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

FALL 2024 Newsletter






—FEATURED ARTICLE: PAGE 5—

AN INDUSTRY-CENTRIC APPROACH TO GRADUATE EDUCATION

Lehigh Bioengineering through the years

LAUNCHED UNDERGRADUATE PROGRAM

2002

GRANTED FIRST BACHELOR'S DEGREES

2006

LAUNCHED GRADUATE PROGRAM

2010

GRANTED FIRST MASTER'S DEGREES

2011

GRANTED FIRST DOCTORAL DEGREES

2014

CONVERSION TO DEPARTMENT OF BIOENGINEERING

2017

ANAND RAMAMURTHI APPOINTED AS DEPARTMENT CHAIR

2020

HEALTH, SCIENCE & TECHNOLOGY RESEARCH HUB OPENS

2022

BIOE LAUNCHES PARTNERSHIPS WITH INDIAN UNIVERSITIES

2024

DEPARTMENT WELCOME

Welcome to Bioengineering at Lehigh! It's my pleasure to present our Fall 2024 departmental newsletter. The past year has been one of growth and innovation as we continue advancing bioengineering education and research.

This issue focuses on the essential connection between industry and graduate education, showcasing how we are preparing our students for impactful careers. Industry-centric training has become a key focus in our department, and we're rather proud to highlight our ongoing collaboration with alumni and industry leaders to further our education and training mission and prepare our graduates for success in industry. Through initiatives like the MS Product Development track and cross-disciplinary efforts with Mechanical Engineering, we're equipping students with the skills to address real-world challenges.

This year, we are very excited to welcome new members to the Lehigh Bioengineering family; Dr. Taneka Jones, an expert in uterine tissue engineering, joins our research faculty, contributing to our growing focus on women's health. Dr. Bonaire Berry, a Lehigh alumna with extensive experience in the medical device industry, and Dr. Janice Phillips, our former external advisory council member, and renowned industry expert in biotech process development and manufacturing technologies, join us as adjunct faculty. Also listed in this issue are our new postdoctoral researchers, who critically contribute to further expanding our research initiatives.

This newsletter edition showcases groundbreaking research in women's health, one of our emerging themes. We spotlight Dr. Taneka Jones' work in uterine tissue engineering and my own research on nanomedicine, focusing on estrogen priming of stem cell vesicles for aneurysm repair. The latter project is led by a stellar 2nd year doctoral student, Ali Mutah, a proud recipient of support through the American Heart Association Diversity in Science Award. These projects reflect our commitment to addressing critical health challenges through innovative bioengineering solutions and addressing sex-disparities in research and medicine.

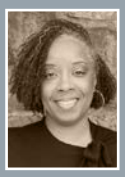
Our graduate students are also making impressive strides. You'll read about Colin Herna's work in biocomputations and health data analytics, Christie Ortega's research in biomaterials, and Anthony Cino's innovations in diagnostics and devices. Their contributions underscore the diversity of emerging technologies being explored within our department.

We continue to strengthen our international partnerships, bringing our first cohort of masters students and our second cohort of undergraduate researchers from SRM, while forging a new engagement with VIT Bhopal; likewise, we have many other student and faculty successes to report that have become synonymous with Lehigh Bioengineering publications, grant awards, recognitions and student and alumni achievements! We are so very proud of our faculty, students, and our broader bioengineering community for their dedication and achievements. Thank you for your continued support, and we look forward to sharing more of our journey with you. Drop a line and engage!

ANAND RAMAMURTHI, PHD, FAHA
PETER C ROSSIN PROFESSOR AND DEPARTMENT CHAIR

Welcome

NEW BIOENGINEERING FACULTY & STAFF



Taneka Jones
Joined Lehigh's Department of Bioengineering in January 2024 as a Research Assistant Professor. She received her PhD in Bioengineering & Biomedical Engineering from the University of Illinois Chicago.

Bonaire Berry
A 2018 Lehigh BioE undergraduate alumna, Berry joined the department as an adjunct instructor this fall. She received her doctorate in Engineering Management from George Washington University and is a senior R&D engineer at Medtronic.

Reshma Siddiquie
Received a PhD in MechE from Indian Institute of Technology, Bombay and is now working as a postdoc in the Jagota lab.

Xiaojia (Cindy) Jin
Joined the Jagota lab as a postdoctoral fellow after receiving a PhD in ChemE from Massachusetts Institute of Technology (MIT).

Janice Phillips
Recently finished her term as a member of the Lehigh BioE advisory council and continues to have an impact as an adjunct instructor of Bioengineering, sharing her expertise as a leader in biotech process development.

