doctoral dissertations and to our Master of Science degree recipients: **SAM SHOWMAN**, **SUSAN WESTMAN, XAY RIVERA-GONZALEZ**, **OLIVIA POSADAS** and **RACHEL ZALE**.

Doctoral student **PRANEETHA PULYALA** (Cheng Lab) spent the summer as a Drug Product Development intern at Janssen Pharmaceuticals. At Janssen, Pulyala worked on implementing Process Analytical Techniques (PAT) to improve the manufacturing process of biologics/large molecules. **XINYU CUI**, a PhD student in Anand Jagota's research group, also participated in an in-field internship at Raven Biomaterials, where he worked as a Cell Therapy Scientist. Both students noted the great practical training they received during the internship experience.

CAROLINE FERGUSON, a doctoral student in the Cheng lab, was awarded the 2022 Lehigh Graduate Student Champion Award and also received Honorable Mention for Graduate Life Leadership.

Bioengineering doctoral students **XINYU CUI**, **LUKE WANG** and **MATTHEW ZIARNIK** joined Prof. Anand Jagota at the DaVinci Science Center in Allentown, recently, where they engaged future STEM students at their "Inquiry Island" with hands on activities such as "build a virus."

ALUMNI

ALUMNI UPDATES

GIANNA JARRAH BS '22 (BioE), launched With *Meraki Co.* As Founder and CEO of the new venture, Jarrah was a recent Grand Prize Winner in the EUREKA! Grand Prize Competition, sponsored by Lehigh's Baker Institute for Entrepreneurship, Creativity & Innovation, and also participated in the Baker Institute's Boost Venture Program.

ELLE SANDERS BS '14 (BioE) is the Co-Founder and CEO of Lifelet Medical, a company developing a novel biomimetic leaflet material for heart valve replacements.

ALYSSA (WARRICK) GLOVER BS '14 (BioE) is a Senior Quality Operations Specialist at Regenxbio, a clinical stage biotechnology company developing gene therapy product candidates for the treatment of retinal, metabolic, and neurodegenerative diseases

BRYAN POSTELNEK BS'12 (BioE), **'13 MEng** (T.E) was promoted to Group Product Manager at Procurated.

JOSEPH MCLAUGHLIN BS '09 (BioE), Director of Data, Analytics & Automation at Regeneron, shared professional insight as the keynote speaker for the inaugural Bioengineering Research Day, an event promoting connection to industry and highlighting graduate research. Joe was joined by seven industry panelists, including **THERESE QUINN BS '10** (BioE), a Sr. Director of Biological Manufacturing and Clinical Supply Management at Inovio Pharmaceuticals and **STEVEN (MING-TZO) WEI PHD '14** (BioE), Manager of the Cell Therapy Process Development Team at Bristol-Myers Squibb. A Hearty thanks to all who participated.

WE'D LOVE TO HEAR MORE FROM YOU!

Send your news to inbioe@lehigh.edu, or visit our home page, lehigh.edu/bioe and scroll down to our news update link!

UNDERGRADUATE

STUDENT SUCCESS

Congratulations to **ISABELLA FEDERICO '24** for being awarded the Clare Boothe Luce Undergraduate Research Award, offered on behalf of the Henry Luce Foundation and RCEAS. The Clare Boothe Luce Program supports women seeking to study or teach science, engineering, and mathematics. It is awarded to those with excellence and motivation in academics and research during their undergraduate studies.

Rossin College BioE major, **LINXI (POPLAR) YANG '22** took top honors at the David and Lorraine Freed Undergraduate Research Symposium on April 6 in Lehigh's STEPS building. Yang presented her research on "Machine Learning Cell Type Classification for Cancer Diagnosis" to a panel of distinguished judges to earn a $2,000 conference travel scholarship. BioE major **ANNA EDMUNDSON '23** was awarded Honorable Mention.

Congratulations to the new Bioengineering Rossin Junior Fellows (RJFs): **KAMRYN LI '24**, **ISABELLA FEDERICO '24**, and **ANDRINE LARSON '24**. They join **SYDNEY WATERMAN '23**, **ANNA EDMUNDSON '23**, and **STEPHEN GEE (BIOCOMPE) '23** to round out the 2022-2023 group of Bioengineering RJFs. The RJFs are a prestigious group of students who serve as important ambassadors and student mentors of the Rossin College of Engineering

Several BioE undergrad students were among those recognized individually or collectively during 2022 Student Life Leadership Awards ceremony::

- **James J Duane Student Life Leadership Award** - **TIFFANY PANG '22** - for recognition of her leadership ability, exemplary moral character and dedication to improving campus life through collaboration with faculty, administration and student organizations
- **Student Club/Organization of the Year Award** - awarded to groups that have been most active on campus and pursued their overall purpose to the highest degree.
  - *Lehigh University Emergency Medical Services (LUEMS)* - **PETER JENSEN '22** Crew Chief/EMT), **SUSAN WESTMAN '21**, **MS '22** (Crew Chief/EMT), **MAIA CLAYTON '23** (Crew Chief/AEMT)
  - *Peer Health Advisors* - **SARINA SHAH '22**, **ISABELLA FEDERICO '24**, **SONIA TRINKLE '25**

The 2022 Lehigh Summer Research EXPO capped 10-weeks of summer undergraduate research through several Lehigh programs. Among the BioE undergraduate presenters were **JAILENE GARCIA '23** (First place team project: *Food Carbon and Water Footprint*), **MIA STEVENS '23** (2nd place team project: *Biomarkers for Traumatic Brain Injury*), **SOFIA RUIZ '25**, and student team members from the *Food Product to Fight Malnutrition and Stunting* project, advised by Prof. Lori Herz, and *Sickle Cell Anemia Diagnostic Device* project, advised by Prof. Xuanhong Cheng.

