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

FALL 2023 Newsletter

—FEATURED ARTICLE: PAGE 5—

Building Global Connections

IN THIS ISSUE:

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

LEHIGH LAUNCHES "INSPIRING THE FUTURE MAKERS" STRATEGIC PLAN

2023

DEPARTMENT WELCOME

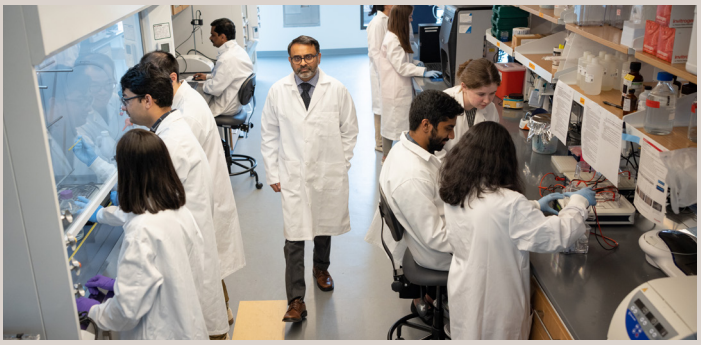
Welcome to Bioengineering at Lehigh! It's been a packed year, full of faculty and student achievements and continuing evolution as a department. The new ten-year Lehigh University Strategic plan was unveiled earlier this year, with the overarching theme of 'Inspiring the Future Makers'. In the BioE department, we are working to align our goals with the three tenets of the strategic plan to 'make it new' – to articulate a vision for how we innovate, 'make a difference' – to apply new knowledge to challenges in health to improve access, diagnosis & treatment and 'make it together' – to redefine how we collaborate with partners and communities and extend beyond existing boundaries. At its core, the plan seeks to foster interdisciplinarity in education via design of innovative, cross-disciplinary and inter-college programs and research opportunities relevant to emerging new career pathways for bioengineers.

In this issue, we highlight how we are aligning our mission with the university strategic plan by addressing the two grand challenges of health and globalization through multidisciplinary approaches to manage societal health challenges posed by infectious diseases and chronic conditions in a globally relevant manner. Our article on 'Engineering Technologies for Health' highlights our initiatives to address challenges in this sphere and also welcomes our newest faculty addition, Dr. Dhruv Seshadri, who brings to our department new but complementary research expertise in wearable and remote sensors, flexible electronics and medical devices. In the article on 'Building Global Connections,' we highlight faculty/student research on sustainable, low-cost solutions in low-resource environments. We also report on exciting, new interdisciplinary collaborations we seek to grow with university partners in India. A year since our move to the state of the art Health Sciences and Technology (HST) facility on campus, we have settled in and are leveraging the stellar core facilities to grow multidisciplinary research collaborations in the area of health, together with other engineering disciplines and our new College of Health.

Our graduate students are not to be outdone when it comes to innovative research! Showcased in this issue are a sampling of exemplary student research projects as diverse as using computational tools to provide new insight on olfactory receptor function and developing innovative engineered systems for improving preclinical drug screening.

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! It must be acknowledged that much of this would not be possible without the engagement and contributions of you all - our collaborators, alumni, well-wishers, and patrons. A big thank you to all of you. We look forward to hearing from you and hosting you soon!