BIOE GRADUATE RESEARCH

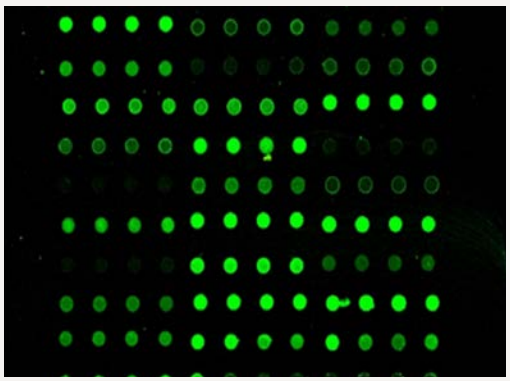
WHERE ENGINEERING INNOVATION IMPACTS HEALTH

EXPLORING THE INTERSECTION OF MACHINE LEARNING AND PATIENT CARE

Colin Herna

BioE Doctoral Student

The interface between statistical learning and patient care has become increasingly pronounced over the last decade with the rise of artificial intelligence and machine learning. In the ***Jedlicka Lab***, we focus on this interface as it relates to the clinical potential of bone marrow aspirate concentrate (BMAC), an autologous, bio-injectable substance coveted for its abundance of growth factors, anti-inflammatory substances, and stem cells, in the treatment of cartilage defects and degenerative orthopedic conditions such as osteoarthritis. Using microarray analysis and machine learning, our goal is to characterize patient-derived BMAC samples by building a proteomic database to use in tandem with patient demographic information. This work may guide physicians in navigating available treatment options to optimize patient care.

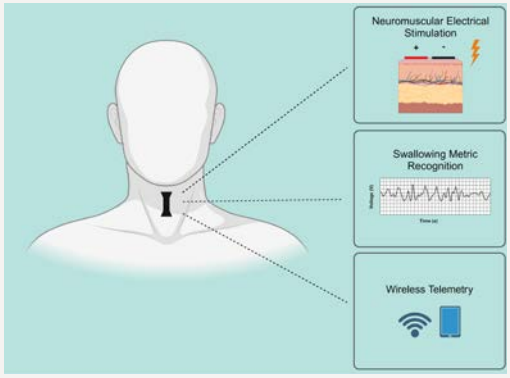


IMPROVING DYSPHAGIA TREATMENT OPTIONS WITH FLEXIBLE ELECTROCEUTICAL ELECTRODES

Anthony Cino

BioE Masters Student

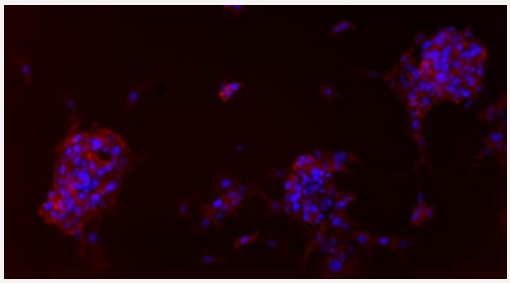
Dysphagia, or difficulty swallowing, has multiple etiologies, including stroke and neuromuscular disorders, among others. Therapeutic methods need to provide rapid treatment, with minimal effort from patients and providers. Neuromuscular electrostimulation (NMES) stands out, as it can promote neuroplasticity and skeletal muscle repair through tetanic muscle contraction. Combining NMES with a biofeedback algorithm to assess swallowing quality can provide necessary assessment of therapeutic efficacy. To optimize technology for improved treatment of dysphagia, in the ***Seshadri Lab***, we are using elastomeric polymers and nanocomposites to develop flexible electrodes with low through-thickness impedance, biocompatibility, and long-term adhesion, to match gold-standard electrode technology performance.



FUNCTIONALIZING SOLVENT-CAST MEMBRANES FOR ARTIFICIAL CORNEAL REPLACEMENT

Christie Ortega

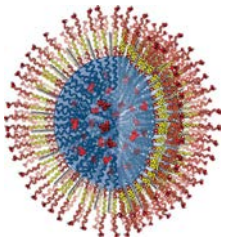
BioE Masters Student



Corneal transplantation from cadaver donors is the primary treatment for corneal blindness caused by injury, infection, or disease. However, less than 2% of the global demand for cornea donor tissue is being met. Corneal allografts can also result in immunological rejection, motivating the need to develop synthetic biomaterial-based corneal replacements. In the ***Chow Lab*** we have developed a cornea-like membrane scaffold composed of synthetic poly(caprolactone) (PCL) and natural chitosan, crosslinked with genipin to enhance mechanical stability. My research is focused on functionalizing the surface of this membrane using poly(ethylene glycol) (PEG)-PCL and RGDS-PCL conjugates to prevent biofouling and enhance cell adhesion, respectively, without compromising mechanical and optical properties. This approach is anticipated to advance the development of biomaterial-based corneal replacements as an alternative treatment for addressing corneal blindness.

GOOD NANOMEDICINE

TRANSFORMING THE TREATMENT OF AORTIC ANEURYSMS



Aortic aneurysms are bulges in the aorta, the largest blood vessel that carries oxygen-rich blood from the heart to bodily organs. Smoking, high blood pressure, diabetes, and injury are risk factors for aneurysms, which most often occur in elderly Caucasian male smokers.

