LEHIGH UNIVERSITY

P.C. Rossin College of Engineering and Applied Science

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Fall 2019 Newsletter

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

COLLEGE OF HEALTH LAUNCHED
2018

DEPARTMENT CHAIR'S MESSAGE

Welcome to the annual newsletter of the Lehigh University Department of Bioengineering. It is a pleasure every year around this time, early in the fall semester and a bit before the annual BMES meeting, to connect with our colleagues, alumni, and friends, as we reflect on our past year. So, here it is!

Bioengineering Research at Lehigh is broadly aligned with one or more major themes: Biocomputations and Modeling; Diagnostics, Sensors and Devices; Materials and Therapies. This year, we're highlighting the Materials and Therapies research of Tommy Pashuck, the newest member of our faculty, who works on novel biomaterials for regenerative medicine. He is tackling the difficult problem of cell-selective targeting and cleavage of peptide sequences. He is developing tools that have the potential to become foundational for a variety of therapies. I invite you also to browse our website at https://engineering.lehigh.edu/bioe/research to see the variety of research interests being pursued by our core and associated faculty members.

A major change at Lehigh is the establishment of the new College of Health, which hired its inaugural dean, Whitney Witt, earlier this year, and is rapidly expanding, with plans to begin enrolling students in fall of 2020. It has a focus on population health and health data analytics, and we foresee strong collaboration with Bioengineering, especially in Diagnostics, Sensors, and Devices and in Biocomputations and Modeling. See the article that highlights how the research of Profs. Cheng, Schultz, and Dailey is providing unique collaborative opportunities across colleges.

A related, important change for Bioengineering is that we are launching a new undergraduate degree program in Biocomputational Engineering. This major will combine training in the essential scientific and engineering base for Bioengineering with modeling, computation, and data science. There is tremendous growth at this intersection, coupled with paucity of undergraduate programs that address this need. We expect Lehigh to emerge as one of national leaders and have plans to extend this into graduate education; it is already an important part of our research portfolio. We will begin admitting students for this new undergraduate major in fall of 2020 – please spread the word!

There's a lot more to read and I invite you to catch-up with what's happened in Lehigh's Department of Bioengineering over the past year. Take a look, particularly, at awards and grants our faculty won, and at the accomplishments of our fabulous undergraduate and graduate students. Happy reading!

Anand Jagota
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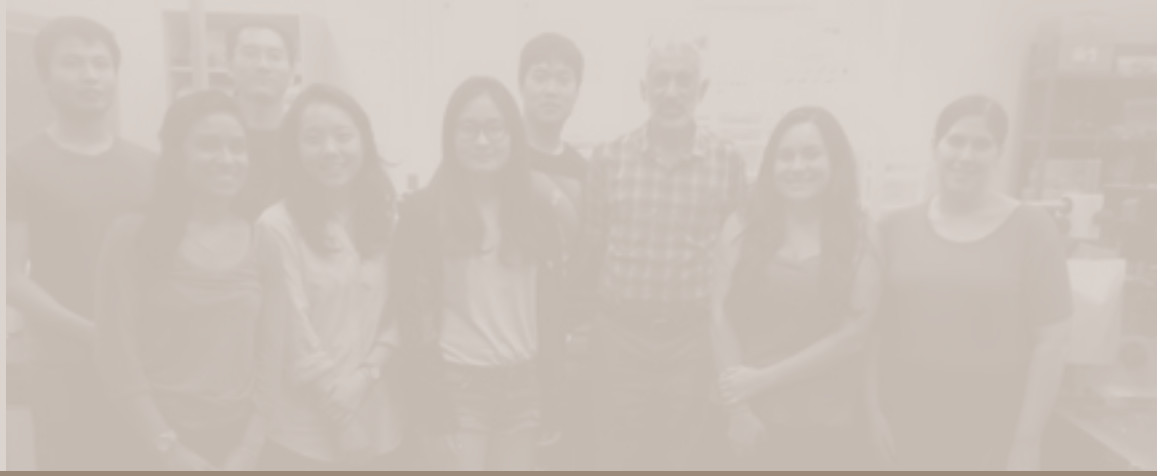


THE DELICATE BALANCE OF

REGENERATIVE MEDICINE

Tommy Pashuck will readily admit to being an inveterate tinkerer since he was a kid, but his motivation to pursue bioengineering in particular had a personal connection.

While working on his doctorate at Northwestern University, Pashuck's adviser, Samuel Stupp, introduced him to biomaterials. Pashuck then began collaborating with Jack Kessler, a neuroscientist at Northwestern. "Jack's daughter had a spinal cord injury from a skiing accident, and she was in a wheelchair," Pashuck recalls. "Jack started working on spinal cord repair, and I teamed up with his lab to come up with hydrogels that you could inject to promote neuron regeneration and stop some of the bad processes from happening."

Pashuck joined the faculty of the Department of Bioengineering last year, and has been researching materials that could lead to therapeutic advances in tissue generation and beyond. "I'm trying to develop these technologies, with the idea of eventually collaborating with clinicians to see how they might be best applied," he says.

Regenerative medicine is by its nature multidisciplinary, one that combines chemistry, engineering, biology, and medicine, says Pashuck. "The therapies are generally optimized for a single cell type, even though every tissue in the body is made up of many different cells working together towards a biological function. Therapies aimed at restoring damaged or diseased tissues will need to be able to support several different cell types simultaneously, and foster the complex relationships that exist during regeneration."

