Joint Department of

BIOMEDICAL ENGINEERING

UNC CHAPEL HILL

NC STATE UNIVERSITY

FALL 2018 / **WINTER** 2019

IN THIS ISSUE

LETTER FROM THE CHAIR

Nancy Allbritton

DEAR BME ALUMNI AND FRIENDS:

Welcome to the Fall 2018 / Winter 2019 edition of the UNC / NC State Biomedical Engineering Newsletter. In this edition, we share a number of stories about entrepreneurship in our department and I would like to highlight some of these here.

Let's begin with UNC / NC State BME's vibrant portfolio of spin-out companies, student start-ups, and industry collaborations. Our faculty members have launched more than 20 spinout companies and work closely with at least a dozen more. These companies encompass a wide range of cutting-edge biomedical engineering areas such as biomedical microdevices (Protein Simple, Intellego, Cell Microsystems, Altis Biosystems); drug delivery (AnelleO, SonoVol, Triangle Biotechnology, Nanosonic Bioreagents, Vivimmune); sensing and diabetes care (Ultizyme International, Bioengineering Laboratory, Zenomics); and tissue engineering (BreStem Therapeutics, Xollent Biotech, Ventrix, Regentys, East River BioSolutions). Our students also are highly regarded translational researchers with 2018 successes such as spin-out 410 Medical receiving $3.1M in new funding; the SenseNC team being invited to represent the United States at the 2018 SensUs international competition in the Netherlands; the "Enabling Pediatric Brain Surgery through Head Stabilization" project winning the NCEES Engineering Education Award $25K Grand Prize; and the naming of 11 undergraduates as NAE Grand Challenge Scholars.

Next topic is the i4 Program. This program, which is generously funded by an anonymous donor, is a novel initiative within the Joint Department of Biomedical Engineering that melds traditional undergraduate engineering education with biomedical entrepreneurship. Composed of four phases of need: Identification, Ideation, Innovation, and Implementation, this mentored design program culminates in an annual competition awarding financial support for further intellectual property development, and the eventual formation of a student-founded company. Bringing talented students together with highly accomplished academic, clinical, and industry professionals, the i4 Program drives young, innovative entrepreneurship into our region, while fostering the creation of practical solutions to real-world problems.

Last but far from least I'm delighted to announce the hire of Dean's Eminent Professor of the Practice in Biomedical Engineering Dr. George T. Ligler. Dr. Ligler comes to the Joint Department most recently from being the 30-year proprietor of his consulting firm GTL Associates where he is a leader in the area of systems integration / engineering and product management services. Dr. Ligler will act as a senior states-person for the UNC / NC State BME Department. In this role, he will assist in the development of the Joint Department in the following ways: mentoring BME faculty members and students; serving as a catalyst to initiate collaborative interactions within BME and between the Department and industry; providing guidance in research, entrepreneurship, patent law, project management, contract negotiation, etc.; and operating as an international spokesperson for BME.

The mission of UNC / NC State BME is to combine medicine, science, and engineering to improve life. Emphasizing the translation of Joint Department research well serves this mission by bringing the achievements of our laboratories to the patients who need them. I invite you to explore this story, and all the stories within this newsletter, and see for yourself the work and results making UNC / NC State BME a department improving lives.

Sincerely,

Nancy Allbritton, M.D., Ph.D.
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COMPANY CO-FOUNDED BY BME CHAIR MAKES **FIRST SALE OF AUTOMATED AIR SYSTEM**

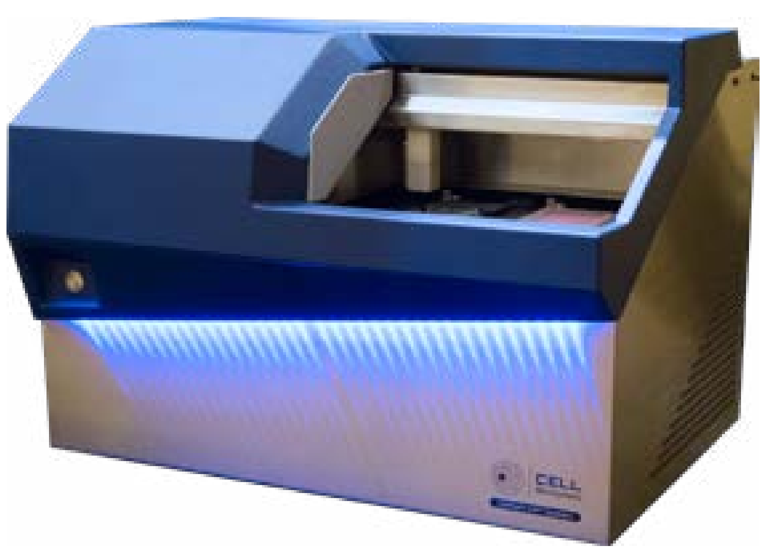
CELL MICROSYSTEMS, a company co-founded by Dr. Nancy Allbritton, head of the BME Department, recently made the first commercial sale of its automated AIR system.