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



Welcome

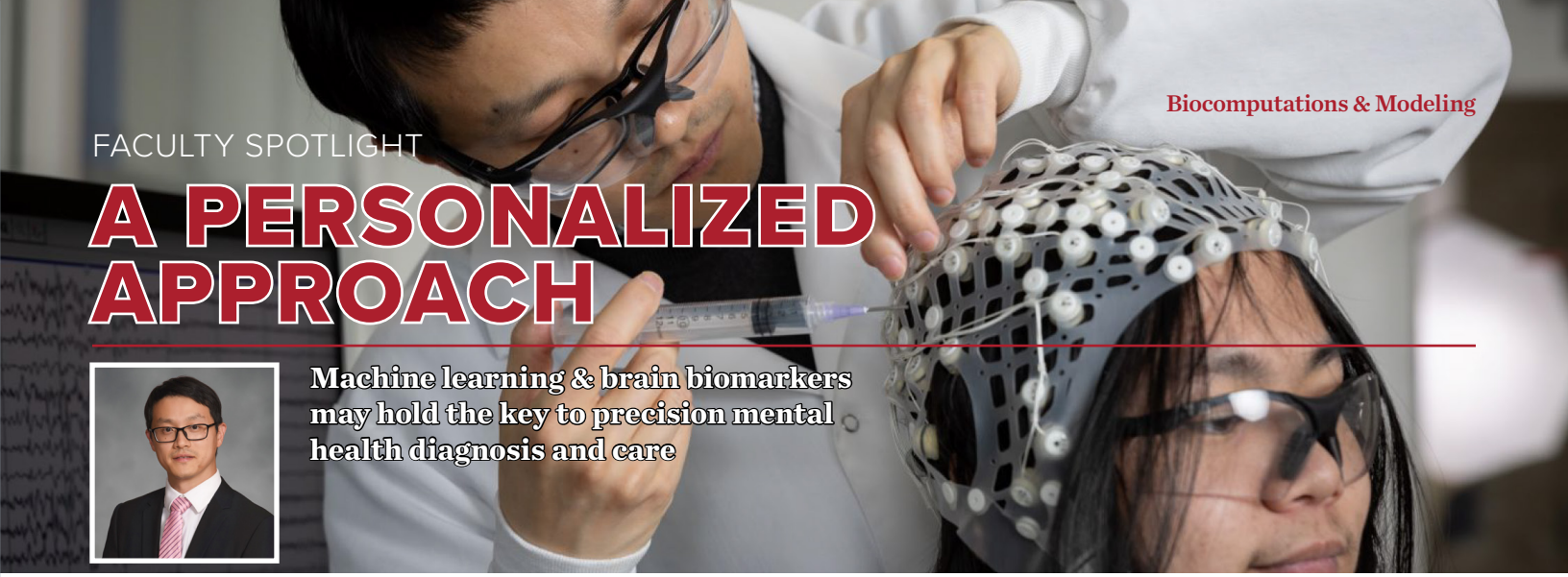
NEW BIOENGINEERING FACULTY & STAFF

DHRUV SESHADRI
Joined Lehigh University's Department of Bioengineering in August 2023 as an assistant professor. He received his B.S. in polymers science and engineering in 2014, M.S. and PhD degrees in biomedical engineering in 2018 and 2022, respectively, from Case Western Reserve University. Seshadri's research is focused on development, validation, and translation of wearable technology, bioelectronic devices, and digital therapeutics targeting human health and performance.

SAJEESH THAMPI
Most recently a Research Scientist in the research group of Dr. Ramamurthi, in August, 2023, Thampi was appointed as a Research Assistant Professor in the Department of Bioengineering. Thampi's work focuses on the development of advanced nanotherapeutics for cardiovascular disorders.

FACULTY SPOTLIGHT

A PERSONALIZED APPROACH



Machine learning & brain biomarkers may hold the key to precision mental health diagnosis and care

The study of biomarkers--powered by cutting-edge machine learning techniques—could redefine the way mental health conditions are diagnosed and lead to more effective, personalized treatments.

That's the goal of ***Yu Zhang***, assistant professor of bioengineering and electrical and computer engineering, who recently landed nearly $4 million in support from the ***National Institute of Mental Health*** (NIMH). The awards fund projects searching for brain biomarkers, measurable indicators of a medical state, using brain imaging and machine learning, to improve diagnosis and treatment for patients with mental health disorders.

A key ***study*** from Zhang aims to improve the treatment of depression. Approximately 280 million people worldwide have the condition, according to the World Health Organization. Antidepressants, the primary form of treatment, are effective in only about half of patients who take them, says Zhang, who leads the ***Brain Imaging and Computation Laboratory*** at Lehigh.

"Our goal is to identify biomarkers that better capture the brain's dysfunction, enabling us to predict whether an individual will respond to medication based on their brain circuits, and helping to guide personalized intervention," Zhang says.

Zhang's team, including collaborators from Dell Medical School (Dell Med, University of Texas at Austin), the Perelman School of Medicine (University of Pennsylvania), and Stanford University School of Medicine, will utilize data from a double-blind, randomized, placebo-controlled clinical trial. The data, including electroencephalography (EEG) measurments collected from patients prior to treatment, will be used to train a machine-learning model to identify brain biomarkers.

"We're looking at large-scale brain networks related to a variety of psychiatric disorders. We hypothesize that the interaction between these networks might reveal informative biomarkers that can predict individual-level treatment response," says Zhang. Essentially, he says, the degree of interaction between networks may indicate the degree to which a person would respond to medication.

He envisions a future where the model—easily installed on any computer—works in tandem with a portable EEG device recording a patient's brain activity. Using the EEG data, the model would assess the strength of the connections between brain regions, and generate output that suggests how well the patient would likely respond to antidepressant medication.

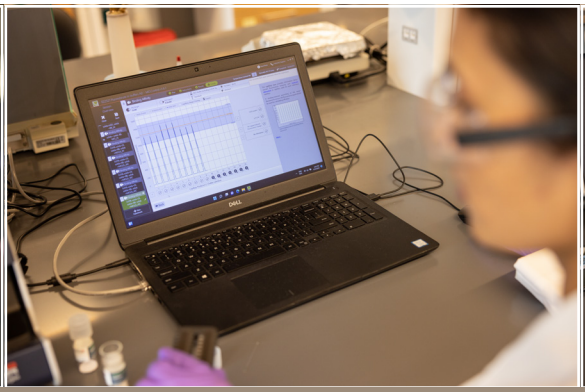
Their artificial intelligence (AI)-guided, personal biomarker approach, he says, may replace the current trial-and-error treatment strategy that wastes time and money. "Often, for patients, time is even more important than money," says Zhang. "Combining cutting-edge AI with brain imaging could drive a novel solution that helps people quickly, and gives them greater confidence about their treatment. This precision mental health care could offer patients real hope."

Zhang's second ***study*** takes a similar approach to redefine the classification of mental disorders. Currently, mental health conditions are grouped according to subjective assessments and self-reported questionnaires, says Zhang. The result is that within a single diagnostic category such as autism, the range of symptoms can be vast.

"At the same time," he says, "across categories like autism, attention-deficit/hyperactivity disorder, and depression, there's considerable overlap in symptoms." Currently, patients diagnosed with a specific disorder are generally treated with a one-size-fits-all approach. Some patients will respond well, others won't respond at all, and others may experience adverse reactions. If the classification system is more fine-tuned, treatments could be dialed more specifically.

"Redefining mental health conditions by combining brain imaging data with machine learning would be a major breakthrough," says Zhang. "It could help establish more effective therapeutics for individual patients, which is something traditional clinical diagnoses can't achieve."