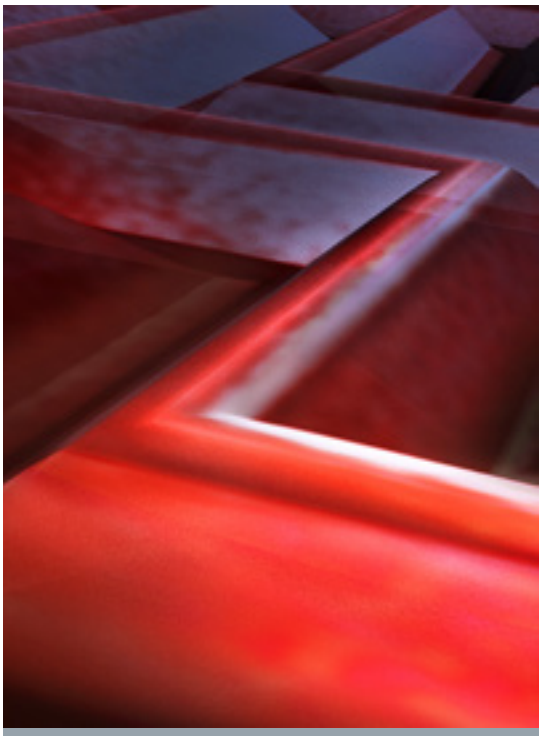
To that end, Pashuck's research takes up the challenge of targeting cells highly selectively, a task that led him to examine cell-secreted proteases. "Proteases are enzymes that cleave proteins into smaller ones by splitting peptide bonds." Pashuck explains. "This is nice from a biomaterials perspective because it's performing a chemical function."

Broadly, Pashuck's endeavor has two prongs: "The first is information gathering, can we understand how different cell types cleave different peptide sequences? The second is, can we turn that into a functional material? So, given the information that a certain cell type cleaves a certain peptide sequence, how can we then make something useful out of it?"

Various cell types will secrete different proteases, giving Pashuck the ability to fine tune which peptides will be cleaved, so one objective for Pashuck is to selectively produce suitable peptides in the lab. "If we know that one cell type cleaves a certain peptide sequence and a second cell type doesn't, then our next goal is to design a biomaterial response such that, upon cleavage of this sequence, something is created that we can target. The next step is to is to figure out how to incorporate these proteases into biomaterials."

Pashuck hopes the end result of his research could potentially produce a foundational tool for many different kinds of therapies. One area where Pashuck wants to collaborate is neuroscience. "Another area that is very interesting is to see what you could do with cancer, because the cancer tumor environment is highly complex," he says. "Some cells do good things and some cells do bad things. You have to really pick and choose which cells you're targeting."

- CHRIS QUIRK



Welcome

NEW BIOENGINEERING STAFF

ARJUN SHARMA
Completed his PhD in Chemistry from the University of New Orleans and began work as a postdoctoral fellow in the Jagota research group.

NICCOLO PINI
Niccolo is a visiting doctoral student from D'Annunzio University of Chieti, Pescara, Italy. He is working on electrical detection of chronic muscle fatigue syndrome, in the lab of Xuanhong Cheng.

A MAJOR DEVELOPMENT

Coming in Fall 2020: A new degree in Biocomputational Engineering will give undergrads an edge in the booming field of healthcare analytics

Working with Big Data doesn't require wearing a lab coat, but it still can be messy.

Take it from bioengineer Jeanna Kwon '17, a consultant at Prognos, a healthcare AI company focused on improving the prediction of disease—and our power to prevail over it—by analyzing patient laboratory diagnostic data.

"Lab data can have all kinds of random input," says Kwon. "Applying data science, artificial intelligence, and machine learning on that is complicated. The algorithm coder needs to understand what the data says, and that's where my role, and my background in bioengineering, comes in."

Kwon is among a growing number of BioE graduates charting career paths in data science and healthcare analytics at companies like Prognos, which analyzes de-identified patient data from diagnostic labs to provide clinical insights to its partners (insurer Cigna and biotech firm Biogen are two). Since 2017, Prognos has built a registry of over 25 billion medical records for over 200 million patients.

To give students a more direct runway to launch careers at the nexus of computational and data science, biological sciences, and bioengineering, the Rossin College is rolling out a new degree, a bachelor of science in Biocomputational Engineering, in fall 2020.

"The two areas where innovation is the strongest in the economy now are information sciences and biotech," says Anand Jagota, professor and founding chair of the Department of Bioengineering, "and because they sit on opposite sides of the spectrum between computation and theory, their confluence is a huge potential growth area. How to handle health data and to connect to diagnostic machines—that's where advances in information technology are coming together, and very few places train people at this intersection."

Lehigh is among the first handful of top-tier U.S. research universities to offer an undergraduate major in this subject. The program will equip students to develop new diagnostic tools and software, model the building blocks of life, identify populations at risk of diseases, shore up healthcare data acquisition methods and security, and design clinical research trials, among other and not-yet-conceived applications.

