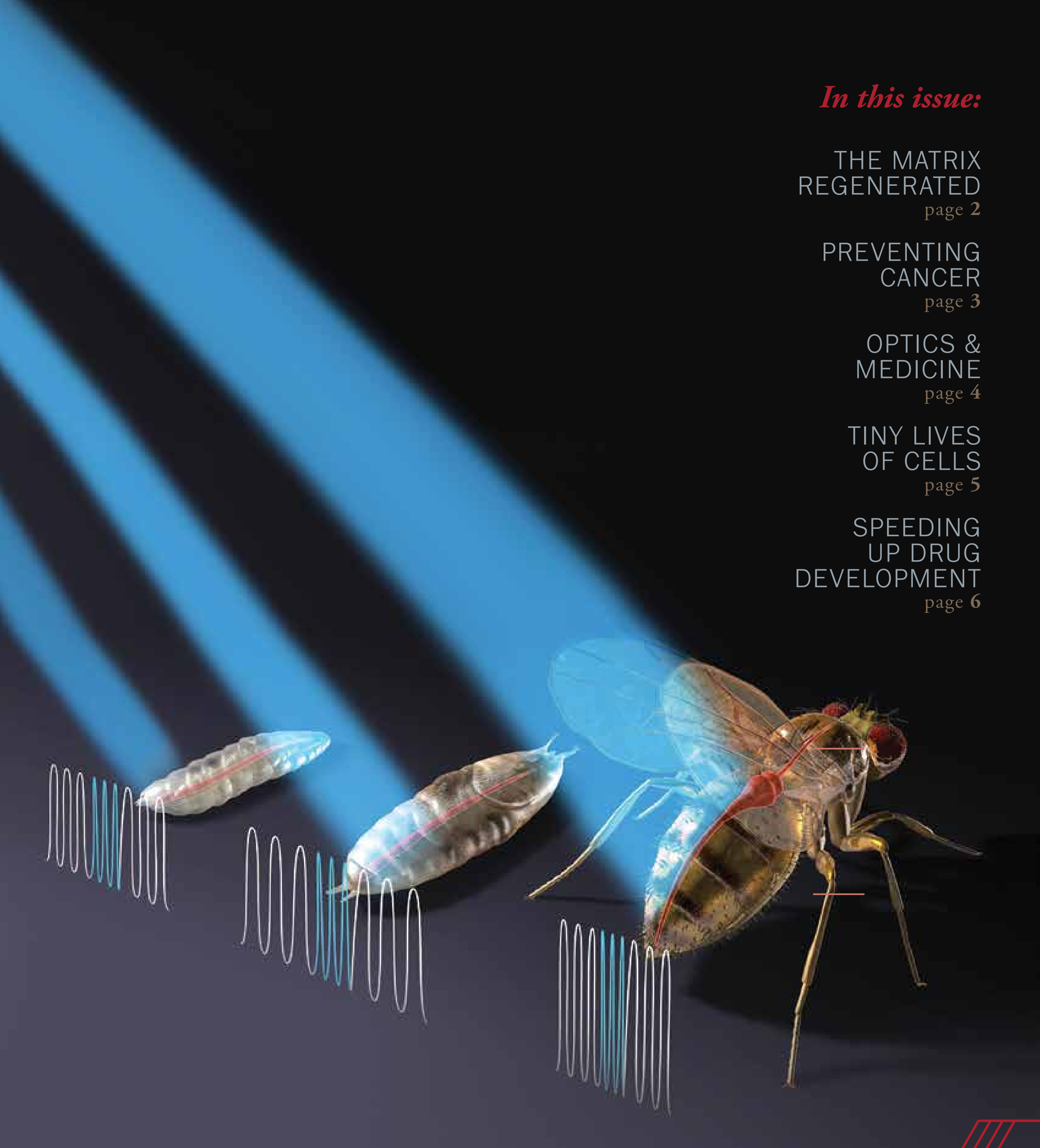
LEHIGH UNIVERSITY | P.C. ROSSIN COLLEGE OF ENGINEERING AND APPLIED SCIENCE



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BIOENGINEERING PROGRAM | FALL 2016 NEWSLETTER

PROGRAM DIRECTOR'S MESSAGE

Welcome to the inaugural newsletter from the Bioengineering Program at Lehigh University. For many of you, our readers, this will be an introduction to the program; for others, an update on what we've been up to, and where we are headed. We are a vibrant, young program, and certainly the most interdisciplinary engineering program at Lehigh. Read this newsletter for vignettes on our undergraduate curriculum and experience, research opportunities for graduate study (and undergraduate student research), and our energetic and engaged faculty.

A quick history, first, for those who don't know us; bioengineering at Lehigh was launched as an undergraduate program in 2002, granting its first bachelor's degrees in 2006, followed by the launch of our graduate program in 2010, with its first master's degrees in 2011 and its first doctoral degrees in 2014. The program has grown steadily this past decade; we are one of the larger undergraduate majors in the engineering college and our graduate program is in a phase of sustained growth.

Our undergraduate program balances the breadth versus depth axis by requiring our students to specialize in one of three tracks: Biopharmaceutical Engineering, Biomechanics and Biomaterials, and Bioelectronics/Biophotonics. It balances the foundation versus practice axis by marrying the base of Lehigh's traditionally strong engineering training with several opportunities for hands-on and open-ended design and research. A glance at the newsletter will show the many ways in which our students are innovating in design, breaking new ground in research, and sometimes doing both. For instance, last year a Bioengineering-led team won the NIBIB design challenge (DEBUT), several students presented their research at the annual BMES meeting, and others placed highly at Lehigh's David and Lorraine Freed undergraduate research symposium. Our alumni are contributing at a variety of bioengineering companies, in related engineering fields, and even in unrelated areas such as finance.