"The blood vessel wall tissues act like rubber bands, with the elastic fibers within allowing them to stretch and snap back," says Professor ***Anand Ramamurthi***, Chair of the Bioengineering Department. "These fibers form in early development and don't regenerate or undergo natural repair after injury in adulthood. When injured or diseased, the aorta wall weakens and bulges, growing to mostly fatal rupture over 7-10 years." During that period, there is no treatment; patients are only screened periodically to monitor the rate of aneurysm growth. Risky surgery is the only treatment for large aneurysms.

Ramamurthi's team is working on minimally invasive approaches to regenerate and repair elastic fibers, in situ, using biodegradable nanobeads, called nanoparticles, designed to release novel, regenerative therapeutics. Their techniques could enable aneurysm treatment soon after diagnosis and potentially slow, reverse, or even stop its growth. Findings in a paper published in the ***Journal of Biomedical Materials Research*** represent a step toward a future where invasive and risky surgery is no longer the only intervention. "We've identified drugs and gene-silencing agents that can coax adult, diseased vascular cells to generate new elastic fibers and inhibit enzymes that break them down," he says. "We are also studying how these nanoparticles can be designed for efficient delivery to the aneurysm wall." This design, called active-targeting, incorporates small protein fragments, or peptides, on the nanoparticle surface that recognize components unique to the aneurysm tissue; when injected into the bloodstream, the nanoparticles stick only to the aneurysm wall, slowly degrade and release the drug.

Senior doctoral student, Jimmy Yau in the Ramamurthi lab also investigates how the nanoparticles penetrate the aneurysm wall to deliver the drug within and has developed a novel model to examine mechanisms of nanoparticle transport in a simulated aneurysm setting: specifically, how nanoparticles of different kinds interact with endothelial cells (ECs) and move through them. Yau found that nanoparticle shape matters - rod-shaped particles, as opposed to spherical particles, were selectively taken up by diseased ECs. "Rod-shaped particles showed very little uptake into healthy ECs versus the spheres, which is good because we don't want them interacting with healthy vessel walls," he says. "The longer and skinnier they were, the less likely they were to remain within the EC layer, which means they transport to the affected tissue underneath for more effective therapy."

The team will now integrate their findings on nanoparticle transport and active-targeting in animal models, with the ultimate goal of developing a nonsurgical, regenerative therapy to slow aneurysm growth. "Reversing aneurysm growth is the preferred, but more ambitious long-term outcome," he says. "We are excited because our findings will help guide nanoparticle design for more efficient delivery to the aneurysm. It's an opportunity to get closer to that reality." They are also working on enhancing repair through a variety of mechanisms, including the use of female hormones such as estradiol. (See inset) — Adapted from ***Resolve*** article by Christine Fennessy.

TACKLING SEX-DISPARITIES IN ANEURYSM TREATMENT

Aortic abdominal aneurysms (AAA) have far lower incidence in females versus males, leading to sex-disparities in research and treatment of this condition. Ali Abba Mutah, a doctoral student in the Ramamurthi lab, is trying to better understand aneurysm disease mechanisms in females and if and how they are regulated by female sex hormones (e.g., estradiol, a form of estrogen). There is evidence that estradiols reduce vascular inflammation and protect against aneurysm growth, possibly explaining why aneurysms in females occur mostly post-menopause.

Mutah, recipient of an American Heart Association Diversity in Science Award, is investigating aneurysm disease mechanisms in females through a stem cell-inspired, regenerative therapy for aneurysm wall repair. Ramamurthi's team previously determined that extracellular vesicle (EV) secretions of stem cells (SCs) enhance elastic matrix regenerative properties of vascular cells. Mutah's work combines the two concepts of EV-stimulated elastic matrix regeneration with vascular-protective effects of female sex hormones in an innovative rat model of aneurysms.

Mutah's approach utilizes nano-sized EVs containing biological factors secreted by adult stem cells primed with estradiol. After injecting the estradiol-primed EVs into the bloodstream to bind and stimulate repair of the elastic fibers, Mutah monitors the effectiveness of aneurysm wall matrix repair.

By regenerating elastic fibers which enable vessels to stretch and recoil, the approach could, for the first time, enable non-surgical reversal of aneurysm growth. Additionally, by delivering EVs for therapy instead of the SCs themselves, patient complications could be reduced.

"The hope is to better address sex-disparities in AAA treatment in the future" says Mutah.

A PASSIONATE MISSION

Dr. Taneka Jones, an emerging leader in the burgeoning field of uterine tissue engineering, is brimming with enthusiasm for her groundbreaking research. Her fervor is fueled by a personal and professional commitment to transforming women's health care, particularly in addressing significant health disparities.

The field of uterine tissue engineering represents a revolutionary frontier in medical science. It aims to create functional uterine tissues that can be used to treat a variety of uterine conditions, including fibroids, endometriosis, and congenital anomalies. For Dr. Jones, a research assistant professor in Bioengineering and a recent arrival at Lehigh, this research is more than a professional endeavor; it is a passionate mission to improve the quality of life for women who face these often-debilitating conditions.

In her research, Dr. Jones and her growing team are developing innovative techniques to engineer uterine tissues that could serve as experimental platforms for other researchers. Their work involves using advanced biomaterials and additive biomanufacturing to create functional uterine structures that can mimic the natural organ's properties. This research is not just about creating new tissues but also about understanding how healthy tissues interact with diseased tissues.

