UNIVERSITY OF DELAWARE

ENGINEERING

BIOMEDICAL ENGINEERING FALL 2020

BIOMEDICAL ENGINEERING LEADERSHIP

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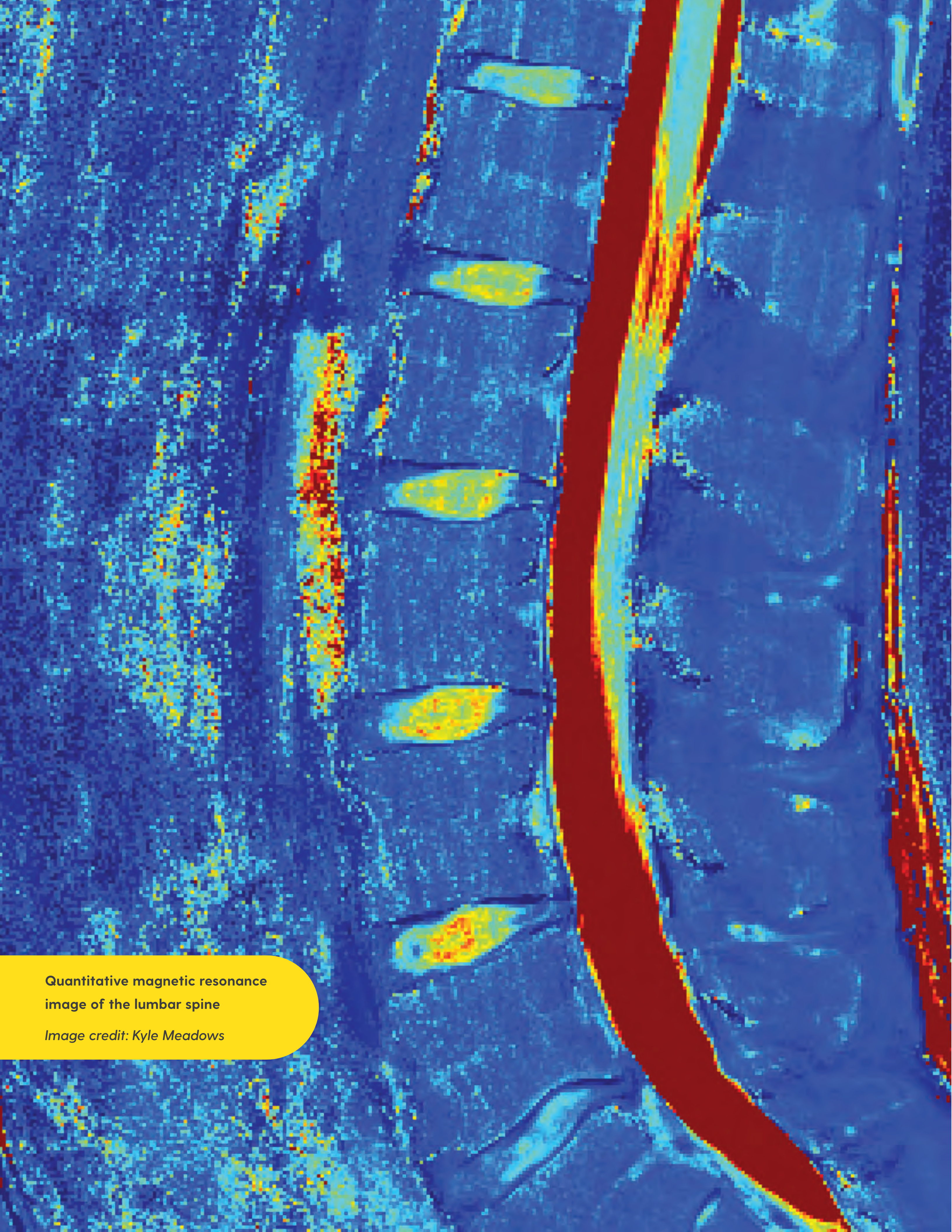
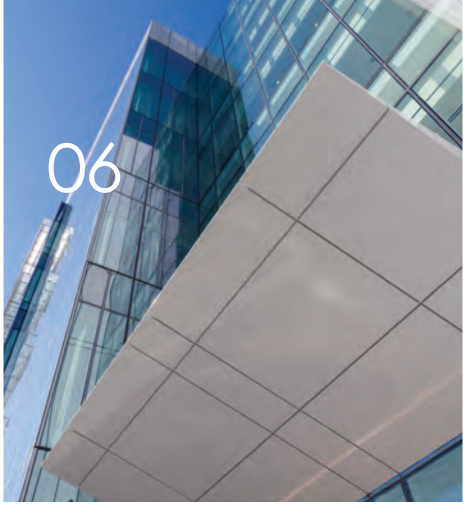


Quantitative magnetic resonance image of the lumbar spine

Image credit: Kyle Meadows



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ENGINEERING LEADERSHIP

TEN YEARS AGO, AWARD-WINNING MENTOR DAWN ELLIOTT FOUNDED UD'S BIOMEDICAL ENGINEERING DEPARTMENT — *AND SHE'S JUST GETTING STARTED*

Dawn Elliott is having a banner year. She's winning awards, reaching milestones and receiving major kudos from students and colleagues who've benefited from her leadership. And yet, she's not all that interested in talking about triumphs. For all her professional prowess, she'd much rather chat about mistakes.