Jagota explains that computation and bioengineering typically converge in three areas: molecules/mechanics of cells, genomics data, and optimization of healthcare delivery. "Lehigh's program will ground students in all three areas and give them a basic bioengineering education as well," he says.

According to Lori Herz, a professor of practice, and associate chair of Department of Bioengineering, biocomputational engineering students will complete core classes in math, science, and engineering, followed by courses across bioengineering, computer science and engineering, and industrial and systems engineering. Options for technical electives will include bioimaging, biostatistics, and bioinformatics.

While Kwon and other recent bioengineering graduates have successfully landed at Prognos, Keyrus, QuintilesIMS, AthenaHealth, Axtria, and other leading companies in the healthcare analytics space, Herz says that with more targeted specialization in areas like bioinformatics and biophysical modeling, Lehigh can lead the way in funneling future innovators into this rapidly emerging industry. Herz adds, "There's never been a better time to do something like this."

Jagota concurs: "We're building on Lehigh's institutional strengths and faculty who apply computational methods to problems across the sciences," he says. "What's coming are a few new courses to round out the major, as well as real-world experts to help prepare students to seamlessly transition into this cutting-edge field—and excel."

He adds, "Lehigh can be not only one of the first to do this, we can also be one of the best."

— JOHN GILPATRICK AND KATIE KACKENMEISTER

PARTNERING FOR

POPULATION HEALTH

The College of Health will begin enrolling students in fall 2020, and will focus on population health and health data analytics.

According to Whitney Witt, who became the inaugural dean of the new College in January, such focus will serve its mission to understand, preserve, and improve the health and well-being of populations and communities through excellence and innovation in education, research, and service. Lehigh's collaborative, health-focused bioengineering research is well-positioned to support this mission.

Because the problems in healthcare are so complex, collaborations are the common denominator when it comes to successful innovation, says Xuanhong Cheng, an associate professor of bioengineering and of materials science and engineering.

"A glucose sensor, for example, requires people with backgrounds in chemistry, biochemistry, chemical engineering, bioengineering," says Cheng. "The instrument itself requires electrical engineering and mechanical engineering. You also need people who can convert the analog data to digital."

"And if you're collecting population data," she continues, "those data often need to be transmitted long distance, which requires experience in computer science and even mathematics. So, bottom line, the development of technology that impacts healthcare requires input from people with an array of expertise."

Cheng's own research is defined by such multidisciplinary efforts and focuses on diagnostic and therapeutic devices on the microscale.

For example, with James Hwang, professor of electrical and computer engineering, she's developing a microelectrical sensor that can detect cancer cells. With Alparslan Oztekin, professor of mechanical engineering and mechanics, and Jim Gilchrist, professor of chemical and biomolecular engineering, she's working on a microfluidic device that can detect infection.

And she has partnerships with Fil Bartoli, professor of electrical and computer engineering, in creating optical sensors that can monitor immune function, and with Frank Zhang, associate professor of bioengineering and mechanical engineering and mechanics, on designing sensors that can detect and rectify mechanical stress within the body.

"There are just so many components involved in health-related problems, that I think it's natural to have these interdisciplinary connections," she says.

For Kelly Schultz, associate professor of chemical and biomolecular engineering and an associated faculty member in the department of bioengineering, the interdisciplinary mindset is key to making healthcare more accessible, affordable, and effective.

Schultz regularly steps outside the boundaries of her discipline to consider questions and solutions that aren't typical in rheology.

"There are only a few of us that collaborate across the biomaterials and rheology communities, and there are so many interesting questions," she says. "I've been pushing to get both communities to listen to each other, and complement each other's work."

She says the College of Health will offer yet another perspective on those interesting questions.

"It will provide us with more depth around some of the social issues that we don't currently consider," says Schultz. "And that will keep us all moving in the right direction towards helping people live better lives."

It's that trajectory that may appeal most to new students.

"Students have fundamentally changed from when I was walking these halls," says Hannah Dailey '02, '06 G, '09 PhD, assistant professor in the department of mechanical engineering and mechanics, and an associated faculty in bioengineering. "Engineers today are motivated by the idea of applying their skills to doing good for others. And one significant way they can do that is through health and healthcare."

"The added visibility of the new college will help new students recognize that one of the ways they can do good is through innovating better healthcare technologies and medical devices and partnering in meaningful ways. I think that's going to be inspiring to this generation."

– CHRISTINE FENNESSY

TAKING TUMORS
OUT OF CIRCULATION

Having cancer is bad, but having cancer that has spread is worse. This basic fact of life—and, too often, death—in the realm of oncology drove much of Wentao Shi's research as a doctoral student in Bioengineering at Lehigh University and continues to inform his more recent work in industry.

Shi's work—and the topic of his 2018 Ph.D. dissertation—focused in part on circulating tumor cells (CTCs), whose appearance in the circulatory system marks the start of cancer metastasis, or spread. "CTCs are what allows cancer from one site to grow anywhere in the body," Shi says. "They're why cancer is so lethal. So it's very important that we, first, try to identify them, which would make cancer diagnosable, and second, remove them, which would make cancer curable."

Diagnosing cancer traditionally has depended on extracting biopsies from tissue, an invasive procedure that can be painful, stressful and sometimes risky. Medical researchers and physicians increasingly are looking for ways to identify cancer through biomarkers such as antibodies, enzymes, proteins and DNA that can be found in a simple blood draw.