Research reported in this story is supported by the National Institute of Mental Health of the National Institutes of Health under award numbers R01MH129694 and R21MH130956.



ENGINEERING TECHNOLOGIES FOR HEALTH

MAKING IT TOGETHER TO MAKE A DIFFERENCE - CHRIS QUIRK

The bioengineering department at Lehigh is making strides in the quickly evolving space at the nexus of health and engineering technology. With strong local and regional partnerships, and an interdisciplinary approach to the creation and refinement of health solutions, the department and university are having an impact in the developing field.

Anand Ramamurthi, chair of the bioengineering department at Lehigh, says that relationships between researchers on campus, population health specialists at the College of Health, and health care centers are facilitating the rapid progress. “Engineers who are designing and building devices and materials, colleagues with research interest in epidemiology and the data space, and clinical institutions are creating a critical mass of expertise and innovation.”

Precision health is one such expanding area, explains Yevgeny Berdichevsky, associate professor of bioengineering. “Precision health individualizes health care to a specific patient. It could be a unique genetic or other condition where specialized monitoring—especially using inexpensive testing devices—would facilitate improved outcomes.” The course of treatment of a malady could be adjusted incrementally based on improved data, and detect incidents that are rare, or occur outside the doctor’s office. These kinds of advances make extended monitoring over time and at distance feasible, and contribute to improved outcomes. “As an example of precision health technologies, our faculty are developing innovative materials designed to custom-calibrate therapeutic stimuli for optimal healing outcomes for sports injuries,” said Ramamurthi. “These topical or implantable materials will integrate biosensors and electrical stimulation to improve wound healing responses.” The smart devices can also be linked to mobile apps that can collect data and use AI to predict specific clinical outcomes and required feedback interventions for the patient.

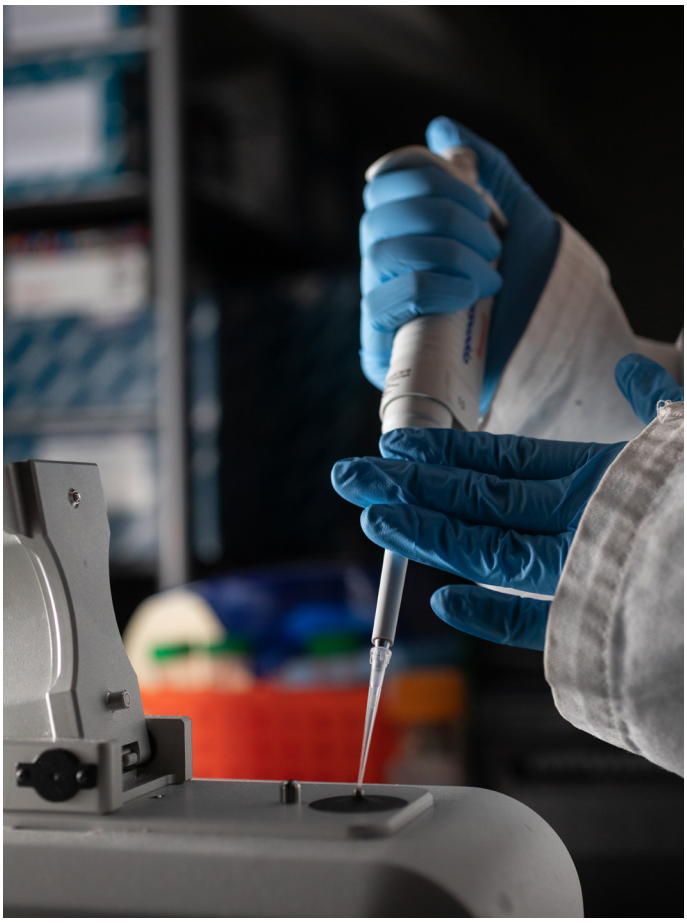
The breadth of experience and expertise in the department allow for a broad palette of innovation. Partnerships with facilities like the Good Shepherd Rehabilitation Hospital, the Cleveland Clinic, and the Geisinger Commonwealth School of Medicine are increasingly providing clinical resources that are driving research forward. “Geisinger is a leader in health care data,” says Ramamurthi. “They have huge archives of retrospective data collected over the years, and they are also a leader in health analytics, so we are partnering with them to develop joint Ph.D. programs and encourage faculty collaboration.”

The concept of interdisciplinary research is often lauded but not as frequently found in practice. For Vinod Namboodiri, a professor in the department of community and population health at the College of Health, who directs the Accessibility and Assistive Technologies Research

Laboratory, the collaborative work between the bioengineering department and the College of Health is deeply rooted and highly pragmatic. "Often what happens is those in engineering work with engineers and those in health work with health. We break down the silos at Lehigh. It can be complicated to cross disciplines but there are great efforts being made here," he says. "The health sector is extremely interdisciplinary—there are medical, engineering and policy issues. Here, the College of Health is great at working with populations, and the bioengineering folks are really good at manufacturing sophisticated devices and materials, so it is a useful partnership that connects everything together."

Point of care devices and new technologies for health will be a vital part of the movement to improve health nationally, bring down costs and address demographic disparities in medical care availability and results. "Some of the areas we are looking at are social determinants and behavioral determinants of health. For example an inner city environment versus an environment like Lehigh, a highly urbanized versus a semi-rural kind of setting. How does that affect the patient's baseline health?" asks Ramamurthi. "This offers excellent opportunities for our faculty—such as Dhruv Seshadri, who develops devices to monitor vital statistics in remote patients—to scale up the technology platform and enable monitoring of larger population groups. These advances will help us answer some of the critical questions regarding health and living environments."