"In science, you experience more failure than success," said Elliott, a Blue and Gold Distinguished Professor of Biomedical Engineering at the University of Delaware. "And you learn more from it as well."

In 2010, Elliott founded UD's Department of Biomedical Engineering, which she chairs. With help from UD and College of Engineering leadership, she made it her mission to hire a dynamic faculty — 50 percent women — who would feel a sense of ownership in building a robust program from the ground up. Her efforts paid off. In its infancy, the unit had the capacity to enroll 40 eager undergraduates — now, it accommodates up to 100 new students each fall, plus a thriving graduate program. It is rated among the top one-third of all biomedical engineering departments nationwide.

This rapid rise in national ranking is partially due to Elliott's position as president of the Biomedical Engineering Society — heading this body of more than 7,500 distinguished members continues to bring great visibility to the program. But this growth is also due to Elliott's on-campus leadership.

"The role of a chair isn't just to build their own career; it's to build the career of every person in the department," said Emily Day, associate professor of biomedical engineering who has worked with Elliott since 2013. "So you need someone who is incredibly selfless, and that's Dawn. She does whatever she can to get us the resources we need for success."

Under the department's purview is Elliott's own laboratory, which focuses on the functionality of orthopedic soft tissues. She's had more than 150 peer-reviewed papers published, collaborated on the creation of two patents and spearheaded several breakthroughs in the field. Among them? The development of a better method for seeing into the human spine as it functions.

"What sets my group apart is the way we combine experiments, imaging and modeling," Elliott said. "Sometimes, people have a deep expertise in one of these areas, but when you integrate them all together you can address your problem in a more holistic way. An advantage of working at UD is access to the bioimaging and MRI centers here — these core facilities are top in the nation and very accessible to faculty. At other institutions, resources like this are often sequestered for use only by certain people."

Throughout her academic life, Elliott has taken students under her wing, mentoring them in and out of the lab. In recent years, Elliott's received national

"In science, you have to be resilient," said Dawn Elliott, the founder of UD's Department of Biomedical Engineering and a leader in her field. "Whether your experiment doesn't work or your grant doesn't get funded or you get bad reviews on your paper and need to revise, there are challenges. You get pushed down, and you need to learn how to accept that, be resilient in the face of it and just move forward."

recognition for outstanding mentorship, In June, the American Society of Mechanical Engineers (ASME) announced Elliott would receive the prestigious Robert M. Nerem Education and Mentorship Medal for being a tireless champion of students.

“She is a big reason why I decided to pursue a career in academia,” said Grace O’Connell, who nominated Elliott for the award. An associate professor of mechanical engineering at the University of California Berkeley, she studied under Elliott at her previous appointment at the University of Pennsylvania. “For her, it’s not just about the nuts and bolts of the research, but really looking at giving back to the scientific community — and reshaping the community itself. Now that I am in the academy and learning my own mentorship style, taking bits and pieces of what I’ve learned from Dawn, I’ve grown to really appreciate the emotional part that she puts into listening to her mentees.”

Elliott will be the first to tell you — and here is where that comfort with admitting missteps comes in — she wasn’t always the world’s best adviser. It took some time at the beginning of her career to realize that “not all students were just like me,” she said. “We’re not all motivated by the same things. I like to get an early start, others work best late at night; I thought everyone working toward a PhD wanted to be a professor, but there are many different career paths. Over time, I’ve learned from the unique perspective that every student brings, and I’ve changed my mentoring style.”

Talking openly about mistakes is something Elliott encourages from all her mentees. At a weekly meeting of her research team, one of the items on the agenda is to share slipups made in the previous seven days, whether that’s breaking a piece of lab equipment, failing to properly record the steps of an experiment or forgetting about an appointment (it happens even to the organized, science-minded set).

“We’ve found that this has made a huge difference,” Elliott said. “It helps everyone understand that other people make mistakes, too. Oftentimes, it’s easy to feel like you’re all alone in screwing up and you can’t do anything right. So this becomes a bonding — and a learning — opportunity.”

Take Babak Safa, who completed his doctoral dissertation on tendon damage mechanics at UD in 2019. When he struggled a couple of times to get his first theoretical paper through the peer-review process, he found comfort in Elliott’s don't-get-discouraged philosophy. She normalized rejection — and reworking — as part of the process. Eventually, the paper was published.

“Dawn models persistence, perseverance and having faith in the work that you’re doing,” said Safa, now a postdoctoral fellow at the Georgia Institute of Technology. “She taught me how to make my contribution without being easily intimidated.”

WE MOVED!

The UD biomedical engineering department is now based in the Ammon Pinizzotto Biopharmaceutical Innovation Center, the new home for biopharmaceutical innovation, life sciences research and numerous education programs at UD. The 228,000-square-foot building also serves as the hub for the National Institute for Innovation in Manufacturing Biopharmaceuticals (NIIMBL) and the Delaware Biotechnology Institute.