Dr. Jones's journey into uterine tissue engineering began with a deeply personal experience. Recently, she underwent surgery to have uterine fibroids removed—an all-too-common procedure for women suffering from these benign tumors. This experience provided her with a visceral understanding of the challenges and limitations faced by women undergoing similar procedures. This personal connection sparked her drive to explore innovative solutions in the realm of reproductive health.

This research aligns with a broader national focus on women's health. In recent years, there has been a significant increase in attention and funding dedicated to understanding and improving women's health, particularly in areas that have historically been underfunded or overlooked. This shift is part of a larger movement to rectify disparities in research and care, acknowledging that women's health issues often require distinct approaches and solutions.

Jones is particularly thrilled about the collaborative opportunities her research presents. She is actively working with both local clinicians in the Lehigh Valley and leading experts from around the country to push the boundaries of what is possible in uterine tissue engineering. These partnerships are pivotal in translating her lab-based innovations into real-world applications. By collaborating with clinicians who are on the front lines of patient care, Dr.Jones ensures that her research is aligned with the practical needs and challenges faced by women undergoing uterine treatments.

The potential impact of Dr. Jones's research extends far beyond the laboratory. Her work could lead to more effective treatments for a wide range of uterine conditions, ultimately improving outcomes for women nationwide. Moreover, by addressing the disparities in women's health research and ensuring that these new treatments are accessible to all, Dr. Jones hopes to contribute to a more equitable healthcare system and offer new insights into how the "lived experiences" of women suffering from uterine fibroids affect them biologically.

"My passion for advancing this field reflects a broader movement toward improving women's health care," says Jones, "and I'm confident that my collaborative approach will unlock new opportunities for addressing some of the most pressing challenges in reproductive health."

Fibroids surgically extracted from the uterus of Dr. Taneka Jones. The largest fibroid is >7 cm in diameter, comparable to an American baseball.

AN INDUSTRY-CENTRIC APPROACH TO GRADUATE EDUCATION

TRAINING FOR SUCCESS - CHRIS QUIRK

As the path from academia to industry for bioengineering graduates becomes ever more popular, the Lehigh bioengineering department is finding innovative ways to support students on their journey. "Our career-focused curriculum delivered by both our faculty and industry experts, including our own alumni, provides students with technical expertise and real-world experiences, giving them a competitive edge in industry," says ***Anand Ramamurthi***, chair of the Department of Bioengineering at Lehigh.

One example of this is a new course offered this fall. Lehigh BioE alumna, ***Dr. Bonaire Berry***, (BS '18), a senior research and design engineer at Medtronic in Boulder, Colorado, is teaching an overview of the product development process for medical devices. "The goal is to provide an introduction on what new engineers entering the industry can expect," Berry says.

Berry likens the course to reading the full assembly instructions for a piece of furniture before starting, to avoid surprises like leftover parts or hinges mounted backwards—so when students take on product development for the first time on the job, they will already have a familiarity with the process from concept to finished item. "The course introduces students to how things really get done in industry, to the lingo, and to the importance of why we do what we do," she says, "And also, to what, as an engineer, you should be thinking about as you are either designing a new device or making a change to an existing device."

DR. BONAIRE BERRY

Often, Berry explains, the product development process is more about upgrading than inventing a new product from scratch in the lab. "A lot of people, when they think about the medical device industry, they think you're always making new products," she says. "The reality is that with some of these big companies, they already have a lot of amazing products, and there's a huge effort to either improve upon them, or a need to change them for compliance reasons or material reasons, for example."

Berry points out that this kind of revision process is most likely what a new hire at a bioengineering firm would be first tasked with, rather than the wholesale development of a new device. "Oftentimes engineers new to the industry will be working on these small projects where there is, for instance, a color that needs to change on a device, or a material that needs to change, and they will get to own that process and work through it."

"This is just one example of the bioengineering department's focus on pragmatic and diversified career preparation for students", says Ramamurthi. "Another is through the opportunity for student to enroll in closely aligned certificate programs, where they can gain cross-disciplinary skills for success at the intersection of bioengineering and innovation." The career focus, immersive experiences and options afforded mean that the bioengineering graduate program can be optimized for a student's career trajectory. "Flexible and personalized, our programs allow students to tailor their education through a carefully curated set of courses and experiences focused on their preferred career interest areas," Ramamurthi says.

Erwang Li is an example of what is possible in terms of the flexibility of the program and opportunities for immersion. A part-time doctoral student in bioengineering, Li also works full time as an associate director of Biomarker Service at Frontage Laboratories, a pharmaceutical company, and appreciates the opportunity to work while pursuing an advanced degree in bioengineering. As an operations lead on biomarkers, Li does assay development in addition to other responsibilities. "The ***Lehigh bioengineering program*** has greatly increased my critical thinking as well as my research skills, and my academic background helps me quickly extract key information I need from references, which improves my efficiency."