The sale was made to Albert Einstein College of Medicine investigator Jan Vijg, Ph.D. The AIR system is used in single cell genomic analysis, or for genome editing methods. Members of Dr. Vijg's laboratory and neighboring labs praised the system as "very useful," and said that it "allows (them) to do imaging-based characterization of genome edited cells that (they) otherwise couldn't do."

Cell Microsystems is an early growth stage company that develops, manufactures, and markets innovative products for single cell biology. The Company's proprietary CellRaft™ Technology addresses two widespread challenges in the single cell analysis field; the ability to selectively obtain viable, single cells based on their phenotype for molecular analyses and cell selection, and doing this from a sample too small for traditional cell separation techniques.

The CellRaft™ Technology was developed in Allbritton's lab and she co-founded the company with Dr. Chris Sims, professor Division of Rheumatology in the Department of Medicine at UNC-Chapel Hill and senior scientist in the lab, and Dr. Yuli Wang, a research associate in the lab, in 2010 to develop and commercialize product applications for the CellRaft™ Technology.

Cell Microsystems continues to develop novel research tools supporting the basic research behind scientific and medical discovery. Products based on the CellRaft™ Technology offer scalable solutions making the isolation, recovery, and analysis of single cells available for every lab. The company is one of the top awardees of NIH funding in the state of North Carolina, and will be exhibiting its products at several upcoming national life science conferences. •



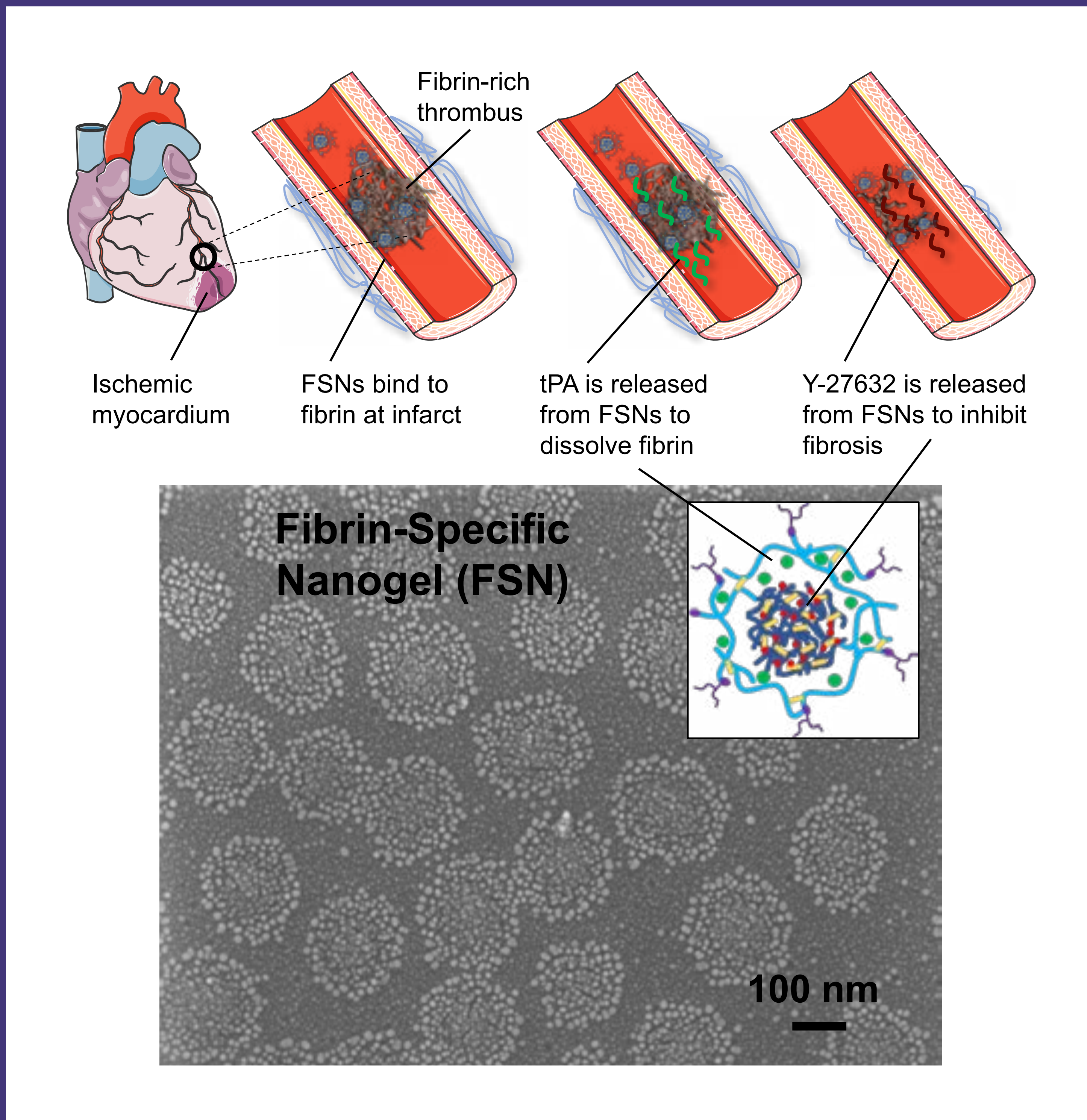
COMPANY WITH BME TIES SEES NEW FUNDING

410 MEDICAL, a medical device company that in 2017 commercialized a product created in part by BME students, has recently received $3.1 million in new funding.