INNOVATION AT THE CELLULAR LEVEL

BLOOD STEM CELL RESEARCH

ASSOCIATE PROFESSOR **EMILY DAY** IS WORKING ON TECHNOLOGY THAT MAY ONE DAY REPLACE BONE MARROW TRANSPLANTS.

Currently, bone marrow transplants are used to replace damaged bone marrow in the body with healthy blood stem cells, which give rise to all blood cell types in the human body.

Day is developing nanoparticle carrier systems to deliver therapeutic treatment directly to stem cells without the need to remove them from the body. It is a platform technology with the potential to transform the treatment of benign and malignant blood disorders including HIV, cancer, aplastic anemia and sickle cell disease.

Now, with $200,000 in funding through a QED grant from the University City Science Center in Philadelphia, Day will test whether methods developed in the lab are effective and can be commercialized. QED is short for quod erat demonstrandum, a Latin phrase meaning proven as demonstrated. *(continued on next page)*

UD associate professor Emily Day is working on technology that may one day replace bone marrow transplants. The platform technology has the potential to transform treatment of blood disorders, including HIV, cancer, aplastic anemia and sickle cell disease.

"MOST OF THESE DISEASES, CURRENTLY, ARE TREATED BY BONE MARROW TRANSPLANTS, WHICH ARE DIFFICULT FOR PATIENTS AND ARE EXPENSIVE."

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Day and her research group were among three teams selected from among 45 applicants from eight institutions in the Greater Philadelphia region for the QED Proof-of-Concept Program, designed to help researchers commercialize their work. Equally funded through the QED program and UD, the grant helps researchers effectively bridge the gap between academic research and product commercialization.

"Most of these diseases, currently, are treated by bone marrow transplants, which are difficult for patients and are expensive," said Day. "We hope our nanoparticle delivery vehicles can enable the repair of abnormal bone marrow in the body, improving the patient experience and leading to better outcomes."

Additionally, the UD team's work will provide a valuable research tool to improve the understanding of blood stem cell biology. Blood stem cells are important targets for therapies.

This is because when they fail, it can lead to a number of diseases or disorders.

Day's research group, in collaboration with UD chemical engineer Terry Papoutsakis, already has successfully demonstrated that membrane-wrapped nanoparticles can target and deliver cargo to blood stem cells in the lab. With the QED funding, the research team will test whether these same methods are effective in living organisms.

DAY SELECTED FOR U.S. FRONTIERS OF ENGINEERING SYMPOSIUM

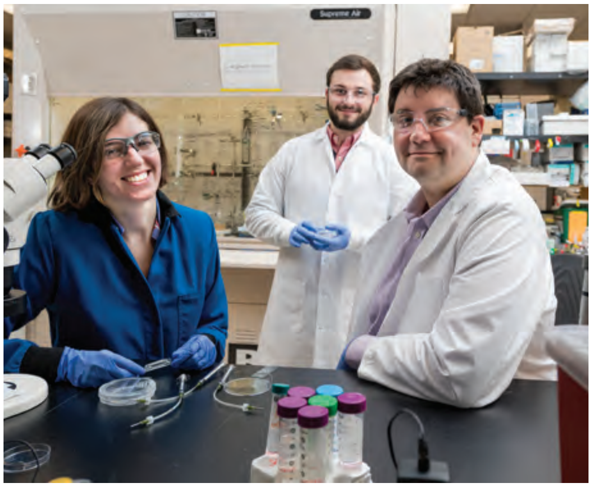
Emily Day was among 82 of the nation's brightest young engineers selected to participate in the 2019 National Academy of Engineering's (NAE) 25th annual U.S. Frontiers of Engineering (USFOE) symposium.

Early-career engineers who are performing exceptional engineering research and technical work in a variety of disciplines came together for the event in September 2019. The participants—from industry, academia, and government—were nominated by fellow engineers or organizations.

UD's Cathy Fromen, an assistant professor of chemical and biomolecular engineering, was also selected for the symposium.

INNOVATION AT THE CELLULAR LEVEL

LUNG EXPERTS TACKLING COVID CRISIS



UD assistant professor Jason Gleghorn (right) is pictured with doctoral students Jasmine Shirazi (left) and Michael Donzanti.

Jason Gleghorn, an associate professor of biomedical engineering, studies how lung tissue develops, and Cathy Fromen, an assistant professor of chemical and biomolecular engineering, studies immune response in lungs. In the age of COVID-19, a disease that ravages lung tissue, their work—and collaboration—is more important than ever.

This team received a six-month, $40,000 grant through the Delaware Clinical and Translational Research Program ACCEL's COVID-19 Rapid Science Grant Program to develop an inhalable microparticle system for the sequestration of SARS-CoV-2, the virus responsible for COVID-19, within the lung airspaces.