"Lehigh is a resource-rich environment, with world-class faculty and cutting-edge facilities," says Ramamurthi. "These aspects of our program empower our students to excel in their careers." The

bioengineering program at Lehigh has some of the most accomplished faculty in the field, with a focus on the kind of collaboration that opens up new vistas in research and applied applications. The combination of academic rigor and entrepreneurial thinking that are the hallmarks of the department means that students are prepared in substance and approach for groundbreaking work, whether they pursue a path in academia or industry.

Berry's course will also cover how the regulatory process fits into the product development cycle, a topic also included in associated medical device product development courses offered by Lehigh's mechanical engineering department (see inset). "The healthcare industries work very much in tandem with the FDA, and companies have to get many approvals before they release products onto the market," says Praneetha Pulyala, a doctoral candidate who has completed two internships at Johnson & Johnson while pursuing her doctorate. "For students planning to move into an industry position, having knowledge of that regulatory process ahead of time is going to be extremely helpful." ***Read more*** *about Pulyala's graduate internships.*

By the end of the class, Berry believes students will be far more equipped for navigating the business terrain. "If you're able to enter into a product development cycle, and you already at least know the baseline of what you need to do and what needs to happen, you can be so much more effective, efficient, and even confident."

TEAMING UP FOR IMPACT

New 3-course Interdisciplinary Offering on Medical Device Development

To more fully prepare graduates for real world situations they will face in industry, and expand their engineering know-how, the Bioengineering and Mechanical Engineering departments at Lehigh have teamed up to create a set of three courses merging the two disciplines. "The courses walk students through an actual medical device stage gate product development process from concept to product launch, including project approval, surgeon inputs, development, cadaver lab validations, regulatory approvals and product launch. This device experience provides students the background to plug directly into a development team of a fast-paced medical device company," says Greg Kowalczyk (BS '96 MechE), vice president of Patient Specific at Paragon 28.

"We feel strongly that the industry-centric and interdisciplinary approach that Bioengineering is taking with the department of Mechanical Engineering and alumni industry partners, to provide graduate students with courses providing practical experience in the area of medical device development, will position them for career acceleration," says Susan Perry, professor and director of the ***master's programs*** in the Department of Bioengineering. "And this is just the start. Moving forward, we plan to expand the use of this model, more broadly, across the whole of the Bioengineering graduate curriculum to ensure that our students are equipped with the knowledge and skills expected in the modern workforce."

2024 FACULTY FUNDING AWARDS

Professor TOMAS GONZALEZ-FERNANDEZ (BioE) received a $200K Engineering Research Initiation (ERI) grant from the National Science Foundation for the proposal, *"Integrating Non-Viral CRISPR Gene Activation and Deep Learning for Biomanufacturing Precision Stem Cell Products."* The award supports exploration of novel synthetic biology tools for the modification of primary stem cells with improved therapeutic capacity.

Professor TANEKA JONES received funding from the Lehigh Faculty Success Program for the proposal, *"Writing for Women: Advancing Uterine Tissue Engineering for Enhanced Women's Health."*

In collaboration with the Energy Research Center (ERC), a team of researchers, including Professor XUANHONG CHENG, received a $2.5 million grant from the Department of Energy (DOE) to identify rare earth elements (REEs) and elements of interest (EOIs) in wastewater and solid waste streams, and to develop the technology that could extract those elements.

Professor LESLEY CHOW is the recipient of a 2024 Lehigh Faculty Innovation Grant (FIG) for the project, *"Functionalizing 3D-Printed Biomaterials with Polymer Bottlebrushes for Independent Control of Surface and Bulk Properties"* to jumpstart a new approach to create soft, hydrogel-like layers on scaffolds for enhanced mechanical cueing. Chow also received a Lehigh Faculty Research Grant (FRG) to support a new project *"Functionally Assessing Antioxidant Peptide-Polymer Biomaterials in Physiologically Relevant Fluidic Systems"* in collaboration with a visiting scholar, Dr. Anthony Callanan (University of Edinburgh).

Professor THOMAS PASHUCK, has received a $140K funding award from the National Institutes for Health (NIH). The 2-year grant supports work on ***"Designing Hydrogels that Recapitulate Physiological Cell-Matrix Adhesions."***

Three bioengineering faculty were awarded funding from the Pennsylvania Infrastructure Technology Alliance (PITA). The grants, totaling $100,000 were received by Professors SABRINA JEDLICKA and SUSAN PERRY, *"Development of a Novel Vortex Filtration System for Industrial Water Quality Maintenance,"* and Professor LORI HERZ, *"Evaluation of a Novel Horizontal Single-Use Pressurizable Fermenter for Microbial Culture to High Cell Densities for Production of Biopharmaceuticals and Vaccines."*

RECENT PUBLICATIONS

Lehigh Bioengineering faculty members and Bioengineering students co-authored more than 75 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)

BROWN, T.P., Santa, D.E., Berger, B.A., Kong, L., Wittenberg, N.J. and IM, W., 2024. CHARMM GUI Membrane Builder for oxidized phospholipid membrane modeling and simulation. *Current Opinion in Structural Biology, 86, p.102813.*