The key, says Ramamurthi, is to leverage the relationships and resources across campus to continue to implement the long-term departmental plan that integrates the master's degree tracks in bio-computations and biomedical analytics and device development and commercialization. "The future of bioengineering in health will be collaborative," says Ramamurthi. "We are building the academic and research infrastructure to drive creative development of medical devices and wearables, and recruiting stellar faculty with strong interdisciplinary perspectives and collaborative mindsets to put Lehigh at the forefront of precision health technologies."



DHRUV SESHADRI

Extending the Reach of Healthcare Through Technology

Medical technologies that make possible the treatment of disease outside of clinical venues are extending the reach of health professionals to help patients in new ways. Dhruv Seshadri, an assistant professor of bioengineering, is working at the cutting edge of this emerging discipline.

Seshadri's lab focuses on wearable technologies for health and performance assessment, with a goal of matching and exceeding current clinical results to address unmet medical needs. "Broadly speaking, we seek to answer three questions," says Seshadri. "First, what is the efficacy of wearable devices and medical technologies versus the gold standard of care. Second, how do we develop musculoskeletal and physiological models or predictive analytics from the date acquired from the device. And finally, what do we do with the data."

Despite arriving only recently—he began at Lehigh in August—Seshadri has hit the ground running and has several projects in progress. One is a study Seshadri is conducting, funded by the American Orthopedic Society for Sports Medicine, using wearable technology to analyze recovery of athletes from anterior cruciate ligament reconstruction. At present, assessments of progress after ACL surgery are subjective. To get more reliable measures, Seshadri is employing a device that continually surveys biomarkers and compares results to the healthy ligament to determine when an athlete can safely return to activities. "We are leveraging wearable technology that employs near infrared spectroscopy to measure changes in oxygenated and deoxygenated hemoglobin levels and quantify muscle oxygen saturation levels to see how the limb is performing," he explains. Eventually, the technology could be used in rehabilitation clinics, or to check the fitness of astronauts, who suffer muscle atrophy during extended stays on gravity-free space missions.

Another innovation Seshadri is designing is a wearable device that delivers electrical stimulation to promote the healing of chronic wounds. "One clinical problem this addresses is in veteran populations, as most live more than 50 miles from the nearest VA medical facility," says Seshadri. The closed loop technology delivers the therapy, reports the status to a control device on a tablet or phone, which processes the information and adjusts the therapy. "The goal of all these devices is licensing them out at scale or as startups," he says. "We want to leverage the strength of the Lehigh Valley in that regard, but also with pharmaceutical companies in New Jersey and New York, and make the Lehigh bioengineering department a mainstay for medical device research in this growing field."

BUILDING GLOBAL CONNECTIONS

LEHIGH BIOE ESTABLISHES PARTNERSHIPS AND EXTENDS ITS IMPACT

Countering complex societal health challenges posed by infectious diseases such as COVID-19, malnutrition, climate change and an aging population are of foremost concern today. Addressing these challenges on a global scale and developing sustainable solutions for deployment in diverse, resource-constrained environments are critical, mandating multidisciplinary approaches. Recognizing this, Lehigh University's strategic plan emphasizes developing sustainable solutions for health and disabilities, including through global outreach and partnerships, as a means of achieving international distinction in education for purpose and research for impact.

Lehigh Bioengineering is well-positioned to tackle key global health challenges and provide solutions with our collective faculty expertise in detecting and diagnosing diseases, and developing active treatments, technologies and patient-personalized approaches to monitor and manage healthcare.

Indeed, our Bioengineering faculty and students are having an impact in Sierra Leone, addressing malnutrition by developing nutrient rich food products and combating high childhood mortality rates with low cost, point-of-care diagnostics. Recognizing the need for interdisciplinary partnerships to collaboratively develop low-cost technology for health, we are exploring opportunities with a non-governmental organization (NGO) in Spain for developing low-cost, motorized mechanical prostheses. Additionally, as a department, we aim to holistically engage with international institutions to enhance interdisciplinary research, provide experiential training and professional development opportunities for graduate students, and prepare a future workforce with multidisciplinary perspectives.

Particularly exciting is our engagement with institutions in India, towards creating innovative, collaborative education and research partnerships. The Global Health Security Agenda (GHSA) (2021) identified India as a key partner to accelerate bilateral collaborations in developing mass implementable technologies for effective global healthcare, in alignment with inclusive and resilient economic development. Through these partnerships, Lehigh BioE can provide a graduate learning environment that attracts students from diverse academic backgrounds in science and engineering who are passionate about creating innovative solutions and technology for health, for implementation on the global stage.

We are happy to announce that in the past year, Lehigh BioE has signed its first agreement with SRM Institute of Science and Technology, a leading private institution based in Chennai, India. The initial phase of the collaboration creates a new 4+1 BTech/MS program, with opportunities for accelerated completion of the MS degree. Our first cohort of students, competitively selected from undergraduate degree programs in biotechnology, biomedical engineering, and genetic engineering will join us for their MS degree in Fall 2024. We are also hosting a semester abroad program (SAP), where SRM IST students perform their senior thesis research projects with Lehigh BioE faculty advisors.