In addition, Fromen, Gleghorn, associate professor Ryan Zurakowski, biomedical engineering doctoral students Jasmine Shirazi and Michael Donzanti, and chemical engineering doctoral student Katherine Nelson authored a review and perspective paper in the journal *Cellular and Molecular Bioengineering* highlighting questions surrounding SARS-CoV-2, including temporal immune dynamics, infection of non-pulmonary tissue, early life exposure, and the role of circadian rhythms.

INNOVATION AT THE CELLULAR LEVEL

BUILDING A FAT-FREE CELL

A dream team of scientists from across the country is building and studying synthetic, fat-free cells that could someday be used to advance biotechnology, tissue engineering and—perhaps most importantly—to further our understanding of the rules of life.

Millicent Sullivan, a professor of chemical and biomolecular engineering with a joint appointment in biomedical engineering, is part of a transdisciplinary team that is building a cell without lipids. Sullivan will contribute expertise in biomaterials and tissue engineering, especially in peptide design and assembly and subcellular processing mechanisms.

The research team, which also includes experts from from Arizona State University, Michigan State University, Penn State University, the University of California at Santa Barbara and the University of Minnesota-Twin Cities, received a $3.9 million grant from NSF in 2019.

The team is building cells without lipids, using polypeptides in their place. Polypeptides can assemble into large proteins, act as enzymes to catalyze chemical reactions and more. The team aims to use polypeptides to assemble and compartmentalize cells and also to replace the lipid bilayer.

These fat-free cells, once realized, could be useful in biotechnology and tissue engineering applications, said Sullivan. Importantly, this fundamental research will also allow scientists to discover new insights about how cells come together.

GLEGHORN TO DEVELOP MICRO-SIZED DEVICES TO UNDERSTAND THE BODY'S IMMUNE SYSTEM

Jason Gleghorn, an associate professor, received a National Science Foundation (NSF) CAREER Award to understand how the body's adaptive immune system activates. He is developing a new class of microfluidic devices to culture an entire lymph node outside the body and study the cells' behavior in real time.

The work has broad application to the understanding of chronic infection and inflammation, and metastatic cancer to the lymph node. It also could inform drug delivery strategies for chemotherapy and antiretroviral therapies for HIV.

A lymph node's complex structure prevents drugs from penetrating inside to target viruses, bacteria and metastatic cancer cells that collect there. Gleghorn is interested in how immune cells go through the lymph node, and how these immune cells work and behave.

"Sometimes cells bring viruses like HIV and bacteria into the lymph node. When these foreign invaders, or metastatic tumor cells themselves, move into privileged areas called lobules within the lymph node, the drugs that work well in the rest of the body cannot get in to kill the infection," said Gleghorn.

"We believe this is why you get recurrence of viral infection like HIV and why cancer metastasis to lymph nodes is so devastating. To-date there is no tractable way to solve this problem; we do not know how this works." Gleghorn is developing experimental devices that can enable researchers to see, understand and image how things work and behave in the more complex organ in real time.

Initial work on the project will include developing the system to culture an entire lymph node with collaborators at University of Pennsylvania's School of Veterinary Medicine, a unique approach that will allow the researchers to retain the organ's complexity in its natural state. Then, in collaboration with Penn Medicine's transplant team, Gleghorn's research team will advance the system to enable culture and imaging of human lymph nodes.

The UD-developed device will be made from molded silicon rubber and tiny glass needles that the researchers make. They will load the lymph node into the middle of the mold, then connect the teeny-tiny glass tubes into the blood and lymphatic vessels that go into and out of the lymph node.

Using this "plumbing" the team plans to insert specific cells or drugs and track them as they move through the lymph node.

The team will collect real-time measurements to validate that what they see in this new whole-organ culture system actually replicates what can be expected inside the body.

SERGI TO STUDY HUMAN-ROBOT INTERACTION USING MRI

Assistant professor **Fabrizio Sergi** received a National Science Foundation (NSF) CAREER award to support fundamental research in motor control that could, in the future, improve practices in neurorehabilitation for individuals with motor impairment.

With the award, Sergi is using magnetic resonance imaging (MRI) to study how the human brain and body respond to interactions with robotic devices.

Sergi develops new robots and tools to elucidate the physiology of human motor control, the body's regulation of volnary and involuntary movements.

This work is important because movement disorders, which can limit a person's voluntary movements or cause involuntary movements, can be difficult to treat and cause significant burdens on quality of life.

Motor difficulties affect patients with a variety of diagnoses, from stroke to Parkinson's Disease to dystonia and more.

Sergi has created a niche area by developing MRI-compatible robots to study how the brain and muscle work during physical interaction with robotic devices. Many robots used in medical research can't be used with an MRI machine, making it difficult to study brain activity during their use.

Sergi is a world leader in developing robotic tools that are compatible with MRI imaging techniques. For example, he has developed a wrist-controlled robotic device that can be controlled like a joystick. While the user moves the device and responds to actions applied from the robot, their brain is scanned by the MRI machine, revealing new insights about what drives movements during human-robot interaction.

By developing a better understanding of movements even in healthy subjects, Sergi and experts can figure out robot-based interventions to help those with movement disorders. This insight is much needed because, currently, there is a poor fundamental understanding of how exactly the human brain and muscles interact with robots during robot-assisted motor tasks.