Dahal, S., BASTOLA, S., and RAMAMURTHI, A. 2024. JNK2 silencing lipid nanoparticles for elastic matrix repair. *Journal of Biomedical Materials Research Part A, 112(4), pp.562-573.*

Gorti, B., Stephenson, C., Sethi, M., Gross, K., Ramos, M., SESHADRI, D. and Drummond, C.K., 2024. Overarm Training Tolerance: A pilot study on the use of muscle oxygen saturation as a biomarker. *Sensors, 24(14), p.4710.*

Hui, C.Y., Xiao, X., Dong, H., and JAGOTA, A. 2024. The role of adhesion on soft lubrication: a new theory. *Journal of the Mechanics and Physics of Solids, p.105720.*

Hui, C.Y., JAGOTA, A., and Liu, Z. 2024. How the geometry of patterned surfaces affects the thickness distribution of the oxidized silica layer on polydimethylsiloxane (PDMS) after ultraviolet/ozone treatment. *Soft Matter, 20(1), pp.89-93.*

Kennedy, O., KITSON, A., OKPARA, C., CHOW, L.W., and GONZALEZ-FERNANDEZ, T. 2024. Immunomodulatory strategies for cartilage regeneration in osteoarthritis. *Tissue Engineering Part A, 30(7-8), pp.259-271.*

Khare, E., Gonzalez Obeso, C., Martín-Moldes, Z., Talib, A., Kaplan, D.L., HOLTEN-ANDERSEN, N., Blank, K.G., and Buehler, M.J. 2024. Heterogeneous and cooperative rupture of histidine–Ni2+ metal-coordination bonds on rationally designed protein templates. *ACS Biomaterials Science & Engineering, 10(5), pp.2945-2955.*

Le Roy, H., Song, J., Lundberg, D., Zhukhovitskiy, A.V., Johnson, J.A., McKinley, G.H., HOLTEN-ANDERSEN, N., and Lenz, M. 2024. Valence can control the nonexponential viscoelastic relaxation of multivalent reversible gels. *Science Advances, 10(20), p.eadl5056.*

Linnes, J.C., Moore, E., Porras, A.M., Wayne, E., Boyle, P.M., CHOW, L.W., Maisel, K., Peyton, S.R., Stabenfeldt, S.E., Stevens, K.R., and Winter, J.O. 2024. Framework for department-level accountability to diversify engineering. *Nature Reviews Bioengineering, pp.1-10.*

Pietrangelo, T., Cagnin, S., Bondi, D., Santangelo, C., Marramiero, L., Purcaro, C., Bonadio, R.S., Di Filippo, E.S., Mancinelli, R., Fulle, S., Verratti, V., and CHENG, X. 2024. Myalgic encephalomyelitis/chronic fatigue syndrome from current evidence to new diagnostic perspectives through skeletal muscle and metabolic disturbances. *Acta Physiologica, 240(4), p.e14122.*

SESHADRI, D.R., VanBibber, H.D., Sethi, M.P., Harlow, E.R. and Voos, J.E., 2024. Wearable devices and digital biomarkers for optimizing training tolerances and athlete performance: A case study of a national collegiate athletic association division III soccer team over a one-year period. *Sensors, 24(5), p.1463.*

Tolbert, J.W., French, T., KITSON, A., OKPARA, C., Hammerstone, D.E., Lazarte, S., Babuska, T.F., GONZALEZ-FERNANDEZ, T., Krick, B.A. and CHOW, L.W. 2024. Solvent-cast 3D printing with molecular weight polymer blends to decouple effects of scaffold architecture and mechanical properties on mesenchymal stromal cell fate. *Journal of Biomedical Materials Research Part A.*

TONG, X., Xie, H., Fonzo, G.A., ZHAO, K., Satterthwaite, T.D., Carlisle, N.B., and ZHANG, Y., 2024. Symptom dimensions of resting-state electroencephalographic functional connectivity in autism. *Nature Mental Health, 2(3), pp.287-298.*

YAU, J., CHUKWU, P., JEDLICKA, S., and RAMAMURTHI, A. 2024. Assessing trans-endothelial transport of nanoparticles for delivery to abdominal aortic aneurysms. *Journal of Biomedical Materials Research Part A, 112(6), pp.881-894.*

ZHAO, Y., WU, Y., Islam, K., Paul, R., Zhou, Y., QIN, X., Li, Q. and LIU, Y. 2024. Microphysiologically engineered vessel-tumor model to investigate vascular transport dynamics of immune cells. *ACS Applied Materials & Interfaces, 16(18), pp.22839-22849.*

ZHAO, K., Xie, H., Fonzo, G.A., Carlisle, N.B., Osorio, R.S. and ZHANG, Y. 2024. Dementia subtypes defined through neuropsychiatric symptom–associated brain connectivity patterns. *JAMA Network Open, 7(7), pp.e2420479-e2420479.*

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

LESLEY CHOW (BioE/MSE) and Hannah Dailey (MechE) were issued a patent for 3D Printed Scaffolds of Peptide Conjugate Polymer. (*US 11,839,699 B2*)

Three BioE faculty members were among those recognized at the Rossin College's annual awards ceremony. 2024 award recipients were YU ZHANG – *Interdisciplinary Research Excellence* Award, ANAND RAMAMURTHI – *Excellence in Research Scholarship and Leadership Award,* and TOMAS GONZALEZ-FERNANDEZ – *Diversity, Equity, and Inclusion Award.*

LESLEY CHOW (BioE/MSE) was awarded the 2024 Society for Biomaterials Mid-Career Award.