The product, called LifeFlow, was developed in Dr. Andrew DiMeo's Senior Design class by a five-woman team of BME students: Denise Witman, Laura Rucker, Ashley Hayes, Alex Eller, and Elizabeth Davenport. The team shadowed Dr. Mark Piehl of WakeMed Hospitals and studied real-world medical needs to develop the prototype a handheld rapid infuser used for resuscitation of critically ill patients, including children with sepsis and other forms of shock. The technology was then developed into a commercially viable product by Dr. Piehl and passed FDA regulation in 2016.

Following positive feedback from local medical institutions, 410 Medical expanded its market for LifeFlow nationwide and gained its first major investor, Triangle Venture Alliance, in July 2017. The recent round of funding, reported by WRAL TechWire, was led by the AIM Group and includes other investors such as the North Carolina Venture Capital Multiplier Fund, Kleinheinz Capital, and WakeMed Health & Hospitals. Per WRAL, the LifeFlow device is being used or tested in more than 40 hospitals, and 410 Medical is looking toward expanding that market as well as use of the technology in clinical studies. •

NEW SYSTEM ALLOWS RAPID RESPONSE TO HEART ATTACKS, LIMITS CARDIAC DAMAGE



RESEARCHERS IN THE DEPARTMENT have developed a drug-delivery system that allows rapid response to heart attacks without surgical intervention. In laboratory and animal testing, the system proved to be effective at dissolving clots, limiting long-term scarring to heart tissue and preserving more of the heart's normal function.

"Our approach would allow health-care providers to begin treating heart attacks before a patient reaches a surgical suite, hopefully improving patient outcomes," says Dr. Ashley Brown, corresponding author of a paper on the work and an assistant professor in BME. "And because we are able to target the blockage, we are able to use powerful drugs that may pose threats to other parts of the body; the targeting reduces the risk of unintended harms."

Heart attacks, or myocardial infarctions, occur when a thrombus – or clot – blocks a blood vessel in the heart. In order to treat heart attacks, doctors often perform surgery to introduce a catheter to the blood vessel, allowing them to physically break up or remove the thrombus. But not all patients have quick access to surgical care.

And more damage can occur even after the blockage has been removed. That's because the return of fresh blood to tissues that had been blocked off can cause damage of its own, called reperfusion injury. Reperfusion injury can cause scarring, stiffening cardiac tissue and limiting the heart's normal functionality.

To address these problems, researchers have developed a solution that relies on porous nanogel spheres, about 250 nanometers in diameter, which target a thrombus and deliver a cocktail of two drugs: tPA and Y-27632.

A thrombus can be made of various substances, such as platelets or arterial plaques, but they all contain a substance called fibrin. So, to target blockages, each nanogel is coated with proteins that bind specifically to fibrin. In other words, when the nanogels reach a thrombus, they stick.

The tPA and Y-27632 are layered inside the nanosphere, with the tPA forming a shell that surrounds the Y-27632. As a result, the tPA leaks out first at the thrombus site, allowing it to do its job – which is to break down fibrin and dissolve the clot.

As the tPA is released, the Y-27632 escapes the nanogel. While the tPA targets the clot itself, the Y-27632 aims to limit the damage caused by reperfusion injury. It does this by limiting the rigidity of the cells in the area that contribute to scarring. This allows these cells to retain more of their plasticity, improving their ability to function normally and preserving more cardiac function.

In vitro, the researchers found that the targeted tPA/Y-27632 cocktail dissolved clots in a matter of minutes. While this has yet to be tested in clinical trials, it may work more quickly than surgical interventions, which require time to prep the patient and get the catheter in place.

In tests using laboratory rats, the researchers also found that their technique limited scarring and preserved heart function after heart attack better than targeted tPA or Y-27632 by themselves – and far better than a control group in which animals received neither drug.

Specifically, animals that received the targeted cocktail had a left ventricular ejection fraction, which measures a heart's functionality, of around 67 percent four weeks after the heart attack – which is healthy. The tPA by itself was around 57 percent, which is at the low end of the normal range, while both the control group and Y-27632 by itself dipped into the 40s. Similarly, the targeted cocktail resulted in scar tissue across less than 5 percent of the affected area. The tPA and Y-27632 had scar tissue across approximately 7 percent of the area, with the control group seeing scarring across more than 10 percent.

What's more, the researchers found that the targeted nanogels resulted in little or none of the nanogels being found in other tissues – such as the lungs and liver – particularly when compared to the use of the non-targeted nanogels. •

BIOSENSOR ALLOWS REAL-TIME OXYGEN MONITORING FOR "**ORGANS ON A CHIP**"

A NEW BIOSENSOR allows researchers to track oxygen levels in real time in "organ-on-a-chip" systems, making it possible to ensure that such systems more closely mimic the function of real organs. This is essential if organs-on-a-chip hope to achieve their potential in applications such as drug and toxicity testing.