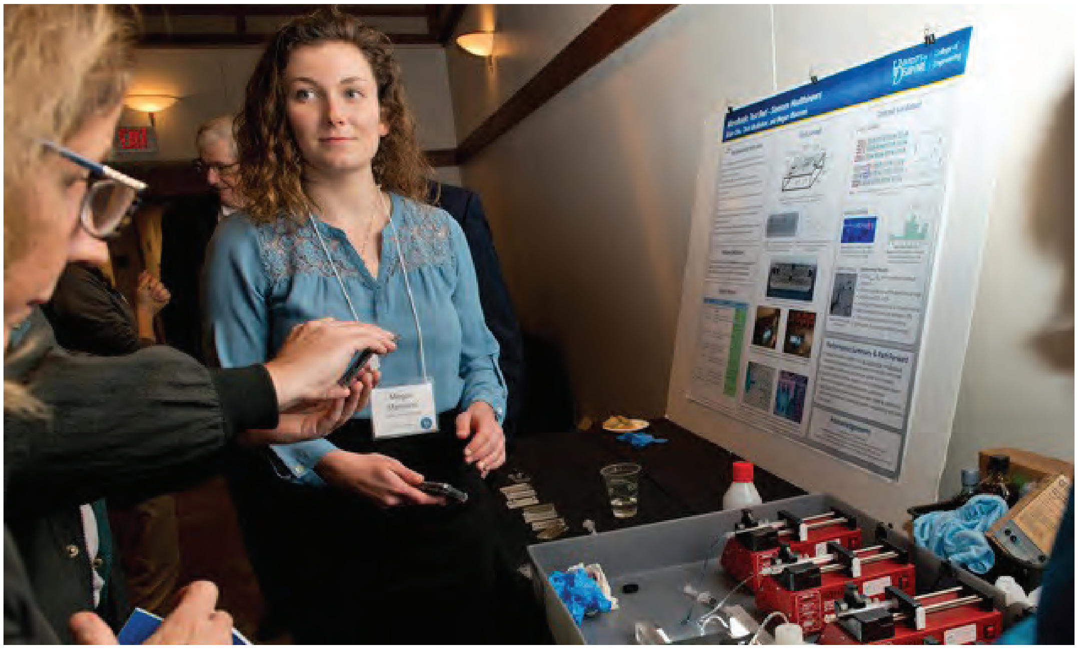
Most studies on human physiology are focused on the humans themselves, but when you're studying how humans work with robotic devices, it's more complicated.

"There are additional neuromuscular mechanisms that we use to control interaction with active agents, such as co-contracting our muscles, or relying on fast reactive responses (also called reflexes), but these processes have not been studied in the context of human-robot interaction," said Sergi.

Ultimately, Sergi and his students are paving the way for personalized robotic devices people could someday use to recover from neurological injuries that affect motor function.

THRIVING IN A REAL WORLD ENVIRONMENT

STUDENTS FLEX THEIR SKILLS THROUGH SENIOR DESIGN



UD engineering student Megan Mannino and her teammates built a microfluidics technology testbed in partnership with sponsor Siemens Healthineers Diagnostics.

Megan Mannino, a 2019 alumna of our undergraduate program, was intrigued by microfluidics—the study of fluid behavior at a submillimeter scale—when she first learned about the subject during a technical engineering elective course.

For her final project before graduating, Mannino and two classmates built a microfluidics technology testbed to help Siemens Healthineers Diagnostics explore the feasibility of utilizing microfluidics technology in high-throughput clinical analyzers.

Clinical analyzers evaluate samples of bodily fluid. Perhaps your doctor draws blood to check your cholesterol levels or asks you to urinate in a cup to check for a urinary tract infection. The fluid goes into a clinical analyzer, which mixes it with reagents to determine if it is normal.

The trouble is that clinical analyzers are huge, taking up one or more rooms of many healthcare facilities.

"Hospitals are already low on space, as well as people, to do these tests," said Mannino. "Microfluidics could revolutionize healthcare."

Using pumps, an imaging system, and specially designed acrylic chips, Mannino's team built a testbed that merged water-based and oil-based fluid droplets, one by one. With more research, a similar device could be developed to merge individual drops of blood, plasma, or urine with individual drops of reagent, allowing for meaningful analysis of patient samples.

In December, the team explained their device to a room full of people, including expert judges. It was all part of Senior Design, a six-credit interdisciplinary capstone engineering course.

"Senior Design has probably been the most valuable part of my undergraduate degree," said Mannino.

During the fall semester of 2019, Senior Design brought together 141 students, including all seniors majoring in biomedical engineering and mechanical engineering as well as some students majoring in electrical and computer engineering and civil and environmental engineering. Students were divided into 36 teams guided by 13 faculty advisors.

Projects were sponsored by industrial, clinical and academic partners.

"What stood out most in senior design this year was the excellent interdisciplinary integration and teamwork, which enabled engineering seniors to make the best possible prototypes in the shortest possible time," said Ashutosh Khandha, an assistant professor of biomedical engineering. "It was exhilarating to see students working with industry, business and clinical sponsors, and thriving in a real-world environment."