DHRUV SESHADRI and his research group are teaming up with ***Beyond Pulse***, a leading innovator in wearable technology. This partnership marks a significant advancement in the realm of health and performance monitoring, particularly in the context of athletics and beyond.

TANEKA JONES received a travel award from the Lehigh University ADVANCE Center for Faculty Development, Interdisciplinary Collaboration and Leadership to attend the inaugural National Science Foundation 2024 ElevateHER Women's Health Conference in College Station, TX.

GRADUATE

GRADUATE STUDENT NEWS

XINYU CUI who successfully defended his doctoral dissertation in May 2024, has started a postdoctoral fellowship at the University of Pennsylvania.

Congratulations to LISETTE WERBA, for receiving the MS degree in BioE in August!

Doctoral student PRANEETHA PULYALA (Cheng Lab) spent the summer as a Product Development intern in Biologics Formulation at Johnson & Johnson. ESRAA ISMAEL, also a PhD student in Xuanhong Cheng's research group, participated in an in-field co-op at Regeneron, where she worked on the Human Systems team.

MATTHEW ZIARNIK, a doctoral student in Anand Jagota's research group has started a Supply Chain and Innovation co-op at Unilever to develop his interests in the intersection of business and engineering.

SAMUEL ROZANS (Pashuck lab), was awarded the 2024 Lehigh Graduate Life Leadership Award.

Bioengineering doctoral student TAYLOR KREJEWSKI, was a mentor for the summer CHOICES (Charting Horizons and Opportunities in Careers in Engineering & Science) camp, a hands-on learning experience in engineering and science for 6th, 7th, or 8th grade middle-school girls

PhD student JOSH GRAHAM presented his work at the 7th Annual TERMIS World Congress, in Seattle WA.

ALUMNI

ALUMNI UPDATES

DAVID MORRA **BS '10** (BioE), was recently named Senior Director of Regulatory Digital Health at Merck. We're thrilled to note that David has also joined the Lehigh Bioengineering Advisory Council and we're looking forward to his insight!

SYDNEY YANG **BS'18** (BioE) successfully defended her PhD dissertation in Biomedical Engineering at the University of Maryland

KAYLEIGH ATANASOFF **BS '20, MS '21** (BioE) was recently named Manager of Fill/Finish Ops at Eli Lilly, where she will support the pre-filled syringe platform in operations

JULIANNE KERWOOD **BS'17** (BioE), Senior Scientist in the engineering division of Bioprocess Drug Substance Commercialization at Merck, was named the Philadelphia section president of the Society of Women Engineers. Congratulations!

KYLE GARLAND, PHD **BS '16** (BioE) is Director of Translational Science at Factor Bioscience, Inc, where he works to advance cell & gene therapy technology to clinical testing.

MATTHEW FAINOR **BS'20** (IDEAS), a Research Engineer at the University of Pennsylvania has ramped up to full speed with his industry blog, ***Fleshy Futures: Tissue Engineering for the 21st Century***, for "those interested in living materials of all kinds and their impact on people and planet." Check it out!

UNDERGRADUATE

STUDENT SUCCESS

KRISHNA JAYARAM '25 attended the Clare Boothe Luce (CBL) Program Women in STEM conference at the University of Chicago in July. Jayaram, a 2023 CBL Awardee, is an undergraduate researcher in the lab of Prof. Gonzalez-Fernandez, working to optimize an in vitro model of osteoarthritis to recapitulate cartilage degradation under inflammatory conditions. Also among the 2024 CBL Undergrad Research Scholars, awarded to those with excellence and motivation in academics and research, are LAYLA PUIG '26 (faculty mentor Tomas Gonzalez-Fernandez), and ALEXIS KELECHIRIAN '26 (faculty mentor, Lesley Chow). Kelechirian participated in the STEM-SI program this summer and was awarded first place in the oral presentation at the 2024 Summer EXPO.