Meeting on the sidelines of a recent visit to India as part of his Provost's Faculty Fellowship project on 'India-Partnerships for Advancing International Research (i-PAIR) at Lehigh', BioE department chair, Anand Ramamurthi conducted productive initial discussions with several other stellar institutions (Vellore Institute of Technology, Pandit Deen Dayal Energy University, Ashoka University, Amity University) with highly regarded health-focused research activities across India. Ramamurthi noted, "With their different academic and research models and programs, each provides unique and innovative opportunities to create differentiated collaborative programs."

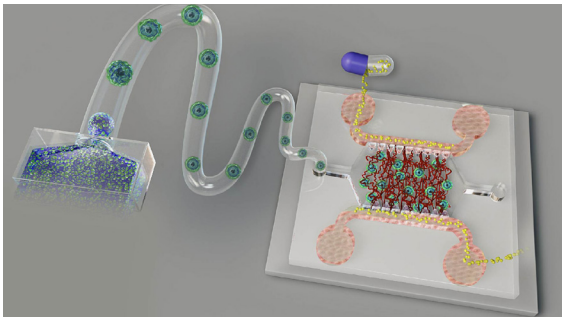
BIOE GRADUATE RESEARCH

WHERE ENGINEERING INNOVATION IMPACTS HEALTH

A 3D TUMOR MODEL TO IMPROVE PRECLINICAL DRUG DISCOVERY

Anthony Wu

BioE Doctoral Student



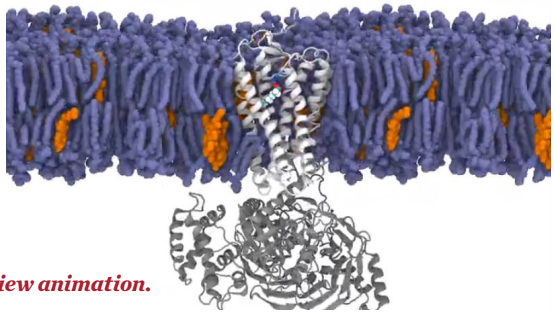
The most common model for in vitro drug testing remains the two dimensional cell monolayer. However, the natural in vivo tumor microenvironment (TME) consists of a 3D extracellular matrix (ECM) supporting stromal cells and vasculature, which participates in the progression of tumors and inhibits drug delivery. In the Liu Lab, we have designed an integrated engineering system to generate vessel-supported tumors for preclinical drug screening. In this system, tumor cells are encapsulated in a model tumor ECM. Normal human lung fibroblasts then are mingled with tumor cells to imitate the tumor–stromal interaction, forming a biomimetic heterotypic tumor model with a core–shell structure. Finally, the cell-laden ECM component is incorporated into a functional, on-chip vessel network to recreate the tumor microenvironment. Using the anticancer drug paclitaxel, we demonstrated that the blood vessel-associated TME conferred significant drug resistance. This system is expected to enable the large-scale fabrication of vessel-supported, heterotypic tumor models, and may improve the efficiency of preclinical drug discovery processes.

The full journal article can be read in the March 2023 issue of ***ACS Applied Materials & Interfaces***

UNRAVELING THE MECHANISMS OF OLFACTION THROUGH MOLECULAR MODELING

Seonghan Kim

BioE Doctoral Student



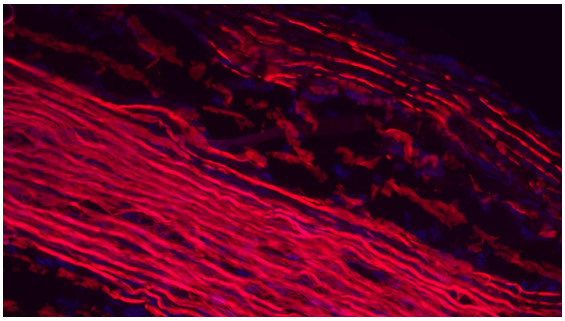
Click here to view animation.

Our sense of smell is triggered by the stimulation of odorant receptors through various odorants, a process accomplished by the combinatorial activation of around 400 functional olfactory receptors (ORs). ORs belong to the class A G protein coupled receptors (GPCR), the largest family of membrane proteins involved in cellular signal transduction, yet they possess unique biostructural characteristics - for instance, an extracellular loop that obstructs odorant access from the extracellular side of the receptor - that differentiate them. In Wonpil Im's Research Group, we focus on the applications of theoretical and computational methods to solve chemical and physical problems in biology and material science. Through molecular modeling and simulation, combined with experimental studies, we unveil the molecular mechanisms of odorant binding and activation of the OR family. These efforts contribute to our understanding of OR function and also lay the foundation for future experimental and computational endeavors.