As an interdisciplinary engineering program at Lehigh, the Bioengineering program draws its faculty members from a number of departments in the engineering and arts & sciences colleges. (See "Program at a Glance".) Our 18 core faculty members – those most closely involved in teaching and administration of the program – hold primary appointments within four engineering departments and three departments in the college of arts and sciences. We have a growing faculty and its members run vigorous, collaborative, well-supported, research programs covering a range of bioengineering topics and applications. This year we welcome the latest addition to our faculty, Professor Wonpil Im, a computational biologist who joins us as the Presidential Endowed Chair in Health Science & Engineering. We also celebrate the recent tenure and promotion of Professor Sabrina Jedlicka, and research awards to Professors Bryan Berger and Chao Zhou (see these stories and more in the newsletter). In the 2016-17 academic year, we are conducting two new faculty searches, both in collaboration with the DATA-X initiative at Lehigh (http://www1.lehigh.edu/datax), part of plans to build curricula and research at the intersection of data science and bioengineering. I specifically invite prospective graduate students to read the stories in the newsletter about our faculty members, and current and former graduate students, and to explore, further, the many exciting opportunities for research in bioengineering at Lehigh.

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Lehigh Bioengineering over 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**

THE MATRIX REGENERATED

Lesley W. Chow has developed functional scaffolds for bioengineered healing.

We marvel at what hands can do—play a minuet, paint a landscape, build a cabinet, wield a scalpel. But we might take for granted how hands work—a marvel all its own. "Bone, ligaments, and muscle interface with each other," says Lesley W. Chow, a faculty member in Lehigh University's Bioengineering Program, and assistant professor in Materials Science and Engineering. "If something terrible happens and you need surgical reattachment, we need ways to regenerate that interface."

Regenerative medicine promises to heal conditions that might otherwise be beyond repair. The concept encompasses more than organ replacement or even tissue engineering to include understanding the body's own repair processes and how to marshal them in conjunction with biomaterials. Orthopedic treatments such as hand or knee repair are a major potential application. But there's hardly an area of the body that couldn't benefit from the promises of regenerative medicine.

Chow's work focuses on understanding and directing the ways different tissues are organized. Cells generally create their own support structures through what's called the extra-cellular matrix, or scaffolds. But scaffolds don't just support cells, they provide important signals that tell cells what to do and where to go. "Orthopedic cells are surrounded by molecules like collagen and hyaluronic acid that help regulate function," Chow says.

"WE WANT TO FIND A WAY TO RECREATE THOSE ENVIRONMENTS AND PROVIDE A MATERIAL THAT CELLS CAN LIVE ON, GROW ON, AND ULTIMATELY PROVIDE THEIR OWN MATRIX."

Once regeneration kicks off with the right chemical cues, biodegradable engineered materials can dissolve. "The bioengineered material is a template that says 'do this here and that there,'" Chow says. "But you end up with just the tissue that cells produce themselves."

Past efforts have focused on first creating synthetic scaffolds, then adding chemical-signaling peptides in a post-modification process. Chow's lab has developed ways to use advanced manufacturing techniques such as 3D printing and electrospinning to create peptide-polymer conjugates that are embedded with chemical instructions. "We functionalize the scaffold surface," Chow says.

Precisely controlling properties such as which peptides are used and where they're placed in the microenvironment is important because such variables influence cell function. Chow likens the process to using an ink-jet printer to merge and change various colors in a document to achieve a visual effect by adding or withholding ink. The techniques allow finer-tuned scaffolds to restore intricate interfaces between different types of tissue once the precise mix of chemical signals has been established.

"Limitations in material science haven't previously allowed the ability to make materials that could directly address interfaces in these materials," Chow says. "My lab has been able to develop that." Still, the research is two-pronged. "We're trying to learn why organs are organized a certain way and how we can design better materials," Chow says. "We want to guide cells to go where they're supposed to go and do what they're supposed to do so they're organized the same way as native cells."

—Richard Laliberte

Welcome
NEW BIOENGINEERING FACULTY AND STAFF

Wonpil Im joined the Lehigh Faculty in the Department of Biological Sciences and Bioengineering program in August, 2016. He has been named the Presidential Endowed Chair in Health–Science and Engineering. His research focuses on the applications of theoretical/computational methods to chemical and physical problems in biology and material science.

Katherine Hudson is a new postdoctoral fellow, supervised jointly by Prof. Lesley Chow and Hannah Dailey (MEM). Katie did her PhD work with Prof. Lawrence Bonassar at Cornell in biomedical engineering.

Marta Dies Miracle joined Prof. Javier Buceta's research group in February, as a postdoctoral fellow. Marta obtained her PhD in Physics from Polytechnic University of Catalonia, Barcelona in 2015, for her thesis, "Coupled Dynamical Processes in Bacteria".

COULD A SYNTHETIC PEPTIDE BE THE KEY TO

PREVENTING CANCER?

When it comes to defeating disease, studying the intricacies of cell communications has revealed an innovative pathway to a cure.

Bryan Berger, an associate professor of chemical and biomolecular engineering, is putting his studies of cellular protein structure and molecular recognition to practical use. He's collaborating with clinicians and biomedical scientists at University of Pennsylvania to develop a tool that can guide a cell away from developing abnormally.