CTCs are high-value biomarkers because finding them can flag cancer early, which boosts a person's odds of surviving, and because they may offer targets for drug screening and therapies. But isolating circulating tumor cells poses a number of challenges.

One is that CTCs are relatively rare in blood. That makes it difficult to acquire them efficiently in small blood samples and isolate them from other types of cells.

As a student in the laboratory of Yaling Liu, professor in Lehigh's Departments of Bioengineering and Mechanical Engineering and Mechanics, Shi approached these challenges through the use of microfluidics, a rapidly growing, multidisciplinary field involving precise observation and manipulation of fluids at the micro or nanoscale.

"Microfluidic devices minimize chemical and biological reactions—even whole systems—to a very small range where you can do a lot using small amounts of reagents," Shi says—even two or three drops of blood. At small scales, differences in cell characteristics such as size or surface proteins can be exploited to capture, isolate and screen CTCs.

In his Lehigh research, Shi developed several devices that capture CTC's from whole blood samples at the high rate of 81 to 95 percent, and allow isolation of CTC clusters—even more dangerous aggregations of circulating tumor cells—from white blood cells and other blood components.

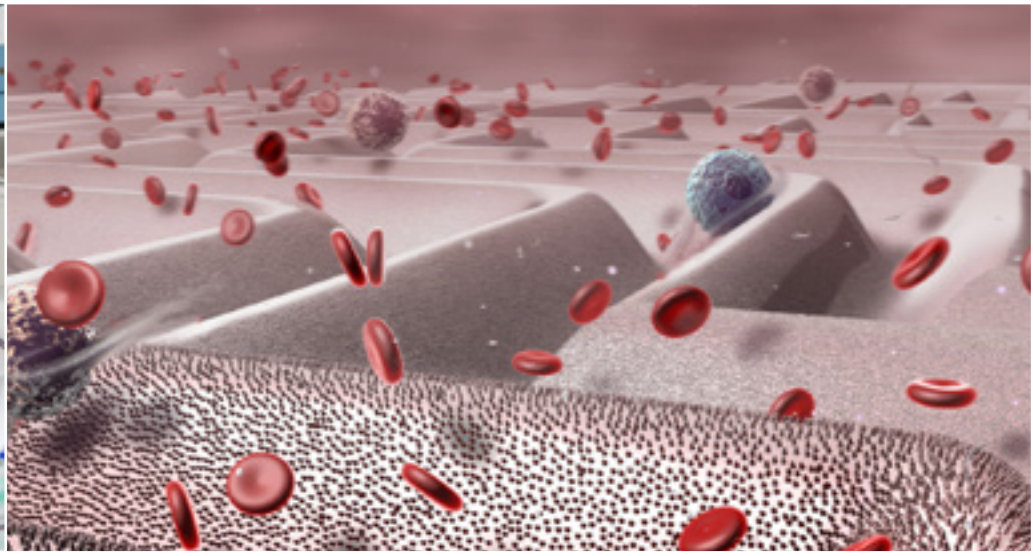
Shi also developed methods for getting CTCs to form 3D spheroids that can then be screened in a bi-level microfluidic device that more closely mimics the blood vessel environment than a more typical 2D petri dish.

Shi now works as a research and development scientist at Aptitude Medical Systems, a Santa Barbara, California, company that develops aptamers—molecules that have a high affinity for binding with specific targeted molecules, giving them high potential as diagnostic and therapeutic tools.

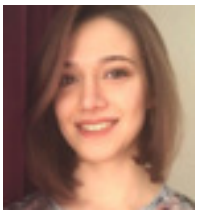
"The company right now has two major directions," Shi says. One is researching the use of aptamers as drugs to treat ocular diseases. Another is employing aptamers' ability to bind with proteins to develop biosensors. "We can get results in a couple minutes or so," Shi says. "We're still developing this, but it promises to be quite fast and easy."

Shi looks back on his Lehigh work in and out of the classroom—including taking both chemistry and biology classes—as important preparation for his research in industry. "My Lehigh training—especially the way we did research and how we thought in terms of broader views—has had a lot of benefits in my current job," Shi says.

— RICHARD LALIBERTE



AN INTREPID SCHOLAR PROBES NEURAL ENIGMAS



New country. New culture. New language. New science.

None of this has fazed Shabnam Ghiasvand, a doctoral student in bioengineering who will finish her degree in the spring.

Ghiasvand came to Lehigh three years ago from Iran, and had to quickly adjust to her new surroundings and get up to speed. "It was a little scary, making such a huge change and coming to a country I had never seen before, but you have to be brave," she says. "When I think about this big decision—which changed my life completely—I feel great about it. My adviser has been very supportive, as have my colleagues in the lab and the bioengineering faculty here."

Despite her longstanding interest in the brain, Ghiasvand studied electrical engineering at Shahid Beheshti University in Tehran due to limitations in the curriculum. "I was always captivated by the brain, as I love complex things, but there was no bioengineering major."

At Lehigh, working with her adviser, Yevgeny Berdichevsky, an associate professor of bioengineering, Ghiasvand's research is focused on discovering the dynamics of how epilepsy can be triggered by trauma to the brain.