The organ-on-a-chip concept has garnered significant attention from researchers for about a decade. The idea is to create small-scale, biological structures that mimic a specific organ function, such as transferring oxygen from the air into the bloodstream in the same way that a lung does. The goal is to use these organs-on-a-chip — also called microphysiological models — to expedite high-throughput testing to assess toxicity or to evaluate the effectiveness of new drugs.

But while organ-on-a-chip research has made significant advances in recent years, one obstacle to the use of these structures is the lack of tools designed to actually retrieve data from the system.

"For the most part, the only existing ways of collecting data on what's happening in an organ-on-a-chip are to conduct a bioassay, histology, or use some other technique that involves destroying the tissue," says Dr. Michael Daniele, corresponding author of a paper on the new biosensor. Daniele is an assistant professor of electrical engineering at NC State and in the Joint BME Department.

"What we really need are tools that provide a means to collect data in real time without affecting the system's operation," Daniele says. "That would enable us to collect and analyze data continuously, and offer richer insights into what's going on. Our new biosensor does exactly that, at least for oxygen levels."

Oxygen levels vary widely across the body. For example, in a healthy adult, lung tissue has an oxygen concentration of about 15 percent, while the inner lining of the intestine is around 0 percent. This matters because oxygen directly affects tissue function. If you want to know how an organ is going to behave normally, you need to maintain "normal" oxygen levels in your organ-on-a-chip when conducting experiments.

"What this means in practical terms is that we need a way to monitor oxygen levels not only in the organ-on-a-chip's immediate environment, but in the organ-on-a-chip's tissue itself," Daniele says. "And we need to be able to do it in real time. Now we have a way to do that."

The key to the biosensor is a phosphorescent gel that emits infrared light after being exposed to infrared light. Think of it as an echoing flash. But the lag time between when the gel is exposed to light and when it emits the echoing flash varies, depending on the amount of oxygen in its environment. The more oxygen there is, the shorter the lag time. These lag times last for mere microseconds, but by monitoring those times, researchers can measure the oxygen concentration down to tenths of a percent.

In order for the biosensor to work, researchers must incorporate a thin layer of the gel into an organ-on-a-chip during its fabrication. Because infrared light can pass through tissue, researchers can use a "reader" — which emits infrared light and measures the echoing flash from the phosphorescent gel – to monitor oxygen levels in the tissue repeatedly, with lag times measured in the microseconds.

The research team that developed the biosensor has tested it successfully in three-dimensional scaffolds using human breast epithelial cells to model both healthy and cancerous tissue.

"One of our next steps is to incorporate the biosensor into a system that automatically makes adjustments to maintain the desired oxygen concentration in the organ-on-a-chip," Daniele says. "We're also hoping to work with other tissue engineering researchers and industry. We think our biosensor could be a valuable instrument for helping to advance the development of organs-on-a-chip as viable research tools." The paper resulting from this work, "Integrated phosphorescence-based photonic biosensor (iPOB) for monitoring oxygen levels in 3D cell culture systems," was published in the journal Biosensors and Bioelectronics, and can be read at **bit.ly/2Nzh8u5**. The research team included Ph.D. student Kristina Rivera. •

NEW TECH MAY MAKE PROSTHETIC HANDS **EASIER FOR PATIENTS TO USE**

RESEARCHERS IN BME have developed new technology for decoding neuromuscular signals to control powered, prosthetic wrists and hands. The work relies on computer models that closely mimic the behavior of the natural structures in the forearm, wrist and hand. The technology could also be used to develop new computer interface devices for applications such as gaming and computer-aided design (CAD).

The technology has worked well in early testing but has not yet entered clinical trials — making it years away from commercial availability.

Current state-of-the-art prosthetics rely on machine learning to create a "pattern recognition" approach to prosthesis control. This approach requires users to "teach" the device to recognize specific patterns of muscle activity and translate them into commands — such as opening or closing a prosthetic hand.

"Pattern recognition control requires patients to go through a lengthy process of training their prosthesis," says BME professor Dr. He (Helen) Huang. "This process can be both tedious and time-consuming.

"We wanted to focus on what we already know about the human body," says Huang, who is senior author of a paper on the work. "This is not only more intuitive for users, it is also more reliable and practical.

"That's because every time you change your posture, your neuromuscular signals for generating the same hand/wrist motion change. So relying solely on machine learning means teaching the device to do the same thing multiple times; once for each different posture, once for when you are sweaty versus when you are not, and so on. Our approach bypasses most of that."

Instead, the researchers developed a user-generic, musculoskeletal model. The researchers placed electromyography sensors on the forearms of six able-bodied volunteers, tracking exactly which neuromuscular signals were sent when they performed various actions with their wrists and hands. This data was then used to create the generic model, which translated those neuromuscular signals into commands that manipulate a powered prosthetic.

"When someone loses a hand, their brain is networked as if the hand is still there," Huang says. "So, if someone wants to pick up a glass of water, the brain still sends those signals to the forearm. We use sensors to pick up those signals and then convey that data to a computer, where it is fed into a virtual musculoskeletal model. The model takes the place of the muscles, joints and bones, calculating the movements that would take place if the hand and wrist were still whole. It then conveys that data to the prosthetic wrist and hand, which perform the relevant movements in a coordinated way and in real time — more closely resembling fluid, natural motion.