Berger was a post-doc at Penn and still holds an adjunct faculty position there in the School of Medicine, where he works closely with his former colleagues. He strives to understand signal transduction, molecular cell signaling from a cell's exterior to its interior. When a signaling molecule wakes up a receptor on the cell surface, the receptor delivers a specific set of biochemical instructions to the interior of the cell that determine its behavior.

One particular class of receptors, called integrins, sit on the surface of cells and are responsible for cells sticking to other cells, a crucial function for platelet activation in blood clotting and the organization of tissues and larger structures in the body. An NIH grant supports Berger and his Ph.D. student Sajedehalsadat Yazdanparast Tafti's study of integrins, but the technology they are developing is more broadly applicable to studying all kinds of receptors.

Berger's team is exploiting the fact that two receptors get together to function in new ways. They are developing a tool to design synthetic peptides that can target and inhibit the receptors' function. If a particular receptor known to be active in disease development is prevented from functioning, then the disease could effectively be prevented.

"Think about this analogy: there are 10,000 genes in the human genome, but about 30,000 possible functions in the body," said Berger. It's true that one gene equals one protein that can perform one function. But nature has created additional cell functions using a simple solution: dimerization. When cell receptors come in contact with each other, they can take on a new shape, and are therefore able to perform a new task.

While dimerization is an essential mechanism for fulfilling the body's everyday needs, it also underlies potentially life-threatening developments, notably cancer growth. Cancer cells grow uncontrollably because they have mutated into a state that causes the dimerization of growth factor receptors to be permanently switched on.

"So our approach is to try to physically block the signal being transduced for dimerization with a peptide we design," Berger said. "This solution would work alongside, and be complementary with, other solutions for cancer. It's different from the classic drug-screening methods to cure cancer."

Berger and his colleagues are using directed evolution as a tool to predict and fine-tune peptide designs that could block specific signals. Berger has been studying the problem for the past 10 years. "We're still developing the technology, trying to make the process more efficient for clinicians," Berger said. A hematologist for example, could use the technology to discover potential drug compounds more quickly.

Together with his former Penn advisors, a hematologist and a clinician, Berger's team is developing translational studies and computational and experimental tools, as well as doing the design and the testing of peptides in a clinical setting. The grant has given the team a four-year goal to develop its technology. "Through this process, we'll be able to learn more about how receptors function, and we'll really be able to test our hypothesis of how to design peptides for the specific dimerization domain. We now have nice industrialized process for blocking all kinds of receptors, which may even give drug discovery companies a better understanding of how these things work," Berger said.

Berger's other research project, the environmentally friendly manufacturing of quantum dots (semiconducting nanoparticles used in transistors, solar cells, LEDs, lasers and medical imaging), originated with reports of Stenotrophomonas maltophilia, a stubborn bacterial strain that had managed to colonize metal surfaces in a hospitals. While pursuing a medical solution for Lehigh Valley Hospital, Berger and his colleagues, Steve McIntosh, associate professor of chemical and biomolecular engineering, and Christopher Kiely, professor of materials science and engineering, uncovered the mechanism responsible for the bacteria's tight hold on metal. By producing a biofilm containing polysaccharides, a sugary compound akin to the stuff in dental plaque, the bacteria can adhere to a smooth surface.

These bacteria could also be manipulated to forego normal biological functions and only generate quantum dots, since it had previously been known to grow metallic nanocrystals naturally when exposed to metals. The work by Berger and his colleagues has significant implications, since an industrial-scale process for making quantum dots is a faster, cleaner and cheaper alternative to the current processing technology.

"What we have discovered is that the bacteria were evolving types of chemical structures that were different to what was known previously. They seemed to adapt quickly," Berger said.

The discovery was unexpected.

"You don't have to go far in medicine and biology to find something really challenging. There are an infinite number of things to be discovered," Berger said.

—Manasee Wagh

AT THE BOUNDARY OF

OPTICS AND MEDICINE

Chao Zhou uses optical technologies to probe fruit flies for clues about human disease.

The typical fruit fly is about 3 mm long, 2 mm wide, has compound eyes and a mouth specially developed to sop up liquids. Yet this tiny creature flitting over past-their-prime peaches on your kitchen counter bears fundamental genetic similarities to humans. About 75 percent of disease-related genes in people have counterparts in fruit flies, making the insect the lab rat of genomic research and one of the best-described eukaryotic organisms on the planet.

Chao Zhou, a faculty member in Lehigh University's Bioengineering Program and assistant professor in Electrical and Computer Engineering, has a special interest in the fly's heart, which measures about 100 microns when fully dilated and 10 to 20 microns when contracted. He has adapted optical coherence tomography (OCT) and optical coherence microscopy (OCM) technology to peer into the tiny organ—and other biological structures—with a high degree of resolution at the micrometer or nanometer scale.

OCT/OCM technologies use short-wavelength light (typically near infrared) and its measured reflection to capture images from deep inside tissues in a technique akin to ultrasound. OCT is widely used in ophthalmology to produce 3D diagnostic scans of the eyes—and Zhou's research group has developed a beam-splitting technology that allows OCT eye exams to be done 10 times faster than possible using current tools. But early in his career, Zhou saw ways that OCT and OCM could reveal inner workings in tissues beyond eyes.

In the case of the fruit fly heart, technologies that Zhou and his colleagues developed have produced some intriguing—even startling—observations. "An advantage of OCT/OCM is that the technology is completely noninvasive," Zhou says. "Combined with ways to modify fly DNA, they give us a very powerful system for understanding how different genes affect heart development." Having noninvasive tools allows researchers to follow development in a single specimen as it progresses from larvae to adult.