Several BioE Global Social Impact Fellows traveled internationally to address sustainable development challenges. **EMMA BURKE '22** worked on-site in the Philippines with the Plastech Ventures team to implement a solution for recycling plastic into high value construction material; travelers to Sierra Leone included **KAMRYN LI '24,** (*Food Product to Fight Malnutrition and Stunting*), **ANJALI SHAH '24** and **KATHLEEN GIFFORD '24** (*Sickle Cell Anemia Diagnostic Device*) and, **GRACE DUKE '25** (*Ukweli Test Strips for Maternal Health*).

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INTERESTED IN SUPPORTING UNDERGRADUATE RESEARCH?

At gocampaign.Lehigh.Edu click on give now — Under Areas of Support, add* BIOENGINEERING *in the comments box

BIOENGINEERING RESEARCH
AT LEHIGH UNIVERSITY

Names in **BOLD** are Lehigh BioE core faculty

BIOCOMPUTATIONS AND MODELING

Biomolecular Modeling
Bioinformatics
Bioengineering Systems & Controls
Biophysics
Modeling of Biological Systems
Computational Bioengineering
Data Analytics
Biomedical Image Analysis

Y. BERDICHEVSKY, B. Chen, H. Dailey, **J. HSU, A. JAGOTA,** M. Kotare, **Y. LIU,** D. Lopresti, **D. OU-YANG,** D. Vavylonis, A. Voloshin, **Y. ZHANG**, **W. IM**.

DIAGNOSTICS, SENSORS AND DEVICES

Biomedical Imaging
Biophotonics
BioMEMS
Biosensors
Microfluidics
Bioelectronics
Medical Devices

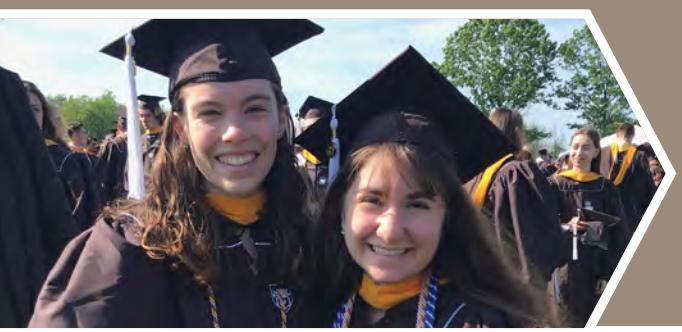
Y. BERDICHEVSKY, D. Brown, **X. CHENG**, H. Dailey, J. Hwang, **Y. LIU**, D. Lopresti, **D. OU-YANG**, **S. TATIC-LUCIC**, D. Vavylonis, **Y. ZHANG**

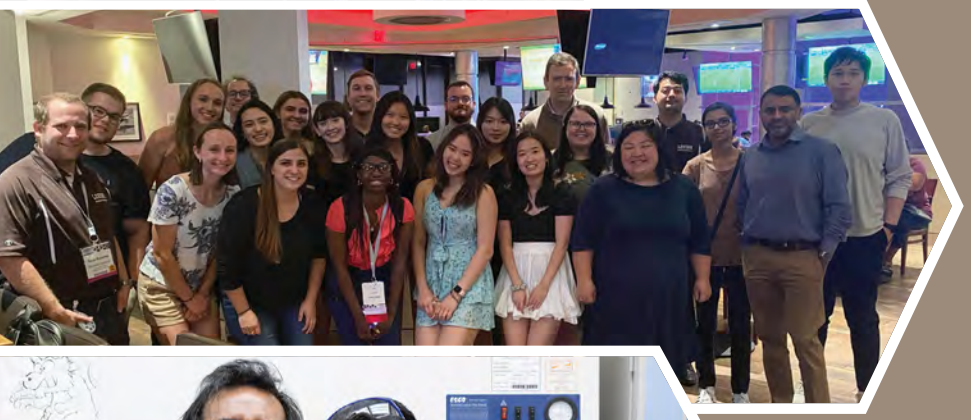
MATERIALS AND THERAPIES

Biomaterials
Molecular Bioengineering
Biopharmaceutical Engineering
Tissue Engineering & Regenerative Medicine
Nanotechnology & Nanomedicine
Biofluid & Solid Mechanics
Biomolecular & Cellular Mechanics
Environmental Bioengineering

Y. BERDICHEVSKY, A. Brown, D. Brown, **X. CHENG**, **L. CHOW**, H. Dailey, M. Falk, **T. GONZALEZ-FERNANDEZ** , **N. HOLTEN-ANDERSEN, J. HSU**, **A. JAGOTA**, **S. JEDLICKA**, H. Jain, **Y. LIU**, **D. OU-YANG**, **T. PASHUCK**, **A. RAMAMURTHI**, **I. SEABRA**, K. Shultz, **S. TATIC-LUCIC**, D. Thevenin, A. Voloshin

Department members missing from the picture: Yevgeny Berdichevsky, Steve DeWeerth, Tomas Gonzalez-Fernandez, Niels Holten-Andersen, Jim Hsu, Anand Jagota, Sabrina Jedlicka, Svetlana Tatic-Lucic and Will Xia.





Department at a glance:

19
CORE FACULTY MEMBERS

13
ASSOCIATED FACULTY MEMBERS

4
POST-DOCTORAL SCIENTISTS

4
TECHNICAL & ADMINISTRATIVE STAFF

31
PHD LEVEL GRADUATE STUDENTS

12
MS LEVEL GRADUATE STUDENTS

150
UNDERGRADUATE MAJORS IN 2 MAJORS:
(Bioengineering and Biocomputational Engineering)

Photos courtesy of Douglas Benedict/Academic Image & Ryan Hulvat/Meris