"By incorporating our knowledge of the biological processes behind generating movement, we were able to produce a novel neural interface for prosthetics that is generic to multiple users, including an amputee in this study, and is reliable across different arm postures," Huang says. •

FACULTY NEWS

Allbritton referenced in *Carolina Law Magazine*

Dr. Nancy Allbritton

Dr. Nancy Allbritton has many accomplishments and awards spread over her years as a scholar, distinguished professor and inventor. In addition to being the chair of the Joint Department of Biomedical Engineering, she is the scientific founder of several companies and has issued even more patents. These and several more of her unique accomplishments were referenced by the dean of the UNC School of Law in the August 2018 edition of *Carolina Law Magazine*. To read the full letter from the dean and what he wrote about Allbritton, visit **bit.ly/2CXSDFa**.

Brown invited to join 2018 Frontiers of Engineering Program

Dr. Ashley Brown

Dr. Ashley Brown's innovative research on advanced wound healing and her belief in pursuing collaborative projects has landed her with an invitation to join the 2018 Frontiers of Engineering (FOE) program.

The goal of the Frontiers of Engineering Program is to bring together engineers from all disciplines and from industry, universities and federal labs to facilitate cross-disciplinary exchange and promote the transfer of new techniques and approaches across fields in order to sustain and build U.S. innovative capacity. The program brings together a select group of emerging engineering leaders to discuss pioneering technical work and leading-edge research. The goal of the programmatic meetings is to introduce these outstanding early career engineers to each other, and through this interaction facilitate collaboration in engineering, the transfer of new techniques and approaches across fields, and establishment of contacts among the next generation of engineering leaders.

Brown, an assistant professor in the department, attended the 2018 US FOE Symposium at the MIT Lincoln Laboratory in September.

Benhabbour presents research at RTP entrepreneur event

Dr. Rahima Benhabbour, left, with Chancellor Carol Folt.

This past summer, BME Assistant Professor Dr. Rahima Benhabbour presented her research at an event honoring the sixth anniversary of Blackstone Entrepreneurship Network-RTP, a partnership between four Triangle universities (including UNC) and the Blackstone Charitable Foundation.

Held at UNC-Chapel Hill, the event celebrated the accomplishments of the network and included such attendees as Blackstone Charitable Foundation Executive Director Amy Stursberg and UNC Chancellor Dr. Carol L. Folt. The event also highlighted the success of Benhabbour's company AnelleO, which makes the first 3D-printed intravaginal ring designed as a platform technology to treat women's health conditions. Read more at **unc.live/2NZZz5U**.

Benhabbour had the chance to speak with Folt at a follow-up meeting after the event and discuss her research in further detail — a chance Benhabbour referred to as "wonderful" and a "highlight."

Benhabbour's research featured by UNC

BME Assistant Professor Rahima Benhabbour's HIV treatment research has been featured by UNC Health Care and UNC School of Medicine news services. The research was also featured by EurekAlert.

Dr. Benhabbour and her co-PIs worked to develop a long-acting injectable HIV treatment which has shown promise when used with animal models. The injectable treatment is composed of an anti-HIV drug, a polymer, and a solvent which harden into an implant upon injection and slowly release HIV-treatment drugs into the body over time. It has shown to be effective for as long as five months, and is also easily and safely removed in case of complication, which gives it an edge over similar, nonremovable treatments.

Benhabbour and her collaborator have received a second NIH grant to continue this research for the next five years. Read more about the research at **bit.ly/2DDJ7Ye**.

Two professors awarded grants from Chancellor's Innovation Fund

Every year, the Chancellor's Innovation Fund awards grants to a small group of NC State innovators. The fund aims to bridge the gap between public and private funding, and allows researchers to invest in testing and prototyping to prepare their research or products for the commercial market. Established in 2010, the fund uses a highly competitive selection and application process; this year, two of the five awardees were BME faculty members.

The first, Dr. Ashley Brown, works with materials that imitate blood platelets and help create necessary clots for wound healing; these materials also deliver targeted antimicrobial agents to aid in tissue regeneration and preventing infection. Brown has helped expand the shelf life of these antimicrobial agents and decrease their cost. The Chancellor's Innovation Fund will help her to further test safety and efficacy of the agents.

The second, Dr. Michael Daniele, developed microneedle patches for biofluid extraction used for diagnostic tests. Normally, interstitial fluid (ISF) that is used in these tests is difficult to extract due to pain levels and risks of infection; Daniele has created microneedle patches that extract ISF painlessly and much more easily. The Chancellor's Innovation Fund will help reach an industry-specified rate of fluid extraction, which Daniele and his researchers are working toward.

That two of the five awardees of such a prestigious award are BME faculty members is a fantastic example of the real-world impact of BME research and the extraordinary work done in the department. To read more about this year's award winners, visit **bit.ly/2Mx787g**.

Cole receives World Changer Award

Dr. Jacque Cole

NC State University does not hand out accolades such as the World Changer Award lightly. It is with great pleasure, then, that BME announces that Dr. Jacque Cole has received this prestigious award from the University's College of Engineering.