One line of Zhou's research is exploring the impact of a gene that controls the body clock cycle. "If you knock out this gene in the fly, heart function is severely affected, especially in late development," Zhou says. "This is not a surprise, but we now have first-hand evidence of this connection." The knowledge can now be used to further investigate genetic risks for heart disease.

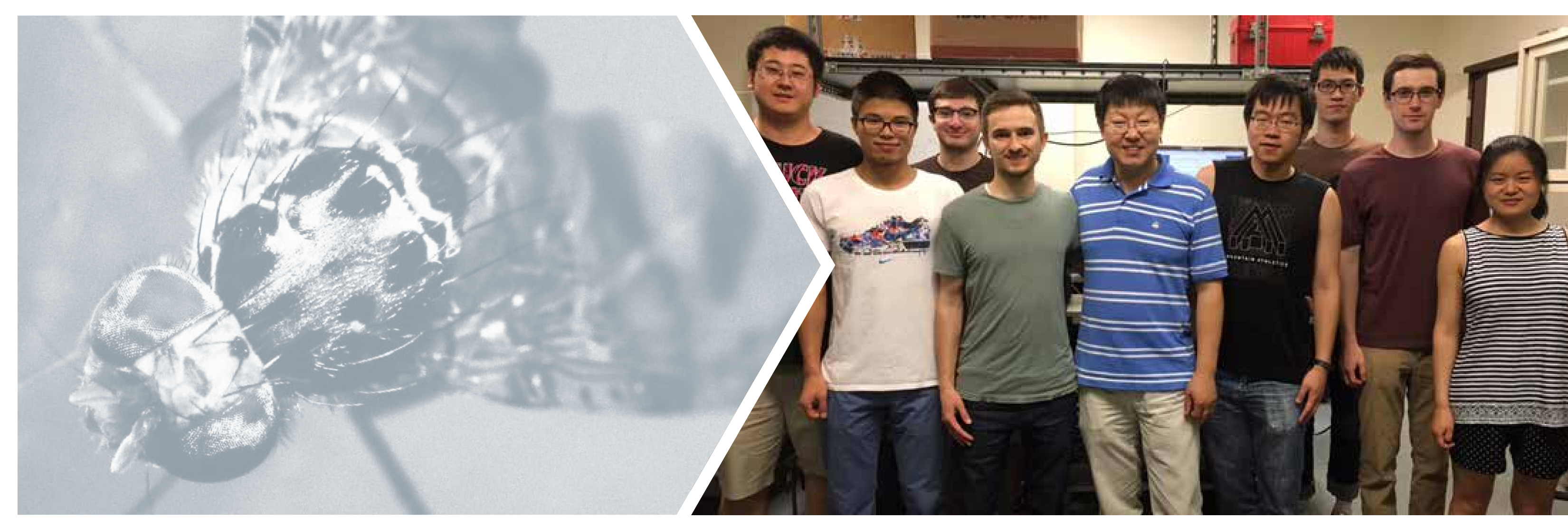
What was a surprise: Finding that a fly's superfast 300-to-400-beats-per-minute heartbeat slows and completely stops for about a day when it transitions from larvae to pupae, then cranks up again from pupae to adult. "We didn't know this before because we didn't have the tools to see it," Zhou says. "Nothing like this is known to happen in humans, and we're not sure what it means. Yet much of our fundamental biology is the same, and we need to know more about the mysteries of metabolic changes during development."

In research combining OCM and optogenetics (a method of genetically modifying cells to make them sensitive to light that can be used to control function), Zhou's team has shown that by altering the frequency of a low-power blue laser beamed at a fly's heart, researchers can change the insect's heart rate. The finding raises the possibility of developing a noninvasive optical pacemaker and other novel medical treatments.

Other Zhou research has focused on using OCM to monitor growth of blood vessels in engineered tissue, track how tumor cells develop, and observe changes in nerve cells that illuminate how neurons communicate, especially in the presence of disease.

"PEOPLE SAY A PICTURE IS WORTH A THOUSAND WORDS," ZHOU SAYS. "NOW WE CAN TAKE PICTURES AT THE NANOSCALE ON LIVING SAMPLES. THE BOUNDARY OF OPTICS AND MEDICINE IS A VERY EXCITING PLACE TO BE."

—Richard Laliberte



PROBING THE TINY LIVES OF CELLS

A human cell, a dynamic, living entity measuring just about 30 microns in diameter, presents a special challenge to researchers wishing to poke and prod. While earning his PhD from Lehigh, alumnus Ming-Tzo (Steven) Wei and his research team developed a new technique called an optical tweezer to reach inside HeLa cells and Dental Pulp Stem Cells.

Led by Physics Professor H. Daniel Ou-Yang Wei, Wei's team hypothesized that an understanding of cell mechanics, stiffness and elasticity would be the key to controlling cell behavior, which is imperative to decoding the mechanics of disease.

The optical tweezer technique involves trapping an artificial particle inside a cell and then observing what happens to the particle as the network of cytoskeletal proteins around it responds to increased stress. "We found that the cells regulate their own stiffness, and so a cell can stretch itself. If a cell is like a cloth tent that you want to erect, you need to apply stress to create the steeper angle," Wei said. His team observed that after the stem cell attains a certain degree of stiffness, it begins to differentiate into specific cell types. "This observation suggests that cells can regulate their mechanical properties by adjusting intracellular stress," he said.

Wei worked with Physics Professor Dimitrios Vavylonis and Professor Sabrina Jedlicka, Associate Chair of Materials Science and Engineering, as well as researchers at State University of New York at Stony Brook on the project.