Epilepsy affects 1 in 100 persons in the United States, but its causes are not deeply understood. Traumatic brain injury often leads to epilepsy, and around 40-50% of those who suffer TBI will develop it, says Ghiasvand. "We are looking at acquired epilepsy, which can happen as a result of blow to the head, a brain tumor or an infection, for example. The initial injury causes cellular or subcellular damage, which then progresses."

Ghiasvand's hypothesis is that damage to neurons from TBI triggers a disproportional regeneration response in the neurons, creating conditions that can lead to seizures. "When the neurons are damaged, they tend to sprout an excessive number of axons, the tendrils that connect neurons to each other," Ghiasvand says. "That causes the network of neurons to become hyper-excitable."

To learn more about the mechanisms that trigger the excessive sprouting of axons, Ghiasvand has been simulating TBI in hippocampal cultures. By slicing samples of different sizes, Ghiasvand essentially produces damage to the tissues in vitro. "Think of a scalpel cutting the tissue. Some neurons are destroyed, others will lose their appendages, the axons," Ghiasvand says. "The neurons seek homeostatic equilibrium, and begin to reproduce axons and make connections with neighboring axons on the damaged edge of the tissue. We think this causes a feedback loop that makes the network of neurons more excitable."

In essence, Ghiasvand's method creates an epileptic response in the in vitro tissue. "The hyper-excitability happens spontaneously in the sample, as in this hyper-connected network, the chance for seizure is higher," she says. "Interestingly, and contrary to our original hypothesis, the smaller samples have been more excitable, which seems to indicate that a greater proportion of damaged tissue in the overall sample may be a factor."

Ghiasvand is working to validate her results with the hope it could be a foundation for more proactive therapies. "Right now, because we don't understand the underlying mechanisms of post-traumatic epilepsy, therapies are limited to anti-convulsants to stop the seizures, but they don't halt the progress of the disorder."

— CHRIS QUIRK

GRANT SUCCESS

ANAND JAGOTA (BioE/ChBE), Chung-Yuen Hui (Cornell University) and Constantine Khripin (Michelin) recently received funding in the amount of $2mil from National Science Foundation (NSF) for a 5-year research project titled "LEAP-HI/GOALI: Meso-Scale Mechanisms for Friction in Structured Soft materials: Elastic Hysteresis and Dislocation Arrays".

JAVIER BUCETA (BioE/ChBE), Nicholas Butzin (South Dakota State University) and Madhav P. Nepal (South Dakota State University) have received a 4-year grant from National Science Foundation (NSF) for their project titled "Using a Queuing Framework to Explore the Design Principles of Synthetic Circuits in Microorganisms". Funding of this research will run through 2023.

JAVIER BUCETA (BioE/ChBE) received a Faculty Innovation Grant (FIG) of $30,000 for his proposal titled "Scutoids as a New Paradigm of Cellular Organization in Tissues: Biomechanics and Topology".

2019 PUBLICATION SPOTLIGHT

Lehigh Bioengineering faculty members and Bioengineering students co-authored more than 40 publications that were accepted for print in 2019, to date. Some of the notable ones are listed below. (Names in BOLD are current Lehigh BioE faculty or current/ former Lehigh BioE students)

Hasan, MD Fayad, GHIASVAND, S., Wang, H., Miwa, J.M., BERDICHEVSKY, Y. 2019. Neural Layer Self-assembly in Geometrically Confined Rat and Human 3D cultures. *Biofab* 11 (4), 045011

Liu, J., Sternberg, AR., GHIASVAND, S., and BERDICHEVSKY, Y. 2019. Epilepsy-on-a-chip System for Antiepileptic Drug Discovery. IEEE *Trans on Biomed Eng* May; 66 (5):1231-1241. doi: 10.1109/TBME.2018.2871415

Derr, K., Zou, J., Luo, K., Song, MJ., Sitta Sittampalam, G., ZHOU, C., Michael, S., Ferrer, M. and Derr, P. 2019. Fully Three-Dimensional Bioprinted Skin Equivalent Constructs with Validated Morphology and Barrier Function. *Tissue Eng* Part C: Methods 25 (6), 334-343

Krook, NM., Jaafar, IH., Sarkhosh, T., LeBlon, C., Coulter, JP., and JEDLICKA, SS. 2019. In-vitro Examination of Poly (glycerol sebacate) Degradation Kinetics: Effects of Porosity and Cure Temperature. *Intl J Polymeric Mat and Polymeric Biomat*, 1-9

Pirbhai, M., CHANDRASEKAR, S., Zheng, M., Ignatova, T., Rotkin, SV., and JEDLICKA, SS. 2019. Augmentation of C17. 2 Neural Stem Cell Differentiation via Uptake of Low Concentrations of ssDNA-Wrapped Single-Walled Carbon Nanotubes. *Adv Biosystems*, 4, 1800321

Lin, Y., Penna, M., Thomas, MR., Wojciechowski, JP., Leonardo, V., Wang, Y., PASHUCK, ET., Yarosky, I., and Stevens, M. 2019. Residue-Specific Solvation-Directed Thermodynamic and Kinetic Control Over Peptide Self-Assembly with 1D/2D Structure Selection. *ACS Nano* 13 (2), 1900-1909

Deter HS, Dies M, Cameron CC, Butzin NC, BUCETA J. 2019. A Cell Segmentation / Tracking Tool Based on Machine Learning. *Methods Mol Biol*. 2040:399-422.