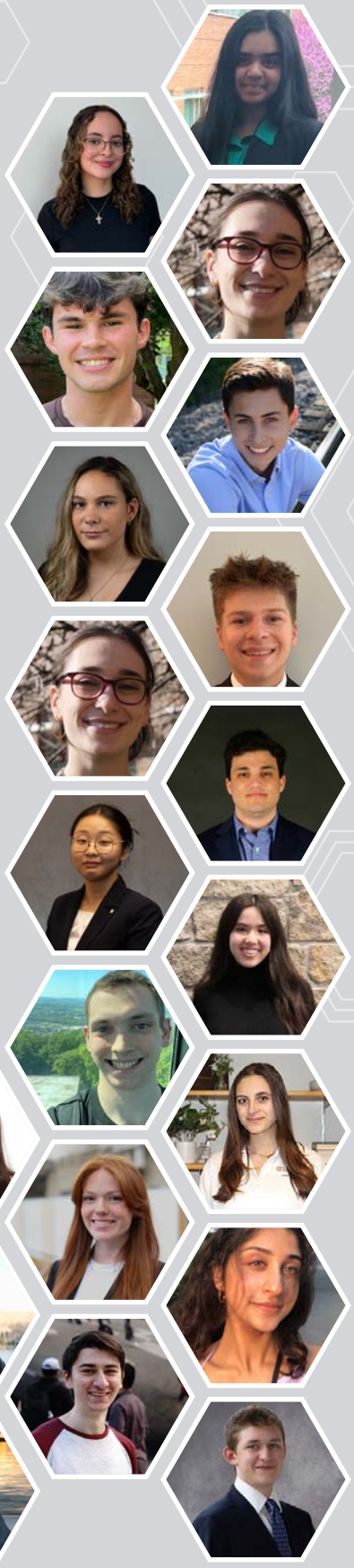
MICHAEL DWORNICKI '27 a RARE scholar, participated in the STEM-SI program in the Chow Lab and presented a poster, "Synthesis and Characterization of Degradable Peptide-Polymer Conjugate Scaffolds for Bone Tissue Engineering," at the 2024 Summer EXPO.

Student members of ***LU e-Nable, Lehigh's chapter of the online global group Enabling the Future, in collaboration with Ayúdame3D***, a Spanish nongovernmental organization (NGO), are working to incorporate muscle sensors and electronics into the NGO's 3D printed prosthetic devices to enhance the product's abilities. Led by ZACHARY WEISER '25 and DANI SCHMOYER '25, LU e-NABLE is refining designs and hopes to work with staff and patients at Good Shepherd Rehabilitation Clinic in Center Valley, PA for further feedback and testing.

Congratulations to the new Bioengineering Rossin Junior Fellows (RJFs): RYAN BEAM '26, ALEXIS KELECHERIAN '26, MICHAEL CILIBERTI '26, BINGXIN LIU '26 and SONYA SAVINI '26. They join LILY MAKKAS '25, DANI SCHMOYER '25, GRACE DUKE '25 and ADITI SATHI '25 (RJF President) to round out the 2024-2025 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.

Lehigh's Summer Mountaintop Program hosted several BioE students for 10-weeks of impactful summer undergraduate research. Among the BioE undergraduate researchers were NICHOLAS EVARISTO '27 (*AgriWrap*), BURHAN GOKALP '26 (*Building a DNA Computing and Storage Platform*), OWEN HOLST and NANCY CÁRCAMO PAIZ '27 (*SicklED*). Holst and Cáracamo Paiz traveled to Sierra Leone with other student team members and adviser, Prof. Xuanhong Cheng, for onsite work on the *SicklED* project.

BioE students explored the world this summer, while gaining technical skills through independent research. COLE SHAUB '25 and JOSE-GABRIEL CASTRO '25 were selected as Iacocca International Interns, spending 10 weeks this summer as undergraduate student researchers in Bordeaux, France. and SYDNEY WILLIAMS '25 traveled to Ireland to participate in undergraduate student research at the University of Galway



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CURRENT BIOENGINEERING RESEARCH AT LEHIGH UNIVERSITY

Names in BOLD are Lehigh BioE core faculty

BIOCOMPUTATIONS AND MODELING

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

Y. BERDICHEVSKY, B. Chen, H. Dailey, W. Im, A. JAGOTA, S. JEDLICKA, M. Kotare, Y. LIU, D. Lopresti, D. OU-YANG, N. HOLTEN-ANDERSEN, D. Vavylonis, A. Voloshin, Y. ZHANG

DIAGNOSTICS, SENSORS AND DEVICES

Biomedical Imaging
Biophotonics
BioMEMS
Biosensors
Microfluidics
Bioelectronics
Medical Devices
Wearable Technology

Y. BERDICHEVSKY, D. Brown, X. CHENG, H. Dailey, Y. LIU, D. Lopresti, D. OU-YANG, D. SESHADRI, 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, A. JAGOTA, S. JEDLICKA, H. Jain, T. JONES, Y. LIU, D. OU-YANG, T. PASHUCK, A. RAMAMURTHI, I. SEABRA, D. Thevenin, A. Voloshin

Fall 2024 Bioengineering Department, Welcome Back Open House

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

Department at a glance:

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CORE FACULTY MEMBERS

12
ASSOCIATED FACULTY MEMBERS

5
POST-DOCTORAL SCIENTISTS

3
ADMINISTRATIVE & 2 TECHNICAL STAFF

31
PHD LEVEL GRADUATE STUDENTS

24
MS LEVEL GRADUATE STUDENTS

124
DECLARED UNDERGRADUATE MAJORS IN 3 TRACKS
(Biocomputational Engineering, Biomechanics & Biomaterials and Biopharmaceutical Engineering)

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