DRIVEN TO DISCOVER: ARIF PERACHA

__Arif Peracha__, a recent alumnus of our undergraduate program, was one of more than 500 students doing research across UD during the summer of 2019. At UD, he was also a McNair Scholar and triathlete. He participated in a Q&A about his experience spending a summer in a UD lab.

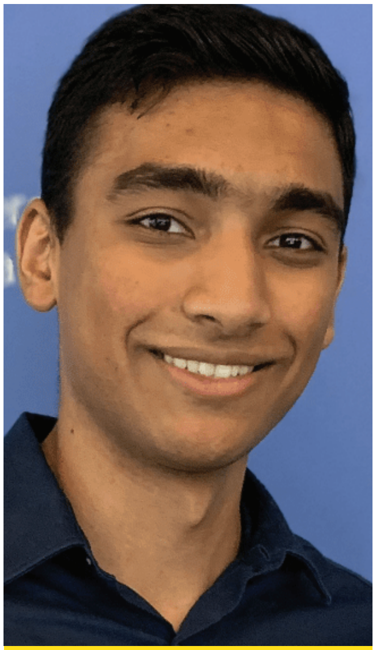
Q. What have you been studying this summer?

Peracha: I am at the STAR (Science, Technology and Advanced Research) Campus, working in the Muscle and Tendon Performance Lab with Dr. Karin Silbernagel, associate professor of physical therapy. My project is studying whether leg dominance is correlated with different mechanical properties of the Achilles tendon in healthy subjects, such as how stiff it is and how well it behaves like a spring in response to forces. As the Achilles tendon responds at the cellular level to forces and loading to heal, reinforce itself and improve its mechanical properties, it may be possible that consistently using a dominant leg for tasks could have formed differences between the dominant to nondominant side.

Q. What inspired this project and what interests you most about it?

Peracha: As a runner, the fact that Achilles tendinopathy is a very common occurrence in runners makes the Achilles tendon a topic of interest for me. I also aspire to be a physical therapist and — dreaming big — if this research helps clinicians better understand how important limb dominance is to the Achilles tendon it may aid in making decisions about when people should be cleared for activities after Achilles tendinopathy. For example, if it is found that the dominant leg has stiffer properties in the tendon, a physical therapist may have to tell a soccer player who has injured the tendon on that side that it needs to be rehabilitated to better mechanical properties than the non-dominant side before the player can safely return to the field.

Read more at: www.udel.edu/007767



UNDERGRADUATE AUTHORS PAPER IN JAMA INTERNAL MEDICINE

Akram Ahamed, an undergraduate biomedical engineering and Honors College student, spent the summer of 2019 as a Delaware INBRE summer scholar under the guidance of Dr. Jennifer Goldstein at ChristianaCare.

Ahamed was part of a research group that quantified and characterized illegal advertisements on Craigslist for the prescription medications insulin, albuterol and epinephrine. He was the first author of a Research Letter published in JAMA Internal Medicine in 2020 reporting that the group found 432 advertisements for insulin and albuterol in a 12-day period and studied pricing and seller motivations.

FROM THE MINDS OF HENSWEAR

It seems like the right idea, at the right time, in the right place: Bring together a handful of UD's top researchers, get the ideas percolating, and come up with "smart wearables."

It's called HensWEAR, and this cross-campus collaboration has already sparked some envelope-pushing ideas, inspired student-led innovations, and raised the possibility of commercial applications for a variety of people, from stroke survivors to athletes.

At its core, the Unidel-funded effort capitalizes on core UD strengths: entrepreneurship, rehabilitation, materials science, physical therapy, and fashion and apparel studies. By brainstorming, good ideas soon grow into real solutions, ranging from customized face masks for athletes to activity trackers for people with intellectual disabilities.

"Eventually, we hope to see them commercialized by our industry partners," says **Jill Higginson**, the biomedical engineering and mechanical engineering professor who is helping lead the effort.

Higginson and **Fabrizio Sergi**, director of the Human Robotics (HuRo) lab at UD, are working on an upper-body "active exoskeletal garment" that would help stroke survivors move their limbs with the help of embedded motors and cables, overseen by a computer that senses when the patient needs help.

SOFTNESS, EXPLAINED

"What's the Softest Thing?" When the publication Gizmodo sought to answer that very question, they asked five academic experts, including our very own assistant professor **Charles Dhong**. An excerpt from his answer appears below–for the whole scoop, visit https://gizmodo.com/whats-the-softest-thing-1841303714.

"...Recently, instead of perceiving a single material property (most people might guess 'elastic modulus'), we showed that humans use a combination of two physical cues to determine the perceived softness of an object. These cues are determined in part by material properties and in part by the shape of the object. When you touch an object, two things happen to your finger. First, your finger pushes, or indents, into the object and the object also pushes into your finger. Second, the object spreads across your finger with a certain contact area. This combination of indentation and contact area on your finger forms the physical basis for perception of softness. So, any object which generates a large indentation depth or contact area will feel 'soft.'"