Hughes, AV., Patel, DS., Widmalm, G., Klauda, JB., Clifton, LA. and IM, W. 2019. Physical Properties of Bacterial Outer Membrane Models: Neutron Reflectometry & Molecular Simulation. *Biophys J* 116 (6), 1095-1104

Lee, J., Patel, D.S., Stahler, J., Park, S-J., Kern, N.R., Kim, S., Lee, J., Cheng, X., Valvano, M.A., Holst, O., Knirel, Y., Qi, Y., Jo, S., Klauda, J.B., Widmalm, G. and IM, W. 2019. CHARMM-GUI Membrane Builder for Complex Biological Membrane Simulations with Glycolipids and Lipoglycans. *J Chem Theory and Comp*. 15 775-786

Wang, Y., Morabito,M., ZHANG, XF., Webb III, E., Oztekin, A., and Cheng, X. 2019. Shear-Induced Extensional Response Behaviors of Tethered von Willebrand Factor. *Biophys J* 116, (11), 2092-2102

Qian, Y., Zeng, X., Gao, Y., Li, H., Kumar, S., Gan, Q., CHENG, X., and Bartoli, FJ. 2019. Intensity-modulated Nanoplasmonic Interferometric Sensor for MMP-9 Detection. *Lab on a Chip* 19 (7), 1267-1276

UHL, CG. and LIU, Y. 2019. Microfluidic Device for Expedited Tumor Growth Towards Drug Evaluation. *Lab on a Chip* 19 (8), 1458-1470

SHI, W., Reid, L., Huang, Y., UHL, CG., He, R., ZHOU, C., LIU, Y. 2019. Bi-layer Blood Vessel Mimicking Microfluidic Platform for Antitumor Drug Screening Based on Co-culturing 3D Tumor Spheroids and Endothelial Layers. *Biomicrofluidics* 13 (4), 044108

CAMACHO, P., Busari, H., Seims, KB., Tolbert, JW., CHOW, LW. 2019. Materials as Bioinks and Bioink Design. In: Guvendiren M. (eds) 3D Bioprinting in Medicine. Springer, Cham. 67-100

CAMACHO, P., Busari, H., Seims, KB, Schwarzenberg, P., Dailey, HL., CHOW, LW. 2019. 3D Printing with Peptide-Polymer Conjugates for Single Step Fabrication of Spatially Functionalized Scaffolds. *Biomat Sci*, 7 (10): 4237-4247

Nuansri, R., Buranasiri, P., OU-YANG, HD. and Biaggio, I. 2019. Dielectrophoresis and Colloidal Phase Transitions for Ultra-Broadband Optical Limiting. *Optics Letters* 44 (15), 3801-3804

Shi, H., Qiu, T., OU-YANG, HD., Xu, H., Lu, Q., Zheng, Y., Liu, K., He, L., Guo, l. and Li, X. 2019. ABA-type Triblock Copolymer Micellar System with Lower Critical Solution Temperature-type Sol-gel Transition. *J Colloid and Interface Sci* 545, 220-230

Yang, Y., Zheng, M., and JAGOTA, A. 2019. Learning to Predict Single-wall Carbon Nanotube-recognition DNA Sequences. *Nature Partner Journals (npj) - Computational Materials* 5 (1), 3

Dragovich, M., Fortoul, N., JAGOTA, A., Zhang, W., Schutt, K., Xu, Y., Sanabria, M., Moyer, D., Moller-Tank, S., Maury, W., and ZHANG, X. 2019. Biomechanical Characterization of TIM Protein–mediated Ebola Virus – Host Cell Adhesion. *Sci Reports* 9 (1), 267

ZHANG, XF., Zhang, W., Quach, ME., Deng, W., and Li, R. 2019. Force-Regulated Refolding of the Mechanosensory Domain in the Platelet Glycoprotein Ib-IX Complex. *Biophysl J* 116 (10), 1960-1969

ZHANG, XF., CHENG, X. 2019. Platelet Mechanosensing Axis Revealed. *Nature Mat* 18 (7), 661

SEABRA, IJ., Braga, MEM., Oliveira, RA., de Sousa, HC. 2019. Two-step High Pressure Solvent Extraction of Walnut (Juglans regia L.) Husks: scCO2+ CO2/ethanol/H2O. *Journal of CO2 Utilization* 34, 375-385

Reis, D., Biscaia, S., SEABRA, IJ., Veloso, A., Morouco, P. 2019. Fabrication of Poly (Glycerol Sebacate)-Poly (ε-Caprolactone) Extrusion Based Scaffolds for Cartilage Regeneration. *Applied Mech and Mat* 890, 268-274

CHEN, Y., and BUCETA, J. 2019. A Non-linear Analysis of Turing Pattern Formation. *PloS one* 14 (8)

FACULTY

NOTABLES AND MEDIA MENTIONS

LESLEY CHOW (BioE/MSE) has been appointed the Harold Chambers Junior Professorship in Materials Science and Engineering in recognition for her outstanding accomplishments. Harold B. Chambers had a distinguished career in the steel industry and gave generously to Lehigh's Department of Materials Science and Engineering. His donation has made possible this professorship, given to a promising young member of the faculty.