Cole was nominated for her work on K-12 outreach, specifically with National Biomechanics Day and the Engineering Bits & Bytes Days, by Dr. Laura Bottomley and her staff at The Engineering Place. The Engineering Place is the NC State College of Engineering's K-20 engineering outreach program.

You can read more about the incredible National Biomechanics Day program at **bit.ly/2jHiVjv**.

Cole's lab also won first place in the Biomechanics in Art competition co-hosted by the Sanford Sports Science Institute and National Biomechanics Day. The image was primarily the work of undergrad researcher Maggie Tamburro and lab manager Stephanie Teeter.

Daniele elected as Senior Member of IEEE

Dr. Michael Daniele

Dr. Michael Daniele, assistant professor in BME and in the Department of Electrical and Computer Engineering at NC State, has been elected as a Senior Member of IEEE, the Institute of Electrical and Electronics Engineers.

IEEE Senior Membership is an honor bestowed only on those who have made significant contributions to the profession. Daniele more than meets this requirement and is very highly regarded for his innovative and collaborative research.

Daniele holds bachelor's and Ph.D. degrees in materials science and engineering from Rutgers University and Clemson University, respectively. He joined the NC State faculty after working as a National Research Council postdoctoral associate and as a staff scientist at the US Naval Research Lab.

Daniele selected for German-American Frontiers of Engineering

Dr. Michael Daniele, assistant professor, has been selected by the National Academy of Engineering for the German-American Frontiers of Engineering program in Hamburg on March 21-23, 2019.

Daniele will be one of 60 early-career engineers to participate in interdisciplinary discussions ranging from biomedical optics to technologies for space exploration. For more information and a list of sessions to be held, visit the NAE website: **bit.ly/2B0h5n6**.

Franz receives two major NIH research grants

BME Assistant Professor Dr. Jason Franz, in a remarkable example of the interdisciplinary nature of biomedical engineering and the impact of collaborative science, was recently awarded two new major research grants from the National Institutes of Health.

First, in collaboration with the UNC Division of Geriatrics and Co-PI Dr. Gregory Sawicki in the Georgia W. Woodruff School of Mechanical Engineering at Georgia Tech, Franz was awarded a new five-year NIH R01 to study (1) neuromechanical explanations for the greater metabolic energy cost of walking in older adults and (2) translation of that understanding to biologically inspired wearable robotics for preserving independent mobility in our aging population. Ultimately, the researchers hope to use ultrasound imaging to guide optimal prescription of assistive devices to improve locomotor function in aging – an outcome that will have significant positive impact on quality of life for millions.

Dr. Jason Franz

Second, in collaboration with Co-PI Dr. Brian Pietrosimone in the UNC Department of Exercise and Sport Science, Franz was awarded a new NIH R21 to study how altered lower extremity loading affects knee joint biomechanics, joint tissue biochemistry, cartilage deformation and quadriceps muscle contractile behavior during walking in people following ACL reconstruction. By combining real-time biofeedback, ultrasound imaging, and biochemical markers, this study will be the first to determine the acute effects of joint loading on a collection of critical factors associated with the pathogenesis of post-traumatic osteoarthritis in a relevant patient population.

George Ligler briefs Congress, White House on drone policies

Dr. George Ligler

Dr. George Ligler, Dean's Eminent Professor of the Practice in BME, recently briefed the White House Office of Science and Technology Policy and the House Aviation Subcommittee on assessing risks of unmanned aircraft systems in US airspace.

As the chair for the National Academies committee of the same name, Ligler drove home the point that the current "one-size-fits-all" FAA policy related to commercial drone use is stifling progress and integration of this technology. According to the report drafted by Ligler and other members of the National Academies committee, this "overly conservative" approach by the FAA is preventing potentially life-changing applications of drone usage, such as inspecting cell phone towers and aiding firefighters.

The report, along with Ligler's insights, has been reported on by the *Wall Street Journal*, *Forbes*, *Safety+Health* and numerous other news outlets.

Dr. Frances Ligler

Frances Ligler published on gender gap in technology commercialization

A recent article in *Technology and Innovation* by BME's Dr. Fran Ligler and former NC State Assistant Vice Chancellor Dr. Kelly Sexton highlights the gender gap in technology commercialization in the academic community.

According to the study, women inventors only accounted for 18.8 percent of all patents issued in 2010. Even more troubling, only 5 percent of utility patents issued to NC State between 2015 and 2016 listed a female faculty member as inventor. The article provides potential explanations for this troubling gap and posits potential remedies for the same.

In order to fully address the problem, the authors suggest that offices of technology transfer and commercialization (OTT) take the following actions: disseminate their own university's gender gap data; reach out to faculty members to ensure that all inventions with commercial potential are identified; and educate faculty inventors about the commercialization process. Finally, Ligler and Sexton suggest that universities emphasize to their faculty members the positive societal impact their inventions can have if commercialized and made available to the general public. Potential benefit to the human condition seems to motivate faculty members more than financial gain and acclaim.