Wei's research at Lehigh laid the groundwork for his post-doctoral work at Princeton. Since 2014, he has been focused on how nerve cells involved in progressive neurodegenerative diseases such as amyotrophic lateral sclerosis and Alzheimer's disease behave.

When a normal nerve cell undergoes stress or damage, it tries to protect itself by exuding liquid stress granules made of RNA molecules and proteins. The liquid shields the cell's RNA from damage. However, in people with ALS, this stress granule forms a gel-like solid instead of a liquid, preventing the RNA from functioning.

Now Wei is using not only optical tweezers but also a novel technique, ultrafast-scanning fluorescence correlation spectroscopy, which yields more precise measurements of proteins within affected nerve cells. "We're trying to increase our understanding of what happens at a cellular level in terms of cell mechanics," Wei said.

A NEW DEVICE COULD SPEED UP DRUG PRODUCTION

A device that reproduces a section of the human vascular system would give drug developers a cheaper, quicker platform to test a candidate drug. That's precisely what Christopher Uhl, a fourth year bioengineering Ph.D. student, is hoping his team's microfluidic device can do.

"The current processes to deliver therapeutic drugs are time-consuming and expensive," Uhl said. Typically, companies begin with thousands of potential drug compounds and go through multiple rounds of elimination to find a handful of promising drugs. They use computer models, lab tests, animal-based tests and, eventually, human clinical tests. "If we can help you whittle down 10 of your compounds to five, by more closely mimicking the conditions found in a mouse or human, we can cut down on your time and dollars," Uhl said.

Uhl's research team, led by mechanical engineering professor Dr. Yaling Liu, has developed a functional testing platform that can identify how therapeutics work, long before drug developers enter animal testing. Started as an academic research project, the technology has matured into a tool the group believes is ready to support actual human drug development.

To that end, Uhl's team received an NSF I-CORPS grant for its project, "Microfluidic Device for the Evaluation of Drug Carrier Delivery," in December 2015. To date, the group has received $50,000. "The I-CORPS process is grueling," Uhl said. "It helps us understand how to make a product for customers. We've realized that our technology could not be sold as it exists in the lab."

The microfluidic devices resemble transparent sheets the size of a standard playing card, a few millimeters thick and made of polymers and glass. Fluid traverses the sheets through channels cut to 100 micrometers wide, the diameter of a human hair. Sandwiched layers of material enclose a system that mimics arterial blood vessels. When the team introduced cells found in the inner lining of blood vessels into the channels, followed by therapeutic drugs, they could examine the resulting interaction in a realistic vascular setting.

"Because the devices are transparent, we can visualize everything going on in real time, using a wide range of microscopy techniques," Uhl said. However, the researchers must avoid any imaging tools that would result in the death of living cells, such as electron microscopes, which require a vacuum. Instead, they use light-based microscopy with phase contrast to visualize cells, and they label drug delivery carriers with fluorescent markers for tracking.

With this device, the team can analyze the behavior of various types of carriers, including studying how well they bind to blood vessels and how effectively they deliver their payload.

After conducting 100 interviews with potential companies, Uhl's group realized that pharmaceutical companies find the technique attractive but prefer outsourcing such testing services nowadays. "So we would run the tests they request and provide data and analysis about what drug X is doing and what we think it's well suited for," Uhl said.

With a well-developed piece of technology and an evolving business model, the group expects to begin benchmark testing soon.
—Manasee Wagh

GRANT SUCCESS

Lehigh's Bioengineering faculty is a highly research-active group, with funding from agencies such as the NIH, NSF, Dept. of Energy and the Army Research Office. Listed below are examples of recent grants seeding new research directions.

CHAO ZHOU (Bioengineering/ECE) received a grant from the National Institutes of Health to develop innovative imaging technology. The NIH grant is entitled "Novel Optical Imaging and Pacing Platform for Developmental Cardiology", and runs through 2018.

LESLEY CHOW (Bioengineering/MatSci & Eng) recently received two Lehigh grant awards: a Lehigh Faculty Research Grant titled "Advanced bioinks for 3D printing multifunctional scaffolds" and a Collaborative Research Opportunity (CORE) grant with Hannah Dailey (MEM/BioE associated faculty) titled "Design of 3D-Printed Biodegradable Scaffolds for Functional Osteochondral Tissue Regeneration". Matching funds for the latter grant come from St. Luke's University Health Network.

XUANHONG CHENG (Bioengineering/Mat Sci & Eng), Alparslan Oztekin (MEM), Edmund Webb (MEM) and **XIAHUI "FRANK" ZHANG** (Bioengineering/MEM) comprise an multi-disciplinary research group, supported through 2018 by the National Science Foundation, under the project, "Mechano-Biologically Informed Molecular Models of Flow Sensitive Biopolymers". http://www.lehigh.edu/engineering/news/faculty/2016/20160412_vwf_cheng_oztekin_webb_zhang.html

2016 PUBLICATION SPOTLIGHT

Lehigh Bioengineering faculty members and Bioengineering students co-authored more than 30 journal articles that were accepted for publication in the first half of 2016. Some of the notable ones are listed below. (Names in **BOLD** are current Lehigh BioE faculty or current/former Lehigh BioE students)

CHOW, L.W. and **J.F. FISCHER**. 2016. "Creating biomaterials with spatially organized functionality." *Exp. Biol Med* 241: 1025-1032.