Congratulations to 2019 P.C. Rossin College award recipients, SVETLANA TATIC-LUCIC (BioE/ECE) (Faculty Peer Mentoring Award), JAVIER BUCETA (BioE/ChBE) (Excellence in Research Scholarship and Leadership Award) and FRANK ZHANG (BioE/MEM) (Interdisciplinary Research Excellence Award).

ANAND JAGOTA (BioE/ChBE) and a team of scientists, inspired by snail biology, have discovered a reversible superglue-like material. Their findings were published in *Proceedings of the National Academy of Sciences of the USA*, titled "Intrinsically reversible superglues via shape adaption inspired by Snail Epiphragm". The discovery has been featured in The Guardian, Science Daily, The Times (UK), and Gizmodo.

JAVIER BUCETA'S (BioE/ChBE) publication titled "Scutoids Are a Geometrical Solution to 3-D Packing of Epithelia" in *Nature Communications* 9, Article number: 2960, is the ***2nd most read article*** in the Life and Biological Sciences collection.

GRADUATE NEWS

Congratulations to our 2019 Bioengineering graduate degree recipients: AMANDA STRATTON, MS CHUQIAN XIONG, MS and JIAJUN "LUKE" WANG MS.

Two current BioE PhD students, PAULA CAMACHO and SWETHA CHANDRASEKAR have been accepted to Lehigh's 2019 Creative Scholarship Institute Program.

ALUMNI

UPDATE

BioE held the 1st (ever) Annual Alumni Reception on June 8th. Attending were MARIAH BRANTLEY BS '17 (Sanofi), MIRANDA GANNETT BS '14 (Grantek), HAO HUANG BIOE MS, CHBE PHD '18 (Axalta Coating Systems), KATHERINE JENNISON BS '17 (Merck), MICHELLE MAZZEO CHBE BS '17, BIOE MS '18 (Regeneron), JAMESON PETROCHKO BS '15 (Temple/St. Luke's School of Medicine) and MYRNA YEHIA BS '18 (Eurofins).

AMANDA STRATTON MS '19 has taken a position with Regeneron Pharmaceuticals as a Process Development Engineer I.

CHRISTOPHER UHL PHD '18 is now a Post-Doctoral Research Fellow with the Center for Discovery and Innovation at Hackensack Meridian Health in New Jersey.

CHUQIAN XIONG MS '19 has accepted a position at Tameii Medical-China.

DANIELLA FODERA BS '18 has received a prestigious National Science Foundation (NSF) Graduate Research Fellowship and is currently pursuing graduate studies at Cornell University. She joins fellow alumni, KATHRYN KUNDROD '15, ERIN AKINS '18 and SYDNEY YANG '19 in this growing group of elite Lehigh BioE graduates.

WE'D LOVE TO HEAR MORE FROM YOU!

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UNDERGRADUATE

STUDENT SUCCESS

SYDNEY YANG '19, who was an undergrad researcher in the lab of Lesley Chow, has received a 2019 National Science Foundation Graduate Research Fellowship and will enter the bioengineering program at the University of Maryland, College Park.

ASHLEIGH CRAWFORD '20 joined a prestigious group of women undergraduates of the P.C. Rossin College of Engineering by being named a Clare Boothe Luce Research Scholar. Ashleigh joined the lab of Prof. Xuanhong Cheng in Fall 2018. Ashleigh is also a member of the Lehigh Women's Cross Country and Track & Field teams.

JESSICA DONALDSON '20 received the "Contribution to Student Life Award" at the 33rd Student Life Leadership Awards ceremony in May 2019.

For the fourth year in a row, Bioengineering students received awards at the 2019 David and Lorraine Freed Undergraduate Research Symposium. Third place went to LARA REID '19 for her research titled "A Biomimetic Microfluidic Platform for Anti-Tumor Drug Evaluation." NICOLE MALOFSKY '19 was recognized with an honorable mention and the People's Choice Award (voted on by symposium attendees) for her research titled "Developing Functionalized Bioresorbable Membranes Using Natural and Synthetic Polymer Blends."

The BioE Department was represented at the 2019 MSE Undergraduate Research Symposium by ANNIE BEHRE '19 and SYDNEY YANG '19 (both from The Chow Lab), with Annie receiving the award for "Largest Scientific Impact."

CLARE SEVERE '19 qualified for the NCAA East Track & Field Prelims in the 1500m, finishing 41st. This followed 3rd place podium finishes in the 1500m and 4x800m relay at the Patriot League Championships. In her 2019 indoor and outdoor seasons, Clare broke her own school record (4:22.78) in the 1500, set multiple personal records, was named Lehigh's outstanding Graduating Female Athlete at the year-end Athletics Convocation and named to the Patriot League Academic Honor Roll. Clare was also a 4-year starter on the Lehigh Women's Soccer team, where she was a key contributor.

ALYSSA SPILLER '20 attended and presented at the 45th American Association for Pediatric Ophthalmology and Strabismus (AAPOS) 2019 annual meeting held in San Diego, CA.

The 2019 BMES Coulter College was held on August 1st - 4th in Minneapolis, MN. MADDIE LINDQUIST '20, IVANN SPANN '20, JACK COYNE '20, and SUSAN WESTMAN '22 were presenters on behalf of Lehigh.