National Inventors Hall of Fame Optibot project inspired by Ligler

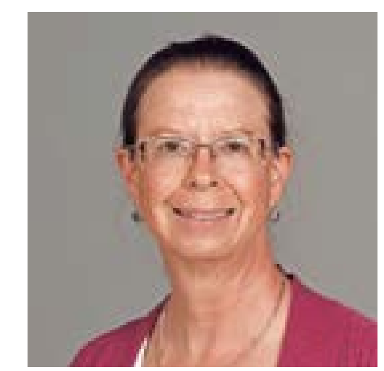
Each year, the National Inventors Hall of Fame (NIHF) holds scientific summer camps for students in kindergarten through sixth grade who are enthusiastic about innovation. This year's favorite project at Camp Invention seems to be the Optibot robot project, expressly labeled by the NIHF as having been inspired by Dr. Frances Ligler's work on optical biosensors.

Camp Invention gives students a chance to get up close and personal with real scientific concepts and provides hands-on experience with various inventions. This year, Drs. Frances and George Ligler visited Swift Creek Elementary in Raleigh, NC, to assist with the camp's Optibot activity. The Optibot is a small robot with an optical biosensor that is made to follow a route produced by the students with a black marker. The Drs. Ligler also visited a camp for kids from underserved portions of the community in Hyattsville, Md., as well as another camp in the Raleigh area.

The NIHF runs more than 1,000 camps each summer, reaching more than 150,000 children across the country, 45,000 of which are underserved.

Frances Ligler explains the project in more detail in an NIHF Education video that can be found at **bit.ly/2G6Sq4w**.

Bernacki wins NC State Award for Excellence



Dr. Susan Bernacki

Dr. Susan Bernacki, research associate and director of the BME Culture Core Labs and 15-year BME veteran, has won an NC State University Award for Excellence.

At a ceremony presided over by NC State Chancellor Dr. Randy Woodson, Bernacki was given an Award for Excellence in Outstanding State Government Service. This outstanding service was honored because of Bernacki's exceptional devotion to duty that goes well above and beyond requirements or even advanced expectations. The award made Bernacki eligible to win a Governor's Award for Excellence, the highest honor that can be awarded to a state employee. She also begins a dynasty, as Bernacki's award marks the second year in a row that a BME winner went on to be a College of Engineering winner and then a University-level Excellence Award winner.

Read more about the NC State University Award for Excellence and Bernacki's selection at **bit.ly/2PDMl0h**. •

STUDENT NEWS

Students receive 2018 NC State dissertation and research awards

BME graduate students are making waves at NC State. Yue Lu received a 2018 NC State Distinguished Dissertation Award, which recognizes the scholarly contributions of NC State doctoral students in their dissertation projects.

Yuqi Zhang has been selected as the recipient of the 2018 College of Engineering Early Doctoral Research Achievement Award. These awards highlight original and innovative work and are only presented to a small cohort of students each year.

Department, Hanne receive National Biomechanics Day Greatest Impact Award

National Biomechanics Day, sponsored by the American Society of Biomechanics, seeks to foster the development of biomechanics as a component in high school curricula across the country.

Faculty members and students from BME participated in the 2018 National Biomechanics Day, welcoming groups of 8th-12th graders and their teachers and parents to participate in interactive biomechanics activities and demonstrations. Part of the annual event is two Student Competitions: Best Content and Greatest Impact.

Recipients in the Best Content competition had high program quality for sharing biomechanics with judging based on the educational value and creativity of the content. Recipients in the Greatest Impact category had a NBD reaching a large number of people with judging based on participation and event advertisement/coverage. At the 2018 event BME, represented by graduate student Nicholas Hanne, was awarded a Greatest Impact award.

Student team takes NCEES Engineering Education Award

Pictured, from left, are: Brian Gentry, Zachary Watkins, Sarah Moore, Dan Fuccella and Pat Tami, PS, immediate past president of NCEES.

The 2018 NCEES Engineering Education Award $25,000 grand prize went to a BME student team for their work on a project that enables pediatric brain surgery through head stabilization. The outstanding students on this team include Veronica Lavelle, Sarah Moore, Zach Watkins, Brian Gentry, Sophia Silver, and Anya Trell.

The team was mentored by Dr. Andrew DiMeo, Dr. Nandan Lad and Dan Fuccella. The team collaborated with clinicians and engineering professionals to design a device that allows for complete skull immobilization for pediatric patients during neurosurgery. This innovation allows for the use of neuronavigation technology, opening new possibilities for treatment in pediatric neurosurgery.

BME SensUs team invited to represent the U.S. at international competition

The BME SensUs team, SenseNC, was invited to represent the United States at the 2018 SensUs international competition in Eindhoven, Netherlands. The students are: Calvin Shanahan, Chuck Geddie, Brendan Turner, Hannah Johnson, Chris Fesmire, Dhruvi Fulfagar, Arnab Raijkhava, Madisen Andersen, Sydney Floryanzia, Alice DiFazio, Mike Wilkins and Kristina Rivera. The team is mentored by Dr. Michael Daniele.

The goal of SensUs is to stimulate the development of biosensors in a friendly, competitive manner whereby students make and design innovative biosensors.

Cone selected as 2018 Horizon Award recipient

Stephanie Cone

BME graduate student Stephanie Cone has been selected as a recipient of the 2018 Horizon Award by the UNC Graduate School.