NSF GRADUATE RESEARCH FELLOWSHIPS

UD BME students and alumni receive funding to pursue educational goals

The National Science Foundation (NSF) Graduate Research Fellowship Program (GRFP) awarded a fellowship to **Ariel Hannum**, a member of the class of 2020, and alumnus **Lauren Baker**. Graduate student **Mackenzie Scully** received an honorable mention.

Since 1952, the NSF has received more than 500,000 applications and funded more than 50,000 fellowships. Recipients have gone on to win 42 Nobel Prizes, while more than 450 awardees have become members of the National Academy of Sciences.

ARIEL HANNUM
Hannum graduated in 2020 with an Honors bachelor's degree with distinction in biomedical engineering. Next, she will pursue a doctoral degree in bioengineering at Stanford University. She is interested in the application of MRI as a tool to detect and diagnose disease in the human body.

Hannum's research focuses on understanding what causes lower quality images in magnetic resonance elastography (MRE), an MRI technology that captures images while vibrating the back of a person's head in order to calculate mechanical properties, such as stiffness, in the brain. She said stiffness has been shown to be associated with brain health and is used to characterize Alzheimer's, multiple sclerosis and other diseases.

Her work identifies and quantifies different sources of signal noise that exist in MRE, and her ultimate goal is to develop techniques to reduce signal noise present in images to further improve MRE as a tool for evaluating brain health.

Hannum is appreciative of the mentorship provided by Curtis Johnson, UD assistant professor of biomedical engineering, who has been her principal investigator. Along with creating a lab dynamic that is open and friendly, which makes it easy to approach classmates, Johnson has provided great support for her project.

"I am grateful for the opportunity to work with resources that are not available elsewhere," said Hannum. "Because I was trained to operate the MRI scanner, conveniently located on the main campus, I am able to independently collect my own data and run experiments, which is not common for an undergraduate student."

Hannum, who received the Engineering Alumni Association Scholarship and was a Telkes Distinguished Scholar at UD, would like to be a professor conducting research, teaching and liaising with industry, academia and healthcare. She is interested in unifying research through collaboration to improve imaging technologies.

LAUREN BAKER graduated from our undergraduate program in 2016 and is now a graduate student at Harvard's John A. Paulson School of Engineering and Applied Sciences.

MACKENZIE SCULLY is a doctoral student studying engineering membrane-wrapped nanoparticles for targeted RNA delivery to cancer in the laboratory of Professor **Emily Day.**

TA AWARD

Harrah Newman received a University of Delaware 2020 Excellence in Teaching Award for graduate students. Newman was the teaching assistant for BMEG311: Bioengineering Mechanics 11, a course taught by assistant professor Ashutosh Khandha in spring 2019. This course introduces engineering mechanics and dynamics to biomedical engineering juniors, and the topics include particle/rigid body kinematics and kinetics, impulse, moment of inertia, work and energy as well as viscoelasticity and muscle mechanics.

STUDENT DEGREES & HONORS

Masters Degrees

Andrew Brown
Faculty Advisor: Jason Gleghorn

PhD Degrees

Danielle Valcourt
Biomedical Scientist at Leidos
Faculty advisor: Emily Day

Andrea Zonnino
R&D Reahab Robotics at Heaxel
Faculty advisor: Fabrizio Sergi

Keely Keller
Faculty advisor: John Slater

University Fellowship Awards

Jasmine Shirazi
Delaware Space Grant Graduate fellowship

Grace McIlvain
Doctoral fellowship

Saurabh Modi
Dissertation fellowship

Andria Farrens
Dissertation fellowship

Megan Dang
Graduate scholar

N'Dea Irvin-Choy
Graduate scholar

Ryan Taitano
Graduate scholar

Nicholas Trompeter
Graduate scholar

Biomedical Engineering Departmental Awards

Danielle Valcourt
Best Doctoral Thesis Award

Omar Banda
Biomedical Engineering Best Paper Award

Ryan Locke
Biomedical Engineering Distinguished Graduate Scholar Award

Michael Donzanti
Biomedical Engineering Graduate Teaching Assistant Award

Grace McIlvain
Biomedical Engineering Rising Star Award

Grace McIlvain
Kyle Meadows
Outstanding Graduate Student Service Award

Ellen Bloom
Daniel Minahan
Outstanding Biomedical Engineering Outreach Award

Extramural Awards

Jasmine Shirazi
Delaware Space Grant Graduate fellowship

Fellowship Awards

Grace McIlvain
Brielle Hayward-Piatkovskyi
NIH F31 Fellowship

Undergraduate Departmental Awards

Siena Pyle
Michael Slemko
Biomedical Engineering Chairperson's Award

Maria Lilley
Nicholas Paulter
Biomedical Engineering Distinguished Junior Award

Akram Ahamed
Alexis Anderson
Carolina Gomez Casas
Biomedical Engineering Distinguished Sophomore Award

Madeleine Dugan
Matthew Maguire Celebration of Life Memorial Award

Ahlad Neti
Ariel Hannum
Biomedical Engineering Distinguished Senior Award

WHERE ARE THEY NOW?

SEE HOW UD BME GRADUATES ARE SUCCEEDING WITH THEIR DEGREES.