Ten BioE students were among the 23 Lehigh students who traveled to Sierra Leone to assist in addressing population health, nutrition and social issues within the country, as part of the Creative Inquiry+Mountaintop Initiatives. MARIA LANCIA '22 and JANNAH WING '19, under the direction of Prof. Xuanhong Cheng (BioE/MSE), are part of a team developing a low-cost, point of care, screening device for sickle cell anemia. SEANNA CORR'20, CHRIS FERENO '20, RACHEL CAFFREY '22, MATT FERYO '22, NEENA SHAH '21 and KAYLA MCMILLAN '21 worked to address the malnutrition challenges in Sierra Leone under the mentorship of Prof. Lori Herz (BioE), who also advised ROHAN EKAMBARAM '22 and NAAKESH GOMANIE '20 on the Ukweli Test Strips project, focused on improving screening for urinary tract infections and preeclampsia. Prof. Javier Buceta (BioE/ChBE) led a team developing a cellphone app that doctors can use to register socioeconomic factors and habits of Ebola patients.

Lehigh was well-represented by BioE undergraduates at the 2018 Biomedical Engineering Society Meeting in Atlanta, GA and the 2019 meeting in Philadelphia, PA. BioE undergrads that attended and presented posters at the 2018 meeting were ANNIE BEHRE '19, SYDNEY YANG '19, ABBIE NOBLE '20, ABDUL-NAFEA SYED '21, MONIKA BUCZAK '19. The Undergrads attending and presenting in Philadelphia, were ASHLEIGH CRAWFORD '20, MIN LAESSIG '20, ABDUL-NAFEA SYED '21, ESTHER PARK '20, ALYSSA SPILLER '20, MATTHEW FAINOR '20, AMANDA FERRANTE '20, SAREENA KARIM '21, OLIVA O'DONNELL '20. All students who attended took advantage of the opportunity to network with graduate program and corporate representatives.

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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, J. BUCETA, B. Chen, J. HSU, A. JAGOTA, M. Kothare, Y. LIU, D. Lopresti, J. Mittal, D. OU-YANG, D. Vavylonis, A. Voloshin

DIAGNOSTICS, SENSORS AND DEVICES

Biomedical Imaging
Biophotonics
BioMEMS
Biosensors
Microfluidics
Bioelectronics
Medical Devices

Y. BERDICHEVSKY, D. Brown, J. BUCETA, X. CHENG, H. Dailey, J. Hwang, Y. LIU, D. Lopresti, L. Lowe-Krentz, D. OU-YANG, S. TATIC-LUCIC, D. Vavylonis, D. Vezenov

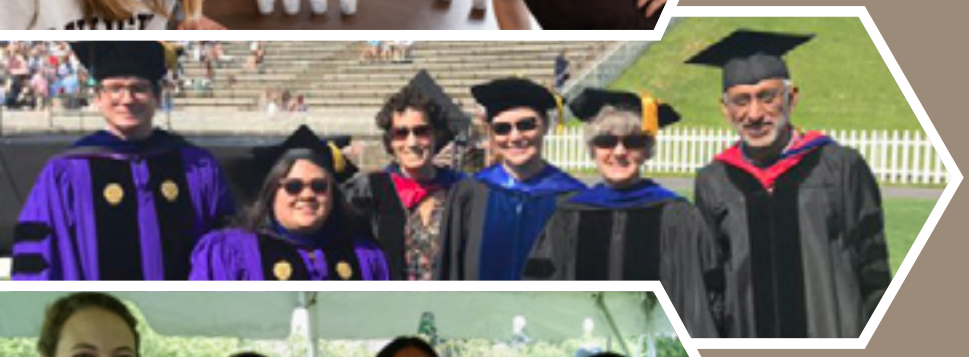
MATERIALS AND THERAPIES

Biomaterials
Molecular Bioengineering
Biopharmaceutical Engineering
Cell & Tissue Engineering
Neuroengineering
Biofluid & Solid Mechanics
Biomolecular & Cellular Mechanics
Environmental Bioengineering

Y. BERDICHEVSKY, A. Brown, D. Brown, J. BUCETA, X. CHENG, L. CHOW, H. Dailey, M. Falk, J. Hsu, A. JAGOTA, S. JEDLICKA, H. Jain, Y. LIU, D. OU-YANG, T. PASHUCK, K. Shultz, S. TATIC-LUCIC, D. Thevenin, D. Vezenov, A. Voloshin, F. ZHANG

Additional Bioengineering related research can be found in
Industrial Systems Engineering ISE.LEHIGH.EDU
Healthcare Systems Engineering HSE.LEHIGH.EDU

Faculty members missing from the picture: Yevgeny Berdichevsky, Sabrina Jedlicka and Daniel Ou-Yang.



Department at a glance:

14
CORE FACULTY MEMBERS

16
ASSOCIATED FACULTY MEMBERS

2
POST-DOCTORAL SCIENTISTS

1
TECHNICAL &
2 ADMINISTRATIVE STAFF

15
PHD LEVEL GRADUATE STUDENTS

8
MS LEVEL GRADUATE STUDENTS

205
UNDERGRADUATE MAJORS IN 3 UNDERGRADUATE TRACKS

(Biopharmaceutical Engineering, Bioelectronics & Biophotonics, andBiomechanics & Biomaterials)

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