A MORE ROBUST IN VITRO MODEL TO ASSESS SMOOTH MUSCLE CELL BEHAVIOR

Taylor Krajewski

BioE Doctoral Student



In the Ramamurthi laboratory, we work to develop novel therapeutics to treat abdominal aortic aneurysms (AAA), a highly-fatal disease involving the degradation of elastin in the aorta. My project focuses on improving in vitro culture systems of cells implicated in AAA in order to expedite their translation into clinical use. We use decellularized and proteolytically degraded extracellular matrix (ECM) isolated from porcine abdominal aortae to generate a cell culture coating that is more biosimilar to the AAA microenvironment than traditional tissue culture plastic. Results showed that when cultured on the ECM coating, smooth muscle cells were morphologically more similar to native smooth muscle cells and had increased cell-specific gene production and AAA-specific cytokine production. This ECM coating can be used in future studies to provide a more comprehensive, biomimetic microenvironment to study AAA-diseased smooth muscle cells in vitro

2023 FACULTY FUNDING AWARDS

Four bioengineering faculty were awarded funding from the Pennsylvania Infrastructure Technology Alliance (PITA). The grants, totaling $121,000 were received by Professor XUANHONG CHENG (BioE/MSE) for *"Detection of Bacterial Binding with Polymers and Their Degradation Products,"* Professors SABRINA JEDLICKA and SUSAN PERRY, *"Investigation of the cellular and biochemical composition in alpha-2-macroglobulin therapies,"* 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."*

Professor ANAND RAMAMURTHI was awarded over $365K in funding for two grants from the American Heart Association. The two awards, *"Actively targeted extracellular nanovesicles for regenerative aortic aneurysm repair"* and *"Nanotherapeutics for Matrix Repair in Small Abdominal Aortic Aneurysms"* support Ramamurthi's research on regenerative nanotherapeutics and cardiovascular tissue engineering

Professor YU ZHANG, along with collaborators from the University of Texas at Austin, the University of Pennsylvania and Stanford University, received two grants from the National Institute of Mental Health (NIMH) totaling nearly $4 million to support his AI-driven approach that could revolutionize the way conditions such as depression are classified, diagnosed, and treated.

Professor NIELS HOLTEN-ANDERSEN was the recipient of $60K in funding from the Lehigh Collaborative Research Opportunity (CORE) grant program for his proposal, *"Tuning Mineral Architecture in Bioinspired Gels through Magnetically Induced Stress and Transport."*

Professor ANAND JAGOTA, received nearly $850K in grants to explore the *"Role of the Glycocalyx and Spike-Like Proteins in Virus-Cell Adhesion,"* (NSF) and for a collaborative effort to develop a *"Nanosensor Array Platform to Capture Whole Disease Fingerprints,"* (NIH). Jagota and collaborators from Lehigh, Sloan Kettering and NIST also were awarded nearly $2 million for developing *"DNA-Nanocarbon Hybrid Materials for Perception-Based, Analyte-Agnostic Sensing,"* as part of a large NSF initiative to design revolutionary materials.

RECENT PUBLICATIONS

Lehigh Bioengineering faculty members and Bioengineering students co-authored more than 55 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)

ABEDIN, M.J., Michelhaugh, S.K., Mittal, S., BERDICHEVSKY, Y. 2023 3D models of glioblastoma interaction with cortical cells *Frontiers in Bioengineering and Biotechnology* 11, 1150772

BASTOLA, S., Kothapalli, C., RAMAMURTHI, A. 2023 Sodium Nitroprusside Stimulation of Elastic Matrix Regeneration by Aneurysmal Smooth Muscle Cells *Tissue Engineering* Part A 29 (7-8), 225-243

CUI, X., Zhang, X.F., JAGOTA, A. 2023 Penetration of Cell Surface Glycocalyx by Enveloped Viruses Is Aided by Weak Multivalent Adhesive Interaction. *The Journal of Physical Chemistry* B 127 (2),486-494

DAYAL, S., Broekelmann, T., Mecham, R., RAMAMURTHI, A. 2023 Targeting Epidermal Growth Factor Receptor to Stimulate Elastic Matrix Regenerative Repair *Tissue Engineering* Part A 29 (7-8), 187-199

FERGUSON, C. A., Hwang, J.C.M., ZHANG, Y., CHENG, X. 2023 Single-Cell Classification Based on Population Nucleus Size Combining Microwave Impedance Spectroscopy and Machine Learning *Sensors* 23

Fung, S.L., Cohen, J.P., PASHUCK, E.T., Miles, C.E., Freeman, J.W., Kohn, J. 2023 Rational design of poly (peptide-ester) block copolymers for enzyme-specific surface resorption. Journal of Materials Chemistry B 11 (28), 6621-6633Rational design of poly (peptide-ester) block copolymers for enzyme-specific surface resorption *Journal of Materials Chemistry* B 11 (28), 6621-6633

Hammerstone, D.E., Babuska, T.F., Lazarte, S., Krick, B.A., CHOW, L.W. 2023 Characterizing properties of scaffolds 3D printed with peptide-polymer conjugates *Biomaterials Advances* 213498

Hao, D., Liu, R. GONZALEZ-FERNANDEZ, T., Pivetti, C., Jackson, J.E., Kulubya, E.S., Jiang, H.J., Ju, H.Y., Panitch, A., Lam, K.S., Leach, J.K., Farmer, D.l., Wang, A. 2023 A bioactive material with dual integrin-targeting ligands regulates specific endogenous cell adhesion and promotes vascularized bone regeneration in adult and fetal bone defects. Bioactive Materials 20

KIM, S., LIU, Y., ZIARNIK, M., Seo, S., Cao, Y., Zhang, X.F., IM, W. 2023 Binding of human ACE2 and RBD of omicron enhanced by unique interaction patterns among SARS-CoV-2 variants of concern *Journal of Computational Chemistry* 44 (4), 594-601

Mayerberger, E.A., YAZDANPARAST TAFTI, S., JEDLICKA, S.S., Jellison, K.L. 2023 Effect of Glycosaminoglycans on Cryptosporidium Oocyst Attachment and Excystation *Applied and Environmental Microbiology*, E01737-22