DILLEN, J, Z. He, C-Y Hui, and **A. JAGOTA**. 2016. "Geometry of defects at shape-complementary soft interfaces." *Extreme Mech Let.* doi:10.1016/j.eml.2016.05.006

Dragovich, M. K. Genemaras, **H.L. DAILEY**, **S.S. JEDLICKA**, **X. ZHANG** 2016. "Dual regulation of L-selectin mediated leukocyte adhesion by endothelial surface glycocalyx" *Cellular and Molecular Bioengineering.* Accepted 07/16 and in press.

Dunleavy, R., L. Lu, C.J. Kiely, S. McIntosh, and **B.W. BERGER**. 2016. Single-enzyme biomineralization of cadmium sulfide nanocrystals with controlled optical properties. *Proceedings of the National Academy of Sciences*, 201523633.

Emri, I. and **A. VOLOSHIN**. 2016. "Statics – learning from engineering examples" Springler, ISBN: 978-1-4939-2100-3.

He, R., S. Wang, G. Andrews, **W. SHI**, and **Y. LIU**. 2016. "Generation of customizable micro-wavy pattern through grayscale direct image lithography." *Sci Rep.* 6: 21621.

Liu, J., L. Pan, **X. CHENG**, and **Y. BERDICHEVSKY**. 2016. "Perfused drop microfluidic device for brain slice culture-based drug discovery." *Biomedical microdevices* 18, no. 3: 1-10.

MACDONALD, L.C., **S. O'KEEFE**, **M-F. PARNES**, **H. MACDONALD**, **L. STRETZ**, S.J. Templer, E. Wong, and **B.W. BERGER**. 2016. "A secreted andyrin-repeat protein from clinical *Stenotrophomonas maltophilia* isolates disrupts actin cytoskeletal structure." *ACS Infect. Dis.* 2(1): 62-70. DOI: 10.1021/acs/infecdis.5b00103.

MACDONALD, L. C., **E. B. WEILER**, and **B. W. BERGER**. 2016. Engineering broad-spectrum digestion of polyuronides from an exolytic polysaccharide lyase. *Biotechnology for Biofuels*, 9(1), 43.

MEN, J., Y. Huang, J. Solanki, X. Zeng, A. Alex, J. Jerwick, Z. Zhang, R.E. Tanzi, A. Li, and **C. ZHOU**. 2016. "Optical coherence tomography for brain imaging and developmental biology." *IEEE Journal of Selected Topics in Quantum Electronics* 22, no. 4: 1-13

Surawathanawises, K., **K. KUNDROD**, and **X. CHENG**. "Microfluidic devices with templated regular macroporous structures for HIV viral capture." *Analyst 141*, no. 5 (2016): 1669-1677.

THOMAS, A., **H.D. OU-YANG**, **L. LOWE-KRENTZ**, V.R. Muzykantov, and **Y. LIU**. 2016. "Biomimetic channel modeling local vascular dynamics of pro-inflammatory endothelial changes" Biomicrofluidics, 10, 014101, DOI:10.1063/1.4936672.

Wang, S., **A. THOMAS**, E. Lee, S. Yang, **X. CHENG**, and **Y. LIU**. 2016. "Highly efficient and selective isolation of rare tumor cells using a microfluidic chip with wavy-herringbone micro-patterned surfaces." *Analyst*, 141: 2228-2237, DOI: 10.1039/C6AN00236F

Weber, M. and **J. BUCETA**. 2016. "The cellular Ising model: a framework for phase transitions in multicellular environments." *J. Royal Soc., Interface*, 13 (119).

WONGANU, B. and **B.W. BERGER**. 2016. A specific, transmembrane interface regulates fibroblast activation protein (FAP) homodimerization, trafficking and exopeptidase activity. *Biochimica et Biophysica Acta (BBA)-Biomembranes*, 1858(8), 1876-1882.

Xu, J., J. Yang, N. Huang, **C. UHL**, Y. Zhou, and **Y. LIU**. 2016. "Mechanical response of cardiovascular stents under vascular dynamic bending." *BioMedical Engineering OnLine* 15 (1):21, DOI: 10.1186/s12938-016-0135-8

ZHANG, X., W. Zhang, M. Dragovich, W. Deng, and R. Li. 2016. "Biophysical Characterization of Mechanosensors within the Plasma Protein von Willebrand Factor and its Receptor Platelet Glycoprotein Ib-IX." *Biophysical Journal* 110, no. 637a.

ZHOU, T., **S. PERRY**, Y. Ming, and **S. TATIC-LUCIC**. 2016 "Estimation of the physical properties of neurons and glial cells using dielectrophoresis crossover frequency. *Cell Biochem. Biophys*, in press, DOI 10.1007/s10867-016-9424-5

FACULTY

NOTABLES AND MEDIA MENTIONS

Lehigh's Board of Trustees approved the tenure and promotion of **SABRINA JEDLICKA** to Associate Professor at their Spring 2016 meeting. Jedlicka joined Lehigh's faculty as a member of the Bioengineering Program and the Department of Materials Science & Engineering in 2008. Her research revolves around biologically functional material design for use in cell-based therapeutics and biomolecule/material interactions with applications in stem cell research, regenerative medicine and biosensing technologies.

BRYAN BERGER (Bioengineering/ChBE) was the recipient of the 2016 Alfred Noble Robinson Faculty Award, an award given to faculty members who have shown extraordinary enthusiasm for Lehigh's goals and priorities. Berger's research group was also recently featured in the NY Times Science section (http://www.nytimes.com/2016/05/06/science/quantum-dots.html?_r=1).