The award recognizes outstanding graduate student research that holds extremely high potential for making a significant contribution to the educational, economic, physical, social or cultural well-being of North Carolina citizens and beyond. The Horizon/Impact Awards Selection Committee, comprised of faculty members from across the UNC campus, chose Cone's project, "Understanding How Pediatric ACL Injuries Are Different, Toward Better Treatment" due to its exceptional quality and impact.

She was honored at the Graduate Student Recognition Celebration in April 2018, where she had the opportunity to present her work to the campus community and visiting state legislators.

Two students travel to Japan for international symposium

Two BME students recently won travel awards to the 2018 IEEE International Ultrasonics Symposium in Kobe, Japan. The two students, Danai Soulioti and Murad Hossain, each received $1,000 to help fund the trip, which took place from October 22-25, 2018. Both students presented at the conference in three separate sessions on October 24.

Soulioti presented "Human transcranial super-resolution imaging" at a session titled "Super Resolution and Contrast Brain imaging." Hossain presented two abstracts; the first was titled "Assessing Mechanical Anisotropy in Transversely Isotropic (TI) Elastic Materials Using ARFI-Induced Peak Displacement (PD) at Electronically Steered Rotation Angles" at a session titled "Prostate, Thyroid Elasticity, and Mechanical Anisotropy." The second abstract, "VisR, SWEI, and SDUV Ultrasound Detect Increased Degree of Mechanical Anisotropy Following Ischemia-Reperfusion Injury in Pig Kidney, In Vivo," was presented at a session titled "Abdominal Organ Elasticity."

Students take home Undergraduate Research Symposium awards

Each spring, NC State holds an undergraduate research symposium to encourage collaboration and creativity among its students. Three BME students walked away with Outstanding Presentation awards:

- Rahul Kathard, mentored by Dr. Ashley Brown
- Margaret Tamburro, mentored by Dr. Jacqueline Cole-Husseini
- Zaid Ali, mentored by Dr. Omer Oralkan (Department of Electrical and Computer Engineering)

The presentations were evaluated by faculty and post-doc judges from various departments around NC State. The top presenters received a certificate and were invited to a reception in April held by the NC State chapter of Sigma Xi, The Scientific Research Society.

Eleven BME undergraduates named NAE Grand Challenge Scholars

The College of Engineering and the National Academy of Engineers' Oversight Committee have named 11 BME undergraduates as 2018 Grand Challenge Scholars.

These students are: Lydia Ashburn, Jack Davis, Emily Fomin, Kat Green, Sujay Kestur, Brian Kim, Sarah Kubik, Michael McKnight, Joshua Peck, Labannya Samanta, and Nalia Segule.

NC State engineering NAE Grand Challenge Scholars become members of a premier association of students who network with high-achieving, highly motivated engineering students across the nation so they can work together to face the Grand Challenges of Engineering in the 21st century. These students will be finding sustainable solutions using engineering know-how, cross-disciplinary approaches and cutting-edge technologies. •

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BME Students Leading the Way

BME students are enjoying the best of both worlds of UNC Chapel Hill and NC State University. They are also enjoying outstanding opportunities to travel abroad, participate in innovative educational experiences and professional development programs. Our students and alumni have often shared how important these experiences were to their academic success and career preparation.

Recent headlines include:

BME Students Danai Soulioti and Murad Hossain Travel to Japan for International Symposium
Two BME students recently won travel awards to the 2018 IEEE International Ultrasonics Symposium in Kobe, Japan. The two students, Danai Soulioti and Murad Hossain, each received $1,000 to help fund the trip, which took place October 22-25.

BME SensUs team invited to represent the U.S. at international competition
The BME SensUs team, SenseNC, has been invited to represent the United States at the 2018 SensUs international competition in Eindhoven, Netherlands. This remarkable achievement comes as no surprise as the students involved in the team are some of BME's most inventive, innovative, and hard-working.

BME team takes first place in NCEES Engineering Education Award
A NC State Engineering / BME Department Senior Design team was named the $25,000 grand prize winner of this year's NCEES Engineering Education Award. The outstanding students on this team include Veronica Lavelle, Sarah Moore, Zach Watkins, Brian Gentry, Sophia Silver and Anya Trell.

BME Students Emily Fomin and Sarah Kubik Have Summer Research Experience at the Czech Academy of Science in Prague

Product Developed By BME Students Sees New Round of Funding after Commercial Launch in 2017
410 Medical, the company that in 2017 commercialized a product created by BME students, has recently received $3.1 million in new funding.

The College of Engineering and the National Academy of Engineers' Oversight Committee named three BME undergraduates as 2018 Grand Challenge Scholars

We are asking you to consider a gift today to help provide support, so more students will be able to take advantage of these exciting opportunities. Gifts of all sizes will be helpful to underwrite travel, supplies, registrations and fees for students. Gifts can be made through the website, **www.bme.unc.edu/give-to-bme**, (BME 21st Century Fund through the School of Medicine or Biomedical Engineering Enhancement Fund through the College of Engineering).

If you have any questions, or would like to discuss your gift, please reach out to Laura Schranz, **lschranz@unc.edu** or **lschran@ncsu.edu**, **919.962.6212**.