Paul, R., ZHAO, Y., Coster, D., QIN, X., Islam, K., WU, Y., LIU, Y. 2023 Rapid prototyping of high-resolution large format microfluidic device through maskless image guided in-situ photopolymerization *Nature Communications* 14 (1) 4520

QIN, X., Paul, R., ZHOU, Y., WU, Y., CHENG, X., LIU, Y. 2023 Multiplex solid-phase RPA couple CRISPR-based visual detection of SARS-CoV-2 *Biosensors and Bioelectronics* 100381

Sarkhosh, T., Mayerberger, E., Jellison, K., JEDLICKA, S. 2023 Development of Cell-Imprinted Polymer Surfaces for Cryptosporidium Capture and Detection *Journal of Japan Water Works Association* 92 (2), 23-25

Song, J., HOLTEN-ANDERSEN, N., McKinley, G. H. 2023 Non-Maxwellian viscoelastic stress relaxations in soft matter. *Soft Matter* DOI: 10.1039/D3SM00736G.

TONG, X., Xie,H., ZHAO, K., Carlisle, N., ZHANG, Y. 2023 Contrastive Connectivity Profiles of Resting-State EEG Link With Symptom Dimensions in Autism *Biological Psychiatry* 93 (9), S111-S112

Wu, H., Hui, C.Y., JAGOTA, A. 2023 Solving transient problems in soft Elasto-Hydrodynamic lubrication. *Journal of the Mechanics and Physics of Solids* 170

WU, Y., ZHAO, Y., ZHOU, Y., Islam, K., LIU, Y. 2023 Microfluidic Droplet-Assisted Fabrication of Vessel-Supported Tumors for Preclinical Drug Discovery *ACS Applied Materials & Interfaces* 15 (12)15152-15161

ZHAO, K., Xie, H., Fonzo, G.A., TONG, X., Carlisle, N., Chidharom, M., Etkin, A., ZHANG, Y. 2023 Individualized fMRI connectivity defines signatures of antidepressant and placebo responses in major depression *Molecular Psychiatry* 1-10

ZHOU, Y., WU, Y., Paul, R., QIN, X., LIU, Y. 2023 Hierarchical Vessel Network-Supported Tumor Model-on-a-Chip Constructed by Induced Spontaneous Anastomosis. *ACS Applied Materials & Interfaces* 15

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FACULTY

ALUMNI GRADUATE

NOTABLES AND MEDIA MENTIONS

SABRINA JEDLICKA, associate professor of bioengineering and materials science & engineering, has been named Lehigh's Deputy Provost for Graduate Education. In this role Jedlicka will oversee all aspects of graduate education and graduate life. Jedlicka previously served as Associate Dean for Academic Affairs in the P.C. Rossin College of Engineering since 2020, and since joining Lehigh in 2008, Jedlicka has advanced cutting edge research in biomaterials synthesis and characterization, stem cell engineering, neuroengineering, biointerface design, surface science and biosensing.

LESLEY CHOW (BioE/MSE) was among those recognized at the Rossin College's annual awards ceremony. Chow's award for Outstanding Doctoral Student Advising recognizes a Rossin college faculty member who has a strong commitment to doctoral education and provides excellent support and mentorship to doctoral students with whom they work. Chow's commitment to students was also recognized by the seniors in the department of Materials Science & Engineering who honored her with the *Gilbert E. Doan Student Mentoring Award.*

XUANHONG CHENG, professor (BioE/MSE) and SUSAN PERRY, teaching full professor (BioE) were award recipients at the annual University Awards ceremony. Cheng received the *Hillman Faculty Award* and Perry, the *Hillman Award for Excellence in Graduate Advising.* Cheng's collaborative work with Lehigh colleagues, James Gilchrist (*ChBE*) and Kelly Schultz (*ChBE*) was recently highlighted in ***Lehigh's Alumni Bulletin.*** The team is pairing terrestrial experiments with those in microgravity onboard the ***International Space Station (ISS).***

ANAND RAMAMURTH, Bioengineering professor and department chair, was named a 2023 Lehigh Provost's Faculty Fellow. In this role promoting the strategic goals of the university, Ramamurthi traveled to India in July, focusing on *'India-Partnerships for Advancing International Research (i-PAIR) at Lehigh.'* Ramamurthi was also elected to the Executive Council of the Biomedical Engineering Society (BMES), where he will serve a 3-year term.

WILL XIA, facilities manager of Lehigh's Health Research Hub and adjunct professor (BioE), gave an invited talk at the 2023 European Molecular Imaging Meeting. The presentation, *"Nonlinear optical imaging for early detection of cancer"* was part of a tribute to Xia's dissertation advisor, Dr. Robert Gillies, founding president of the World Molecular Imaging Society.

Best wishes to our Grad Coordinator, GWEN HUGHES, who retired on Sept 1st. Hughes was a champion of the Lehigh Bioengineering graduate students for nearly five years. She worked to establish a set of standardized procedures, was always willing to learn new things, and provided a great spirit of community to the department.

GRADUATE STUDENT NEWS

SURAJ BASTOLA of the Ramamurthi Lab was awarded a highly competitive Predoctoral Fellowship from the American Heart Association. The title of his project is Nanotherapeutics for Matrix Repair in Small Abdominal Aortic Aneurysms.