The recipient of the 2016 Eleanor and Joseph F. Libsch Early Career Research Award, recognizing faculty who have demonstrated potential for high-quality research early in their career, is **CHAO ZHOU** (Bioengineering/ECE). Zhou's work focuses on developing novel optical imaging technologies for a variety of biological and clinical applications, including cancer research, neuroscience, developmental biology and tissue engineering.

GRADUATE

NEWS

Congratulations to our 2015-16 Bioengineering graduate degree recipients: **BENJAMAPORN WONGANU, PHD** (May'15; Berger Lab) , **ANTONY THOMAS, PHD** (May'15; Liu Lab), **LOGAN MACDONALD, PHD** (Dec'15; Berger Lab), **YU SONG, PHD** (May'16; Berdichevsky Lab), **CHENYU WU, PHD** (May'16; Zhang Lab), **JONATHAN DILLEN, MS '16**, **MARK MAHONEY, MS '16**, and **COLIN ORR, MS '16**.

WENTAO SHI was named a Rossin Doctoral Fellow for the 2016-17 academic year. Shi, a third-year student in the Bioengineering doctoral program will take part in the special preparation for careers in academia and research provided by a gift from the late Peter C. Rossin '48.

ALUMNI UPDATE

BENJAMAPORN WONGANU, PHD '15 (Berger Lab) now is an assistant professor at King Mongkut's University of Technology, North Bangkok, Thailand.

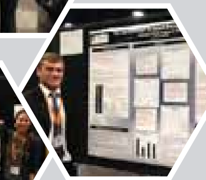
STEVEN (MING-TZO) WEI, PHD '14 (Ou-Yang Lab) is a post doctoral fellow at Princeton University (see associated story).

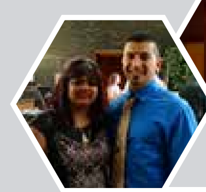
ANTONY THOMAS, PHD '15 (Liu Lab) is currently a Scientist at Ionis Pharmaceuticals, located in Carlsbad, CA. Antony informs us that he is the "first recruit working towards miniaturizing cell culture using droplet microfluidics."

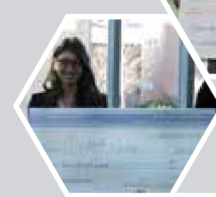
COLIN ORR, MS '16 has taken a position as a Process Development Engineer at Regeneron Pharmaceuticals. He joins other Lehigh alums, **MEGHAN CASEY, BS '11, MS' 13**, **AMY HOSKINSON BS '10**, **BRIDGET NOLAN '15**, and **AUDREY RODRIGUEZ '12** at the company.

UNDERGRADUATE

STUDENT SUCCESS


Kelly Callahan (BIOE '16; Berger Lab), Josh Webb (BIOE '16, Brown lab) and Dennis Moyer (IDEAS, '16 Zhang lab) were among five Lehigh undergraduate students who traveled to Tampa in October 2015 for the Biomedical Engineering Society Meeting. Callahan, Webb and Moyer presented their independent research work in the undergraduate research poster session, and all students in attendance took advantage of the opportunity to network with graduate program and corporate representatives.

Several Bioengineering undergraduates were honored at the 2016 Student Life Leadership Awards Ceremony in May: Evan Eckersley '17 and Jeremy Sordan '16, received "Contribution to Student Life" awards; Nicholas Leight '16 was presented with the "Service Above Self" award and Richard Johnson '16 was honored with an Alumni Association Undergraduate Merit Award. We are very proud of their contributions to the Lehigh!

The Bioengineering Program had a great showing at the 2016 INNOVATE! CELEBRATE! Awards dinner sponsored by the Baker Institute of Lehigh. Nicholas Hirdt ('17, South Mountain Medical; Grand Prize), Emily MacMillan ('16, IronArm Exoskeleton, 3rd place) and Aileen Bidad ('16, Cyclic Solutions, 2nd Place) won individual awards in the 2015-16 EUREKA! competition, sponsored by the Baker Institute of Lehigh University. Patrick Zager ('17) and Jialu Wang ('17) were participants in the iPrize competition.

Lehigh Bioengineers had a great showing at the 2016 David and Lorraine Freed Undergraduate Research Symposium. Lauren Boller '16 was the 1st place winner for her research titled "IGF-I Promotes the Development of Epilepsy through Activation of Akt-mTOR Cascade" under the supervision of Prof. Yevgeny Berdichevsky. As the top winner, Boller received a $2000 travel award.

Elizabeth Weiler, '16 received an Honorable Mention and a $400 travel fellowship for her work on "Designer enzymes for broad-spectrum digestion of polysaccharides" under the supervision of Prof. Bryan Berger.

Ani Nahapetian, '16 finished a stellar career as the goalie for the Lehigh University Varsity Women's Soccer Team. Ani was named as the Patriot League "Goalie of the Week" twice in the Fall 2015 season.

The undergraduate Biomedical Engineering Society at Lehigh sponsored a Health-Related Careers Alumni Panel in May to give undergraduate bioengineers and other majors interested in health related careers an opportunity to network with bioengineering professionals. The event featured several Lehigh alumni who are currently employed in consulting and engineering at companies such as IMS Health, CytoSorbents, Syntheses, Axtria, Sanofi Pasteur and the Linde Group. The event was a big success, with over 60 attendees from various majors across campus joining the alumni for a night of career information.