BACHELOR'S ALUMNI

of biomedical engineering graduates are employed or pursuing further education.

$60,000

Median starting salary

TOP EMPLOYERS

Siemens Healthineers
University of Delaware
Suvoda
Terumo Medical Corporation
Agilent Technologies
Eurofins Lancaster Laboratories
Nemours/Alfred I. duPont Hospital for Children
QPS Holdings
Stryker
U.S. Navy
W. L. Gore & Associates
Acell
Air Liquide
Cook Medical
Danico Medical
Globus Medical
Johnson & Johnson
LabWare Global Services
MTF Biologics
Perry Initiative
Smith & Nephew Orthopaedics

Source: University of Delaware Career Outcomes, BME Classes of 2015-2020

PhD ALUMNI

20% Assistant Professor

20% Industry Research Scientist

20% Postdoc

6.67% Interviewing

6.67% Physician

6.67% Research Specialist

6.67% Associate Medical Director

6.67% Investigator

6.67% R&D Rehab Robotics

2016-2020

ALUMNI SPOTLIGHTS

EDUCATION IN ACTION: ALUMNI Q&A

DOCTORAL ALUMNI LAMONT CANNON AND RACHEL RILEY RECENTLY LANDED FACULTY POSITIONS AT VIRGINIA COMMONWEALTH UNIVERSITY AND ROWAN UNIVERSITY, RESPECTIVELY. WE CAUGHT UP WITH THEM TO FIND OUT MORE:

Lamont Cannon

What was your main motivation for pursuing a career in academia?

Prior to earning my Ph.D. in BME, I spent seven years working as an engineer in industry. While I enjoyed working in industry, I realized that I missed the challenge and independence of research in an academic setting. I love learning and solving problems and I felt that a career in academia would allow me to continue to learn about new things and pursue problems that I was interested in.

What did you do for your PhD at UD?

At UD I worked with Professor Ryan Zurakowski. In his lab we used systems biology and modeling techniques to study the dynamics of HIV infection and treatment. The HIV virus continues to persist in infected patients despite treatment with antiretroviral drugs. In a subset of patients the virus continues to replicate in sanctuary sites, anatomical locations where antiretroviral drugs exist in low concentrations. For my thesis I employed the use of a dynamic model of HIV replication in combination with Bayesian Markov Chain Monte Carlo techniques to optimize a clinical technique to detect and quantify any ongoing viral replication in HIV infected patients.

What will the start of your new lab look like?

At Virginia Commonwealth University (VCU) I was hired as an Assistant Professor in the Life Sciences Center for the Study of Biological Complexity (CSBC). This unique center is an interdisciplinary unit developed to foster collaboration across the various scientific, medical and engineering departments on campus. My lab will be mostly computational and will operate at the intersection of engineering, mathematics, biology and statistics to study various biological phenomena. We will work with our experimental and clinical collaborators by employing advanced data analysis techniques to uncover novel discoveries and to develop new computational tools.

Rachel Riley

What was your main motivation for pursuing a career in academia?

I chose a career in academia because of the freedom to pursue any avenue of research that I, and my future lab members, are interested in. The second part of my decision to continue in academia is the opportunity to work with students who are passionate about learning both in the lab and in the classroom. Academia is one of the only work environments that allows a balance between pursuing your own research ideas and mentoring the next generation of engineers.

What did you do for your PhD at UD?

I completed my Ph.D. in Dr. Emily Day's lab, which focuses on the development of high precision nanomaterials to treat cancer and other diseases. In my thesis, I used nanoshells, which are comprised of silica cores and thin gold shells, to treat triple-negative breast cancer. I was interested in nanoshells due to their unique optical properties that enable their use as image contrast agents, photothermal transducers (in which nanoshells convert light into heat to kill cancer cells), and cancer targeting abilities. My research showed that nanoshells can be used as tools for multimodal cancer therapy by actively targeting cancer cells to inhibit oncogenic cell signaling, enabling dual photothermal and photodynamic therapy, and facilitating on-demand gene regulation to treat triple-negative breast cancer.

What will the start of your new lab look like?

My new lab will build off of my Ph.D. and postdoc research to develop new drug delivery technologies, and use existing ones, for applications in women's health. The two main avenues that will build the foundation of my lab will be to treat gynecological cancers and maternal/placental diseases during pregnancy. I am excited to see how these plans develop and change over time as students pursue areas of research that they are interested in as well. My biggest goal is to build a supportive and inclusive lab environment full of curious and excited scientists!

Michael Raccuglia, Jr., who graduated in 2019 with an honors degree in biomedical engineering, is a lead reviewer in the Office of Cardiovascular Devices for the FDA.

Danielle Niremberg, who graduated in 2020 with a degree in biomedical engineering, is now a systems engineer at Medtronic in the surgical robotics division.

Riley Curtin, who graduated in 2019 with an honors degree in biomedical engineering, is now a medical student at West Virginia University.

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Endotronix, VP of Marketing & Medical Education

Biomedical Engineering
161 Colburn Lab
150 Academy Street
Newark, DE 19716