Doctoral student, JOSH GRAHAM, received a prestigious NSF Graduate Research Fellowship. Under the mentorship of Prof. Tomas Gonzalez-Fernandez, Graham works to incorporate CRISPR gene editing into 3D printed biomaterial scaffolds for applications in tissue engineering and regenerative medicine.

Congratulations to 2023 graduates MD. JOYNAL "FARUKY" ABEDIN, CAROLINE FERGUSON and YUYUAN ZHOU for successfully defending their doctoral dissertations and to our Master of Science degree recipients: NATASHA HUNT, ELLEN KLUCZNIK, TAYLOR KRAJEWSKI, JARO PEREZ and DANIELLE PICARELLO. Watch Ferguson's ***Graduate Student Commencement*** speech.

MATTHEW ZIARNIK, PhD student in the Jagota lab, is the recipient of three scholarships from The Polish University Club of NJ, The Society of Tribologists and Lubrication Engineers, and Naval Horizons!

ALUMNI UPDATES

RYAN COCCA BS'09 completed an emergency medicine residency at the University of Washington School of Medicine in June and recently accepted a position as an assistant professor in the Department of Emergency Medicine at the University of Florida College of Medicine-Jacksonville.

MICHAEL HORCH BS'09 is a support specialist II at Brainlab, an industry leader in digital surgery, radiotherapy and integrated operating rooms.

ERIN AKINS BS'18 successfully completed the doctoral program in Bioengineering in the UC Berkeley/ UC San Francisco Joint Bioengineering program!

LIAM DOW BS'18 successfully defended his PhD dissertation in Biophysics & Bioengineering at the University of California, Santa Barbara!

MARYAM KHAN BS '19, MS '20 (BIOE), Associate Director of Data Science at AstraZeneca, shared professional insight as a panelist at the 2nd annual Lehigh Bioengineering Research Day, an event promoting connection to industry and highlighting graduate research. Maryam was joined by fellow industry panelists, YI WANG PHD '21 (MSE), Senior Scientist, John McGlynn, Tech Transfer, and John Loughney, Senior Scientist joining from Merck, Matt Stetz, Data Scientist and Mehdi Ghodbane, Scientific Leader, both at GlaxoSmithKline, Jack Donners, Principal Scientist at Ethicon and Naveen Kumar, Scientist at Janssen. Thanks to all who participated!

UNDERGRADUATE

STUDENT SUCCESS

KRISHNA JAYARAM, Clare Boothe Luce (CBL) Undergraduate Research Awardee, spent the summer in the lab of Prof. Gonzalez-Fernandez, working to optimize an in vitro model of osteoarthritis to recapitulate cartilage degradation under inflammatory conditions. As a CBL scholar Jayaram, receives two years of funding for her UG research as well as conference travel. The funding is offered on behalf of the Henry Luce Foundation and the Rossin College and 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.

MADISON CIPRIANI and SAMANTHA MAPPS were named Rossin College Undergraduate Research Award recipients for their excellence and motivation in academics and research during their undergraduate studies. Cipriani worked with Prof. Sabrina Jedlicka this summer, examining a variety of demographic factors that may play a role in the pathological onset of osteoarthritis. Mapps, who this summer traveled to the National University of Ireland, Galway, focuses on 3D printing scaffolds and the effect of material chemistry on cell viability, under the guidance of Professor Lesley Chow.

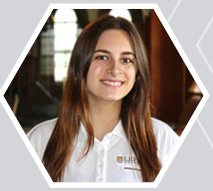
BioE major ANJALI SHAH took top honors at the David and Lorraine Freed Undergraduate Research Symposium. Shah presented her research on SicklED's ***"Low-Cost, Point-of-Care, Sickle Cell Screening Device for Use in Low-to-Middle Income Countries"*** and earned a $2,000 conference travel scholarship. BioE/IDEAS major, FENET DEMISSIE was awarded second prize for her presentation on ***"Spatiotemporal Presentation of Bioactive Peptides in 3D-Printed Scaffolds"***. Both students will present their work at the 2023 National BMES conference in Seattle in October.

Congratulations to the new Bioengineering Rossin Junior Fellows (RJFs): LILY MAKKAS, DANI SCHMOYER, GRACE DUKE and ADITI SATHI. They join KAMRYN LI, ISABELLA FEDERICO, and ANDRINE LARSEN to round out the 2023-2024 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 and Biocomputational Engineering students for 10-weeks of impactful summer undergraduate research. Among the BioE undergraduate researchers were OMAR HOSSAIN (*AI Strengthening Healthcare Access*), AHMED NOURELDAEM (*Make Mountaintop Campus a Destination*), and PRECIOUS OMOIKE (*Neurosalon*).











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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, A. JAGOTA, M. Kotare, Y. LIU, D. Lopresti, D. OU-YANG, 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, W. IM, 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, Y. LIU, D. OU-YANG, T. PASHUCK, A. RAMAMURTHI, I. SEABRA, K. Shultz, S. TATIC-LUCIC, D. Thevenin, A. Voloshin

Fall 2023 Bioengineering Department, Welcome Back Open House

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

Department at a glance:

20
CORE FACULTY MEMBERS

12
ASSOCIATED FACULTY MEMBERS

3
POST-DOCTORAL SCIENTISTS

2
TECHNICAL & 2 ADMINISTRATIVE STAFF

37
PHD LEVEL GRADUATE STUDENTS

17
MS LEVEL GRADUATE STUDENTS

110
UNDERGRADUATE STUDENTS IN 2 MAJORS

(Bioengineering and Biocomputational Engineering)

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