ALUMNI UPDATE

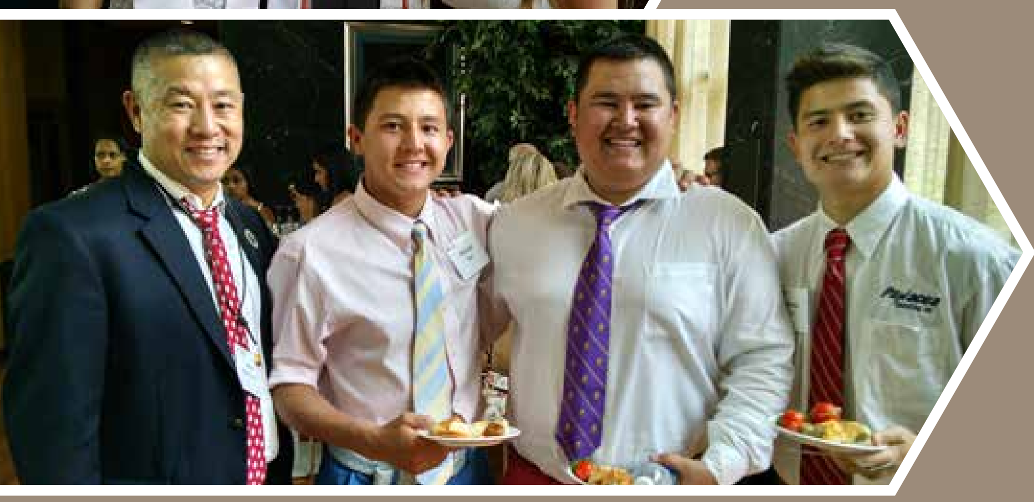
Jay Fraser, BIOE '15, Kathryn Kundrod, BIOE '15, Andrew Di'Onofrio, MechE '15, Kaylynn Genemaras, BIOE '15 and Paul Schroeder, BIOE '15, won first place and a $20,000 prize in the 2015 DEBUT Challenge, sponsored by NIBIB for their entry: Cyclic Solutions Viral Diagnostic Technology. They were recognized in October, at the annual Biomedical Engineering Society Meeting in Tampa.

Jay Fraser and Kathryn Kundrod were also named as Finalists in the 2015 National Collegiate Inventors competition held last November at the U.S. Patent and Trademark Office in Alexandria VA. Fraser is currently in the GOLD program at Catalent Pharmaceuticals, Kundrod is a doctoral student in BME at Rice University, Genemaras is a doctoral student in the Bioinnovation program at Tulane University and Schroeder is a medical student at the Uniformed Services University of the Health Sciences in Bethesda.

BIOENGINEERING RESEARCH
AT LEHIGH UNIVERSITY

BIOMATERIALS	**B. Berger**, **X. Cheng**, **L. Chow**, H. Dailey, M. Falk, **W. Im**, **A. Jagota**, H. Jain, **S. Jedlicka**, **H.D. Ou-Yang**, K. Schultz
BIOMECHANICS	**J. Buceta**, H. Dailey, **A. Jagota**, **S. Jedlicka**, **Y. Liu**, **H.D. Ou-Yang**, **S. Tatic-Lucic**, D. Vezenov, **A. Voloshin**, **X. Zhang**
BIOMEDICAL IMAGING/ANALYSIS	X. Huang, D. Lopresti, D. Vavylonis, **C. Zhou**
BIOMEMS/BIOSENSORS/MICROFLUIDICS	F. Bartoli, **Y. Berdichevsky**, **J. Buceta**, **X. Cheng**, J. Hwang, **Y. Liu**, **L. Lowe-Krentz**, **S. Tatic-Lucic**, D. Vezenov
BIOPHOTONICS/BIOELECTRONICS	F. Bartoli, **H.D. Ou-Yang**, **S. Tatic-Lucic**, D. Vezenov, **C. Zhou**
BIOPHYSICS	**B. Berger**, A. Brown, **J. Buceta**, B. Chen, **W. Im**, **A. Jagota**, J. Mittal, **H.D. Ou-Yang**, D. Vavylonis
CELL & TISSUE ENGINEERING	**Y. Berdichevsky**, A. Brown, **L. Chow**, M. Falk, H. Jain, **S. Jedlicka**, K. Schultz,
COMPUTATIONAL BIOENGINEERING	**J. Buceta**, B. Chen, **W. Im**, **A. Jagota**, G. Lang, D. Lopresti, J. Mittal, A. Voloshin,
ENVIRONMENTAL ENGINEERING	D. Brown, K. Jellison
MODELING OF BIOLOG. SYSTEMS	**J. Buceta**, **T. Hsu**, **W. Im**, **A. Jagota**, M. Kothare, **Y. Liu**, J. Mittal, D. Vavylonis, **A. Voloshin**
MOLECULAR BIOENGINEERING	**B. Berger**, A. Brown, **T. Hsu**, **W. Im**, M. Pires, D. Thevenin, **X. Zhang**
NEUROENGINEERING	**Y. Berdichevsky**, **S. Jedlicka**, M. Kothare

Additional Bioengineering related research can be found in Industrial Systems Engineering **(https://ise.lehigh.edu)** *and Healthcare Systems Engineering* **(http://hse.lehigh.edu)**.



Program at a glance:

18
FACULTY MEMBERS

3
POST-DOCTORAL SCIENTISTS

1
TECHNICAL &
1 ADMINISTRATIVE STAFF

12
PHD LEVEL GRADUATE STUDENTS

4
MS LEVEL GRADUATE STUDENTS

180
UNDERGRADUATE MAJORS IN 3 UNDERGRADUATE TRACKS

(Biopharmeceutical, Bioelectronics & Biophotonics, and Biomechanics & Biomaterials)